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PRODUCTION EMPLOYMENT AND PRODUCTIVITY IN 59 MANUFACTURING INDUSTRIES

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PART ONE: PURPOSE, METHODS, AND
SUMMARY OF FINDINGS



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- B-4 Effects of Mechanization in Cigar Manufacture (*Summary*)
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WORKS PROGRESS ADMINISTRATION

F. C. HARRINGTON
Administrator

CORRINGTON GILL
Assistant Administrator

NATIONAL RESEARCH PROJECT

on

**Reemployment Opportunities and Recent Changes
in Industrial Techniques**

DAVID WEINTRAUB
Director

Studies of the Labor Supply, Productivity, and Production
Harry Magdoff, Statistician in Charge

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**PRODUCTION, EMPLOYMENT, AND PRODUCTIVITY
IN 59 MANUFACTURING INDUSTRIES,
1919-36**

**With an Appendix on the Electric Light and Power
and Telephones Industries**

by

Harry Magdoff

and

Irving H. Siegel Milton B. Davis

**PART ONE: PURPOSE, METHODS, AND
SUMMARY OF FINDINGS**

WORKS PROGRESS ADMINISTRATION, NATIONAL RESEARCH PROJECT

Report No. S-1, Part One

Philadelphia, Pennsylvania

May 1939

**THE WPA NATIONAL RESEARCH PROJECT
ON REEMPLOYMENT OPPORTUNITIES AND RECENT CHANGES
IN INDUSTRIAL TECHNIQUES**

Under the authority granted by the President in the Executive Order which created the Works Progress Administration, Administrator *Harry L. Hopkins* authorized the establishment of a research program for the purpose of collecting and analyzing data bearing on problems of employment, unemployment, and relief. Accordingly, the National Research Program was established in October 1935 under the supervision of *Corrington Gill*, Assistant Administrator of the WPA, who appointed the directors of the individual studies or projects.

The Project on Reemployment Opportunities and Recent Changes in Industrial Techniques was organized in December 1935 to inquire, with the cooperation of industry, labor, and governmental and private agencies, into the extent of recent changes in industrial techniques and to evaluate the effects of these changes on the volume of employment and unemployment. *David Weintraub* and *Irving Kaplan*, members of the research staff of the Division of Research, Statistics, and Finance, were appointed, respectively, Director and Associate Director of the Project. The task set for them was to assemble and organize the existing data which bear on the problem and to augment these data by field surveys and analyses.

To this end, many governmental agencies which are the collectors and repositories of pertinent information were invited to cooperate. The cooperating agencies of the United States Government include the Department of Agriculture, the Bureau of Mines of the Department of the Interior, the Bureau of Labor Statistics of the Department of Labor, the Railroad Retirement Board, the Social Security Board, the Bureau of Internal Revenue of the Department of the Treasury, the Department of Commerce, the Federal Trade Commission, and the Tariff Commission.

The following private agencies joined with the National Research Project in conducting special studies: the Industrial Research Department of the University of Pennsylvania, the National Bureau of Economic Research, Inc., the Employment Stabilization Research Institute of the University of Minnesota, and the Agricultural Economics Departments in the Agricultural Experiment Stations of California, Illinois, Iowa, and New York.

WORKS PROGRESS ADMINISTRATION

WALKER-JOHNSON BUILDING
1734 NEW YORK AVENUE NW.
WASHINGTON, D. C.

F. C. HARRINGTON
ADMINISTRATOR

May 23, 1939

Colonel F. C. Harrington
Works Progress Administrator

Sir:

The administration and planning of programs designed to aid the unemployed must be based on knowledge of trends in the volume of employment and unemployment in the Nation. A primary factor affecting the number of jobs and thus the size of the unemployment problem is the volume of output of the worker in industry. This subject is treated in the report submitted herewith. It gives a picture of production, employment, and productivity for 59 manufacturing industries. One-half of all the manufacturing employees in the country are covered in this investigation.

The importance of manufacturing as an employer of labor has changed in the last 20 years. Every census taken by the United States Government from the Civil War to 1919 showed an increase in the number of wage earners employed in manufacturing industries. Between 1919 and 1929, however, employment as reported by the *Census of Manufactures* declined slightly. Thus manufacturing ceased to play its traditional role as an absorber of the country's growing labor supply.

Another way to view the changing importance of manufacturing employment is by means of the percentages of persons gainfully occupied. In 1870 about 17 percent of the gainfully occupied were in manufacturing. By 1920 the figure had increased to 27 percent. But between 1920 and 1930 it declined to 23 percent.

Although the number of jobs in manufacturing did not increase during the 1920's, there was a considerable rise in production. Improvements in the productivity of labor made possible larger production with about the same number of employees. Nearly all of the

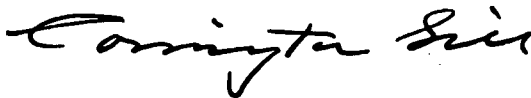
industries studied in this report showed increasing productivity between 1919 and 1929.

There seems to be no prospect for a change in the role of the manufacturing industries as an employer of labor. Output per man-hour continued to increase after 1929. About half of the wage earners in the industries studied worked in branches of manufacturing in which labor productivity increased *faster* between 1929 and 1935 than in the period 1919-29. In general, it took one-fifth less labor time to produce manufactured goods in 1936 than was required in 1929.

Man-hours are one thing; jobs are another. It is a fact that the increases in output per man-hour have been largely offset by a big drop in the average hours worked per week. Average weekly hours were 48 in 1929 and 39 in 1936. Thus, although output per *man-hour* was much higher in 1936 than in 1929, output per *wage earner* was actually a little less.

There is every indication that output per man-hour in the manufacturing industries will continue to increase, and there is little likelihood that more jobs will be available in manufacturing, unless there is a substantial gain in production or a further decrease in working hours. Therefore our manufacturing industries are not again likely to serve as a reservoir of jobs for the growing labor supply of the Nation.

Respectfully yours,

A handwritten signature in cursive script that reads "Corrington Gill". The signature is written in dark ink and is positioned above the typed name.

Corrington Gill
Assistant Administrator

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PREFACE

Several studies conducted by the National Research Project, for example, the report on the manufacture of brick and tile¹ or that on phosphate-rock mining,² have dealt intensively with the technological changes that have taken place in selected industries and their effects on employment opportunities in those industries. These studies were based either on detailed data especially collected for the purpose or on similar data available in the files of various Government agencies. They represent not only contributions to our knowledge of the incidence of changes in technology and labor requirements in individual industries, but case studies of economic factors that affect the relationship between production, productivity, and employment changes; as such they throw light on the way these factors operate in different industries according to the economic characteristics of those industries and their role in the economy as a whole.

There is also, however, a need for extensive information on the degree to which the increased productivity of labor has in recent years reduced the amount of labor required to produce a given quantity of goods and on how widespread these reductions have been. The present report represents this second type of study. It is based on secondary statistical data and measures the changes in production, employment, and productivity that have occurred in 59 manufacturing industries during the post-war years.³ Besides adding to our knowledge of the degree to which productivity has increased, the data presented in this report provide a major element in the eventual construction of more inclusive productivity measures that will reflect changes for a broader aggregate of industries, including mining, agriculture, transportation, and communication as well as the manufacturing section of the economy.

Our approach to the problem of measuring productivity is that the method of measuring must be made dependent on the purpose

¹Miriam E. West, *Productivity and Employment in Selected Industries: Brick and Tile* (WPA National Research Project in cooperation with National Bureau of Economic Research, Report No. N-2, Feb. 1939).

²A. Porter Haskell, Jr., and O. E. Kiessling, *Technology, Employment and Output per Man in Phosphate-Rock Mining, 1880-1937* (WPA National Research Project in cooperation with U. S. Dept. Int., Bur. Mines, Report No. E-7, Nov. 1938).

³Appendix B also contains studies of changing production, employment, and productivity in the Electric Light and Power industry and in the Telephones industry.

which the measure is to serve. One of the principal objectives of the National Research Project was to inquire into the relationship between reemployment opportunities and changes in productivity. The methods used for the present study were developed out of specific questions formulated in the light of this objective. For the first time, so far as we know, formulas for constructing index numbers of production and productivity were specifically designed for use in inquiries on employment opportunities. The formulas developed are presented in chapter I; there also an attempt is made at an explicit formulation of the underlying assumptions and of the economic meaning of these special-purpose measures.

The mere computation of changes in a ratio of quantity produced to labor time consumed does not, of course, establish a significant economic relationship between production and employment. Measures of the type presented in this report do, however, permit the gauging of trends in employment opportunities. Despite the fact that changes in the degree of plant capacity utilization are known to affect labor productivity, that the incidence of changes in industrial techniques differs according to the size of plants, or that computed changes in output per unit of labor may reflect changes in the relative quantities of different products, the conclusion which must be drawn after a careful examination of the data for a large number of manufacturing industries is that the observed trend in labor productivity reflects principally the effects of the continuous changes in industrial techniques on the amount of labor required per unit of output. The annual figures for each industry must, of course, be approached with caution; not only the factors mentioned above, but many others besides technological change may have influenced the level of any industry's productivity figure for a particular year.

In the less than 2 decades covered by the data in this report, output per man-hour in manufacturing increased by more than 75 percent. The increase has been gradual. Aside from the irregular short-time fluctuations, the course of output per man-hour has been steadily upward. The same was true of output per wage earner between 1919 and 1929 when the average and full-time hours worked remained fairly constant. During the years 1930-34 output per worker declined, chiefly in response to the large amount of part-time work before 1933

and to the shortening of the workweek since then. The continuing increases in output per man-hour have, however, turned output per worker upward again, and the 1929 level is rapidly being approached.

The construction of adequate measures of productivity was a considerable statistical task since the data that were available had originally been compiled for other purposes. An attempt was made to canvass as completely as possible all data on production, employment, and hours of work that could be discovered in published and unpublished sources. The two most serious problems were the attainment of comparability between the production and labor series and the derivation of adequate measures of hours worked; data on the latter were especially scarce. Because of these problems of measurement and the degree to which it was necessary to resort to estimating, we have presented in great detail in this report the sources, underlying assumptions, and the specific methods used in constructing the series for the individual industries. These details should be of value not only because they enable the technical reader to evaluate the material but also because they make possible the continuation of these indexes in the future and permit the construction of series for additional industries and thus the extension of the coverage of this sample.

The reader who is interested primarily in the findings of the study will find a summary in Part One, chapter III, followed by charts presenting graphically the indexes for each industry. Tables incorporating the indexes are presented industry by industry in Part Two at the end of each section describing the methods used for the particular industry. The reader interested in the underlying theory is referred to Part One, chapter I, and the reader wishing to investigate still further will want to see chapter II of Part One and Parts Two and Three.

The study was planned and executed by Harry Magdoff. Irving H. Siegel and Milton B. Davis supervised the construction of the indexes and participated in the development of the specific statistical techniques used; they prepared Parts Two and Three and participated in the preparation of Part One. Clement Winston participated in the planning of the study and in the development of the basic techniques; in the early stages he also supervised the construction of the indexes. The study as

a whole was under the supervision of Irving Kaplan, in his capacity as Associate Director of the Project. Ruth Eisner aided in the administrative supervision of the work and made a number of special investigations. The completed manuscript was prepared for publication under the supervision of Edmund J. Stone.

The construction of the indexes contained in the report could not have been accomplished without the cooperation of many individuals outside of our own organization. Isador Lubin, United States Commissioner of Labor Statistics, and Lewis E. Talbert of the United States Bureau of Labor Statistics, as well as W. L. Austin, Director of the United States Bureau of the Census, and LeVerne Beales, T. J. Fitzgerald, and H. H. McClure of the Bureau of the Census, have patiently answered innumerable questions, communicated essential information, supplied unpublished statistics, and prepared special tabulations for a number of industries. Some unpublished material was also made available by O. E. Kiessling and W. W. Adams of the Federal Bureau of Mines; Edgar B. Brossard, Oscar B. Ryder, and Raymond B. Stevens of the United States Tariff Commission; and R. C. Hall and H. B. Steer of the United States Forest Service; in addition, O. E. Kiessling gave us the benefit of his valuable criticism.

The following individuals and private organizations also cooperated by complying with requests for statistics or information: Paul Ryan of the American Gas Association, C. E. Wright of *Iron Age*, F. E. Gorell of the National Cannery Association, Grafton Whiting of the National Paperboard Association, and E. L. Drew of the Tanners' Council of America.

Grateful acknowledgments are due to Solomon Fabricant, who kindly read and criticized a large section of the manuscript and offered helpful advice; to A. G. Silverman, E. E. Lewis, Arthur F. Burns, Miriam E. West, and Raymond T. Bowman for reading and criticizing chapter I of this report; and to Edgar Z. Palmer for reviewing a preliminary draft of Part Two.

The uses to which the data obtained were put and the conclusions contained in this report are, of course, solely the responsibility of the National Research Project.

DAVID WEINTRAUB

PHILADELPHIA

May 19, 1939

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In particular they are indebted to Jacob Grauman, who made the studies of the Agricultural Implements industry and, with the aid of Nathan Spero, of the Iron and Steel and Tobacco Products industries; Joseph Lehner, who participated in editorial and technical decisions, made the study for the Lumber and Timber Products industry, and contributed to the studies of the Cotton Goods, Glass, Knit Goods, and Woolen and Worsted Goods industries; and Vivian E. Spencer, who made the studies of the Bread and Bakery Products and, with the aid of Fred L. Karpin, the Cement, Coke, Leather, Nonferrous Metals, and Petroleum industries. Leo Genzeloff, Bernard Mandel, Max Lipowitz, Abraham Kavadlo, and Joseph P. Cohen did the economic and statistical research for, and participated in the construction of, many of the industry indexes shown in this report. Hans H. Landsberg and Myron Schmittlinger, assisted by Sidney Ginsburg, verified the indexes in the later stages and assembled the materials required for chapter II of Part One, the charts of the NRP measures, and Part Three; in addition, they participated in the statistical research and in the construction of index numbers. Others who contributed to the construction of the indexes in the earlier stages of the work are: Pauline Abrahams, Sybil Applebaum, Irving Cheskin, Albert Kuzminsky, Donald M. Landay, Rudolph Sukonick, Herbert Unterberger, and Sidney Wagman.

In the early stages of the study the bulk of the collection, tabulation, and analysis of the statistical materials used was carried on under the supervision of Sydney Feldman. Julius M. Balick aided in this early work and also, at later stages, supervised verification of, and edited, the industry studies and appendix tables. The work involved in the compilation and checking of the statistical data was performed by Alexander Herskovitz and T. Stanley Gallagher. Valuable clerical assistance was contributed by Edward Kelly, Sadye Jacobs, William B. Podolsky, and Nellie Bunn.

INTRODUCTION

This report is devoted to the presentation and discussion of indexes of production, employment, man-hours, and productivity for 59 manufacturing industries which account for about half the number of wage earners in all manufacturing. It also presents similar measures for 13 combinations or groups, comprising 35 of the 59 industries, and for 2 nonmanufacturing industries, Electric Light and Power and Telephones. These indexes are the product of intensive research into available secondary materials. In the course of their construction, a study was made of relevant published statistics; unpublished statistics in the files of private and Government organizations were also consulted.

Since productivity indexes may serve various purposes and since the method of measurement in each case depends upon the purpose of the analytical inquiry or the social policy to be formulated or administered, the first task is the formulation of our problem and the development of the appropriate types of production and productivity measures. Because of the nature of the available data, it was usually not possible to develop measures that fully satisfy the desired formulas. However, the formulas served as standards for the selection and treatment of these data. The integration of the statistical data around a single viewpoint provided a basis for a critical evaluation and investigation of the validity of the indexes actually constructed.

This report is divided into three parts. Part One consists of three chapters and the summary charts. The first chapter is devoted to the definition of the problem and the development of types of production and productivity measures which meet the defined purposes. Chapter II presents the sources of the statistical data and the general technical methods used in the construction of the indexes, together with a commentary on these indexes in the light of the purposes and methods presented in the first chapter. Chapter III contains a summary of the movements of production, employment, man-hours, and productivity of the 59 individual industries. This is followed by charts showing the indexes for the individual industries. Part

2 PRODUCTION, EMPLOYMENT, AND PRODUCTIVITY

Two comprises 37 sections, of which 24 refer to individual manufacturing industries and 13 to industry groups (these groups include the remaining 35 industries). Each section consists of a definition of the industry (or group), a description of the sources and methods used in the construction of the NRP indexes of production, employment, man-hours, and productivity, and a summary table (or tables) showing the NRP measures. Part Three consists of two appendixes. The first is a compendium of the statistics used in the construction of the NRP indexes for the 59 manufacturing industries presented in Part Two. The second appendix contains the NRP indexes for the Electric Light and Power and Telephones industries, a description of the methods of constructing these indexes, and statistical tables similar to those in the first appendix.

The report does not concern itself with reasons for the changes that have occurred since 1919 in production, employment, man-hours, and productivity for the 59 manufacturing industries surveyed. The movements of production and productivity may be due to a number of factors arising from the economics and techniques of an industry. For example, productivity may change as a result of changes in technology, plant lay-out, managerial technique, efficiency of individual or groups of workers, degree of utilization of capacity, raw materials, or the quality of the products manufactured; productivity may also change as a consequence of the mortality of inefficient and old plants and the entrance of new and more efficient ones, or as a consequence of the shift in production between plants producing at different productivity levels. An analysis of the effects of changes in productivity on employment opportunities and the relationship of changes in production to changes in productivity requires intensive studies of individual industries, strategic sections of the economy, and the conditions and development of the economy as a whole. This report, while planned in such a way that the results may be utilized in inquiries of this type, is itself confined to the task of measurement. As such, it is concerned primarily with the construction of measures which are pertinent to and useful in a study of production and productivity changes and their bearing on employment prospects.

CHAPTER I

THE PURPOSE AND DEVELOPMENT OF MEASURES OF PRODUCTIVITY AND PRODUCTION

THE PURPOSE OF PRODUCTIVITY MEASURES

The central question concerning unemployment today is whether the current unemployment problem is of a different nature from the problem in the past. The question is, in part, one of the changing structure of the economy and the relationship of this factor to the prospects of future employment. Within this context the bearing of the changing productivity of labor on the total volume of labor utilized is of particular interest. The effect of changes in productivity on the total volume of labor time employed depends on the total volume of production as well as on the types of goods produced. It is therefore necessary to construct measures of production and productivity for each of the several commodities produced.

Formulas for the measurement of productivity and unit labor requirements were developed to find answers to questions like the following: How much employment would there be if we again attained the production levels of 1929? How much production is necessary in order to employ the same number of wage earners as were employed in 1929? In more generalized form these questions are of the following two types:

- (1) What relative volumes of labor time are required to produce a given composite of products at different times?
- (2) What relative volumes of production of a given composite of products are obtainable at different times with a given amount of labor time?

Answers to these questions are of use in estimating (1) employment requirements for different levels of production and (2) future production under various conditions of availability and utilization of labor. In the generalized form presented above these two questions in turn define the desired statistical measures of unit labor requirements and productivity. The statistical data necessary to answer these questions are (1) the quantities of each product made and (2) the corresponding numbers of man-hours utilized in their production.

The answer to the first question can be obtained by computing a ratio of the aggregate labor requirements for a given composite of products at different times. The result is a measure of average unit labor requirements.¹

The second question refers to the production that can be obtained at different times with a given volume of labor time and defines the desired statistical measure of labor productivity.² The assumption implicit in the use of this question is that there exists a sufficiently large and diverse unemployed labor supply which could be reemployed if production increased. Hence interest centers only on *volumes* of employment and unemployment; qualitative differences in skills, occupations, and efficiency of the individual employees need not be taken into consideration. From this viewpoint, labor may be considered as homogeneous, and its unit of measurement as an hour of undifferentiated labor. The measure of the volume of labor time is, therefore, the total number of man-hours utilized.

Since the question is to what extent the unemployed would be reemployed under conditions of rising production and increasing productivity, the output of individual commodities is significant only insofar as more or less labor is required to produce them. Since labor time may be considered homogeneous, it is possible to measure quantitatively the relative changes in the volume of a specified group of diverse products in terms of man-hours. This approach is analogous to that adopted in the construction of measures of production and prices for the purpose of analyzing fluctuations in the volume of trade. For that purpose the ultimate unit for measuring production

¹Symbolically, the unit labor requirement for any product may be expressed as follows:

$$l = \frac{m}{q}$$

where l = man-hours required per unit of output,
 q = the quantity manufactured, and
 m = the man-hours utilized in the production of q .

Though the ultimate unit of measurement of labor time is 1 hour, there are questions concerning unit labor requirements and productivity of labor which may require the use of other labor-time units, such as a man-day or man-week. In this report only two measures of labor are used - total man-hours and average number of wage earners. Only the former is referred to in this chapter. It should be understood that whatever is said of man-hours applies equally to wage earners.

²Symbolically, the labor productivity for any product, which is the reciprocal of the unit labor requirement, may be expressed as follows:

$$\pi = \frac{1}{l} = \frac{q}{m}$$

where π = productivity. The term "labor productivity" as used in this report has a definite technical meaning, confined to the ratio of production to the labor time utilized, or relatives of such ratios.

is a pecuniary one.⁵ Since we, on the other hand, are interested in the volume of production as related to the volume of labor time utilized, the logical measure of production for our purpose is in terms of labor time.

If it is granted that for the purposes here set forth labor may be regarded as homogeneous, then the measures of relative volumes of labor time employed and relative average unit labor requirements are conceptually simple and readily deducible. They provide answers to specific questions concerning volumes of labor time actually utilized or required under varying conditions in terms of ratios of *aggregates of labor time*. The fact that the output of different products is measured in diverse physical units precludes, however, a similar direct measurement of aggregate production or of aggregate production per unit of labor. The only meaningful measure of production for any one period would be an inventory, or listing, of the physical output of each product. To measure relative changes of the total output of different products it is first necessary to select an economic or physical attribute common to all products. Reduced to this common additive unit the aggregate volume of production is hardly meaningful unless compared with aggregates of other years similarly obtained. Since the total volume of production in absolute terms for any one period has no independent meaning, the measurement of its movement must be related to changes in the aggregates of the selected attribute.

It has already been seen that the criterion for comparing the relative importance of different products is, for a study of employment fluctuations, the number of man-hours required to produce a unit of each product. However, the method of using these man-hours as weights and the type of average must be determined with relation to a more specific definition of the purpose. Thus, while the measure of production of diverse physical products must be measured as relatives, the measure should have meaning in terms of aggregates of labor time and should satisfy the questions posed on page 3. Hence the necessary index of production is one which, when divided into the relatives of total man-hours, will yield an index of unit

⁵ See, for instance, Arthur F. Burns, "The Measurement of the Physical Volume of Production," *The Quarterly Journal of Economics*, Vol. XLIV (Feb. 1930), p. 251; Edward E. Lewis, "Some Basic Problems in Index-Number Theory," *Economic Essays in Honor of Wesley Clair Mitchell* (New York: Columbia University Press, 1935), pp. 271-8; Gottfried Haberler, *Der Sinn der Indexzahlen* (Tübingen: J. C. B. Mohr, 1927), pp. 64-8.

labor requirements which is expressed in terms of ratios of aggregates of labor time and which measures the relative volume of labor time required to produce a given composite of products. The same measure of labor requirements for a given composite of products should be obtained either by (1) aggregating the labor requirements for the individual items of a given composite of products and reducing these aggregates to relatives or by (2) dividing the relatives of total man-hours by the proper index of production. That is, $L = \frac{M}{Q}$, where L represents the index of unit labor requirements, M the relatives of total man-hours, and Q the production index.

Similarly, the same measure of productivity (which is the reciprocal of the measure of unit labor requirements) should be obtained whether (1) the relatives of productivity for the various products are averaged with appropriate weights or (2) the index of production is divided by the relatives of total man-hours. That is, $\Pi = \frac{Q}{M}$, where Π represents the index of productivity.

The necessity for clearly defining the criterion for measuring changes in the volume of diverse products may be seen in the following illustration for the Cigars and Cigarettes industries (table I). The index of average unit labor requirements for the two industries combined derived from a production index with value weights is higher in 1926 than the unit-labor-requirements index for either industry; after 1929 the index of average unit labor requirements for both industries is lower than that for either. The index of production with value weights results in a measure of unit labor requirements which understates the amount of labor required after 1929 to produce the 1929 volume of cigars and cigarettes. On the other hand, the unit-labor-requirements index obtained from the production index with man-hour weights measures the percentage of the labor time utilized in 1929 that would have been required in any year to produce the 1929 output.

Changes in the labor requirements per unit for a group of products arise out of the joint operation of two factors: changes in the labor requirement per unit of output of the several products and changes in the relative volume of output of the several products. Thus, in order to analyze changes in the unit labor requirements for a group of products, it is

Table 1.- ILLUSTRATION OF DIFFERENCES IN UNIT-LABOR-REQUIREMENT INDEXES DERIVED FROM PRODUCTION INDEXES CONSTRUCTED WITH VALUE AND MAN-HOUR WEIGHTS
Cigars and Cigarettes, 1919-36

Year	Index of unit labor requirements (1929=100)			
	Cigars	Cigarettes	Cigars and Cigarettes combined, based on a production index with ^a -	
			Value weights	Man-hour weights
1919	122.9	323.3	222.0	150.8
1920	110.0	348.2	233.1	143.2
1921	125.9	259.2	214.6	144.3
1922	123.7	227.4	200.5	138.1
1923	121.7	182.4	176.4	130.1
1924	116.4	164.5	158.2	123.1
1925	116.1	145.7	144.9	120.3
1926	109.8	123.8	128.1	111.7
1927	112.5	129.4	127.3	114.8
1928	109.2	129.7	117.8	112.1
1929	100.0	100.0	100.0	100.0
1930	101.5	95.0	94.5	100.7
1931	86.7	92.6	80.2	87.6
1932	85.4	89.9	81.3	84.6
1933	88.2	81.6	70.9	87.3
1934	79.2	98.3	64.3	81.9
1935	66.5	68.6	52.8	69.6
1936	63.9	73.3	47.9	65.2

^aThe production index for Cigars and Cigarettes with man-hour weights was constructed so that the measure of unit labor requirements obtained by dividing this production index into relatives of man-hours would indicate the volume of labor required to produce the 1926 quantities of cigars and cigarettes in each year as compared with the volume of labor actually utilized in 1929. The formula for this production index is presented later; the index with value weights is of the same form.

necessary to eliminate the factor of changing composition of production and to formulate questions only in terms of a given composite of production.

The term "composite" or "production composite" is used here to mean a specific distribution of productive activities, that is, fixed quantities of specified products. In this study it refers to the production schedule of a manufacturing industry or group of industries. The selection of a "given composite"

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for which average unit labor requirements are to be measured does not represent a statistical problem alone but one which depends primarily upon the purpose of the economic analysis. Two alternative types of production composite have been selected for this study. One, which refers to the base year, is used throughout the period for which the index is constructed; it is designated here as a "base-year" or "fixed" composite. The other, which refers to each of the years for which the index is constructed, is different for every comparison with the base year; in other words, the index number for each year involves the composite of that year. This composite, which refers to every year of the period in turn, is designated in this report as a "changing" composite. The usefulness of measures based on the alternative composites will be discussed later in this chapter.

THE DEVELOPMENT OF MEASURES OF AVERAGE UNIT LABOR REQUIREMENTS

The first question posed on page 3 assumes two forms. What relative volumes of labor time are required to produce the base-year composite of products at different times? What relative volumes of labor time are required to produce the changing production composite at different times?

The first form of this question describes a measure of the relative volumes of labor time that would have been required if the same quantities of each product had been produced in each year as were produced in the base year. If the index number of unit labor requirements is 90, then we may say that 10 percent less labor is required to produce the quantities of the base year. The measure of average unit labor requirements for the base-year production composite should indicate the ratio of (1) the volume of labor required to produce the base-year quantities of the several products with the unit labor requirements of each year to (2) the actual volume of labor utilized in the base year. This measure is therefore an aggregative index of the unit labor requirements for the several products weighted by the corresponding quantities manufactured in the base year. An equivalent form of this index is an arithmetic mean of the relatives of unit labor requirements for the several products weighted by the corresponding

volumes of labor time utilized in their production in the base year.⁴

The second form of the question describes a measure of the relative volumes of labor that would have been required if the same quantities had been produced in the base year as were produced in each year. The index of average unit labor requirements for the changing production composite should indicate the ratio of (1) the volume of labor actually utilized in each year to (2) the volume of labor necessary for the same production composite with the unit labor requirements of the base year. The desired index is therefore an aggregative index of the unit labor requirements for the several products weighted by the corresponding quantities manufactured in each year. An equivalent form of this index is a harmonic mean of the relatives of unit labor requirements for the several products weighted by the corresponding volumes of labor time utilized in each year.⁵

⁴Let $l^i, l^{ii}, l^{iii}, \dots$ = the unit labor requirements for products a, b, c, \dots ;
 $q^i, q^{ii}, q^{iii}, \dots$ = the quantities of a, b, c, \dots produced; and
 $m^i, m^{ii}, m^{iii}, \dots$ = the man-hours utilized in the production of $q^i, q^{ii}, q^{iii}, \dots$

Then the volume of labor required to produce the quantities of the base year (indicated by the subscript o), assuming the unit labor requirements of any other year (indicated by the subscript i) =

$$l_i^i q_o^i + l_i^{ii} q_o^{ii} + l_i^{iii} q_o^{iii} + \dots = \sum l_i q_o;$$

and the volume of labor required in the base year to produce the quantities of the base year =

$$l_o^i q_o^i + l_o^{ii} q_o^{ii} + l_o^{iii} q_o^{iii} + \dots = \sum l_o q_o.$$

The ratio between these two volumes of labor is the desired index of unit labor requirements for the base-year production composite:

$$\frac{\sum l_i q_o}{\sum l_o q_o} = L_1 \quad (1)$$

Expressed as a mean of relatives of unit labor requirements the aggregative index (1) becomes

$$\frac{\sum \left[\frac{l_i}{l_o} m_o \right]}{\sum m_o} = L_1 \quad (1a)$$

⁵The volume of labor utilized in any year =

$$l_i^i q_i^i + l_i^{ii} q_i^{ii} + l_i^{iii} q_i^{iii} + \dots = \sum l_i q_i;$$

and the volume of labor required to produce the same composite, assuming the unit labor requirements of the base year, =

$$l_o^i q_i^i + l_o^{ii} q_i^{ii} + l_o^{iii} q_i^{iii} + \dots = \sum l_o q_i.$$

The ratio between these two volumes of labor is the desired index of average unit labor requirements for the changing composite:

$$\frac{\sum l_i q_i}{\sum l_o q_i} = L_2 \quad (2)$$

Expressed as a mean of relatives of unit labor requirements, the aggregative index (2) becomes

$$\frac{\sum m_i}{\sum \left[\frac{l_o}{l_i} m_i \right]} = L_2 \quad (2a)$$

THE DEVELOPMENT OF MEASURES OF PRODUCTIVITY

The first type of index of unit labor requirements measures the relative volumes of labor time required to produce the base-year composition of production. The reciprocal of this index, or the index of productivity, measures the relative changes in the volume of the base-year production composite obtainable at different times with the base-year expenditure of labor time. This index of productivity is equivalent to a harmonic mean of the productivity relatives for the several products weighted by the corresponding volumes of labor time utilized in the base year.⁶

This formula indicates the change in the output of each product obtainable with the labor expenditure of the base year and the productivity of each year. Thus, if the productivity index (1929=100) were 120 in 1936, one could say that, because of productivity changes, 20 percent more of each product would have to be produced in 1936 in order to employ the same number of man-hours that was employed in 1929.

The index of productivity which measures the relative changes in the volume of the production composite of each year obtainable at different times with the current-year expenditure of labor time is the reciprocal of the index of unit labor requirements for the changing composite of production. It may also be computed as an arithmetic mean of productivity relatives of the several products weighted by the corresponding volume of labor time utilized in each year.⁷ If in 1936 the

$$^6 \quad \frac{1}{L_1} = \frac{\sum l_0 q_0}{\sum l_1 q_0} = \Pi_1 \quad (3)$$

where Π_1 is the index of productivity.

Expressed in terms of productivity relatives for the individual products, the index (3) becomes

$$\frac{\sum m_0}{\sum \left[\frac{\pi_0}{\pi_1} m_0 \right]} = \Pi_1 \quad (3a)$$

where π (the productivity of a single product) = $\frac{1}{l}$.

$$^7 \quad \frac{1}{L_2} = \frac{\sum l_0 q_1}{\sum l_1 q_1} = \Pi_2 \quad (4)$$

Expressed in terms of productivity relatives for the individual products, the index (4) becomes

$$\frac{\sum \left[\frac{\pi_1}{\pi_0} m_1 \right]}{\sum m_1} = \Pi_2 \quad (4a)$$

productivity index were 110 (1929=100), one could say that to employ the 1936 man-hours in the base year with the base-year productivity it would have been necessary to produce 91 percent (100÷110) of the 1936 output of each product.

**THE DEVELOPMENT OF PRODUCTION INDEXES SUITABLE
FOR MEASUREMENT OF PRODUCTIVITY**

The production index for a group of products suitable for the measurement of productivity is one which, when divided by the man-hours series, will yield the same index of productivity that could be obtained by averaging the relatives of output per man-hour for the several products.

As we have seen, the index of productivity measures changes in the volume of a given production composite obtainable at different times with a constant labor expenditure. Multiplication of the index of productivity by relatives of man-hours yields a measure of production that reflects (1) changes in productivity and (2) changes in labor expenditure. Thus if the changes in productivity are such that 50 percent more of each product can be made by the same labor, and if in addition twice as much labor is used, then the total output will be three times as great (1.5×2.0) as before. The index may also be interpreted in a different fashion. A threefold increase in production may indicate that if productivity did not change, three times as much labor would be required. If, however, during the same period productivity increased 50 percent, then only twice as much labor (300÷150) would be used.

Changes in unit labor requirements (or productivity) between two years are measured in terms of the same production composite and expenditure of labor, and in a complementary fashion production changes between two years are measured in terms of the same unit labor requirements (or productivity) for each product. The first index of productivity presented above measures productivity changes for the base-year production composite and labor expenditure. Multiplication of this productivity index by the index of man-hours yields an index of production measured in terms of the unit labor requirements of each year. This production index may be computed directly from the quantity series for individual products either by aggregating quantities and reducing them to relatives or by averaging relatives of these quantities. The two equivalent

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formulas are (1) an aggregative index of the quantities of the several products weighted by their respective unit labor requirements in each year and (2) a harmonic mean of the production relatives for the several products weighted by the corresponding volumes of labor utilized in each year.⁸

The second index of productivity measures changes in productivity in terms of the changing production composite. This index when multiplied by an index of man-hours yields an index of production which is measured in terms of the base-year unit labor requirements. The two equivalent formulas for this measure of production are (1) an aggregative index of the quantities of the several products weighted by the corresponding unit labor requirements in the base year and (2) an arithmetic mean of the production relatives for the several products weighted by the corresponding volumes of labor utilized in the base year.⁹

USE OF THE ALTERNATIVE MEASURES FOR ECONOMIC ANALYSIS

For both unit labor requirements and productivity, two alternative measures have been presented, one for the base-year and the other for the changing production composite. The selection of the composite to be used depends principally upon the economic characteristics of the period under consideration. Thus the use of a base-year composite has greater significance under relatively stable conditions of production and is usually

⁸ $Q_1 = \frac{M}{L_1}$, where Q_1 is the index of production consistent with L_1 (or Π_1) and M is

the index of labor time utilized in the industry. Then

$$Q_1 = \frac{\sum l_i q_i}{\sum l_o q_o} + \frac{\sum l_i q_o}{\sum l_o q_o} = \frac{\sum l_i q_i}{\sum l_i q_o} \quad (5)$$

The aggregative index (5) expressed as a mean of relatives becomes

$$\frac{\sum m_i}{\sum \left[\frac{q_o}{q_i} m_i \right]} = Q_1 \quad (5a)$$

⁹ $Q_2 = \frac{M}{L_2}$, where Q_2 is the index of production consistent with L_2 . Then

$$Q_2 = \frac{\sum l_i q_i}{\sum l_o q_o} + \frac{\sum l_i q_i}{\sum l_o q_i} = \frac{\sum l_o q_i}{\sum l_o q_o} \quad (6)$$

The aggregative index (6) expressed as a mean of relatives becomes

$$\frac{\sum \left[\frac{q_i}{q_o} m_o \right]}{\sum m_o} = Q_2 \quad (6a)$$

more appropriate in dealing with relatively short periods of time. There are, however, certain times when the use of a base-year composite may be significant even in periods characterized by shifts in the composition of production. For instance, if the objective were to determine how much labor would be required if we again attained the 1929 volume and composition of production, the base-year (in this case 1929) production composite would have to be used. Despite the changed relative importance of the consumers'-goods and capital-goods sections, one may nevertheless assume that when 1929 volumes of production are again attained the composition of production would revert to one similar to that of 1929. Such an assumption would then permit the construction of measures for the 1929 production composite. Should, however, analysis of present conditions indicate that today's composition of production, rather than that of 1929, is likely to be typical of the future, then the questions would have to be formulated in terms of the composition of production in a more recent year, or in terms of a changing composition of production. When the changing composition of production is in a definite direction, not random, then the question posed in terms of the changing composite is a more appropriate one. The use of a base-year composite has the advantage of permitting comparisons between any two years, since the changes in the required volume of labor in each year are measured relative to the same base-year composite.

The use of a changing composite does not, however, theoretically permit year-to-year comparisons and can only be used to measure the change between the base year and any other year. Such an index has analytical value particularly in periods of major shifts in the composition of production, and is usually more suitable for studying relatively long periods.¹⁰

It is of interest to compare indexes of average unit labor requirements and productivity for both the changing and fixed composition of production. The difference in any year between indexes for changing and fixed composites reflects the effects

¹⁰Another suitable formula for relatively long periods characterized by significant changes in the production pattern is a chain index which takes into account the year-to-year change in the production composite, rather than the change from base year to current year. "The only method of index construction that will progressively take account of the continuous changes in the composition of the productive output is that of index splicing." (Burns, *op. cit.*, p. 258.)

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of changes in the composition of production with respect to the base year. The greater the difference between the two composites, the greater the divergence between the indexes. Index numbers constructed for either composite will give the same result (1) if the percentage change of the quantity of production of each product as measured from the base year is the same¹¹ or (2) if the percentage change in labor requirements (or productivity) of each product is the same.¹² The difference in the results given by the two formulas for the same period reflects the joint changes in the unit labor requirements (or productivity) and the output of the various products.¹³

¹¹If each $q_i = kq_0$, then

$$L_2 = \frac{\sum l_i q_i}{\sum l_0 q_i} = \frac{\sum l_i [kq_0]}{\sum l_0 [kq_0]} = \frac{\sum l_i q_0}{\sum l_0 q_0} = L_1.$$

¹²If each $l_i = cl_0$, then

$$L_2 = \frac{\sum l_i q_i}{\sum l_0 q_i} = \frac{\sum [cl_0] q_i}{\sum l_0 q_i} = c;$$

$$L_1 = \frac{\sum l_i q_0}{\sum l_0 q_0} = \frac{\sum [cl_0] q_0}{\sum l_0 q_0} = c.$$

¹³Generalized formulations of these relationships may be presented in mathematical terms. For example, the percentage difference between the two indexes of unit labor requirements $\left(\frac{L_2 - L_1}{L_1}\right)$ may be expressed as the product of three factors:

- (1) The ratio of the weighted standard deviation of the unit-labor-requirement relatives $\left(\frac{l_i}{l_0}\right)$ to L_1 ,
- (2) The ratio of the weighted standard deviation of the production relatives $\left(\frac{q_i}{q_0}\right)$ to Q_2 , and
- (3) The weighted coefficient of correlation between the unit-labor-requirement relatives $\left(\frac{l_i}{l_0}\right)$ and the production relatives $\left(\frac{q_i}{q_0}\right)$, where the deviations are measured from L_1 and Q_2 , respectively.

The weights in each case are the man-hours utilized for each product in the base year. Since all the factors but the coefficient of correlation are necessarily positive, the sign of this coefficient determines the sign of the difference. If r is zero, the two indexes are equal; if it is positive, the index for the changing composite is greater; and if it is negative, the index for the fixed composite is greater. Similar analyses can be made for the productivity and production formulas.

See H. Staehle, "International Comparison of Food Costs," *International Comparisons of Cost of Living, Studies and Reports: Series N (Statistics) No. 20* (Geneva: International Labour Office, 1934), pp. 14-8; L. von Bortkiewicz, "Die Kaufkraft des Geldes und ihre Messung," *Nordic Statistical Journal*, Vol. 4 (1932), Parts 1-2, pp. 1-68; L. von Bortkiewicz, "Zweck und Struktur einer Preisindexzahl," *Nordis Statistiska tidskrift*, Vol. 2 (1923), Part 3-4, pp. 369-408; Vol. 3 (1924), Part 2-3, pp. 208-51; Part 4, pp. 494-516. See also Lewis, *op. cit.*, pp. 292-3 and W. M. Persons, *The Construction of Index Numbers* (Boston, Mass.: Houghton Mifflin Co., 1928), pp. 33-6.

It is possible that even when there are changes in the composition of production and even when the productivity relatives diverge sharply, the two formulas for productivity will not differ appreciably. The differences will be pronounced when there is a distinct correlation in the relative

Table II.- ILLUSTRATION OF DIFFERENCES IN PRODUCTIVITY INDEXES BASED ON FIXED AND CHANGING PRODUCTION COMPOSITES

Item	Year		Percentage change
	First	Second	
CASE 1			
Production (units)			
Product A	100	200	+100
Product B	50	60	+ 20
Man-hours			
Product A	200	200	0
Product B	75	72	- 4
Output per man-hour			
Product A	0.50	1.00	+100
Product B	0.67	0.83	+ 17
Index of productivity in second year (first year=100) for production composite of -			
Base (first) year - - - - -			171.9
Second year - - - - -			180.1
CASE 2			
Production (units)			
Product A	100	120	+ 20
Product B	50	100	+100
Man-hours			
Product A	200	120	- 40
Product B	75	120	+ 60
Output per man-hour			
Product A	0.50	1.00	+100
Product B	0.67	0.83	+ 17
Index of productivity in second year (first year=100) for production composite of -			
Base (first) year - - - - -			171.9
Second year - - - - -			162.5

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changes of production and productivity of the individual products. Thus, if productivity increases more rapidly for those products showing a more rapid rise in production, the productivity index for the changing composite will be higher than the index for the base-year composite. A hypothetical illustration for two products is shown in table II. In case 1, since the percentage rise for both production and productivity is greater for product A, the index of productivity for the changing composite is higher than the index for the base-year composite. In case 2, however, since the percentage rise in production is higher for product B, which has a smaller percentage increase in productivity, the index of productivity for the base-year composite is higher than for the changing composite.

A practical illustration of the analytical value of the two formulas when used in conjunction with each other follows. This illustration is based on quinquennial series for output per wage earner in 32 manufacturing industries from 1899 to 1914.¹⁴ Two indexes of average productivity were constructed from these series, one for the 1899 (base-year) composite and one for the changing composite:

Year	Index of output per wage earner for 32 industries (1899=100)	
	Fixed (base- year) composite	Changing composite
1899	100.0	100.0
1904	104.1	105.4
1909	103.5	110.0
1914	111.7	127.9

The significant differences, which occur in the years 1909 and 1914, reflect major changes in the structure of the manufacturing economy. As may be seen from the following indexes computed for all 32 industries except Motor Vehicles, one of these major changes was the phenomenal rise of the Motor Vehicles industry after 1909:

¹⁴The series for production and output per wage earner are published in Frederick C. Mills, *Economic Tendencies in the United States* (New York: National Bureau of Economic Research, 1932), p. 33. Mills presents data for 35 industries. For three of these, however, index numbers are not shown for each of the census years in the 1899-1914 period; all computations, therefore, are based upon data for 32 industries only. The necessary weights (the number of wage earners in each industry) were obtained from the *Census of Manufactures*.

Year	Index of output per wage earner for 31 industries (1899=100)	
	Fixed (base- year) composite	Changing composite
1899	100.0	100.0
1904	104.1	105.4
1909	103.5	110.0
1914	111.6	118.8

The index with base-year weights was changed only 0.1 unit by the exclusion of the Motor Vehicles industry. Since the Motor Vehicles industry was insignificant in 1899 (0.1 percent of total employment of the industries in this composite), this index, which presents relative changes in productivity for the composite of production for 1899, does not reflect the effect of the growth and rapidly increasing productivity of the Motor Vehicles industry. When, on the other hand, the index with changing weights includes the Motor Vehicles industry, it reflects the effect of the rapidly rising production in this industry between 1909 and 1914; the industry was given its 1909 weight in the average when 1899 was compared with 1909, and its 1914 weight when 1899 was compared with 1914.

Even when the Motor Vehicles industry is excluded there is a considerable difference between the indexes given by the two formulas. The difference reflects the fact that production generally increased more rapidly in those industries with the higher rates of productivity change. This may be seen in table III, in which the industries represented in the above indexes are distributed according to their rates of increase in production and productivity.

Here, then, the value of using both formulas together may be seen clearly. Each answers a specific question. Together they give added significance to the analysis of productivity changes, since they reflect the influence of the changing composition of production.

Taken together the measures have still another use. There is often a practical value in selecting one measure in describing a given period. The selection of this measure will depend upon the extent of dispersion in the fluctuations of production and productivity. The difference between the two measures affords a good test of the effect of these dispersions. Should

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Table III.- DISTRIBUTION OF 32 MANUFACTURING INDUSTRIES BY CHANGE IN PRODUCTION AND IN OUTPUT PER WAGE EARNER BETWEEN 1899 AND 1914^a

Percentage increase in output per wage earner	All industries	Percentage increase in production						
		Less than 10 ^b	10-19.9	20-49.9	50-99.9	100-149.9	150-199.9	200 or over
All industries	32	5	3	3	7	6	3	5
100 or over	7	1			2	1		3
50-99.9	4					2	1	1
30-49.9	6	1			1	1	2	1
20-29.9	4		1		2	1		
10-19.9	5			2	2	1		
Less than 10 ^c	6	3	2	1				

^aDerived from Frederick C. Mills, *Economic tendencies in the United States* (New York: National Bureau of Economic Research, 1932), pp. 30, 33.

^bIncludes three industries in which production decreased.

^cIncludes five industries in which productivity decreased.

the proportional difference between these two measures be small, we would know that the effect of shifts in the composition is small. Should, however, large differences exist between these two which reflect significant changes in the production pattern, the questions with reference to the changing composite would have further significance.

It might be suggested that "compromise" formulas, such as a geometric average, could overcome the "paradox" of two different measures for the same concept. Such a compromise formula has been avoided for a definite reason. The position taken here is that no "true" measure of productivity or production can be obtained for a group of diverse products, since no such thing exists in reality. The measures of production and productivity should not be considered approximations of an ideal reality. Implicitly or explicitly, different measures for the same concept answer different questions. The usefulness of quantitative measures of dynamic, diverse economic elements depends upon a clear understanding of the questions they answer. The more clearly the purpose, meaning, and applicability of measures of production and productivity are understood, the greater their usefulness. The measures developed here answer two variants of the same question, but they have

distinct meanings and meet different purposes. A compromise formula is not a more correct measure but rather the answer to a different question. One might likewise select another definition of the composite, as, for instance, an average of the base and any other year or an average of several years. The selection of the composite would depend, naturally, upon a more concrete definition of the purpose or the conditions of the period to be analyzed. If the basic purpose of measuring productivity and production is to use these measures for studies other than employment and unemployment (such as a study of the utilization of national resources, of changes in potential productive capacity, or of national-income movements), the questions asked and the development of methods to be used to answer these questions would, naturally, be different.

CHAPTER II

SCOPE OF SURVEY, SOURCES, AND GENERAL METHODS

In the development of the production and productivity measures in chapter I the problem of obtaining the required statistics was not considered. Since the available data were collected for purposes other than ours, numerous compromises and adjustments were necessary in adapting these data for use in the construction of the indexes of production, employment, man-hours, output per wage earner, and output per man-hour shown in Part Two.¹ These indexes represent the closest approximations to the formulas that could be derived with the available statistics.

This chapter is devoted to a discussion of the common sources of the statistics, the problems confronted in the construction of indexes conforming to the standards developed in chapter I, and the general methods of treating the data. Since the nature of the available statistics varied from industry to industry, the sources, problems, and methods peculiar to each are described in detail in Part Two.

In general, although fairly detailed production data can be obtained, the available employment² statistics refer to workers engaged in the manufacture of aggregates of more or less related products. Consequently the productivity index can in almost every instance be constructed only as the quotient of a production index for a group of products and the corresponding labor index. The only weights which could usually be estimated for this production index, furthermore, represent approximations to the relative labor requirements for the base year. This does not mean, however, that the (fixed) weights were always derived from statistics for the base year. Series of such substitute weighting factors were not used as changing weights, however, since there was no reason to believe that

¹No indexes of average unit labor requirements were constructed. These, however, are merely reciprocals of the productivity indexes shown in the summary tables of Part Two.

²"Employment" is commonly used throughout this report to refer to wage earners. The figures for man-hours, usually derived from the employment statistics and corresponding series of average weekly hours, have the same scope as the employment series. The term "labor" is frequently used to designate wage earners, man-hours, or both.

they reflect the year-to-year changes in the relative labor requirements of the various products.³

The discussion hereafter will be devoted principally to the methods of constructing the NRP production and labor indexes for the 59 manufacturing industries and the 13 industry groups.⁴ Unless otherwise indicated, the productivity indexes are quotients of these. All the NRP measures are annual. Most of them extend from 1919 to 1936, but, as will be seen later, not all are continuous. The base year is 1929. This year was selected because it is a natural dividing point of the post-war period and because practical questions concerning changes in productivity (or unit labor requirements), employment, and production usually involve comparison with 1929.

THE NRP INDUSTRY AND GROUP TITLES

Since labor statistics could not usually be obtained for individual products, an attempt was made to construct comparable production and labor indexes for the smallest possible combination of products. This combination of products or the aggregation of establishments manufacturing them was designated an NRP "industry." The Bureau of the Census (United States Department of Commerce) collects and publishes the most comprehensive production and employment statistics which are more or less comparable in scope; the industry definitions selected by NRP are therefore, with few exceptions, the same as or modifications of the industry definitions in the biennial *Census of Manufactures*.⁵ Indeed, the Census provided the basic production and employment statistics for some or all of the odd-numbered years for 41 of the 59 NRP manufacturing industries. It also provided the basic employment statistics

³See discussion of "Weights Used in Construction of NRP Production Indexes."

⁴The indexes for two nonmanufacturing industries, Electric Light and Power and Telephones, are discussed in Part Three, appendix B.

⁵The *Census of Manufactures* has been published biennially since 1919. It was published quinquennially from 1899 to 1919 and decennially prior to 1899. For the sake of brevity, "Census" is used throughout this report as equivalent to "Bureau of the Census"; when "Census data" are referred to without mention of the specific source, they are invariably derived from the *Census of Manufactures*. Similarly, "Census" is sometimes used for "Census of Manufactures"; and no distinction is made between the usual biennial reports and those incorporated as separate volumes in the Fourteenth and Fifteenth Decennial Censuses (i. e., vol. I for 1919 and vol. II of the series of three volumes for manufactures for 1929). Finally, a "census year" is an odd-numbered year for which the Census made a canvass; and an "inter-censal year" is an even-numbered year for which no canvass was made.

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for nine of the remaining industries and the basic production statistics for five others.⁶

The Census definition is based on the establishment as the reporting unit. Thus an industry usually embraces establishments whose products of chief value (intended for sale) are either the same or related.⁷ It should be noted that the types of establishments and the number and degree of detail of the primary products are not uniform for all the industries which the Census distinguishes.

A "group" or "industry group" refers to a combination of two or more NRP industries which either consume similar raw materials or manufacture related products. It should be distinguished from the same Census term, which connotes 1 of the 16 categories in which the 300-odd manufacturing industries canvassed biennially are classified. An NRP group originates in (1) the subdivision of a Census industry into units of smaller area, (2) the explicit recognition of well-defined subdivisions of a Census industry for which supplementary

⁶ Production and employment statistics for 37 of the 41 industries and production statistics only for the remaining 4 were derived from the *Census of Manufactures*. The basic employment statistics for these four, which are the component industries of the Glass group, were supplied in an unpublished Census tabulation.

The four industries not accounted for in the enumeration are: (1) Beet Sugar, for which no satisfactory wage-earner index could be constructed; (2) Electric Lamps, for which W. Bowden, *Technological Changes and Employment in the Electric-Lamp Industry* (U. S. Dept. Labor, Bur. Labor Statistics, Bull. No. 593, 1933), supplied both the production and labor statistics for all years; and (3) Logging Camps and (4) Sawmills and Saw-Plane Mills, the production and employment series for which are based on various estimates in addition to Census statistics.

Two of the nine industries for which the Census provided the basic employment figures, Beehive Coke and Byproduct Coke, are really defined according to the scope of the production statistics, which were supplied by the Bureau of Mines. As a consequence, a small amount of duplication results in the area covered by Manufactured Gas, which is based primarily on Census production and employment statistics, and Byproduct Coke.

⁷ The establishment, which usually consists of one plant or, sometimes, of more than one operated under the same ownership in the same locality, is, with few exceptions, assigned by the Census to only one industry on the basis of the product or products of chief value. (In accordance with Census practice, the terms "products of chief value", "primary products", and "products normally belonging to the industry" are used synonymously throughout this report. Products not normally belonging to an industry are sometimes also referred to as its "secondary products.") One exception is the Newspaper and Periodical Printing and Publishing industry, which includes establishments doing any printing or publishing, regardless of the importance of such activities as measured by the income derived. Another is the Flour and Other Grain-Mill Products industry, which includes plants doing any merchant milling whatever, even if their major activity is custom milling; establishments engaged solely in custom grinding are, however, excluded. Since 1927 the Census has classified mills engaged in the production of both paper and pulp in the two industries of the same names and has distributed the output and employment accordingly. (From the Census schedule for 1937 it appears that the practice for Paper and Pulp has become the general rule.)

In addition to Byproduct Coke and Manufactured Gas, three other pairs of NRP industries have primary products in common: Biscuit and Crackers and Bakery Products Other Than Biscuit and Crackers; Electric Lamps and Pressed and Blown (Glass) Ware; and Planing-Mill Products and Sawmills and Saw-Plane Mills. The three components of the Nonferrous Metals group also have some primary products in common.

Table IV.- NRP MANUFACTURING INDUSTRIES AND GROUPS AND CORRESPONDING CENSUS DESIGNATIONS IN 1929^a

Number and NRP industry or group title	Census industry title
1. Agricultural Implements	Same
2. Beet Sugar ^b	Same
3. Boots and Shoes	Boots and Shoes, Other Than Rubber
4. Bread and Other Bakery Products Group	Same
5. Biscuit and Crackers	Same
6. Bakery Products Other Than Biscuit and Crackers	Same
7. Cane-Sugar Refining	Same
8. Canning and Preserving Group	Same
9. Canned and Preserved Fruits and Vegetables	Canning and Preserving - Fruits and Vegetables, Pickles, Jellies, Preserves, and Sauces
10. Canned and Cured Fish	Canning and Preserving - Fish, Crabs, Shrimps, Oysters, and Clams
11. Cement	Same
12. Chemicals	(Chemicals, Not Elsewhere Classified (Compressed and Liquefied Gases
13. Clay Products (Other Than Pottery) and Nonclay Refractories	Same
14. Coke Group	(Coke, Not Including Gas-House Coke (Byproduct plants of city gas companies in Gas, Manufactured: Illuminating and Heating
15. Beehive Coke	Same
16. Byproduct Coke	All byproduct ovens classified in - (Coke, Not Including Gas-House Coke (Gas, Manufactured: Illuminating and Heating
17. Confectionery	Same
18. Cotton Goods ^c	Same
19. Electric Lamps	Included in - Glass Electrical Machinery, Apparatus, and Supplies
20. Fertilizers	Same
21. Flour and Other Grain-Mill Products	Same
22. Furniture	Same
23. Glass Group ^d	Same
24. Window Glass	-
25. Plate Glass	-
26. Glass Containers	-
27. Pressed and Blown Ware	-
28. Ice Cream	Same
29. Iron and Steel Group	Same
30. Blast Furnaces	Same
31. Steel Works and Rolling Mills	Same
32. Knit Goods Group	Same
33. Hosiery	Same
34. Underwear	Same
35. Outerwear	Same
36. Knit Cloth	Same
37. Leather Group	Leather: Tanned, Curried, and Finished
38. Sole and Harness Leather	-
39. Side and Upholstery Leather	-
40. Calfskin	-
41. Kid Leather	-
42. Sheep and Miscellaneous Leather	-
43. Lumber and Fiber Products Group	Same
44. Logging Camps	-
45. Sawmills and Saw-Plane Mills	-
46. Manufactured Gas	Gas, Manufactured: Illuminating and Heating
47. Manufactured Ice	Same
48. Motor Vehicles	(Motor Vehicles (Motor-Vehicle Bodies and Motor-Vehicle Parts
49. Newspaper and Periodical Printing and Publishing	Same
50. Nonferrous Metals Group	Same
51. Primary Smelters and Refineries	Smelting and Refining - Copper, Lead, and Zinc
52. Secondary Smelters and Refineries	Smelting and Refining - Metals Other Than Gold, Silver, or Platinum, Not From the Ore
53. Alloys, Rolling Mills, and Foundries	Nonferrous-Metal Alloys and Products, Not Including Aluminum Products
54. Paints and Vernishes	Same
55. Paper and Pulp Group	Paper and Pulp (Wood and Other Fiber)
56. Paper	Same
57. Pulp	Pulp (Wood and Other Fiber)
58. Petroleum Refining	Same
59. Planing-Mill Products	Same
60. Rayon	Rayon and Allied Products
61. Rubber Products Group	Same
62. Rubber Tires and Inner Tubes ^d	Rubber Boots and Shoes Rubber Goods, Other Than Tires, Inner Tubes, and Boots and Shoes
63. Other Rubber Goods ^d	Silk and Rayon Manufactures (Meat Packing, Wholesale (Sausage, Meat Puddings, Headcheese, Etc., and Sausage Casings
64. Silk and Rayon Goods	
65. Slaughtering and Meat Packing	

^aSee footnotes at end of table.

**Table IV. - NRP MANUFACTURING INDUSTRIES AND GROUPS AND
CORRESPONDING CENSUS DESIGNATIONS IN 1929^a - Continued**

Number and NRP industry or group title	Census industry title
66. Tobacco Products Group	Tobacco Manufactures
67. Cigars	Cigars and Cigarettes
68. Cigarettes ^b	
69. Chewing and Smoking Tobacco and Snuff ^c	Same
70. Woolen and Worsted Goods Group	Same
71. Woolen Goods ^d	Same
72. Worsted Goods ^d	Same

^aIn this table, typographical and other stylistic differences between the NRP and Census designations are ignored. Some of the Census designations have been changed since 1929.

^bThree sets of indexes are shown for Beet Sugar in Part Two: one for the fiscal year beginning March 1; one for the "campaign", the period of sugar refining; and one for the "inter-campaign", the remainder of the fiscal year.

^cThree sets of indexes are shown for Cotton Goods in Part Two: one for the United States as a whole and one for each of the two principal manufacturing regions, New England and the Cotton-growing States.

^dThe NRP definition (on a production basis) is a modification of the Census definition (on an establishment basis).

statistics are obtainable from other sources, or (3) the combination of industries defined as such by the Census.⁸

The names and numbers assigned to the 59 manufacturing industries and the 13 groups, together with the corresponding Census designations in 1929 are shown in table IV.

COMPARABILITY OF PRODUCTION AND LABOR INDEXES

The formulas presented in chapter I require that the production and labor indexes be strictly comparable in scope. Such comparability, however, is difficult to achieve because of the form of the available production statistics and the Census' use of the establishment as the basis for industry definition. A brief review of the difficulties and the attempts made to overcome them follows.⁹

First, the establishments classified in any industry are engaged not only in the manufacture of the products normally belonging to that industry but also to a greater or lesser degree in the manufacture of products normally belonging to other industries. While the Census reports employment

⁸The Lumber and Timber Products group originated in the subdivision of the Census industry of the same name into Logging Camps and Sawmills and Saw-Plane Mills. The Paper and Pulp group was established in the same manner by the separation of the component industries for the odd-numbered years 1919-25. Two Census industries were resolved into smaller units by the use of extensive unpublished employment statistics: (1) Glass (by means of a special tabulation of the Bureau of the Census) and (2) Leather: Tanned, Curried, and Finished (by means of statistics collected by NRP in cooperation with BLS). Knit Goods, Bread and Other Bakery Products, and Coke are groups by virtue of the fact that they comprise well-defined units which are segregated in the Census but are not included in its industry count. Woolen and Worsted Goods, Canning and Preserving, Tobacco Products, Iron and Steel, and Nonferrous Metals are combinations of industries recognized by the Census as such in its industry count. Rubber Products is considered a group by the Census as well as by NRP.

⁹The ensuing discussion of comparability is restricted to the 41 industries (see fn. 6) and all the groups for which the Census supplied the basic production and employment statistics for the odd-numbered years. Because of the manner in which most of the man-hours series were derived (see fn. 2), what is said of employment applies to man-hours.

for only the establishments within an industry, it includes in the detailed quantity and value statistics any amounts of the primary products made elsewhere. In some instances it was possible to increase the degree of correspondence between the production and employment statistics by redefining a Census industry so that it refers not to establishments but to the total output of the products normally belonging to it. In the instances where no adjustment could be made, it is very likely that a negligible net distortion results from the inclusion in the production index of primary output contributed by other industries and the inclusion in the employment index of the wage earners engaged in the manufacture of products not normally belonging to the industry in question.¹⁰

Second, the Census sometimes reports the combined value rather than the specific quantities of the minor products of an industry. The omission of the quantities of such products from the production index may result in distortion of the relationship between the production and employment measures (i. e., productivity) if they tend either to increase or decrease in importance throughout the period or where there are sharp fluctuations in the importance of these products. The available statistics permitted an adjustment only on the basis of an assumption which was not considered tenable in most industries, viz, that the year-to-year changes in relatives of the aggregate value of the excluded products reflect changes in quantity only rather than changes in both quantity and unit value.¹¹ Similarly, the Census publishes only the aggregate value of custom, contract, and repair work. This item, however, is usually unimportant. Finally, some establishments either reported their aggregate production in terms of value only or were requested by the Census to do so in 1933, but the quantities for the entire industry could usually be estimated.¹²

¹⁰See discussion of "Adjustment of Employment Series for Comparability With Production" later in this chapter. The achievement of comparability of scope on an establishment basis rather than a primary-product basis was usually not feasible since the products normally made in other industries are, with few exceptions, reported in terms of aggregate value only.

¹¹The products in the indexes for Agricultural Implements (No. 1), Clay Products (Other Than Pottery) and Nonclay Refractories (No. 13), and perhaps Cotton Goods (No. 18) show general declines in value coverage for which no satisfactory compensatory adjustment could be made. For comparative purposes, however, value-adjusted indexes were constructed for Nos. 1 and 13 and included in Part Two. Value adjustments were made for Motor Vehicles (No. 48) in order to increase the qualitative as well as the quantitative significance of the NRP index.

¹²No adjustments could be made for the establishments in Sawmills and Saw-Plane Mills (No. 45) and Planing-Mill Products (No. 59) reporting part or all of their output in terms of value only in years other than 1933.

Third, the establishments in any particular industry are not necessarily homogeneous with respect to the degree of integration (which may, furthermore, vary from year to year). Thus, although all the wage earners in a highly integrated establishment are consistently accounted for, the quantity statistics may be defective since part of the production - for consumption in further manufacture on the premises - is generally not reported. The quantities of the same goods produced for sale by less integrated establishments, however, are always reported. Consequently a varying percentage of the total output of each product may be reported by each establishment, and hence by the whole industry, from year to year. A similar difficulty might still exist if the total output were reported for each product since the fluctuations in the volume of nonmanufacturing wage-earner labor (packing, shipping, power generation, etc.), which cannot be excluded from the reported employment figures, need bear no relation to the fluctuations in the reported quantity statistics.¹³ In some instances the available data permitted redefinition of a Census industry for the purpose of minimizing the effects of changes in integration on the comparability of the production and labor indexes. By subdivision of a Census industry greater representation was given in the group production index to various important manufacturing stages;¹⁴ by the combination of two Census industries the effect of transfers of establishments from one to the other (as changes in integration gave a different character to the reported products of chief value) was somewhat mitigated.¹⁵ It was not possible, however, to give representation in the production index to nonmanufacturing workers (since no quantitative measure of their specific

¹³For example, nonmanufacturing labor may be affected unduly by changes in the amount of "goods sold in condition in which purchased" (Fertilizers), the volume of sales activity by the manufacturing establishment (Manufactured Gas), the amount of current generated for power (Paper and Pulp), or the volume of delivery service (Manufactured Ice).

¹⁴The Census industry Paper and Pulp was subdivided for the years prior to 1927 into Paper (No. 56) and Pulp (No. 57) and Lumber and Timber Products into Logging Camps (No. 44) and Sawmills and Saw-Plane Mills (No. 45). No satisfactory method of overcoming a similar difficulty could be devised for Clay Products (Other Than Pottery) and Nonclay Refractories (No. 13) and Cement (No. 11), both of which are engaged to some extent in the quarrying of raw materials. The production indexes for Cotton Goods (No. 18) and Woolen and Worsted Goods (Nos. 70-2), but not for Silk and Rayon Goods (No. 64), include the output of different stages although separate productivity measures could not be constructed for these stages.

¹⁵The Census industries (a) Motor Vehicles and (b) Motor-Vehicle Bodies and Motor-Vehicle Parts were combined into Motor Vehicles (No. 48); (a) Meat Packing, Wholesale and (b) Sausage, Meat Puddings, Headcheese, Etc., and Sausage Casings were combined into Slaughtering and Meat Packing (No. 65); and (a) Chemicals, Not Elsewhere Classified and (b) Compressed and Liquefied Gases were combined into Chemicals (No. 12).

output is obtainable) or to exclude them altogether from the reported employment.

Fourth, the problem arises in seasonal industries of giving adequate representation to the activities characteristic of different parts of the year. Available statistics usually permitted the inclusion of the output of only the season of peak activity.¹⁶

The achievement of comparability between the production and employment indexes is often dependent upon the achievement of chronological comparability within each. This is so particularly when the Census redefines an industry without revising the statistics reported for earlier years. In such cases an attempt was made either to retain the old definition or extend the new one back to the earlier years.¹⁷ The Census' request for the sales, rather than the production, of establishments in 18 of the 59 industries in 1929 gives rise to a similar difficulty. There is reason to believe, however, that the difference between sales and production in this year is not very great.¹⁸ As has already been indicated, the Census collected total-value statistics but not detailed quantity statistics for establishments in some industries in 1933. These establishments, however, generally accounted for less than 10 percent of the value of the output of the respective industries, and satisfactory estimates for all establishments could be made. Finally, the scope of the

¹⁶Indexes of productivity involving annual employment and the output of the peak season, like those for Canning and Preserving, have definite meaning and validity; they should be distinguished from an index, like the one for the Beet Sugar campaign, which is based on production and man-hours for the peak season only.

Monthly relatives of productivity were not constructed by NRP since (1) the *Census of Manufactures* does not report monthly quantity statistics, (2) such monthly quantity statistics as are available (e. g., in the *Survey of Current Business*) are usually much less detailed than Census figures, and (3) the meaning of monthly indexes would not be clear because of the length of the production process (the reported output of any given month is attributable not merely to the employment reported for that month but also to labor expended in preceding months).

¹⁷Such redefinitions were made by NRP for Agricultural Implements (No. 1), Chemicals (No. 12), Furniture (No. 22), and Manufactured Gas (No. 46). In general, adjustments could not be made for redefinitions in 1933 and 1935 of important textile industries (Nos. 18, 22-6, 64, and 70-2).

¹⁸The Census changed its request from production to sales (more strictly, shipments or deliveries) in 1929 in recognition of the fact that "the records kept by manufacturers in practically all cases show their sales, but in many cases do not show their production, during a given period." Furthermore, "the change from the production to the sales basis for reporting value of products had very little effect on the comparableness of the statistics for 1929 with those for preceding census years, since it is likely that the excess of sales over production in some establishments and the excess of production over sales in others counterbalanced each other in large measure." (*Census of Manufactures: 1929*, II, 3.) For the same reason the Census considers the 1929 figures comparable with those for later years (*Census of Manufactures: 1931*, p. 5). For one industry, Rayon (No. 60), for which reliable production statistics were available for this year, the difference between sales and production was found to be only 4 percent.

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Census canvass was reduced slightly in 1921 by the exclusion of establishments whose annual output was valued at less than \$5,000; the minimum in 1919 and earlier years was \$500.¹⁹ Although the comparability between the production and labor indexes is maintained, a slight upward bias may be imparted to the productivity measures between 1919 and 1921 since the small establishments excluded in the latter year were probably less efficient than the average. That the bias is negligible, however, is indicated by the fact that in 1919 establishments with products valued at \$5,000 or more employed 99.5 percent of the reported number of wage earners in all manufacturing industries and accounted for 99.8 percent of the total value of products.

PRODUCTION INDEXES

Time Coverage

NRP production indexes for 44 of the 72 industries and groups²⁰ extend over the period 1919-36. Almost all of the remainder, moreover, begin by 1920 and do not terminate before 1935. Within the terminal years 24 of the 72 indexes are not continuous; 12 of these are incomplete for all the even-numbered years.

Sources of Production Statistics

The production indexes for 48 of the 59 manufacturing industries and for 11 of the 13 groups are based principally on Census quantity figures - at least for the odd-numbered years. The primary sources for five other manufacturing industries and one group (Coke) are publications of the Bureau of Mines, viz, *Mineral Resources of the United States* and *Minerals Yearbook*. Statistics from a variety of Government and private organizations supplemented the Census series for the odd-numbered years. The Census itself, frequently in cooperation with other agencies, collected production statistics for even-numbered years which were used for 12 industries. Other supplementary

¹⁹The Census made no change in the scope of the canvass of Clay Products (Other Than Pottery) and Nonclay Refractories (No. 13) after 1919; all establishments are represented regardless of the value of their output. The minima for employment and production in the Lumber and Timber Products group (No. 43), which are stated in terms of lumber cut or its equivalent, are not only different but were changed in 1921 and 1923, respectively.

²⁰Two regional production indexes - for Cotton Goods (No. 18) - are not included in this or any of the subsequent counts.

statistics were obtained from such Government publications as *Yearbook of Agriculture*, *Agricultural Statistics*, *Survey of Current Business*, mimeographed releases of the Federal Reserve Board, and reports of the Bureau of Labor Statistics, Tariff Commission, Bureau of Internal Revenue, and National Recovery Administration. Some of the trade associations whose periodicals or annual reports were consulted are American Iron and Steel Institute, Automobile Manufacturers Association, National Fertilizer Association, and Textile Economic Bureau. Other periodicals, such as *Rubber Age* and *Chemical and Metallurgical Engineering*, also supplied supplementary production data.

Definition of a Product and Formula for the Production Index

For each industry the definition of a product is usually predetermined by the classification used by the agency collecting the quantity statistics. In general, such agencies request the quantities of "economic" products only, i. e., of products intended either for consumption in further fabrication within or outside of a particular industry or for sale to dealers or ultimate consumers. "Uneconomic" output, like waste, is usually not reported, but salable byproducts are reported.²¹ The criteria probably used in distinguishing products are physical characteristics and composition, function or use, process of manufacture, unit and aggregate values as compared to those of other recognized primary products of the same industry, and trend of quantity production.²² For the construction of the NRP indexes an additional criterion is the difference in labor requirements. The more detailed the product classification, the greater the likelihood that differences in labor requirements will be reflected. Hence the most detailed classification consistent with the achievement of chronological comparability was usually preferred in the construction of the NRP indexes.²³

²¹With the advance of technology and the development of new uses the uneconomic output of one period may become economic output in another; the reporting of its quantity would then be specifically requested by the canvassing organization.

²²It should be noted that, whatever the criterion used, each reported product really represents a number of more or less heterogeneous items, or a "range" within which the gradations may be either imperceptible or marked.

The degree of detail or classification is determined largely by the nature of the industry's products, the traditional accounting system, the purposes of the collecting agency, the form of the reporting schedules, etc.

²³Appropriate statistical methods were employed to preserve continuity wherever a change was made in classification (usually the degree of detail was increased). See discussion of "Completion of Census-Year Indexes" later in this chapter.

In nine of the NRP production indexes only one (unweighted) series was used. This series usually represents all of the significant output, which may sometimes properly be regarded as a single product and sometimes as heterogeneous. In a few instances experimental indexes with weights which are not entirely satisfactory were constructed for comparative purposes; these differed little from the corresponding unweighted NRP measures. In others, however, neither a more detailed classification of the products nor an adequate weighting system was available.²⁴

For 47 of the 50 remaining manufacturing industries more than one product series were incorporated in the principal part of the index (usually for the odd-numbered years when the *Census of Manufactures* was the source).²⁵ In these instances the formula for the basic index or, if there was a change in classification, for the constituent segments is almost without exception of the weighted-aggregative type.²⁶ This formula was not employed, of course, for the three industry indexes which are not based primarily on statistics for the physical quantity of production.²⁷

Census Production Series

Since, as has already been noted, the Census supplied the basic production statistics for 48 of the 59 industries and since these statistics usually refer to the odd-numbered years only, the most important problems confronted in the construction of the NRP indexes of production were the derivation

²⁴A single series may properly be used to represent the total output of Beet Sugar (No. 2), Cane Sugar (No. 7), or Manufactured Ice (No. 47) but is less appropriate for an industry like Cigars (No. 87) or Chewing and Smoking Tobacco and Snuff (No. 69). (See Part Two, Cigars, for a comparison of the NRP index with another measure.)

²⁵The series for most industries refer to distinct products in the sense of the above definition. The two series for Manufactured Gas (No. 46), however, represent different stages (manufacture and distribution), while the several series for Cement (No. 11) represent different stages as well as different products.

²⁶The formula is usually $[\sum q_i u_k] + [\sum q_o u_k]$, where u_k , the weighting factor, represents the best approximation to the unit labor requirement of each product in the base year. (See discussion of "Weights Used in Construction of NRP Production Indexes" later in this chapter.)

²⁷Value statistics only were available for Furniture (No. 22), the units for Newspaper and Periodical Printing and Publishing (No. 49) were not considered satisfactory, and only fragmentary data could be obtained for Logging Camps (No. 44). In the first instance, the index was constructed by the deflation of relatives of total value of output by a weighted price index; in the second and third, substitute measures, the total unweighted quantity of newsprint and the minimum log requirements for sawmill production, respectively, were employed. Series of deflated values were also used to supplement the physical-quantity statistics for three industries, and supplementary consumption series were used for six others.

and completion of Census series. The derivation of the Census series is discussed here and the completion of these series in the section which follows.

The reported quantity and value statistics usually represent production for sale and interplant transfer (i. e., to plants under same ownership) and exclude products consumed in further fabrication in the same establishment and commodities purchased for resale in the same condition.²⁸ For some industries which include establishments of different degrees of integration, however, products consumed in further fabrication in the same establishment are also reported.²⁹ No distinction is made by the Census between products destined for sale to other establishments in the same industry and to establishments or customers outside the industry.

Although it would have been desirable to base the production indexes on the total output of each product, no alternative to production for sale was usually available. Such production, furthermore, probably does not have uniform significance throughout the period in some industries, since there doubtless are fluctuations in the percentage of total production made for sale and in the percentage of production for sale destined to establishments or consumers outside the industry. For example, a varying proportion of the total output of sulphuric acid and sodium hydroxide, two of the most important products of the Chemicals industry, may be consumed from year to year in the manufacture of other chemicals in the same establishments; of the amounts made for sale, moreover, a changing percentage may be purchased by establishments in other industries, such as Fertilizers (sulphuric acid) and Pulp (sodium hydroxide). This does not mean, however, that properly weighted indexes for both types of production would necessarily disagree.³⁰

It was pointed out in the discussion of the comparability of the production and labor indexes that, although primary products are reported in terms of both quantity and value, products not normally belonging to an industry and custom,

²⁸Census value statistics represent net selling values at the plant; they are probably based on average f. o. b. prices or prices at which products are invoiced to the sales department. Purchases for resale are considerable in industries like Fertilizers (No. 20).

²⁹Production for consumption is reported, for example, for Blast Furnaces (No. 30) and Steel Works and Rolling Mills (No. 31).

³⁰Indexes for Chemicals (No. 12) based on the two types of production are in general agreement (see Part Two).

contract, and repair work are usually reported in terms of value only.³¹ Consequently the quantity series incorporated in the NRP measures refer to primary products only³² and often (when the Census does not publish separate figures) include the amounts, if any, made in other industries.³³ The percentage of the total value of an industry's output represented by custom, contract, and repair work and secondary products is usually small.³⁴ In a few instances the primary output of some establishments was reported in terms of value only; an adjustment was made to include this output on the assumption that the relation between the (weighted) quantity production of the entire industry and the (weighted) quantity production reported was the same as between the corresponding value figures.³⁵

The difficulties of achieving chronological comparability which resulted from the following were indicated earlier: The reporting of sales instead of production for at least 18 of the manufacturing industries in 1929;³⁶ the reporting of total output in 1933 in terms of value only by the smaller establishments in 19 industries;³⁷ the change in 1921 in the minimum value of output of establishments included in the Census canvass; and changes in Census industry definitions. The method of adjusting the 1933 production quantities for 18 of the 19 industries involved the use of detailed Census statistics for 1931 for the output of (1) all establishments in the industry and (2) only those classes of establishments from which detailed quantity statistics were requested for

³¹The Census apparently requests quantity statistics for custom, contract, and repair work for Leather: Tanned, Curried, and Finished only. Such work is not, of course, performed in all industries.

³²The production index for Motor Vehicles (No. 48), however, was adjusted to include some items reported in terms of value only which became primary products as a result of the combination of two Census industries (see fn. 15).

³³In a majority of cases the Census production series include the output of all industries. No output in other industries is reported for Glass and Leather: Tanned, Curried, and Finished, from which Nos. 23 and 37 were derived, and Rayon (No. 60). Outside production was reported separately and hence could be excluded from the indexes for several other industries, like Manufactured Gas (No. 46) and Paper (No. 56).

³⁴In 1929 the primary output contributed from outside usually amounted to less than 3 percent; the proportion is higher for three of the chemical industries (Nos. 12, 20, and 54) and Ice Cream (No. 28). In the same year the aggregate value of products not normally belonging to the industry and custom, contract, and repair work generally represented less than 5 percent of the total value of output and in many instances less than 3 percent.

³⁵Adjustments of weighted quantities were required for three industries and of single series for four others.

³⁶The names of the 18 industries are given in the "Explanatory Notes" to Part Three, appendix A. See fn. 18 and *Census of Manufactures: 1927*, p. 77, for evidence of the probability that the number of industries is greater than 18 and that sales are sometimes reported in other years too.

³⁷The names of the 19 industries are given in the "Explanatory Notes" to Part Three, appendix A.

1933.³⁸ The reported output of each product in 1933 was raised on the assumption that the relationship between the two quantity figures for the same product was the same as in 1931.

The achievement of chronological comparability was also obstructed by changes in the scope or degree of detail of the Census quantity figures. In several instances the output of primary products within a given industry only was reported for some years and the output of the same products in all industries was reported for others;³⁹ in other instances the product classification was extended or revised either by the addition of new items or by a thorough change in the categories previously reported.⁴⁰ The statistical device commonly employed in such cases involved (1) the construction of overlapping, internally consistent segments of weighted aggregates of the products reported in the successive intervals (or relatives of such aggregates) and (2) the "linking" or "splicing" of these segments (i. e., joining by successive multiplication by the ratios in the common years) so as to obtain a chronologically comparable series of weighted aggregates (or relatives).⁴¹ Variants of this method were employed where adjustments were required for isolated years.⁴² The indexes for odd-numbered years for 25 manufacturing industries and 2 groups include more than one segment.⁴³ Absolute discontinuity resulted only rarely from changes in the manner of classifying production.⁴⁴

It was frequently necessary to distribute items reported in combination and to combine items reported separately for

³⁸The absence of 1931 statistics for the establishments reporting in detail in 1933 precluded the possibility of an adjustment for Confectionery (No. 17). The value of the output not reported in detail in 1933, however, represented but 3.1 percent of the total for the industry. (This index required an adjustment for incompleteness of the quantity statistics in every year. It is one of the three indexes referred to in fn. 35.)

³⁹The Census quantity and value statistics for the products of the textile industries (Nos. 18, 32-6, 64, and 70-2) represent the output of only the respective industries in 1927 and earlier years; the statistics reported since that year, however, represent output in all industries. Strict continuity was achieved in some of these cases by means of the "splicing" technique described subsequently in the text and in fn. 41. The scope of the figures for Planing-Mill Products (No. 59) was also enlarged in 1931, but no adjustment was made to include the negligible amount (about 1 percent by value) contributed from outside.

The statistics for the industries canvassed annually by the Census are not strictly comparable from year to year. The figures for the even-numbered years probably omit primary products made outside an industry even though the figures for odd-numbered years may include such output.

⁴⁰Usually, the changes in classification increased the number of product series without significantly affecting the percentage of total value represented. In at least three cases the number of products was diminished, but value coverage remained fairly constant. In Clay Products (Other Than Pottery) and Nonclay Refractories (No. 13), however, a decline in coverage accompanied a considerable expansion in the number of products included in the index.

Footnotes 41, 42, 43, and 44 appear on following page.

34 PRODUCTION, EMPLOYMENT, AND PRODUCTIVITY

the purpose of maintaining the chronological comparability of individual product series. The segregation was usually accomplished on the basis of the relationship between the figures for the separate items in the nearest year for which they were available. Sometimes no adjustment could be made, but the resulting error in the production index is likely to be small.⁴⁵

The quantity statistics for certain products were not reported in identical physical units from year to year. Conversion to a single unit, however, could usually be effected by means of either standard factors or the observed relationship between the different units in years for which production was reported in both.⁴⁶

A more serious difficulty which usually cannot be overcome arises from the reporting of quantities in units inappropriate for our purposes. Sometimes the difficulty may be traced to the use by the collecting agency of a classification which is insufficiently detailed. An example is the absence of a distribution of the total number of doors or other definable millwork by dimensions; the result is that changes in the character of the output which may affect the production index

⁴¹The procedure described may be illustrated as follows for three segments extending over 4 consecutive years; the fourth year is the base:

Year	Segment A	Segment B	Segment C	Final spliced series (Segment C includes base year)
1	A ₁			$(C_1) = \frac{C_3}{B_3} \times \frac{B_2}{A_2} \times A_1$
2	A ₂	B ₂		$(C_2) = \frac{C_3}{B_3} \times B_2$
3		B ₃	C ₃	C ₃
4			C ₄	C ₄

(C₁) and (C₂) represent the estimated weighted aggregates or relatives for years 1 and 2.

⁴²See Part Two, Agricultural Implements (1933 and 1935), Canned and Cured Fish (1933), and Chemicals (1935).

⁴³Of these 27, 17 have two segments, 8 have three, 1 has four, and 1 has five.

⁴⁴Changes in classification of Woolen Goods (No. 71), Worsted Goods (No. 72), and Knit Cloth (No. 36) in 1933 resulted in the termination of the corresponding NRP indexes in 1931. The group indexes could, nevertheless, be extended beyond this year.

⁴⁵No attempt was made to separate products reported together if the combination was considered to have no serious consequence.

⁴⁶For example, chemicals reported in different concentrations were often reduced to the same basis by the application of standard factors. An empirical relationship, on the other hand, was used to convert "actual cases" of canned fruits and vegetables to "standard cases", and linear yards of certain silk goods to square yards.

are obscured. In other cases the quantities may be reported in units which are not the most satisfactory ones available for a production index to be used in the derivation of a productivity measure. The output of rubber tires is reported by the Census in terms of number, a unit less likely than weight to reflect differences in labor requirements; it was possible in this instance to convert number to weight. Similarly the output of coke, reported by weight, was converted to thermal equivalents. Finally, when a product is very complex or lacks uniformity, its output may not be measurable in a more satisfactory unit than number or weight. This difficulty occurs in the construction of indexes for motor vehicles and agricultural implements, the various kinds of which have also undergone considerable change in quality. Although no quantitative adjustment for such qualitative changes within each product series is possible, it is widely believed that the changes in the post-war years have been improvements (e. g., in design, power, efficiency of operation, and durability). Thus, if the NRP indexes of production and productivity could be corrected for such quality changes, they would probably be tilted upward. The indexes take account of changes in the proportions of the various grades of each product only insofar as the available classifications differentiate the significant grades.

Completion of Census-Year Indexes

The production index derived from Census quantity series was usually completed (i. e., interpolated and extrapolated) for the even-numbered years by means of a continuous auxiliary index derived from sources other than Census publications.⁴⁷ The auxiliary index often includes more than one product series, comprises more than one segment, and refers to a smaller and somewhat different universe from that canvassed by the Census. It was selected even when it does not include production series,⁴⁸ because it is at least qualitatively related to production and has the same general movement.

⁴⁷It has already been indicated that the Census provided annual statistics for 12 industries. The statistics for the even-numbered years were in most of these instances used with little or no adjustment to form continuous series with those for odd-numbered years; in the case of Paints and Varnishes (No. 54), however, interpolation and deflation of value by price were necessary.

⁴⁸For example, the auxiliary index for Bread and Other Bakery Products (No. 4) and four other auxiliary production series represent consumption.

In the interpolation of the Census index (i. e., completion for the intermediate even-numbered years) the auxiliary relative for each even-numbered year was multiplied by the average of the ratios of the Census relatives to the auxiliary relatives for the adjacent odd-numbered years. In the extrapolation of the Census index (i. e., extension beyond either terminal odd-numbered year) the auxiliary index was multiplied by the ratio between the Census and auxiliary relatives in the last common year.⁴⁹ Although the auxiliary index is usually based on series other than those included in the census-year index, it was sometimes derived by the combination of several Census product series which had first been rendered continuous.⁵⁰

Weights Used in Construction of NRP Production Indexes

As was indicated in chapter I, weights were necessary for the reduction of the several product series for each industry to a common (additive) unit. Whatever the weighting system, each weighting factor should correspond exactly to the quantity series; i. e., the sum of the weighted quantities in each year should represent - if the weights are unit labor requirements - the total volume of labor required for the fabrication of the several products under assumed or actual conditions, as the case may be.⁵¹

⁴⁹The processes of interpolation and extrapolation (referred to in Parts Two and Three as "completion" or simply "interpolation") may be illustrated by the following scheme:

Year	Census index	Continuous auxiliary index	Final index
1	C_1	A_1	C_1
2		A_2	$(C_2) = \frac{1}{2} \left(\frac{C_1}{A_1} + \frac{C_3}{A_3} \right) \times A_2$
3	C_3	A_3	C_3
4		A_4	$(C_4) = \frac{C_3}{A_3} \times A_4$

(C_2) is an interpolated index number; (C_4) is an extrapolated one.

⁵⁰This method was used for Boots and Shoes (No. 3), Chemicals (No. 12), Steel Works and Rolling Mills (No. 31), Rubber Tires and Inner Tubes (No. 82), Other Rubber Goods (No. 83), and Slaughtering and Meat Packing (No. 85).

⁵¹If each quantity series is reduced to relatives, the weights should be such that the averages of relatives give the same results as weighted aggregates (see chapter I).

Sometimes, the quantity series and the corresponding weights may refer to the same physical product at different stages - e. g., gas produced and gas distributed.

It was also indicated in chapter I that the desired weights for a production index of the aggregative type are unit labor requirements, or the number of man-hours or wage earners required per unit of each product.⁵² But such weights are not available for each year and for each product, except in the case of a minor industry, Electric Lamps.⁵³ The formulas presented in chapter I could, nevertheless, be used directly in the combination of industry indexes into group measures since proper weights - the number of man-hours and wage earners were available. Two NRP indexes of output are, therefore, presented for each group in Part Two; both are harmonic means (at least for some or all of the odd-numbered years), one with changing man-hour weights and the other with changing employment weights.⁵⁴ The former was used in determining output per man-hour and the latter in determining output per wage earner. These two indexes were preferred since we are particularly interested in measuring productivity for the 1929 (base-year) production composite. In accordance with the discussion in chapter I, arithmetic means with fixed (1929) labor weights were also computed for comparative purposes. In almost every instance the four indexes (i. e., the two with changing and the two with fixed weights) show a remarkable degree of similarity.⁵⁵ It would seem from these results that, at least for the period considered, fixed weights may generally be substituted for changing ones. But satisfactory labor weights for even one year were seldom obtainable for individual products. They could be derived for series entering into but six industry indexes.⁵⁶ For

⁵²The problem of joint products, which at least in view of the nature of available statistics appears insoluble, was not considered a matter of special inquiry in this report.

⁵³For convenience in computation, the product series for this industry were used in the form of relatives. (The weights were, therefore, the total number of wage earners and man-hours.) Comparable production and labor statistics are available for the several products of this industry only because they were collected by BLS for the specific purpose of determining productivity in different departments.

⁵⁴NRP production indexes with both changing employment and man-hour weights were computed for 8 of the 13 groups; indexes with only changing employment weights were computed for 4 others. The measure for the thirteenth, Lumber and Timber Products (No. 43), includes fixed (man-hour) weights. The relatives for all or most of the even-numbered years for 11 of the 13 groups also represent averages of production relatives for the component industries; the two exceptions are Bread and Other Bakery Products (No. 4) and Woolen and Worsted Goods (No. 70).

⁵⁵Differences appear in only the early years of indexes for four groups. Comparative group indexes are shown in Part Two.

⁵⁶The six industries are Cement (No. 11), Sawmills and Saw-Plane Mills (No. 45), Manufactured Gas (No. 48), Paper (No. 56), Pulp (No. 57), and Rubber Tires and Inner Tubes (No. 62). The weights for Manufactured Gas represent the relative number of wage earners engaged in the manufacture of a unit of gas (and its byproducts) and in its distribution; those for Cement, relative man-hours, were assigned on a functional as well as product basis. For a seventh industry, Silk and Rayon Goods (No. 64), estimated wage-earners-per-unit weights for 1936 were used for a short period of years (1929-35).

all the others it was necessary to use substitute weights. Since these were not considered sufficiently reliable to reflect changes from year to year in the relative unit labor requirements of the different products, they were used only as fixed weights (which are, by implication, proportional to unit labor requirements in the base year). Hence, most of the NRP production indexes are, at least in form, consistent with productivity measures for changing production composites. In our opinion, however, these indexes are generally equivalent to those for base-year production composites.

The best available substitute for unit labor requirements was unit value added, which could be used for but two industries. Unit-value weights, derived from Census statistics, were used for at least some of the odd-numbered years for 36 other industries. For 25 of those, the unit values refer to 1929; for the remaining 11, they represent averages for a period of odd-numbered years. The unit values for 1929 were selected if the relative magnitudes were fairly stable throughout the period; averages were employed if the distribution of unit values varied or significant changes in classification, which necessitated the construction of several segments, occurred. Price was used in several instances where unit values were not available.⁵⁷

Had a choice been afforded by the available statistics, the substitute weights would have been preferred in the following order, which probably represents the relative likelihood of their proportionality to unit labor requirements:⁵⁸

1. Labor cost per unit
2. Value added per unit
3. Value per unit
4. Price

Labor cost per unit seems to be a satisfactory substitute since it is equivalent to labor time per unit translated into

⁵⁷Unit values computed from Census data for the products of some industries probably represent selling price rather than unit value at the plant. Census unit values were used as weights for many of the auxiliary indexes, which often include the same or similar products as the segments for the odd-numbered years.

⁵⁸The term "unit labor requirements" is used here in the general sense of both man-hours per unit and wage earners per unit. Of course, the best substitute weighting system for man-hours per unit is likely to be wage earners per unit, since the average annual hours worked tend to be similar for the wage earners engaged in the manufacture of the various products of an industry (particularly when these products are made in the same plants, when the technology is similar, when production is concentrated in a single region, or when regional differences are not marked). When any other substitute weights are used in the construction of an NRP production index, the implication is that they are proportional to both

[Continued]

value terms. Its use implies that the average hourly earnings for all the workers engaged in the manufacture of any product of an industry are the same as for all the workers making any other product of that industry. Value added per unit is somewhat further removed from unit labor requirements. It has, however, a fairly high labor-cost content and also does not include raw-material costs. It is particularly appropriate for (1) industries with establishments of varying degrees of integration reporting their output in full (for sale, interplant transfer, and consumption on the premises) and (2) industries making products whose raw-material costs differ considerably. With the exception of prices, unit values are farthest removed from unit labor requirements. In addition to labor cost,⁵⁹ unit value includes cost of raw materials, salaries, profits, rents, interest, depreciation charges, insurance, etc. Price includes not only these factors but also transportation and handling costs, discounts, etc.

Since value weights were used predominantly, an attempt was made to test their proportionality to the preferred labor weights. Usually the comparison could be made for only a few products classified otherwise than in the NRP index; frequently the comparative weights depended upon crude estimates which detract from the conclusiveness of the test. In all, comparisons of different weighting systems or indexes embodying them were made for 11 industries.⁶⁰ In several instances the value weights were found to be fairly proportional to the preferred weights; even where they were not, the indexes based on the two sets of weights were similar. The reason may be that any weighting system would have little influence in the index for an industry where one product dominates, where the

⁵⁸[Continued]

types of unit labor requirements, since the same production index is employed in the derivation of the indexes of output per man-hour and output per wage earner.

In actuality, it is often feasible to measure unit labor requirements for only direct labor. In many cases, it would be possible to distribute at least part of the indirect labor if proper records were kept for this purpose.

⁵⁹From an investigation made in the course of the construction of the NRP indexes, it appears that 25 percent constitutes a fairly high ratio of wages to total value of an industry's products (the maximum lies between 26 and 40 percent for the NRP industries in the post-war period). It should be noted, however, that the stability of the ratio from product to product is more significant than the magnitude of the ratio for the entire industry. Thus unit values may be satisfactory not only for an industry such as Clay Products (No. 13), which had the maximum ratio in several years, but also for Paper (No. 56), which has a very low ratio.

⁶⁰See Part Two, Agricultural Implements (No. 1), Boots and Shoes (No. 3), Chemicals (No. 12), Cement (No. 13), Fertilizers (No. 20), Flour and Other Grain-Mill Products (No. 21), Steel Works and Rolling Mills (No. 31), Paper (No. 56), Pulp (No. 57), Woolen Goods (No. 71), and Worsted Goods (No. 72).

several products have the same movement, where the dispersion of the weights is small, or where the number of products is large. It appears from experiments made in the course of the derivation of the NRP measures, furthermore, that weighted indexes of the same scope but dissimilar degrees of detail frequently have the same general movement and that unweighted indexes, which are tantamount to relatives of but one product, frequently exhibit the same general movement as weighted measures.⁶¹ These considerations lead us to believe that the substitution of unit-value for unit-labor-requirement weights results in satisfactory production measures for most of the industries. It should not be inferred that the problems of weighting and classification may therefore be neglected. On the contrary, the year-to-year differences in magnitude and direction may be sufficient to preclude the use of indexes based on less detailed classifications for the measurement of short-term changes in production and productivity.⁶²

Value Coverage of the NRP Production Indexes

The product series included in the NRP indexes usually represent a large percentage of the total value of all primary output.⁶³ Table V, which refers to 55 manufacturing industries representing over 90 percent of the wage earners in the NRP sample in 1929, shows that (1) value coverage is complete for 17 industries representing about 26 percent of the wage earners embraced in the NRP manufacturing sample, (2) over 95 percent of total value is included in the indexes for 30 industries

⁶¹See Part Two, Boots and Shoes (No. 3), Cotton Goods (No. 18), Plate Glass (No. 26), Motor Vehicles (No. 48), Paper (No. 56), Pulp (No. 57), Cigars (No. 87), and Woolen and Worsted Goods (No. 70).

⁶²If the differences in slope of indexes (based on classifications varying in degree of detail) are considerable, as in the case of Motor Vehicles (No. 48), the less refined indexes may be undependable for even the measurement of long-term changes. The probable influence of the breadth of product classes on the index for Planing-Mill Products (No. 59) has already been indicated. The NRP index for Hosiery (No. 33) affords a striking illustration of the importance of weighting. Between 1919 and 1921 it advanced by 12 percent, while the unweighted aggregate of the same products declined by 5 percent. For an illustration of the magnitude of the error which may result if the substitute unit-value weights tend to be inversely proportional to the desired unit-labor-requirement weights, see chapter I, table I.

⁶³"All primary output" refers to the primary products of an industry made in all industries, unless the Census figures exclude the output of the industries to which these products do not normally belong. The coverage percentages for all the NRP indexes are nevertheless fairly comparable, since only small amounts of the primary products of each industry are usually made in other industries.

An indication of the coverage of the NRP production indexes is given in Part Two. When no statement is made, all the primary output is usually included. In cases where substitute series were used for production, meaningful coverage percentages could not, of course, be computed (see fn. 101).

accounting for three-eighths of all the wage earners, (3) over 90 percent of total value is included in the indexes for 41 industries accounting for well over one-half of the wage earners, and (4) less than 70 percent of the total value is included in the indexes for but 5 industries, which together employed only 6 percent of the wage earners.

Table V.- DISTRIBUTION OF 55 MANUFACTURING INDUSTRIES AND THEIR WAGE-EARNER EMPLOYMENT ACCORDING TO VALUE COVERAGE OF THE PRODUCTION INDEX: 1928^a

Percent of value of all primary products included in NRP index	Number of industries	Wage earners	
		Number	Percent of number for 59 industries
Total	55	4,091,133	90.6
100	17	1,152,843	25.5
95.0-99.9	13 ^b	597,359	13.2
90.0-94.9	11	771,138	17.1
85.0-89.9	3	144,487	3.2
80.0-84.9	1	424,916	9.4
75.0-79.9	3	151,175	3.4
70.0-74.9	2	561,544	12.4
65.0-69.9	0	0	0
60.0-64.9	1	65,885	1.5
55.0-59.9	1	41,863	0.9
50.0-54.9	0	0	0
45.0-49.9	1	65,589	1.5
40.0-44.9	1	90,134	2.0
35.0-39.9	1	24,400	0.5

^aThe four industries omitted are Electric Lamps (No. 19), Sawmills and Saw-Plane Mills (No. 45), Newspaper and Periodical Printing and Publishing (No. 49), and Primary Smelters and Refineries (No. 51).

^bSince coverage could not be computed for the component industries of the Leather group (Nos. 38-42), the group percentage, 98.9, was assumed for each. This assumption seems to be reasonable; in fact, the coverage for some of the components may even be understated.

Failure to achieve complete coverage seldom in itself detracts from the reliability of the NRP production indexes. Certain minor products were sometimes deliberately omitted since their inclusion would neither have increased value coverage commensurately with the effort required nor have altered the indexes appreciably. The inclusion, if possible, of all the products of an industry would probably have a

significant effect on few of the indexes.⁶⁴ The relation between changes in value coverage of the products included in the production index and the comparability of the production and labor measures has already been discussed.

EMPLOYMENT INDEXES

Time Coverage

Of the 71 NRP employment indexes for manufacturing,⁶⁵ 50 were constructed for the period 1919-36. Between the terminal years 20 of the 71 are not continuous, and 10 of these 20 are incomplete for all the even-numbered years. Since employment is of interest in itself, employment indexes were often computed for years for which no production relatives were available.

Definition of Employment

The employment index for each manufacturing industry or group is restricted to wage earners. Salaried workers were excluded because they are not so directly engaged in the processes of production as are wage earners and no statistical series reflecting their specific output were available.⁶⁶ According to the *Census of Manufactures*, the basic source of the employment statistics, wage earners comprise "skilled and unskilled workers of all classes, including piece-workers employed at

⁶⁴That many of the NRP measures would not be altered appreciably if coverage were increased is suggested by indexes for different numbers of products constructed for several industries. The most striking illustration is that for Chemicals (No. 12). Although the NRP index for this industry ranks among the lowest in coverage (49 percent), an index with fewer products and even lower coverage (30 percent) resembles it closely.

⁶⁵No employment index was constructed for Beet Sugar (No. 2). (For reasons see Part Two.)

Two regional employment indexes for Cotton Goods (No. 18) are not included in this or any of the subsequent counts.

⁶⁶Indexes for all employees were constructed for the two nonmanufacturing industries (see Part Three, appendix B) since salaried workers, who constitute a large proportion of the total, perform many services which are essential to the main business.

It should be noted that the distinction between wage earners and salaried employees is based primarily on the type of work done rather than on the method of payment. The *Census of Manufactures* defines salaried workers as the "principal officers of corporations; managers, superintendents, and other responsible administrative employees; foremen and overseers who devote all or the greater part of their time to supervisory duties; and clerks, stenographers, bookkeepers, and other clerical employees on salary."

Although Newspaper and Periodical Printing and Publishing (No. 49), which is not strictly a manufacturing industry, engages a considerable number of salaried employees in nonmanufacturing activities, no summary index for all employees is presented in Part Two since the measure of production for wage earners was not considered appropriate for salaried workers.

the plant, and foremen and overseers in minor positions who perform work similar to that done by the employees under their supervision." This definition also embraces workers in the power plant and maintenance, shipping, warehousing, and other departments. In general, therefore, wage earners may be said to include all manual workers.

It has already been indicated that production and labor indexes constructed for the purpose of measuring productivity should, insofar as possible, be comparable in scope. The annual wage-earners series should represent averages of the number actually working on each workday of the year; the number on the pay roll but not working (e. g., those ill, temporarily laid off, or on vacation) should be excluded since they contribute nothing to production. The available statistics, however, are rarely so comprehensive in time reference or representative of only those actually working. In fact, the NRP employment series are usually based on averages of 12 monthly figures, each of which refers to but one week or day which may, however, not be typical of the average daily employment for the entire month, especially in periods of sharp fluctuations. Since these figures often represent the number of names on the pay roll, they may exceed the average number actually working during the week or the number working on any one day. The overstatement may be considerable when labor turn-over is high and part-time employment is common.

The NRP indexes of wage-earner employment, which are not adjusted to represent full-time equivalents, are significant in themselves for the analysis of employment opportunities; it is desirable to supplement them, however, by measures which take account of the amount of time actually worked. The construction of such measures (i. e., indexes of wage-earner man-hours) will be discussed later in this chapter.

Census Employment Series and Their Completion

The employment statistics for most of the NRP industries were obtained for the odd-numbered years from the *Census of Manufactures*; ⁶⁷ these represent annual averages of 12 monthly

⁶⁷The Bureau of the Census also provided a special tabulation of employment in the component industries of the Glass group (No. 23).

figures.⁶⁸ In 1933 the abridged schedule used in canvassing the smaller establishments in most of the NRP industries called for wage-earner employment in only four months (March, June, September, and December). The average reported for this year by the Census, however, takes account of the wage earners of establishments canvassed by means of both the abridged and unabridged schedules; they are, therefore, comparable with figures for other years.

Various adjustments were made in the reported Census statistics in order to achieve maximum chronological comparability in the employment index for each industry.⁶⁹ Such adjustments were usually necessitated by changes in a Census industry definition, redefinition of an industry by NRP, or incompleteness of and changes in the scope of the Census canvass.⁷⁰

The Census wage-earners series for the odd-numbered years were supplemented by others obtained from various sources, principally the Bureau of Labor Statistics (BLS) and the

⁶⁸The schedules for 1919, 1921, 1925, and 1927 request "the number of wage earners employed on the 15th day of each month"; those for 1923, "the number of names on the pay roll on the 15th day of each month"; those for 1929, 1931, and 1933, "the numbers on the pay roll for the week that included the 15th day of each month, if that was a normal week, or for some normal week in the month"; and those for 1935, "the number . . . on the pay rolls for the week that ended nearest the 15th day of each month, if that was a normal week, or for some normal week in the month." The instructions for at least the 1929 enumeration, moreover, indicate that "what is desired is the total number employed on the given day, not the total number whose names appear on a given pay roll." (See *Census of Distribution, Manufactures, and Mines and Quarries: 1929*, "Instructions for Preparing Distribution, Manufactures, and Mines and Quarries Reports" [U. S. Dept. Com., Bur. Census, 1930], "Cities Having 10,000 or More Inhabitants," p. 38.) The lack of uniformity of the dates of reference probably has no serious effect on the chronological comparability of the Census employment statistics.

Before 1935 manufacturers frequently reported employment for the fiscal rather than the calendar year since the Census instructions permitted this alternative. In 1935, however, when the Census requested both types of statistics, the difference was observed to be small.

⁶⁹See also "Adjustment of Employment Series for Comparability With Production" later in this chapter.

⁷⁰Adjustments of this nature are the exclusion of the estimated number of workers engaged in the manufacture of rayon from the series for Chemicals (No. 12) for the years 1919-23 and the inclusion of the number engaged in the production of liquefied gases in the years 1927-35, the inclusion of the estimated number of wage earners engaged in gas distribution in the 1935 employment figures for Manufactured Gas (No. 46), the addition of workers at byproduct coke ovens owned by city gas companies to the series for Byproduct Coke (No. 18) for 1919-31, the exclusion of the estimated number of workers engaged in the manufacture of woven felts from the 1935 employment for Woolen and Worsted Goods (No. 70), the exclusion of wage earners in establishments producing less than 200,000 feet of lumber from the 1919 employment for Lumber and Timber Products (No. 43), and the inflation of the reported figures for Cigars (No. 87) for 1933 and for the component industries of Knit Goods (No. 32) for 1919 to compensate for the incompleteness of the Census canvass.

In a few instances Census employment figures could not be corrected for changes in the scope of the canvass or in industry definition. For example, delivery employees could not be excluded from the 1919 figure for Manufactured Ice (No. 47), nor could the wage earners in dyeing departments be included with the number reported for 1935 for Cotton Goods (No. 18) and for Silk and Rayon Goods (No. 84). The impossibility of excluding workers engaged in the manufacture of tractors from the 1935 employment figure for Agricultural Implements (No. 1) led to the use of an estimate derived from another source for this year.

National Industrial Conference Board (NICB). Both organizations publish continuous monthly employment indexes (base 1923-25 for BLS and 1923 for NICB) for many of the industries included in the NRP survey.⁷¹ BLS and NICB treat their series, which are derived from data for sample establishments, as comparable with the corresponding Census employment statistics for the same industries and usually adjust them so that the annual averages conform to the trend shown by the biennial Census series.⁷² For this reason, the published indexes for many industries were, with slight alteration,⁷³ shifted to the base 1929 and used as the NRP indexes.

The BLS monthly employment series, many of which begin in 1919, refer to all factory employees on the pay rolls of sample establishments for the week ending nearest the 15th of each month. Factory employees, as defined by BLS, embrace the types of workers designated by the Census as wage earners.⁷⁴ The establishments are canvassed either by BLS or by cooperating State agencies. These establishments (which are reporting units but not necessarily individual plants) are, as in the

⁷¹The BLS statistics are published in L. E. Talbert and A. Olenin, *Revised Indexes of Factory Employment and Pay Rolls: 1919 to 1933* (Bull. No. 610, 1935); *Revised Indexes of Factory Employment and Pay Rolls*, mimeo., November 1936; and various issues of the *Monthly Labor Review*. The NICB series were obtained principally from M. A. Boney, *Wages, Hours, and Employment in the United States: 1914-1936* (New York: 1936).

⁷²The methods employed by both BLS and NICB to adjust the monthly employment relatives are intended, insofar as possible, to preserve the original seasonal pattern. For the BLS method of adjustment to Census figures through 1931, see Talbert and Olenin, *op. cit.*, pp. 15-8. A more refined technique designed to reduce the distortion of the monthly pattern was used in the revision to the 1933 Census levels; those revised indexes were published in the mimeographed release of November 1936 (see fn. 71). Annual BLS relatives for 1934-36 (adjusted by BLS to the 1933 Census level), which are published in the mimeographed release of November 1936 and various issues of the *Monthly Labor Review*, were adjusted by NRP to conform to the movement of the Census series from 1933 to 1935. A simple method equivalent to interpolation and extrapolation as described in connection with production was considered adequate for our purpose since we are not concerned with the pattern of the monthly relatives for intercensal years. In September 1938 BLS released its indexes for 1934-36 adjusted to the 1935 Census levels (for method, see *Continuation Adjustment of Employment and Payroll Indexes*, mimeo., February 15, 1938). Since the differences between the NRP and BLS indexes for these years are usually very slight (rarely exceeding 1 percent where the scope is comparable) and since the present study was by that time almost completed, no revision of the NRP indexes was made. The BLS monthly relatives for 1919-22 (published in Bull. No. 610, pp. 99-106) were constructed by the Federal Reserve Board (from data collected by BLS and cooperating State departments of labor) and adjusted to Census levels for 1919-21; these relatives were linked by BLS to its series for 1923-36. The resulting FRB-BLS indexes, which are internally comparable throughout the entire period, are uniformly referred to as BLS indexes in the remainder of this chapter, in Part Two, and in Part Three, appendix A.

The NICB method of adjusting the annual averages to Census trend is described in Boney, *op. cit.*, pp. 20-2.

⁷³Changes were sometimes necessary because the adjusted indexes did not coincide in a few years with relatives computed from Census data (e. g., Leather, 1919-22). Where Census figures were changed, the BLS and NICB indexes were, of course, made to conform to the trend of the adjusted figures (see fn. 70).

⁷⁴BLS defines factory employees as "all skilled and unskilled piece and time workers, working foremen, gang bosses, and straw bosses in production and other departments, such as maintenance, shipping, power plant, etc." (Schedule for June-December 1937 entitled "Volume of Employment - Manufacturing.")

Census of Manufactures, classified in industries on the basis of their chief product or products. Since the number of responding firms varies from month to month and new ones are often added, BLS constructs bimonthly links for groups of identical establishments in each industry and compounds these links into chain indexes.

In all, BLS indexes were used to supplement Census statistics for 42 manufacturing industries and groups.⁷⁵ More than two-thirds of these indexes refer to at least the years 1923-36. As may be seen from table VI, the BLS employment samples are usually large. In December 1933 and September 1935 only six industry or group samples included less than 50 percent of the wage earners in the corresponding Census industry or group and 16 included 70 percent or more. In the former month 24 samples and in the latter month 22 samples included 60 percent or more of the total number of wage earners.

The NICB employment indexes (which, except for the last six months of 1922, are continuous since June 1920⁷⁶) reflect changes in the number of wage earners on the pay rolls of the canvassed establishments during the first full week in each month. NICB attempts to obtain data for a group of identical establishments in each industry,⁷⁷ but since changes in the composition of the sample are inevitable, it endeavors to maintain chronological comparability by including new companies from time to time and by making appropriate adjustments before constructing the monthly relatives. In all, NICB indexes were used for several years for eight NRP industries and groups.⁷⁸

Other supplementary employment statistics were utilized in addition to the regular BLS and NICB series. The results of special surveys published in BLS bulletins, for example, provided some figures for eight industries, and statistics

⁷⁵The employment series for some of the NRP industries were adjusted for greater comparability with production. See "Adjustment of Employment Series for Comparability With Production" later in this chapter.

⁷⁶The NICB annual averages for 1920 and 1922 are therefore based on figures for seven and six months, respectively. NICB also published employment relatives for July 1914.

⁷⁷Like the Census and BLS, NICB also classifies establishments according to chief product or products.

⁷⁸The eight industries and groups are Agricultural Implements (No. 1), Chemicals (No. 12), Fertilizers (No. 20), Newspaper and Periodical Printing and Publishing (No. 49), Paints and Varnishes (No. 54), Planing-Mill Products (No. 59), Rubber Products (No. 81), and Woolen and Worsted Goods (No. 70). Coverage of the NICB employment samples for these industries is shown in table VII.

Table VI. - COVERAGE OF BLS WAGE-EARNERS SAMPLES^a

NRP industry number	Census industry title in 1929	BLS industry title	Percent of Census number of wage earners represented in BLS wage-earners sample ^b	
			Dec. 1933 ^c	Sept. 1935 ^d
1	Agricultural Implements	Same	61	55
3	Boots and Shoes, Other Than Rubber	Boots and Shoes	59	60
4	Bread and Other Bakery Products	Baking	38	32
7	Cane-Sugar Refining	Same	73	62
6	Canning and Preserving	Same	76	42
11	Cement	Same	80	87
12	Chemicals, Not Elsewhere Classified	Chemicals	47	50
13	Clay Products (Other Than Pottery) and Nonclay Refractories	Brick, Tile, and Terra Cotta	85	50
17	Confectionery	Same	70	67
18	Cotton Goods	Same	72	73
20	Fertilizers	Same	50	79
21	Flour and Other Grain-Mill Products	Flour	68	54
22	Furniture	Same	44	44
23 ^e	Glass	Same	80	80
28	Ice Cream	Same	90	53
29	Blast Furnaces, Steel Works, and Rolling Mills	Same	89	87
32 ^e	Knit Goods	Same	57	61
37	Leather: Tanned, Curried, and Finished	Leather	63	66
48	Lumber and Timber Products	Lumber: Sawmills	48	31
48	Motor Vehicles Motor-Vehicle Bodies and Motor- Vehicle Parts	Automobiles	61	62
49	Newspaper and Periodical Printing and Publishing	Same	47	45
51	Smelting and Refining - Copper, Lead, and Zinc	Same	63	60
58	Nonferrous-Metal Alloys and Products, Not Including Aluminum Products	Brass, Bronze, and Copper Products	82	68
54	Paints and Varnishes	Same	71	72
55	Paper and Pulp (Wood and Other Fiber)	Paper and Pulp	85	82
56	Petroleum Refining	Same	65	53
59	Planing-Mill Products	Lumber: Millwork	53	50
60	Rayon and Allied Products	Same	66	66
61	Rubber Products	Same	83	59
62	Rubber Tires and Inner Tubes	Same	100	96
64	Silk and Rayon Manufactures	Silk and Rayon Goods	53	40
65	Meat Packing, Wholesale	Slaughtering and Meat Packing	63	77
66	Tobacco Manufactures	Same	62	63
67, ^e 68	Cigars and Cigarettes	Same	59	60
69	Chewing and Smoking Tobacco and Snuff	Same	61	67
70	Woolen and Worsted Goods	Same	46	56

^aThe relationship between the BLS and Census industries is indicated in the BLS mimeographed release, *Manufacturing Classification* (No. 2810).
^bThe percentages for the two dates are not strictly comparable for several industries (Nos. 1, 18, 64, and 70) because of changes in the scope of the Census canvass in 1935; those for September 1936 for Nos. 1 and 70 are probably too low, and those for Nos. 18 and 64 are probably too high.
^cL. E. Talbot and A. Glenn, *Revised Indexes of Factory Employment and Pay Rolls: 1910 to 1933* (U. S. Dept. Labor, Bur. Labor Statistics, Bull. No. 610, 1935), p. 4.
^dComputed from the number of wage earners in the BLS sample (as shown in an unpublished BLS tabulation, "Industry and Man-Hour Sample: September 1935") and the number reported by the *Census of Manufactures* for the corresponding industry in the same month.
^ePercentage could not be computed for the samples from which BLS derived the unpublished indexes used by NRP for Glass Containers (No. 23), for the four component industries of the Knit Goods group (Nos. 32-35), and for Cigars (No. 67).

collected in a field study by NRP in cooperation with BLS were used in making estimates for the five component industries of the Leather group.⁷⁹ Bureau of Mines series for man-shifts were used for three industries and State data for three others. Finally, group series were sometimes used for the completion of the series for component industries.⁸⁰

⁷⁹It might also be mentioned here that BLS monthly link relatives of employment for Iron and Steel (No. 29), which were published in the *Monthly Labor Review*, were compounded into chain indexes by serial multiplication and used to extend the regular BLS series from 1923 to 1919.

⁸⁰See, for example, Part Two, Bread and Other Bakery Products (No. 4) and Paper and Pulp (No. 65).

**Adjustment of Employment Series for Comparability
With Production**

As has already been pointed out, the production and labor indexes are seldom exactly comparable in scope since, on the one hand, the employment reported for an industry usually includes workers engaged in the manufacture of products not normally belonging to that industry and, on the other, the production statistics often include the output of primary products of one industry contributed by workers in other industries. The value of output involved, however, is small in most cases.⁸¹ Although adjustments on a value basis for greater comparability between the production and labor indexes were usually not considered satisfactory, such adjustments were made for four industry groups: Glass, Rubber Products, Tobacco Products, and Woolen and Worsted Goods. The adjustment for the Glass group was made on the assumption that for each of the component industries the value of output per wage earner was the same for (1) products not normally belonging to the industry, (2) primary products made within the industry, and (3) primary products made in other industries.⁸² In each of the other three instances the adjustment was made on the assumption that two Census industries (corresponding to the two components of each group) (1) have the same value output per wage earner for primary products of the first and for primary products of the second, (2) together account for the total output of their primary products, and (3) produce

⁸¹For example, the value of secondary products in 1929 represented less than 4 percent of the total value of output in 19 of 29 instances for which the computation could be made. Similarly, the value of products not normally belonging to a group was less than 4 percent of the total value of output in six of nine instances. In the same year no primary products made in other industries were included in at least 18 production indexes, and the value of such extraneous primary output included in 10 of 18 other indexes constituted only 3 percent or less of the total made in all industries.

⁸²This assumption permitted the adjustment of employment for each component industry in each year by the use of the following formula:

$$E = U \left[\frac{a + b}{a + c} \right]$$

where E = adjusted employment, or the total number of wage earners required to produce the total output of the products normally belonging to the industry wherever made;

U = employment reported by the Census for the industry, i. e., the wage earners engaged in making its primary products and the products not normally belonging to it;

a = the value of primary products made in the industry;

b = the value of primary products made in other industries; and

c = the value of products not normally belonging to the industry.

U and a were obtained from a special tabulation made by the Bureau of the Census; $[a + b]$ was reported in the *Census of Manufactures*.

For similar adjustments made for comparative purposes, see Part Two, Ice Cream (No. 28) and Paper and Pulp (No. 55).

only these two types of primary products. Available evidence indicates that the second and third assumptions are justifiable in the three instances. The validity of the first cannot be ascertained.⁸³

MAN-HOURS INDEXES

Time Coverage

Indexes of man-hours were computed for 47 manufacturing industries and all 13 groups.⁸⁴ The 12 industries for which indexes could not be constructed are all components of groups.⁸⁵ Of the 60 series constructed, 45 embrace the period 1919-36 and 5 of the remainder extend from 1919 to 1935. Within the terminal years 17 of the 60 indexes are not continuous and 7 of these 17 are incomplete for all the even-numbered years.

Available Statistics and the Method of Computing Indexes

The methods employed in the construction of the 60 man-hours indexes varied according to the nature and reliability of the available statistics. It should be noted at the outset that statistics for total annual man-hours worked by wage earners or all employees, unlike those for production and employment, are rare and usually fragmentary. The NRP indexes for only three industries could be computed directly and independently from man-hours totals.⁸⁶ The most common substitute method permitted by available statistics was the multiplication of the NRP employment indexes by relatives of weekly hours and division of the resulting products by 100. The man-hours indexes for 27 industries were computed in

⁸³The details of the adjustment are shown symbolically in notes appended to the description of methods for the three industry groups in Part Two.

⁸⁴Four subindexes of man-hours are not included in the count: two for the divisions of the fiscal year for Beet Sugar (No. 2); and two for the principal manufacturing regions for Cotton Goods (No. 18).

⁸⁵The 12 industries are the components of the following groups: Bread and Other Bakery Products (No. 4), Glass (No. 23), Iron and Steel (No. 29), and Knit Goods (No. 32). Consequently, only one production index - with changing employment weights - could be constructed for each of these groups.

⁸⁶The three industries are Beehive Coke (No. 15), Byproduct Coke (No. 16), and Electric Lamps (No. 19). The annual man-hours totals for the two Coke industries, compiled by the Bureau of Mines, represent essentially the same scope as do the employment figures. Part of the index for Primary Smelters and Refineries (No. 51) is also based on annual man-hours statistics reported by the Bureau of Mines (1931-35).

The Census has also collected man-hours figures for large cross sections of various industries but, since these embrace relatively short periods, they could not be used in the same manner as Census production and employment statistics. They were used, however, in the derivation of average weekly hours.

this manner. A second method, employed principally for two industries, involved the division of pay-rolls relatives by an index of average hourly earnings of the wage earners.⁸⁷ Indexes for three other industries were derived from averages of annual man-hours totals yielded by the two methods.⁸⁸ Indexes for seven others were derived by the multiplication of production and unit labor requirements (or by the equivalent method, division of production by output per man-hour).⁸⁹ Variants and combinations of the methods already mentioned were employed in the construction of indexes for the five remaining industries.⁹⁰ Of the 13 group indexes, 5 were computed for all or most years from the sums of the man-hours for the component industries, and 7 were obtained independently from the products of employment and average weekly hours.

Since at least 34 of the NRP indexes of man-hours were constructed principally by the multiplication of employment and average weekly hours, the ensuing discussion will be restricted to the derivation of the series for average weekly hours.⁹¹ It should first be remarked that when indexes of man-hours could be computed in this manner, statistics for the deflation of pay rolls by hourly earnings were also frequently available. A comparison of indexes derived by both methods for 15 industries and groups reveals that, although differences in the magnitude of the relatives are sometimes pronounced, the year-to-year changes are usually in the same direction. The multiplication method was preferred in these instances,

⁸⁷The two industries are Clay Products (Other Than Pottery) and Nonclay Refractories (No. 13) and Cotton Goods (No. 18). The index for Lumber and Timber Products (No. 43) was also derived in part (1930-36) by the division of pay rolls by hourly earnings.

⁸⁸The three industries are Paper (No. 56), Pulp (No. 57), and Rubber Tires and Inner Tubes (No. 62).

⁸⁹The seven industries are Beet Sugar (No. 2), Cement (No. 11), and the components of the Leather group (Nos. 38-42). The unit-labor-requirement series for Beet Sugar and for the components of the Leather group were derived from the results of NRP field surveys made in cooperation with the National Bureau of Economic Research and ELS, respectively.

⁹⁰The five industries are Cane-Sugar Refining (No. 7), Logging Camps (No. 44), Sawmills and Saw-Plane Mills (No. 45), Primary Smelters and Refineries (No. 51), and Other Rubber Goods (No. 63).

⁹¹The details of the other methods may be found in Part Two and appendix A. In particular, the pay-rolls series were usually derived from the same sources as for employment (Census, BLS, and NICB) and the earnings series from the same sources as for average actual weekly hours (BLS and NICB). The BLS and NICB pay-rolls series refer to the same samples as the corresponding employment statistics and also conform to the Census relatives for comparable industries. (In this connection it should be noted that not only were wages used in the derivation of indexes of man-hours but also in the interpolation of value series used in the construction of the production index for Furniture and the employment index for Rayon.) Earnings figures were derived in some instances, e. g., Cotton Goods (No. 18), from BLS bulletins and Clay Products (Other Than Pottery) and Nonclay Refractories (No. 13), from the results of joint NRP-NBER field surveys.

however, for two reasons: (1) simplicity of computation from the NRP employment index and (2) the requirement of consistency between the two labor indexes. Whatever their accuracy, measures derived by the deflation method are sometimes incompatible with the NRP employment indexes since auxiliary employment and pay-rolls statistics from the same source (usually BLS) require different factors for adjustment to the levels of the corresponding Census series. For special technical reasons, however, the deflation method was employed in the derivation of several indexes even when average hours were available.

Average-Actual-Hours Series

The nature of the desired weekly-hours series is conditioned by the nature of the employment index. The sole statistical criterion to be met is that their product should yield a correct index of the corresponding total annual man-hours actually worked. The hours series ought, therefore, to represent actual, not prevailing or full-time hours.

The best actual-hours series now available are compiled by BLS and NICB. Although these differ from the basic NRP employment figures in source and encompass somewhat smaller areas, they seem to give reliable results; they are usually close to even more satisfactory figures for 1933 and 1935 which could sometimes be derived from Census man-hours and incorporated in the NRP weekly-hours series.⁹²

⁹²The specific titles of the Census publications which refer to large samples of wage earners are *Census of Manufactures: 1933*, "Man-Hour Statistics for 32 Selected Industries" and *ibid.*: 1935, "Man-Hour Statistics for 59 Selected Industries." In computing average weekly hours from the sample man-hours statistics it was first necessary to compute annual man-hours totals for the whole industry by summation of the products of the average hours per man for each month, as reported for the sample, and the corresponding employment for the industry; this total was then divided by the product of the average annual number of wage earners and 52. (See also Part Two, Paper and Pulp, fn. 10, for additional details on the method of computing the man-hours totals for 1933.)

Averages of such Census hours were used in the NRP series for three industries and groups in both 1933 and 1935 and for three industries in 1933 only. (In addition, averages of Census actual hours were used for 1929 and 1931 for Petroleum Refining, and total Census man-hours were employed for 1933 and 1935 for both Paper and Pulp.) More extensive use was not made of Census man-hours statistics because of their publication after many of the NRP indexes had been completed. In the instances mentioned the Census hours figures were regarded as the most preferred; those derived from other sources were consequently adjusted to the Census level, if the differences warranted such adjustment, in much the same manner as Census production and employment statistics were interpolated and extrapolated.

Census weekly hours would have been incorporated in 9 other NRP series in 1933 and in 8 additional ones, or a total of 17, in 1935 if they had been available. In 5 of the 9 instances in 1933, however, and in 12 of the 17 in 1935, the Census figures differed by 1 hour or less from the NRP weekly averages; the maximum difference in 1933 was 2.3 hours and in 1935, 2.6 hours.

The BLS and NICB figures are simple arithmetic means of the monthly averages derived from man-hours and employment collected (with pay rolls) on the same schedules.⁹³ The BLS hours samples, however, are somewhat smaller than for employment since some establishments fail to report man-hours; the NICB employment and man-hours samples are apparently identical. The BLS series for most industries begin in 1932; the NICB series, on the other hand, extend back to 1920 and include an isolated initial figure for July 1914.⁹⁴ The BLS series were usually preferred for 1932-36 even when NICB statistics were also available for the same industries and the same years. The reason for this preference is twofold: (1) The BLS series are derived from larger samples, as may be seen from table VII and (2) BLS is recognized, with the Bureau of the Census, as the most authoritative source of labor statistics in the United States. Consequently the BLS hours were customarily used for 1932 and later years (sometimes they were adjusted to the level of the Census weekly hours for 1933 and 1935) and the NICB figures for the earlier years. When the disparity between the two series in their common years was significant, an adjustment factor (the ratio of BLS to NICB hours in 1932 or 1932-35) was applied to the NICB series for the earlier period; when the two series were close, the transition from one to the other was made without any adjustment. Of the 34 industry and group indexes computed principally by the multiplication method, 5 are based primarily on NICB hours and 12 on both the NICB and BLS series; of the latter 12, 8 required no adjustment in the transition. BLS and

⁹³Strictly, employment-weighted means of the several hours figures should have been computed for each year instead of simple means. A comparison involving five highly seasonal industries - Beet Sugar (No. 2), Canning and Preserving (No. 8), Cement (No. 11), Fertilizers (No. 20), and Ice Cream (No. 29) - indicates, however, that the failure to weight has no serious consequences. For all industries but Beet Sugar the differences between unweighted means and means weighted by BLS and Census employment are, for 1933 and 1935, fractional. The differences between the unweighted means and means weighted by BLS employment for Beet Sugar, the most seasonal industry, are of the same order, but, because of differences in the monthly employment pattern, the average with Census employment weights is about 8 percent higher than the other weighted mean in 1935.

⁹⁴The specific sources of the BLS and NICB hours series are usually not noted in Part Two or in the tables of Part Three, appendix A. Most of the BLS data were supplied to NRP in the form of an unpublished manuscript. The BLS hours for January-October 1932 were in three instances, however, derived from transcriptions made by NRA. The most common source of the NICB series is *Wages, Hours, and Employment in the United States: 1914-1936*; in several instances these NICB series were extended to 1936 by the use of additional statistics published in various issues of the *Conference Board Service Letter*. For one industry, Fertilizers (No. 20), the hours for 1920-24 were derived from other NICB research reports.

The BLS series are usually based on figures for each month. The NICB averages for 1920, however, are based on figures for but seven months (June-December) and the averages for 1922 on figures for six months (July-December); the averages for all years for Manufactured Gas (No. 48) refer to but one or two months.

NICB statistics were also used to a greater or lesser degree in the construction of the man-hours indexes for many of the other NRP industries.

The discussion thus far has concerned only the derivation of the hours series for 1920 and subsequent years. Actual hours

Table VII. - COVERAGE OF BLS AND NICB MAN-HOURS SAMPLES

NRP Industry number	Census industry title in 1929	BLS industry title ^a	NICB industry title ^b	Percent of Census number of wage earners represented in man-hours sample of ^c -	
				BLS (Sept. 1935) ^d	NICB (June 1920) ^e
1	Agricultural Implements	Same	Agricultural Implements Manufacturing	53	70
2	Boots and Shoes, Other Than Rubber	Boots and Shoes	Boot and Shoe Manufacturing	40	20
4	Bread and Other Bakery Products	Baking	-	27	-
7	Cane-Sugar Refining	Same	-	55	-
8	Canning and Preserving	Same	-	35	-
13	Chemicals, Not Elsewhere Classified	Chemicals	Chemical Manufacturing	45	19
15	Clay Products (Other Than Pottery) and Nonclay Refractories	Brick, Tile, and Terra Cotta	-	39	-
17	Confectionery	Same	-	37	-
18	Cotton Goods	Same	Cotton Manufacturing	97	12
20	Fertilizers	Same	-	76	-
21	Flour and Other Grain-Mill Products	Flour	-	51	-
22	Furniture	Same	Furniture Manufacturing	59	7
23	Glass	Same	-	76	-
25	Ice Cream	Same	-	37	-
29	Blast Furnaces, Steel Works and Rolling Mills	Same	Iron and Steel Manufacturing	82	30
22	Exit Goods	Same	Hosiery and Knit Goods Manufacturing	53	7
27	Leather: Tanned, Curried, and Finished	Leather	Leather Tanning and Finishing	62	10
48	Lumber and Timber Products	Lumber: Sawmills	-	29	-
46	Gas, Manufactured: Illuminating and Heating	(f)	Gas (Production and Distribution)	-	n.a.
46	Motor Vehicles Motor-Vehicle Bodies and Motor-Vehicle Parts	Automobiles	Automobile Manufacturing	91	20
40	Newspaper and Periodical Printing and Publishing	Same	News and Magazine Printing	29	2
51	Smelting and Refining - Copper, Lead, and Zinc	Same	-	79	-
56	Nonferrous-Metal Alloys and Products, Not Including Aluminum Products	Brass, Bronze, and Copper Products	-	66	-
54	Paints and Varnishes	Same	Paint and Varnish	70	11
55	Paper and Pulp (Wood and Other Fiber)	Paper and Pulp	Paper and Pulp Manufacturing	79	21
53	Petroleum Refining	Same	-	75	6
59	Planing-Mill Products	Lumber: Millwork	Lumber and Millwork	47	-
60	Rayon and Allied Products	Same	-	93	-
61	Rubber Products	Same	Rubber Manufacturing	85	44
62	Rubber Hoses and Inner Tubes	Same	-	91	-
64	Silk and Rayon Manufactures	Silk and Rayon Goods	Silk Manufacturing	36	19
65	Meat Packing, Wholesale	Slaughtering and Meat Packing	-	-	-
67	Cigars ^g	Same	-	n.a.	-
67, 68	Cigars and Cigarettes	Same	-	52	-
69	Chewing and Smoking Tobacco and Snuff	Same	-	85	-
70	Woolen Goods and Worsted Goods	Same	Wool Manufacturing	63	21

^aThe relation of BLS to Census industries is indicated in the BLS mimeographed release, *Manufacturing Classification* (No. 2810).

^bU. S. Bureau, *Wages, Hours, and Employment in the United States: 1919-1929* (New York: National Industrial Conference Board, Inc., 1930).

^cThe BLS and NICB percentages (see items d and e) are not strictly comparable since (1) the samples and the Census totals to which they are related refer to different years and (2) there were many changes in industry definition between 1920 and 1935. If the BLS samples for 1935 were like the NICB samples for 1920, related to Census averages for 1919, the percentages for Nos. 1, 4, 6, 22, 23, 24, 55, 65, and 64 would be even higher since employment was lower in the earlier year.

^dComputed from the number of wage earners in the BLS sample (as shown in an unpublished BLS tabulation, "Industry and Man-Hour Samples: September 1935") and the number reported by the *Census of Manufacturers for the corresponding industry in the same month.*

^eBased on the United States (New York: National Industrial Conference Board, Inc., 1929) presents both coverage figures (pp. 69-70) and industry descriptions. The figures represent percentages of 1919 Census wage-earner employment.

^fThe BLS series for Electric Light and Power and manufactured the combined was used for the former only (see Part Three, appendix B) since it includes several times as many workers as the latter.

^gAlthough in 1929 Cigars were considered part of the Cigars and Cigarettes industry by the Census, it was made a separate category in 1935 and its 1929 employment was reported in *Census of Manufacturers: 1929.*

n.a. Data not available.

for 1919 were derived in 11 instances by the multiplication of Census prevailing hours for this year (to be described below) by appropriate ratios of NICB actual to Census prevailing hours in one or more later years; in 6 other instances they were derived by other methods.⁹⁵

Adjusted and Unadjusted Prevailing-Actual Hours Series

Since NICB hours series were not available for several industries and groups included in the NRP survey, it was sometimes necessary to use Census prevailing weekly hours for 1919, 1921, 1923, and 1929 and estimates for the intervening years derived by straight-line interpolation. In seven instances it was possible, however, to adjust these prevailing hours to the level of actual hours by the application of the ratio for one or more years for which both figures could be ascertained; in eight other instances, representing about one-ninth of the employment in the NRP sample in 1929, no adjustment could be made.⁹⁶ In any case, the adjusted or unadjusted prevailing-hours segments were joined to BLS actual hours for 1932-36 by means of straight-line interpolation.

The Census prevailing weekly hours for 1919, 1921, 1923, and 1929 were computed from tables showing the total number of wage earners in each industry distributed according to the length of the standard workweek in the establishments in which they were employed. There are eight frequency classes in the tables for 1919, 1921, and 1923 and five in the tables for 1929. The extreme classes have open ends: "44 hours and under" and

⁹⁵In the 11 instances in which prevailing hours were reduced, an attempt was made to obtain a reasonable approximation to the ratio of actual to prevailing hours in 1919. A comparison of the levels of production and employment in 1919 and later years provided the basis for selection of the ratio or average of ratios used as the reduction factor in each instance.

Straight-line interpolation between the NICB figures for 1914 and 1920 was employed for Manufactured Gas (No. 46). The estimates for Iron and Steel (No. 29) and Leather (No. 37) were derived from special BLS studies and for Chemicals (No. 12), Paper (No. 56), and Pulp (No. 57) from an NICB report. (The series for the latter two were not derived principally by the multiplication method.)

⁹⁶The reduction of prevailing hours to the level of actual was accomplished for Cane-Sugar Refining (No. 7), Fertilizers (No. 20), Flour and Other Grain-Mill Products (No. 21), Alloyers, Rolling Mills, and Foundries (No. 53), Petroleum Refining (No. 58), Cigars (No. 67), and Cigarettes (No. 68). (The series for Cane-Sugar Refining and Flour and Other Grain-Mill Products are not among those obtained chiefly by the multiplication of employment and average weekly hours. Unpublished prevailing hours figures for 1929 and 1931 were provided for Cigars by the Census.) No adjustment of prevailing hours could be made for Bread and Other Bakery Products (No. 4), Canned and Preserved Fruits and Vegetables (No. 9), Canned and Cured Fish (No. 10), Confectionery (No. 17), Glass (No. 23), Ice Cream (No. 28), Manufactured Ice (No. 47), and Primary Smelters and Refineries (No. 51). See Part Two, Clay Products (Other Than Pottery) and Nonclay Refractories (No. 13) for a comparison of man-hours indexes derived from actual hours and adjusted prevailing hours and by the deflation of pay rolls by hourly earnings.

"over 60 hours" in 1919, 1921, and 1923 and "40 hours and under" and "over 54 hours" in 1929. For the computation of the averages used in the NRP study, a representative figure or concentration point was assumed for each hours interval.

Apart from defects inherent in the method of derivation,⁹⁷ unadjusted Census prevailing hours are not likely to be adequate substitutes for actual hours. They represent the norm, or the average of the scheduled hours of work for the various plants of an industry. Consequently they tend not only to be higher than actual hours worked but also to be rigid from year to year. Unlike actual hours, prevailing hours are insensitive to fluctuations in the volume of part-time work, overtime work, and the number of days of operation.

An endeavor was made to ascertain the effect of the substitution of prevailing hours (in adjusted or unadjusted form) for actual hours on the NRP indexes for the years prior to 1929 and the years following 1929.

First, NICB actual and Census prevailing hours were compared for a number of industries and groups for which both were available - 19 in 1921 and 18 in 1923 and 1929. As was to be expected, actual hours are lower than prevailing hours; in two-thirds of the instances they are lower by not more than 10 percent.

Since prevailing hours tend to be rigid prior to 1929 and actual hours show little variation in the same period except in 1921, it is likely that indexes of adjusted or unadjusted prevailing hours approximate the movement of actual hours, at least between 1923 and 1929. In 1921 a proportionately greater number of industries have lower ratios of actual to prevailing hours. Consequently estimates derived by straight-

⁹⁷The most serious defect in the computed averages of prevailing hours doubtless results from the assumption of concentration points for the class intervals, particularly those with open ends. For some industries the number of wage earners in the open-end classes represents a considerable percentage of the total. In 1919 18 percent of the wage earners in the (Census) Glass industry, for example, were concentrated in the lowest class; and 32 and 43 percent in Cane-Sugar Refining (No. 7) and Manufactured Ice (No. 47), respectively, were concentrated in the highest class. In 1921 and 1923 the percentages in the highest class were 41 and 35, respectively, for Cane-Sugar Refining (No. 7); 42 and 50 percent for Manufactured Ice (No. 47); and 25 and 27 percent for Secondary Smelters and Refineries (No. 52). The reduction in the number of frequency intervals in 1929 introduces the danger of noncomparability; it particularly has the effect of increasing the percentages in the highest class. In this year more than half of the wage earners in Cane-Sugar Refining (No. 7), Fertilizers (No. 20), Ice Cream (No. 27), Manufactured Ice (No. 47), and Secondary Smelters and Refineries (No. 53) are in the class "over 54 hours"; more than a quarter of the wage earners in Canned and Cured Fish (No. 10), Flour and Other Grain-Mill Products (No. 21), Alloyers, Rolling Mills, and Foundries (No. 53), and Petroleum (No. 58) are also in this class.

line interpolation for 1922, and perhaps for 1920 also, may be higher than actual hours by more than the usual percentage. The result of such an overstatement in hours would be an understatement in man-hour productivity for the years 1920-22.

The validity of the method of estimating prevailing hours for 1924-28 by straight-line interpolation was tested by a comparison of 20 series of NICB actual hours with estimates interpolated between the NICB figures for 1923 and 1929. This method appears to be satisfactory since in 80 percent of the instances the estimates are within 2 hours, or 4 to 5 percent, of the NICB figures.

The use of unadjusted prevailing hours for 1929 in conjunction with actual hours for 1932-36 probably results in overstatement of the decline in man-hours after 1929 and, hence, in overstatement of man-hour productivity in each of the years 1932-36. If the relation between the NICB actual and Census prevailing hours for 1929 is typical, the eight NRP indexes of man-hour productivity based on unadjusted prevailing hours⁹⁸ may be too high by as much as 10 percent. Of the eight indexes, seven are above 100 in 1932 and subsequent years. The rise of six of these indexes of output per man-hour above the 1929 level is clearly not attributable to any upward bias resulting from the use of unadjusted prevailing hours; in 1932 and later years these indexes are above 110. It should be noted that the overstatement, whatever its magnitude, does not affect comparisons between 1932 and subsequent years.

An attempt was made to ascertain the reliability of the estimates of actual hours for 1930 and 1931 derived by straight-line interpolation between adjusted prevailing hours for 1929 and actual hours for 1932. A comparison for 19 NICB series similar to those for the years 1924-28 indicates that the estimates for 1930 are likely to be satisfactory while those for 1931 are probably less reliable.

Adjustment of Man-hours Series for Comparability With Production

The man-hours series for the components of three groups were, like the corresponding series for employment, adjusted for greater comparability with production on the basis of value.⁹⁹

⁹⁸See fn. 98.

⁹⁹Footnote 99 appears on following page.

FACTORS TO BE CONSIDERED IN THE EVALUATION OF NRP INDEXES

The NRP indexes are not all of the same quality despite the fact that in their construction a scrupulous endeavor was made to incorporate the best available statistics and to utilize the most appropriate methods. The relative merits of the several indexes cannot generally be determined because of the multiplicity of the statistical sources; the lack of uniformity of the statistics from any one source with respect to scope, coverage, and detail; and the dependence of the validity of the several measures for each industry on the degree to which they are mutually consistent. Certain factors which ought to be considered in any attempt at evaluation of the NRP indexes for individual industries and groups may, however, be indicated. Many of these have already been noted either explicitly or implicitly in the foregoing discussion.

Measures for an NRP group which is equivalent to a Census industry are usually more reliable than those for the component NRP industries. This is a consequence of the fact that production and labor statistics are readily available for such groups while relatively numerous estimates are necessary for the component industries.¹⁰⁰

The chronological comparability of an index is impaired by changes in industry definition, scope of canvass, or instructions to respondents, unless an adjustment could be made. A change in the degree of integration of an industry's establishments, however, results in indexes which do not have uniform meaning throughout the period, even when nominally comparable data are reported from year to year. Whatever the degree of integration of an industry, the index of productivity is more significant the more completely the production index represents the activities of the wage earners in the employment series.

A production or employment measure based on statistics from a single reliable source is more likely to be accurate than one based on series pieced together from several. Similarly, production and employment indexes computed from statistics

⁹⁹The three groups are Rubber Products (No. 61), Tobacco Products (No. 66), and Woolen and Worsted Goods (No. 70). For illustrative adjustments see Part Two, Ice Cream (No. 28) and Paper and Pulp (No. 55). For assumptions underlying the adjustment see "Adjustment of Employment Series for Comparability With Production" earlier in this chapter.

¹⁰⁰The indexes for Glass (No. 23), Leather (No. 37), and Lumber and Timber Products (No. 43) are probably more valid than those for the component industries.

from the same source are likely to be chronologically more comparable than otherwise. Thus more comprehensive production data collected by an organization other than the Bureau of the Census were not preferred if the absence of comparable labor statistics nullified any advantage resulting from their use. The same principle applies to wage-earners and man-hours series. If the former is involved in the derivation of the latter, both are more comparable than otherwise. This fact, however, does not reflect on the accuracy of either. For reasons already mentioned, Census wage-earners statistics are more reliable than estimates made through the use of BLS or NICB indexes for intercensal years. BLS statistics for employment and average weekly hours, in turn, were considered as probably more dependable than those of NICB. Other things being equal, man-hours indexes based on continuous series of average actual weekly hours are preferable to measures based on statistics from different sources which may neither be continuous nor represent actual hours. In particular, the use of unadjusted prevailing hours in the same series with actual hours for 1932 and later years is likely to result in overstatement of the decline in man-hours after 1929.

Caution should be exercised in the interpretation of the movement of indexes based entirely or in part on series other than those specifically required. Thus a consumption series used in the absence of data for production did not necessarily yield an adequate substitute for the desired index of output.¹⁰¹ Index numbers based on statistics derived by interpolation are usually less reliable than those for other years. In particular, when the basic statistics are provided by the Census for the odd-numbered years, the relatives for the even-numbered years are less dependable. When estimates are derived by straight-line interpolation, they are probably less accurate than others interpolated by means of auxiliary series.

Indexes having high coverage in terms of value of output, employment, or number of establishments are not necessarily

¹⁰¹Substitute series entered into the production indexes for Logging Camps (No. 44) (sawmill equivalents are used to represent actual logging-camp output), Newspaper and Periodical Printing and Publishing (No. 49) (newsprint consumption is used for the production of newspapers and periodicals), Bread and Other Bakery Products (No. 4) (flour milled is used instead of the quantities of bread and other bakery products), and Flour and Other Grain-Mill Products (No. 21) (wheat consumption is substituted for flour production); into the employment indexes for the component industries of Bread and Other Bakery Products (No. 4), Iron and Steel (No. 29), Knit Goods (No. 32), Lumber and Timber Products (No. 43), and Tobacco Products (No. 68); and into the man-hours indexes for Rayon (No. 60), Rubber Tires and Inner Tubes (No. 62), and Chewing and Smoking Tobacco and Snuff (No. 69).

more trustworthy than others. The higher the value coverage of a production index, however, the more likely it is to be representative of the entire output - i. e., for consumption, sale, and interplant transfer. The smaller the percentages of secondary products made within an industry and of the primary products made elsewhere, the more satisfactory will be the productivity measure derived from Census production and employment data.¹⁰²

Provided that a suitable weight was available for each product class, the most detailed classification was preferred for a production index. Even though relatives of unweighted quantities often resemble weighted indexes of the same scope, the differences in some years may be considerable. When fairly satisfactory quantity series and weights are available, theoretical difficulties may, nevertheless, arise from the inappropriateness of the units in which the quantities are reported. The units may be so broad or complex as to obscure significant differences of both a qualitative and quantitative character. This problem is inherent in the nature of all production measures for certain kinds of products (such as machinery or clothing).

Comparison of arithmetic means of quantity relatives with fixed weights and harmonic means with changing weights reveals that both are generally in close accord. Conclusive tests could seldom be made to determine the degree to which an NRP production index deviates from either of these means. The use of value weights may sometimes result in an inadequate index if they deviate significantly from proportionality to unit labor requirements. On the other hand, an NRP index with fixed-value weights (which may or may not refer to the base year) is not necessarily less accurate than one constructed with estimated labor-requirement weights, since the statistics used for the computation of the latter were usually crude.

In conclusion it should be noted that, since the various statistical techniques employed in the construction of the NRP measures (such as splicing and interpolation) are designed to yield satisfactory indicators of year-to-year movements rather than absolute levels, many of the defects of the basic statistics in absolute form are not characteristic of the indexes.

¹⁰²When primary products made in other industries can be excluded from the production statistics, the result is, of course, the same as if there were no such extraneous primary output.

CHAPTER III

SUMMARY OF FINDINGS

COVERAGE OF THE NRP MANUFACTURING INDUSTRIES

The 59 manufacturing industries (of which 35 were combined into 13 groups of closely related industries) considered in this report employed over 4,500,000 wage earners in 1929, or about 51 percent of the total number of wage earners reported by the *Census of Manufactures*. In the same year the products of the 59 industries were valued at almost \$40,000,000,000, or about 56 percent of the total.

All but 1 of the 16 Census industry groups, Railroad Repair Shops, are represented in the NRP sample. This group, however, comprises adjuncts to steam- and electric-railroad systems engaged to a greater extent in servicing than in the fabrication of new equipment; moreover, it accounted for only about 4.5 percent of the wage earners in manufacturing in 1929 and only about 1.8 percent of the total value of products. The NRP industries accounted for more than half the wage earners in each of 10 other Census groups and more than half the value of output in each of 11 (tables IX and X). For only one Census group (Machinery, not Including Transportation Equipment) does coverage in terms of wage-earner employment fall below one-quarter and in terms of value of products, below one-third.

Throughout the period 1919-36 the NRP sample consistently represented about 50 percent of the number of wage earners in all manufacturing as reported in the *Census of Manufactures*. The proportion, as estimated for the various census years, ranged between 49 and 54 percent. The changes in coverage are in part explained by changes in the proportions of different classes of goods produced. During years of sharply declining production the proportion of nondurable goods, for which sample coverage is higher, increases and the proportion of durable goods, for which sample coverage (particularly in the Machinery, not Including Transportation Equipment group) is lower, decreases. The net effect of such shifts is the increase in

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Table VIII.- AVERAGE NUMBER OF WAGE EARNERS EMPLOYED IN MANUFACTURING INDUSTRIES FOR WHICH NRP INDEXES HAVE BEEN CONSTRUCTED: 1929

Industry or group number and title	Wage earners	Industry or group number and title	Wage earners
All census manufacturing industries	8,839,743	34. Underwear	41,487
All NRP manufacturing industries	4,524,516 ^a	35. Outerwear	28,966
1. Agricultural Implements	41,663	36. Knit Cloth	8,491
2. Beet Sugar	7,496	37. Leather Group	
3. Boots and Shoes	205,640	38. Sole and Harness Leather	12,300
4. Bread and Other Bakery Products Group		39. Side and Upholstery Leather	12,100
5. Biscuit and Crackers	33,871	40. Calfskin	7,600
6. Bakery Products Other Than Biscuit and Crackers	166,970	41. Kid Leather	10,300
7. Cane-sugar Refining	13,912	42. Sheep and Miscellaneous Leather	7,700
8. Canning and Preserving Group		43. Lumber and Timber Products Group	
9. Canned and Preserved Fruits and Vegetables	98,666	44. Logging Camps	153,200
10. Canned and Cured Fish	13,612	45. Sawmills and Saw-Plane Mills	255,900
11. Cement	33,369	46. Manufactured Gas	43,065
12. Chemicals	65,659	47. Manufactured Ice	32,184
13. Clay Products (Other Than Pottery) and Nonclay Refractories	93,335	48. Motor Vehicles	447,449
14. Coke Group		49. Newspaper and Periodical Printing and Publishing	129,660
15. Beehive Coke	2,708	50. Nonferrous Metals Group	
16. Byproduct Coke	19,016	51. Primary Smelters and Refineries	30,961
17. Confectionery	69,501	52. Secondary Smelters and Refineries	4,134
18. Cotton Goods	424,916	53. Alloyers, Rolling Mills, and Foundries	79,163
19. Electric Lamps	6,703	54. Paints and Varnishes	29,211
20. Fertilizers	20,929	55. Paper and Pulp Group	
21. Flour and Other Grain-Mill Products	27,028	56. Paper	103,320
22. Furniture	193,399	57. Pulp	24,729
23. Glass Group		58. Petroleum Refining	60,596
24. Window Glass	6,000	59. Finishing-Mill Products	60,134
25. Plate Glass	12,100	60. Rayon	38,106
26. Glass Containers	22,600	61. Rubber Products Group	
27. Pressed and Blown Ware	24,400	62. Rubber Fires and Inner Tubes	65,000
28. Ice Cream	22,399	63. Other Rubber Goods	94,100
29. Iron and Steel Group		64. Silk and Rayon Goods	130,467
30. Blast Furnaces	24,960	65. Slaughtering and Meat Packing	128,402
31. Steel Works and Rolling Mills	394,574	66. Tobacco Products Group	
32. Knit Goods Group		67. Cigars	84,200
33. Hosiery	129,542	68. Cigarettes	15,900
		69. Chewing and Smoking Tobacco	
		70. Woolen and Worsted Goods Group	16,000
		71. Woolen Goods	60,099
		72. Worsted Goods	66,860

^aBecause of the rounding off of the figures for several of the group components, this total differs slightly from the sum of the industries listed below.

the percentage of the total represented by the sample in years of low production. Another reason for the change in coverage is the decline in Shipbuilding (not included in the NRP sample), an industry which employed almost 400,000 wage earners in 1919 but only about 60,000 in 1923 and subsequent years.

COMBINED INDEXES FOR NRP SAMPLE

The movements of the NRP indexes of production, employment, man-hours, output per wage earner, and output per man-hour may conveniently be summarized by means of combined measures for the NRP sample. Because of certain defects in the coverage of the NRP sample (particularly the insufficient representation of the capital-goods industries), such indexes are more likely to indicate the direction of the year-to-year percentage changes for all manufacturing than the correct magnitude of these

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Table IX.- PERCENT OF EACH CENSUS INDUSTRY GROUP ACCOUNTED FOR BY NRP INDUSTRIES: 1929^a

Census industry group	Wage earners	Value of products
All groups	51.1	56.3
Food and Kindred Products	80.7	70.8
Textiles and Their Products	53.3	43.1
Forest Products	80.2	77.3
Paper and Allied Products	54.9	63.7
Printing, Publishing, and Allied Industries	36.2	54.8
Chemicals and Allied Products	55.1	46.3
Products of Petroleum and Coal	98.8 ^b	97.8
Rubber Products	100.0	100.0
Leather and Its Manufactures	80.3	75.9
Stone, Clay, and Glass Products	58.6	55.5
Iron and Steel and Their Products, not Including Machinery	47.6	58.0
Nonferrous Metals and Their Products	36.3	65.7
Machinery, not Including Transportation Equipment	3.8	3.9
Transportation Equipment, Air, Land, and Water	76.7	87.0
Railroad Repair Shops	0	0
Miscellaneous Industries	27.8	36.4

^aElectric Lamps (No. 19), which employed about 8,700 wage earners in 1929, is excluded since it is classifiable in both the tenth and thirteenth groups.

^bRepresents a slight overstatement since there is duplication of a small number of wage earners in Byproduct Coke (No. 16) and Manufactured Gas (No. 46).

changes. An examination of the average rates of change in output per man-hour (which will be discussed later) shows distinct tendencies toward uniformity in direction of movement for the post-war period. Although for the years immediately following 1929 there are divergences, uniformity in the direction of movement for the large majority of industries is again exhibited if one considers the net change between 1929 and 1935. These characteristics warrant the belief that the indexes for the sample represent correctly the general movement of productivity. Better coverage of manufacturing industries would probably not change the direction of the over-all indexes, although a more reliable approximation to the magnitude of the changes for manufacturing as a whole would result.

Table X.- PERCENT OF WAGE EARNERS AND VALUE OF PRODUCTS OF ALL MANUFACTURING INDUSTRIES ACCOUNTED FOR BY NRP INDUSTRIES, BY CENSUS INDUSTRY GROUP: 1929^a

Census industry group	Wage earners		Value of products	
	Census group	NRP industries	Census group	NRP industries
All groups	100.0	51.1	100.0	56.3
Food and Kindred Products	8.5	6.9	17.1	12.1
Textiles and Their Products	19.3	10.3	13.1	5.7
Forest Products	9.9	7.9	5.1	3.9
Paper and Allied Products	2.6	1.4	2.7	1.7
Printing, Publishing, and Allied Industries	4.1	1.5	4.5	2.5
Chemicals and Allied Products	3.2	1.8	5.3	2.5
Products of Petroleum and Coal	1.7	1.6 ^b	5.2	5.1
Rubber Products	1.7	1.7	1.6	1.6
Leather and Its Manufactures	3.6	2.9	2.7	2.1
Stone, Clay, and Glass Products	3.7	2.2	2.2	1.2
Iron and Steel and Their Products, not Including Machinery	10.0	4.7	10.1	5.9
Nonferrous Metals and Their Products	3.6	1.3	5.1	2.6
Machinery, not Including Transportation Equipment	12.3	0.5	10.0	0.4
Transportation Equipment, Air, Land, and Water	6.6	5.1	8.6	7.5
Railroad Repair Shops	4.5	0	1.8	0
Miscellaneous Industries	4.7	1.3	4.9	1.8

^aSee table IX, ftm. a.

^bSee table IX, ftm. b.

Two sets of measures were constructed for the sample by the use of the formulas presented in chapter I: one is consistent with a productivity index for the base-year production composite; the other, with a productivity index for the changing production composite. These two sets will be discussed in turn. Only one production index, with man-hour weights, was computed for each set.¹

¹Since all the NRP production indexes were not available for each year, the two general measures for the sample were constructed from a changing number of series.
[Continued]

Changes in Productivity for the 1929 Production Composite

One of the outstanding features of the decade of the twenties is the magnitude of the increase in output per wage earner and per man-hour. As may be seen from table XI, the sample index for the former rose 55 percent and that for the latter 57 percent. In other words, with the unit labor requirements of 1919 approximately 55 percent more wage earners and 57 percent more man-hours would have been necessary to produce the 1929 composite of products. During the same period production² increased about as fast as productivity, but it is noteworthy that both output per wage earner and per man-hour continued to rise even in years during which production declined (1921, 1924, and 1927). Employment and man-hours remained below the 1919 level throughout most of this period.³

Thus it is evident that a major characteristic of manufacturing industries during the 10 years prior to 1929 was the production of an increasing amount of goods with a relatively stable or even declining volume of employment (witness the years 1925-28 as compared with 1923 and 1920). The average hours worked per week changed little during the period under consideration. While there are variations between years, and naturally from industry to industry, the average hours worked per week ranged between 46 and 48 during the entire period and the indexes of employment and man-hours are similar until 1929.

Between 1929 and 1932 production declined 47 percent, the number of wage earners 36 percent, and the number of man-hours 48 percent. In other words, output per wage earner declined as the average hours worked dropped, but output per man-hour

¹[Continued]

The index number for each year, however, is strictly comparable with that for 1929. Wage-earner weights were used in a few cases where man-hours series were not available. Because of the similarity of the distribution of employment and man-hours, however, an index with man-hour weights cannot differ significantly from one with wage-earner weights.

²Standard indexes of production which purport to measure the change in all manufacturing show increases of from 40 to 49 percent from 1919 to 1929. It should be noted, however, that these measures of production are not comparable with the production index presented in table XI. Besides differences in purpose, methods of construction, and composition, the production index in table XI is computed with changing weights whereas the other measures have either fixed (base-year) weights or an average of weights for the base year and each year in the index. Thus while the sample production index with changing weights shows a rise of 57 percent between 1919 and 1929, the index with base-year weights (table XIII) shows a 44-percent increase, which is similar to the rise in the other indexes of production referred to above.

³Employment for all manufacturing industries as reported by the *Census of Manufactures* declined about 2 percent while employment in the sample showed an increase of slightly less than 2 percent. The employment index for the sample and for all manufacturing industries showed similar year-to-year movements, and both showed relative stability on the whole.

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Table XI.- COMBINED INDEXES OF PRODUCTION, EMPLOYMENT, MAN-HOURS, AND PRODUCTIVITY (WITH BASE-YEAR MAN-HOUR WEIGHTS) FOR NRP MANUFACTURING INDUSTRIES: 1919-36^a

(1929 = 100)

Year	Production ^b	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	63.4	98.4	99.9	64.4	63.5
1920	67.3	100.5	100.5	67.0	67.0
1921	54.3	78.8	75.9	68.9	71.5
1922	70.4	91.7	91.5	76.8	76.9
1923	81.7	100.7	100.7	81.1	81.1
1924	77.4	94.8	92.1	81.6	84.0
1925	86.1	98.2	97.5	87.7	88.3
1926	90.2	98.8	98.7	91.3	91.4
1927	88.5	95.6	95.7	92.6	92.5
1928	93.0	96.3	96.0	96.6	96.9
1929	100.0	100.0	100.0	100.0	100.0
1930	80.8	86.3	80.1	93.6	100.9
1931	66.0	73.2	65.2	92.9	104.3
1932	53.4	64.4	51.8	82.9	103.1
1933	62.1	72.6	57.7	85.5	107.6
1934	67.1	84.0	60.5	79.9	110.9
1935	77.9	86.9	65.7	89.6	118.6
1936	89.3	90.9	73.3	98.2	121.8

^aFor many industries data are lacking for some of the years of the period 1919-36. Hence the index numbers were constructed by chaining links for identical industries.

^bEquivalent to an index whose component indexes were weighted with changing man-hour weights.

remained fairly stable and even increased slightly. By 1936 production had recovered to 89 percent of the 1929 level and employment to 91 percent, but the index of man-hours was still 27 units below. Output per wage earner was only slightly below 1929, but output per man-hour had reached a point 22 percent above 1929. From table XII it may be seen that the average hours per week declined from 48 in 1929 to 38 in 1932;⁴ the

⁴The reduction in the average hours worked per week between 1929 and 1933 does not necessarily reflect a conscious attempt to spread the work. The methods of production in modern industry (for example, detailed division of labor and integration of processes) are such that with a sharp decline in production the number of man-hours utilized may be expected to decline more than the number of workers employed. Certain industrial processes require the employment of a minimum number of men to perform the necessary series of operations (aside from maintenance labor); when production drops so low that this minimum number cannot be employed full-time, the maintenance of any production at all necessitates the employment of the work force on a part-time basis.

average was further reduced to 36 in 1934, which no doubt reflects the influence of the NRA codes; although it rose thereafter, it was still only 39 in 1936.

Table XII.- AVERAGE HOURS WORKED PER WEEK IN NRP MANUFACTURING INDUSTRIES: 1920-36^a

Year	Number of hours	Year	Number of hours
1920	48.2	1929	48.2
1921	46.3	1930	44.5
1922	48.2	1931	43.0
1923	48.4	1932	38.3
1924	48.8	1933	38.4
1925	48.0	1934	35.8
1926	48.2	1935	36.6
1927	48.3	1936	38.7
1928	48.1		

^aThe averages, computed with wage-earner weights, are based on 49 BLS, NICB, and Census series for 1933 and 1935, 44 for 1934 and 1936, and 28 for 1920-32. The averages for 1933 and 1935 represent the entire NRP sample with the exception of Beet Sugar and Electric Lamps; the averages for the other years were adjusted to the same level.

Changes in Productivity for the Changing Production Composite

The use of the indexes discussed above for estimating future labor requirements involves the assumption that the 1929 composition of production remained constant. What difference would it make in the indexes if we took into account the changes which actually occurred from year to year in the relative importance of the products manufactured? In accordance with the methods outlined in chapter I, indexes of output per wage earner and output per man-hour with changing weights were constructed in order to examine the possible effect of changing composition of production.

As may be seen from a comparison of tables XI and XIII, output per man-hour⁵ for the fixed (1929) composite of production increased by a greater percentage between 1919 and 1929; it rose from 63 to 100, while the index for the changing composite rose from 69 to 100. This difference reflects the fact that, in general, production advanced at higher rates in industries registering the greater gains in productivity. In

⁵Although the discussion is restricted to the indexes of output per man-hour, the relations noted are also characteristic of the indexes of output per wage earner.

other words, those industries which experienced a more rapid rise in production received relatively more weight in the 1929 composite than in the 1919 composite; since it was these industries which had the more rapid rise in output per man-hour, the greater increases in output per man-hour were weighted more heavily in the fixed-weight index with 1929 weights than in the changing-weight index with 1919 weights. Hence the index with 1929 weights shows a higher percentage increase in output per man-hour from 1919 to 1929 than does the index with changing weights.

Despite the fluctuations in composition after 1929, the differences between the productivity measures for the fixed and changing composites is not so great as might have been expected. Output per man-hour for the fixed composite rose 3 percent from 1929 to 1932; it rose 22 percent from 1929

Table XIII.- COMBINED INDEXES OF PRODUCTION, EMPLOYMENT, MAN-HOURS, AND PRODUCTIVITY (WITH CHANGING MAN-HOUR WEIGHTS) FOR NRP MANUFACTURING INDUSTRIES: 1919-36^a

(1929 = 100)

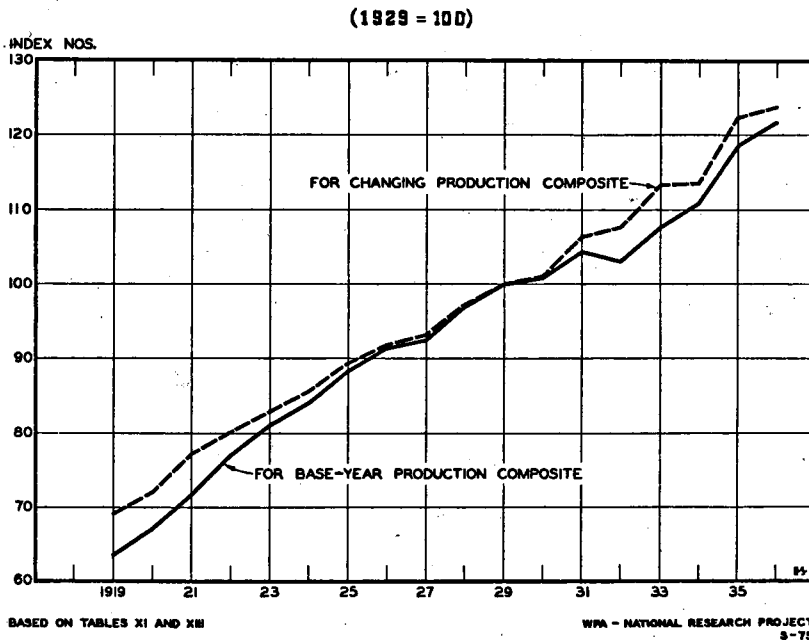
Year	Production ^b	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	69.0	98.4	99.9	70.1	69.1
1920	72.4	100.5	100.5	72.0	72.0
1921	58.6	78.8	75.9	74.4	77.2
1922	73.3	91.7	91.5	79.9	80.1
1923	83.4	100.7	100.7	82.8	82.8
1924	78.8	94.8	92.1	83.1	85.6
1925	87.1	98.2	97.5	88.7	89.3
1926	90.7	98.8	98.7	91.8	91.9
1927	89.2	95.6	95.7	93.3	93.2
1928	93.3	96.3	96.0	96.9	97.2
1929	100.0	100.0	100.0	100.0	100.0
1930	81.0	86.3	80.1	93.9	101.1
1931	69.3	73.2	65.2	94.7	108.3
1932	55.8	64.4	51.8	86.6	107.7
1933	65.5	72.6	57.7	90.2	113.5
1934	68.7	84.0	60.5	81.8	113.6
1935	80.4	86.9	65.7	92.5	122.4
1936	90.8	90.9	73.3	99.9	123.9

^a See table XI, ftm. a.

^b Equivalent to an index whose component indexes were weighted with base-year man-hour weights.

to 1936. The corresponding increases for the changing composite were 8 and 24 percent, respectively. The difference between the two indexes for the period 1929-32 is due to the association, in general, of declining output per man-hour in industries with the sharper declines in production and increasing output per man-hour in industries with less severe reductions in output. While not true in every instance, the durable-goods industries not only suffered sharper declines in production between 1929 and 1932 but also were characterized by fairly stable or even declining output per man-hour. On the other hand, production in the nondurable-goods industries, in general, decreased less while output per man-hour rose. Since the indexes of output per man-hour for the latter industries were weighted more heavily in the production composite following 1929 than in 1929, the productivity measure with changing weights is higher than the index with fixed weights in 1932.⁶ (See figure I.)

Figure I.- COMBINED INDEXES OF OUTPUT PER MAN-HOUR FOR
NRP MANUFACTURING INDUSTRIES: 1919-36



⁶ It is interesting to note that the index of productivity for the changing composite, unlike the index for the fixed composite, rises in every year, even between 1931 and 1932.

Estimates of the man-hour requirements based on either index would not differ greatly after 1929. True, the index for the changing composite was 6 points (or about 5 percent) above the other in 1933, but by 1936 the difference was only 2 points (or less than 2 percent).

AVERAGE ANNUAL RATES OF CHANGE FOR INDIVIDUAL INDUSTRIES

Useful as indexes for the entire sample may be, they nevertheless conceal differences in the movements of the indexes for the individual industries or groups. Study of the differences between the individual parts of the total is necessary for an inquiry into the relationships between changes in productivity, in technology, and in economic factors; it also serves to facilitate estimates of future employment opportunities. An intensive study of these factors would require a detailed analysis of strategic classes of industries in their relation to the changing structure of the economy and their behavior under varying economic conditions. Such studies were outside the scope of this report, but a statistical analysis of the movements of production, employment, and productivity of the individual industries constitutes a necessary preliminary step. The remainder of this chapter will be devoted to such an analysis.

A careful examination of the character of the period under consideration and of the fluctuations in the individual series resulted in the adoption of the following technique of summarization:

- (1) The period 1919-35⁷ was first divided into two parts, 1919-29 and 1929-35. This was done because the indexes for productivity, and of course for production, employment, and man-hours as well, exhibit different characteristics before and after 1929. It is of special interest, moreover, to compare the rates of change in productivity for the recent prolonged depression with the previous period of rising production.
- (2) A geometric average annual rate of change was used to compare changes in production, labor, and productivity for the individual industries. The comparison of average rather than of total percentage changes was desirable

⁷The year 1938 was omitted from the comparison since indexes for some industries were not available for this year.

because some indexes were not available for the earlier years of the period 1919-35. Also, the use of annual averages facilitates comparison of periods of different lengths. A geometric rather than arithmetic average was selected because the former indicates the rate of growth not only per unit of time but also from year to year.⁸

Before the decision to use this mean was made it was necessary to determine whether the computed rate of change between the terminal years was characteristic of the actual movement throughout the period. This was found to be the case for the period 1919-29. In some instances there was some doubt as to whether the rates computed between the years 1919 and 1929 were characteristic of the entire decade. In these cases, however, the method used seemed as reliable as the use of a fitted trend line. It was also necessary to determine for those industries for which indexes were not available for the earlier years whether the average rate of growth between 1921, 1923, or 1925 and 1929 was typical of the entire period 1919-29. Analysis revealed that this was likely to be the case. Similar rates of change were computed for the period 1929-35 in order to facilitate comparisons with pre-1929 years.

- (3) Geometric average rates of change were computed for production, employment, man-hours, output per wage earner, and output per man-hour for as many individual industries and groups as possible. (Hereafter, all references to annual average rates of change will signify a geometric average of year-to-year changes.) These rates were then classified in frequency distributions. Employment in 1929 was selected as the criterion of the relative significance of the rates of change for the various industries.

Frequency distributions for production, employment, man-hours, output per wage earner, and output per man-hour were constructed for 49 industries or groups.

⁸More strictly, the average is a geometric mean of the year-to-year link relatives of the index numbers minus unity. This is equivalent to the n th root of the ratio between the index numbers for the terminal years minus unity, which is the form used in the computation of the annual average rates of change. Thus, if the index numbers are a_1, a_2, \dots, a_n , the average rate of change is

When indexes of output per man-hour were available for all components as well as groups, the rates for the components were used. In cases where output per man-hour data were available for the group alone or only for some of the component industries, the group index was used.⁹

Average Annual Rates of Change Between 1919 and 1929

Production.- It was pointed out earlier that production for the sample as a whole increased considerably in the decade 1919-29 and that it declined only in the years 1921, 1924, and 1927. More striking, however, is the fact that for the period as a whole the average annual rates of change were positive for 42 of the 49 industries, representing 93 percent

Table XIV.- DISTRIBUTION OF 49 MANUFACTURING INDUSTRIES AND THEIR 1929 EMPLOYMENT ACCORDING TO AVERAGE ANNUAL RATES OF CHANGE OF PRODUCTION, EMPLOYMENT, AND MAN-HOURS BETWEEN 1919 AND 1929

Average annual rate of change	Production		Employment		Man-hours	
	Number of industries	Percentage distribution of 1929 employment	Number of industries	Percentage distribution of 1929 employment	Number of industries	Percentage distribution of 1929 employment
Total	49	100.0	49	100.0	49	100.0
Over -10.0	0	0	1	0.1	1	0.1
- 7.6 to -10.0	1	0.1	0	0	0	0
- 5.1 to - 7.5	0	0	2	1.2	3	1.8
- 2.6 to - 5.0	0	0	8	4.1	6	3.2
- 0.1 to - 2.5	6	6.6	12	33.7	14	30.6
0	0	0	3	11.7	3	12.6
+ 0.1 to + 2.5	12	28.6	13	23.1	13	26.4
+ 2.6 to + 5.0	13	27.6	8	25.1	7	24.4
+ 5.1 to + 7.5	8	19.8	1	0.1	1	0.1
+ 7.6 to +10.0	4	1.6	0	0	0	0
+10.1 to +12.5	3	13.4	0	0	0	0
+12.6 to +15.0	0	0	0	0	0	0
Over +15.0	2	2.3	1	0.9	1	0.8

⁹These frequency distributions cover the entire sample with the exception of Electric Lamps (No. 19), for which the indexes could not be extended beyond 1931.

of the total employment in the sample in 1929¹⁰ (table XIV). Although the annual rates are concentrated in the class +0.1 to +7.5 percent, as many as 15 percent of the wage earners were engaged in industries having rates as high as +7.6 to +12.5 percent. Two industries, Rubber Tires and Inner Tubes and Rayon (the latter has been developed only since the war), have unusual rates of more than 15 percent. In but one industry, Beehive Coke, did production show a significant decline (10 percent per annum). This industry, however, accounted for only 0.1 percent of 1929 employment in the NRP sample, and the decline reflects the trend toward the use of the more efficient byproduct ovens rather than the absolute decrease of coke production. Only seven industries, together accounting for less than 7 percent of the number of wage earners, had negative rates of change, and six of these are concentrated in the interval -0.1 to -2.5 percent.

Wage Earners.— The distribution of the rates of change in employment during the period 1919-29 is unlike that of the changes in production. Of the 49 industries, 23, representing 39 percent of the 1929 number of wage earners in the sample, showed negative rates of change; 20 of these were between -0.1 and -5.0. Three other industries, covering 12 percent of the wage earners, showed no net change in employment. In most of these instances production was increasing, and the relative rise in output per wage earner was even greater than the rise in production. It is also noteworthy that in each of the seven industries in which production declined the negative rate for employment was greater. Finally, in the industries where employment increased the rates were lower than for production (except in the Canned and Cured Fish industry).

Man-hours.— As may be seen from table XIV, the distribution of the rates of change in man-hours is similar to that for wage earners. This is to be expected in view of the stability of average weekly hours throughout the decade (table XII).

Output per Man-hour.— The concurrence of productivity increases with increases in production is characteristic not only of the sample as a whole but also of most of the industries or

¹⁰In subsequent references to employment as an indicator of the significance of rates, the number of wage earners in 1929 is implied; the implied total, moreover, is the number in the 49 industries and groups. For the sake of convenience the industries and groups are referred to simply as industries in the remainder of the chapter.

groups. Only two industries, which account for less than 8 percent of the 1929 wage-earner employment in the sample, showed declining output per man-hour for the decade 1919-29 (table XV). Of the 47 industries with increasing output per man-hour, 11, representing 30 percent of the employment, were concentrated in the interval +0.1 to +2.5 percent; 20, representing 26 percent of employment, in the interval +2.6 to +5.0 percent; and 14, representing 34 percent of employment, in the interval +5.1 to +10.0 percent. In two industries (Alloyers, Rolling Mills, and Foundries, and Cigarettes) output per man-hour increased at average annual rates of between +10.1 and +12.5 percent; together these two industries account for 2 percent of the 1929 number of wage earners in the 49 industries.

Output per Wage Earner.- The distribution of rates of change in output per wage earner is similar to the one for output per man-hour, except for a heavier concentration of rates of

Table XV.- DISTRIBUTION OF 49 MANUFACTURING INDUSTRIES AND THEIR 1929 EMPLOYMENT ACCORDING TO AVERAGE ANNUAL RATES OF CHANGE OF OUTPUT PER WAGE EARNER AND OUTPUT PER MAN-HOUR BETWEEN 1919 AND 1929

Average annual rate of change	Output per wage earner		Output per man-hour	
	Number of industries	Percentage distribution of 1929 employment	Number of industries	Percentage distribution of 1929 employment
Total	49	100.0	49	100.0
Over -10.0	0	0	0	0
- 7.6 to -10.0	0	0	0	0
- 5.1 to - 7.5	0	0	0	0
- 2.6 to - 5.0	0	0	0	0
- 0.1 to - 2.5	1	0.3	2	7.7
0	0	0	0	0
+ 0.1 to + 2.5	13	38.2	11	30.0
+ 2.6 to + 5.0	20	34.6	20	26.0
+ 5.1 to + 7.5	9	11.8	10	21.2
+ 7.6 to +10.0	4	13.0	4	13.0
+10.1 to +12.5	2	2.1	2	2.1
+12.6 to +15.0	0	0	0	0
Over +15.0	0	0	0	0

increase in the lower class intervals. In most of the industries studied the indexes of output per man-hour during 1919-29 are either close to or slightly higher than those for output per wage earner.

Average Annual Rates of Change Between 1928 and 1935

General Considerations in Productivity Movement During Production Decline.— There is no uniform behavior of productivity characteristic of all manufacturing industries under conditions of sharply fluctuating production. When the volume of production is declining there are factors affecting the change in productivity of labor in different directions. Each of these factors may affect different types of industries in varying degree, according to their organization and operating conditions.¹¹ There is little doubt, however, that depression stimulates efforts to reduce unit labor requirements, particularly by speeding up operations and introducing technical and managerial improvements which require little capital outlay. Furthermore, declining production volume may encourage, in some industries, the shift of production to plants producing at a higher level of productivity. This shift can be deliberate, however, only where there is centralized ownership of several plants, and in some industries such shifts are no doubt also limited by restrictions imposed by transportation costs of raw materials or finished products. During periods of declining output productivity in some industries may decline despite efforts to decrease unit labor requirements, depending upon the needs for maintenance and overhead labor. The need for such labor will, of course, vary according to the nature of the industry, the production techniques, and the policy of management. Declines in productivity owing to these factors

¹¹Economists have long been interested in the movement of productivity during the business cycle. The analysis has usually been concerned with the efficiency of the individual workers or groups of workers rather than with "labor productivity." One frequently encountered line of reasoning holds that the efficiency of the employed wage earners increases particularly during periods of depression owing to (1) the effect of the pressure of a surplus labor supply and (2) the fact that in the interest of cutting unit costs the least efficient workers are dismissed first. While the first reason, which cannot be tested with the available data, seems plausible, the second is subject to considerable qualification. The belief that in years of depression the least efficient workers are the first to be laid off rests on the seemingly crude assumption that all employers have a uniform lay-off policy which is based solely on the criterion of efficiency, and that there are no restraints to the execution of this policy. (For some other selective factors in lay-off, see, for instance, WPA National Research Project reports published in the series "Studies of the Effects of Industrial Change on Labor Markets" and "Philadelphia Labor Market Studies.") Moreover, declines in employment often occur as a result of complete shut-downs of plants, in which event both the efficient and inefficient workers are dismissed, while other plants, still in operation, may continue to employ relatively less efficient personnel.

are particularly marked in industries which have a relatively high proportion of overhead and maintenance labor and which experience exceptionally sharp declines in output. These two conditions are frequently met in industries producing durable goods.

Whatever the immediate effects on man-hour productivity during depression may be, the fact is that when production recovers, output per man-hour in many industries tends to increase because plant capacity is utilized more efficiently than during the depression. This may, however, be partially offset by resumed operation in less efficient plants. Efforts at reducing unit costs and unit labor requirements during depression frequently result in increasing economies in the utilization of labor when production rises.

Productivity, 1929-35.- The outstanding characteristic of the period 1929-35 as a whole is the increase in man-hour productivity in the face of a general decline in production

Table XVI.- DISTRIBUTION OF 49 MANUFACTURING INDUSTRIES AND THEIR 1929 EMPLOYMENT ACCORDING TO AVERAGE ANNUAL RATES OF CHANGE OF OUTPUT PER WAGE EARNER AND OUTPUT PER MAN-HOUR BETWEEN 1929 AND 1935

Average annual rate of change	Output per wage earner		Output per man-hour	
	Number of industries	Percentage distribution of 1929 employment	Number of industries	Percentage distribution of 1929 employment
Total	49	100.0	49	100.0
Over -10.0	1	0.1	0	0
- 7.6 to -10.0	0	0	0	0
- 5.1 to - 7.5	6	13.8	1	0.1
- 2.6 to - 5.0	9	18.9	2	1.6
- 0.1 to - 2.5	14	39.1	4	6.2
0	0	0	0	0
+ 0.1 to + 2.5	14	23.5	10	36.2
+ 2.6 to + 5.0	3	2.3	18	32.7
+ 5.1 to + 7.5	1	1.4	9	17.7
+ 7.6 to +10.0	1	0.9	3	3.2
+10.1 to +12.5	0	0	1	1.4
+12.6 to +15.0	0	0	1	0.9
Over +15.0	0	0	0	0

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from 1929 to 1932 and the continued rise in man-hour productivity with the recovery of production after 1932. In table XVI it may be seen that the rates of change in output per man-hour between 1929 and 1935 increased for 42 of the 49 industries; these 42 accounted for 92 percent of the wage earners in the 49 industries. In sharp contrast, output per wage earner declined in most of the industries; only 19 industries, representing about 28 percent of the wage earners, have higher wage-earner productivity in 1935 than in 1929, and 14 of these are concentrated in the interval +0.1 to +2.5 percent.

The rates of increase in man-hour productivity are in general lower for this period than for the preceding decade; the concentration in the lower intervals is denser and the dispersion generally greater. Nevertheless, in 23 instances, representing 53 percent of employment, the rate of increase is higher for 1929-35 than for 1919-29 (table XVII). With few exceptions these 23 industries had attained higher production levels by 1935, relative to 1929, than had the 22 others which had lower

Table XVII.- CLASSIFICATION OF 49 NRP MANUFACTURING INDUSTRIES BY RELATIONSHIP OF AVERAGE ANNUAL RATES OF CHANGE DURING THE PERIODS 1919-29 AND 1929-35^a

Industry whose average annual increase in output per man-hour during 1929-35 was -		
Smaller than during 1919-29 (22 industries having 45.7 percent of total sample employment)	Equal to that during 1919-29 ^b (4 industries having 1.4 percent of total sample employment)	Greater than during 1919-29 (23 industries having 52.9 percent of total sample employment)
1. Agricultural Implements ^{c,d}	7. Cane-Sugar Refining	3. Boots and Shoes
2. Beet Sugar	38. Sole and Harness Leather	4. Bread and Other Bakery Products Group ^e
11. Cement	40. Calfskin	9. Canned and Preserved Fruits and Vegetables
12. Chemicals	54. Paints and Varnishes	10. Canned and Cured Fish
13. Clay Products (Other Than Pottery) and Nonclay Refractories ^d		17. Confectionery ^f
15. Beehive Coke ^d		18. Cotton Goods
16. Byproduct Coke ^d		23. Glass Group
20. Fertilizers		28. Ice Cream
21. Flour and Other Grain-Mill Products		32. Knit Goods Group
22. Furniture		39. Side and Upholstery Leather
29. Iron and Steel Group		42. Sheep and Miscellaneous Leather
41. Kid Leather		44. Logging Camps
48. Motor Vehicles		45. Sawmills and Saw-Plane Mills ^g
49. Newspaper and Periodical Printing and Publishing		46. Manufactured Gas
51. Primary Smelters and Refineries ^d		47. Manufactured Ice
53. Alloys, Rolling Mills, and Foundries ^d		52. Secondary Smelters and Refineries
56. Paper		20. Rayon ^h
57. Pulp		22. Rubber Tires and Inner Tubes ^g
58. Petroleum Refining		23. Other Rubber Goods ^{g,h}
59. Planing-Mill Products ^d		24. Silk and Rayon Goods
65. Slaughtering and Meat Packing		27. Cigars
68. Cigarettes		29. Chewing and Smoking Tobacco and Snuff
		70. Woolen and Worsted Goods Group

^aBased on geometric averages for individual industry series. Group movements excluded except as indicated.

^bWhere differences between rates of increase were of a magnitude of 0.5 percent or less, the geometric rates were considered equal.

^cInitial period is 1919-29.

^dReversal of direction of rate of change.

^eInitial period is 1923-29.

^fInitial period is 1925-28.

^gInitial period is 1921-29.

rates of change in man-hour productivity for the later period. The industries with annual rates of increasing output per man-hour above 10 percent - Rubber Tires and Inner Tubes and Rayon - account for 2 percent of the 1929 wage-earner employment in the sample. Twelve industries, representing 21 percent of employment, are found in the interval +5.1 to +10.0 percent; 18, representing 33 percent of employment, in the interval +2.6 to +5.0 percent; and 10, representing 36 percent, in the interval +0.1 to +2.5 percent.

These advances in man-hour productivity beyond the 1929 level were registered before the output of most industries had regained the 1929 level. Between 1929 and 1935, 35 industries, representing 78 percent of employment, had negative average annual rates of change in production (table XVIII). Furthermore, 36 industries, representing 79 percent of employment,

Table XVIII.- DISTRIBUTION OF 49 MANUFACTURING INDUSTRIES AND THEIR 1929 EMPLOYMENT ACCORDING TO AVERAGE ANNUAL RATES OF CHANGE OF PRODUCTION, EMPLOYMENT, AND MAN-HOURS BETWEEN 1929 AND 1935

Average annual rate of change	Production		Employment		Man-hours	
	Number of industries	Percentage distribution of 1929 employment	Number of industries	Percentage distribution of 1929 employment	Number of industries	Percentage distribution of 1929 employment
Total	49	100.0	49	100.0	49	100.0
Over -10.0	7	12.4	2	2.1	9	18.2
- 7.6 to -10.0	3	9.4	6	14.2	8	18.3
- 5.1 to - 7.5	6	13.6	5	8.7	13	31.2
- 2.6 to - 5.0	8	26.9	5	4.3	14	28.2
- 0.1 to - 2.5	11	15.7	18	50.0	3	4.9
0	0	0	1	2.3	1	0.9
+ 0.1 to + 2.5	11	18.6	9	15.2	1	0.3
+ 2.6 to + 5.0	2	2.5	3	3.2	0	0
+ 5.1 to + 7.5	0	0	0	0	0	0
+ 7.6 to +10.0	0	0	0	0	0	0
+10.1 to +12.5	0	0	0	0	0	0
+12.6 to +15.0	1	0.9	0	0	0	0
Over +15.0	0	0	0	0	0	0

engaged a smaller force of wage earners in 1935 than in 1929 while 1 used a similar force. Of the 49 industries, all but 2, accounting for 1 percent of the sample employment, utilized fewer man-hours in 1935 than in 1929. The reduction in man-hours was more severe than the reduction in employment. Industries accounting for 29 percent of the 1929 employment in the sample showed annual rates of decrease in the number of wage earners ranging above -2.5 percent; 94 percent of the 1929 wage earners are included in the same range for man-hours.

Productivity, 1929-33.— Since the years 1929-35 are characterized by sharp fluctuations in production, it is of interest to examine the movements of productivity first during the period of decline, between 1929 and 1933,¹² and then during the period of recovery, between 1933 and 1935. The decline in production after 1929 persisted in most industries until 1932. This decline was usually accompanied by a decline in output per man-hour in the years immediately after 1929. Between 1929 and 1930 man-hour productivity decreased in 15 industries, which employed half the total wage earners in the sample of 49 industries in 1929; the decrease was less than 7 percent in all but one instance. Although by 1931 man-hour productivity had risen above the 1929 level in many of these industries, new declines were registered in others. Between 1929 and 1931 industries which employed almost half the wage earners in 1929 suffered a decline in output per man-hour. The same is true for the interval 1929-32. These later declines, moreover, were more severe than those of 1929-30. In 1933, when production began to rise, output per man-hour was below the 1929 level in only nine industries, which employed 14 percent of the wage earners in the sample; two industries, which accounted for 12 percent of 1929 employment, showed the same output per man-hour in 1933 and in 1929 (table XIX). In the remaining 38 industries, however, output per man-hour was higher in 1933 than in 1929. In 24 of these, which employed 57 percent of the wage earners, the average annual rate of increase between 1929 and 1933 was from +0.1 to +5.0 percent; in 11, representing 14 percent of the employment, the rate of increase was between 5 and 10 percent; and in the remaining 3 industries it was over 10 percent.

¹²The more appropriate period 1929-32 was not selected for this purpose because indexes were not available for some of the 49 industries in 1932.

Table XIX.- DISTRIBUTION OF 49 MANUFACTURING INDUSTRIES AND THEIR 1929 EMPLOYMENT ACCORDING TO AVERAGE ANNUAL RATES OF CHANGE OF OUTPUT PER WAGE EARNER AND OUTPUT PER MAN-HOUR BETWEEN 1929 AND 1933

Average annual rate of change	Output per wage earner		Output per man-hour	
	Number of industries	Percentage distribution of 1929 employment	Number of industries	Percentage distribution of 1929 employment
Total	49	100.0	49	100.0
Over -10.0	4	12.0	2	1.0
- 7.6 to -10.0	2	4.7	0	0
- 5.1 to - 7.5	6	16.0	1	0.4
- 2.6 to - 5.0	9	23.8	1	1.8
- 0.1 to - 2.5	10	15.9	5	10.5
0	2	4.7	2	12.0
+ 0.1 to + 2.5	11	19.5	10	37.1
+ 2.6 to + 5.0	4	2.5	14	19.8
+ 5.1 to + 7.5	0	0	6	5.0
+ 7.6 to +10.0	0	0	5	8.6
+10.1 to +12.5	0	0	1	1.5
+12.6 to +15.0	1	0.9	1	1.4
Over +15.0	0	0	1	0.9

The rise in output per man-hour may be overstated by some of the NRP indexes. In many consumers -goods industries there was probably a shift toward the manufacture of lower grade and cheaper products requiring less labor per unit. Though an attempt was made, through the use of a productivity formula for a fixed production composite, to exclude the effect of changes in the composition of production, this could not often be accomplished because of the lack of the necessary data. An upward bias in the indexes of output per man-hour for eight industries may also result from the assumption that full-time and actual average weekly hours were the same in 1929.¹³ Though the effect of this bias may well be to exaggerate the rates of increase in industries with rising output per man-hour, it probably does not result in the transfer of industries with declining output per man-hour into class intervals of increasing productivity.

¹³See "Adjusted and Unadjusted Prevailing-Actual Hours Series" in chapter II.

80 PRODUCTION, EMPLOYMENT, AND PRODUCTIVITY

With the sharp drop in average weekly hours between 1929 and 1933, output per wage earner, of course, declined more rapidly than output per man-hour. The former declined in 31 industries which employed 72 percent of the wage earners in the sample in 1929. Of these 31 industries, 8, accounting for 21 percent of 1929 employment, showed average annual rates of decrease of from 5.1 to 10.0 percent; 4 others, which employed 12 percent of the wage earners in 1929, had rates of decrease greater than 10 percent.

Productivity, 1933-35.- With the increase in the volume of production between 1933 and 1935, output per man-hour rose in 37 industries and groups, which together accounted for 85 percent of the wage earners in the sample in 1929. The average annual rates of increase, moreover, were greater than in the period 1919-29; in 22 instances, accounting for 65 percent of 1929 employment, the rates were from 2.6 to 7.5 percent.

Table XX.- DISTRIBUTION OF 49 MANUFACTURING INDUSTRIES AND THEIR 1929 EMPLOYMENT ACCORDING TO AVERAGE ANNUAL RATES OF CHANGE OF OUTPUT PER WAGE EARNER AND OUTPUT PER MAN-HOUR BETWEEN 1933 AND 1935

Average annual rate of change	Output per wage earner		Output per man-hour	
	Number of industries	Percentage distribution of 1929 employment	Number of industries	Percentage distribution of 1929 employment
Total	49	100.0	49	100.0
Over -10.0	0	0	0	0
- 7.6 to -10.0	2	3.0	1	0.1
- 5.1 to - 7.5	2	0.9	2	3.5
- 2.6 to - 5.0	6	12.8	2	1.8
- 0.1 to - 2.5	8	17.1	7	9.5
0	0	0	0	0
+ 0.1 to + 2.5	12	21.3	4	5.1
+ 2.6 to + 5.0	6	6.5	10	31.0
+ 5.1 to + 7.5	4	14.7	12	34.2
+ 7.6 to +10.0	6	18.0	5	4.2
+10.1 to +12.5	0	0	3	4.9
+12.6 to +15.0	2	4.8	0	0
Over +15.0	1	0.9	3	5.7

A decrease in output per man-hour was recorded for only 12 industries, accounting for but 15 percent of the wage earners in 1929. (See table XX.)

Output per wage earner rose in this interval in 31 industries which employed 66 percent of the wage earners in 1929. There were more cases of declining output per wage earner than declining output per man-hour between 1933 and 1935. Wage-earner productivity decreased in 18 industries which accounted for 34 percent of 1929 employment in the sample.

Conclusions

Output per man-hour rose considerably and almost without exception in the period of increasing production, 1919-29. Even in the years of declining production which followed, the movement of man-hour productivity persisted upward in industries employing about half the wage earners. When production increased in 1933, output per man-hour rose also, and at a more rapid rate than in the immediately preceding years. By 1935 output per man-hour was above the 1929 level in industries or groups accounting for 92 percent of employment, even though production was generally below the 1929 level. Furthermore, in those instances where production was higher in 1935, the rate of increase in productivity was generally higher for 1929-35 than for 1919-29. In view of these facts it may be expected that even if production does not rise beyond the 1935 level output per man-hour will exceed the 1935 level, and that if production surpasses the 1929 level and continues upward, output per man-hour will probably advance at a rate comparable at least to that for the period 1929-35.

Reemployment prospects, however, have to be considered in terms of men rather than man-hours. In these terms it should be noted that because of the large reduction in the average hours worked per week between 1929 and 1935 the output per wage earner in most of the industries declined in spite of the fact that the output per man-hour rose. With the upturn of production after 1932, however, the output per wage earner for the sample as a whole began to rise again and it appears that the reattainment of 1929 production is likely to find the output per wage earner back again at or beyond the 1929 level. If this statement based on the NRP sample is generalized,

the same may be said for all manufacturing provided that the average number of hours worked per week remains as it was in 1936 and that the composition of production does not change significantly.

The probability for the future seems to be that there will be less rather than more employment in manufacturing industries. Should manufacturing industries reach and sustain the 1929 level of output within the next few years, the average number of wage earners required will not far exceed, if at all, the average number employed in 1929, despite the 20-percent reduction in the average number of hours worked per week that occurred between 1929 and 1936. In the longer run, since output per man-hour seems certain to increase further, manufacturing employment will probably be below that of 1929. Only a great increase in production or a marked decline in hours worked per week could bring manufacturing employment to levels appreciably higher than 1929. It is well to recall, however, that even the 50-percent increase in output between 1919 and 1929 left the average number of wage earners in manufacturing almost stationary.

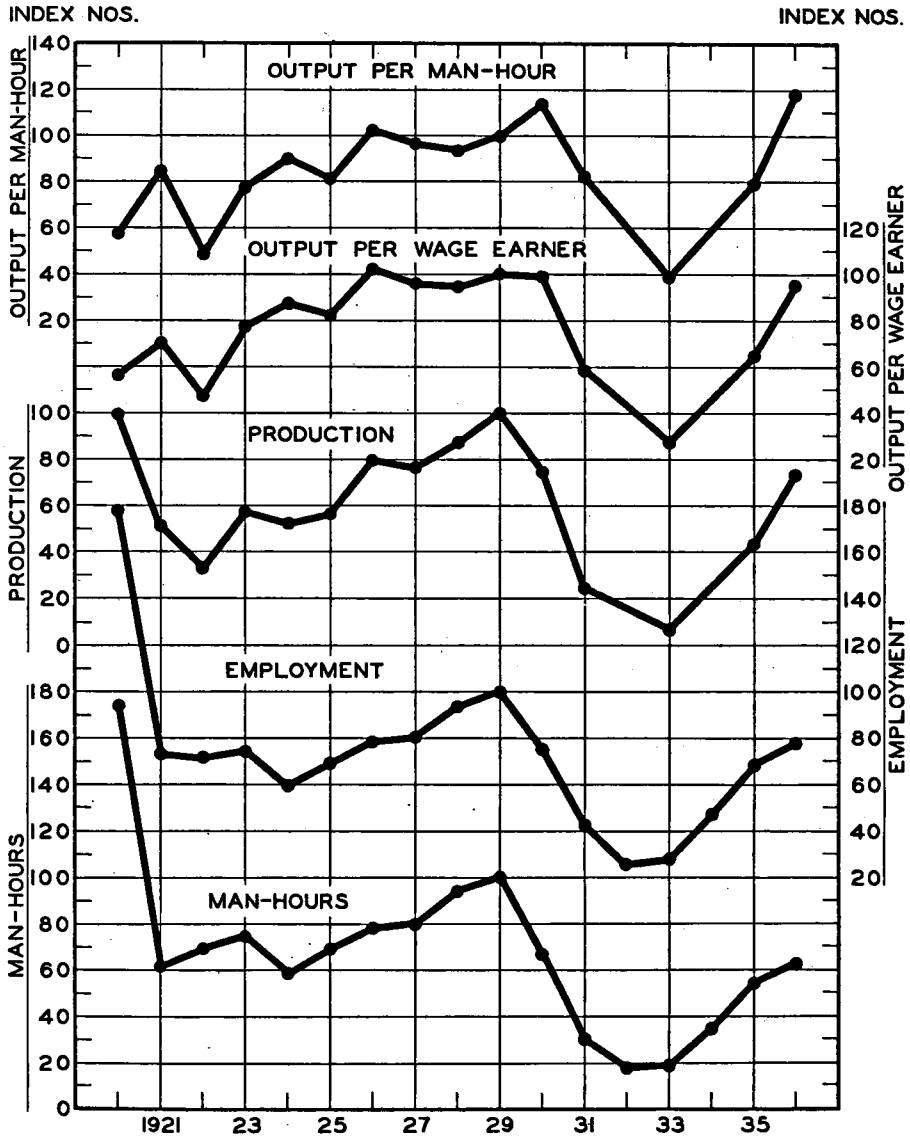
SUMMARY CHARTS FOR INDIVIDUAL INDUSTRIES AND GROUPS

The 72 charts which follow present the summary indexes for production, employment, man-hours, and productivity for the 59 manufacturing industries and the 13 industry groups into which 35 of the industries were combined.

The indexes shown on the charts may be found in tables which appear at the conclusion of the discussion of the corresponding industries and groups in Part Two. The charts and tables bear similar numbers. All indexes have the base 1929.

**Figure 1.- SUMMARY INDEXES FOR THE AGRICULTURAL IMPLEMENTS
INDUSTRY: 1920-36**

(1929 = 100)



**Figure 2a.- SUMMARY INDEXES FOR THE BEET SUGAR
INDUSTRY: 1918-38**

(1928 = 100)

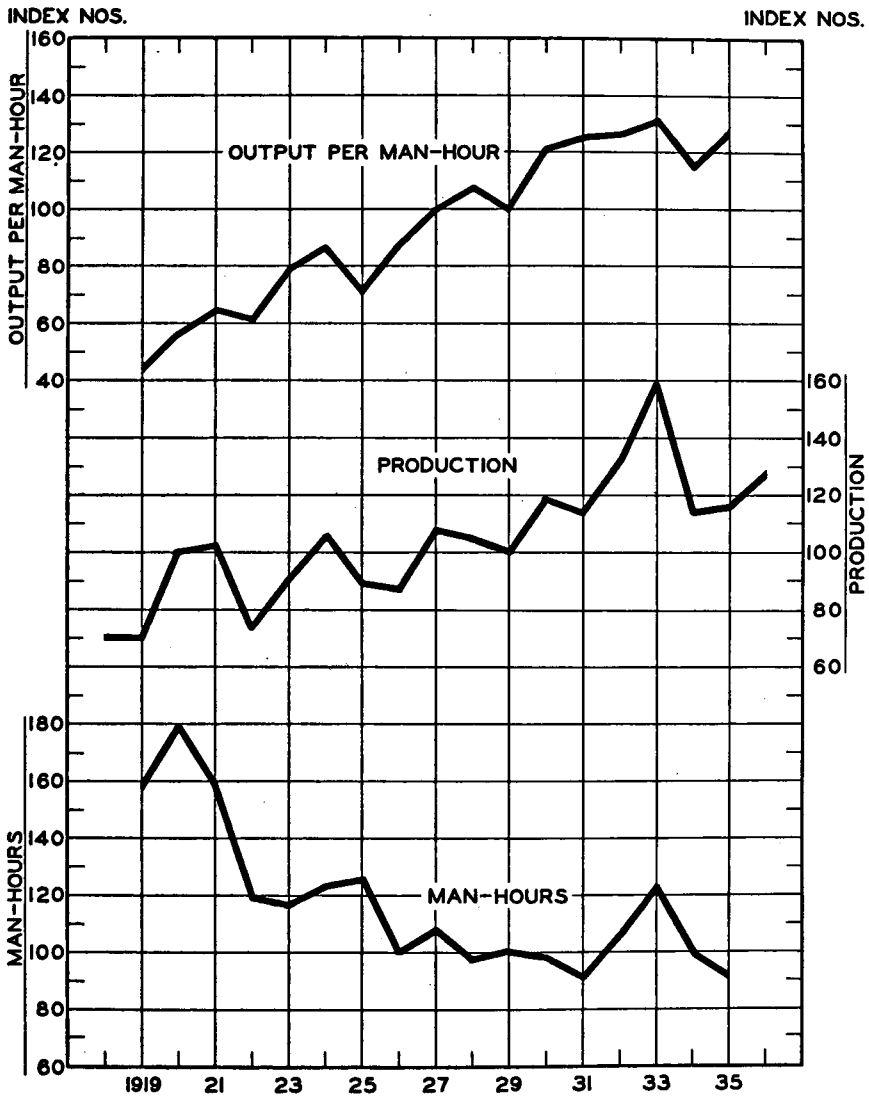


Figure 2b.- SUMMARY INDEXES FOR THE BEET SUGAR INDUSTRY: CAMPAIGN AND INTERCAMPAIGN MONTHS, 1918-36
(1928 = 100)

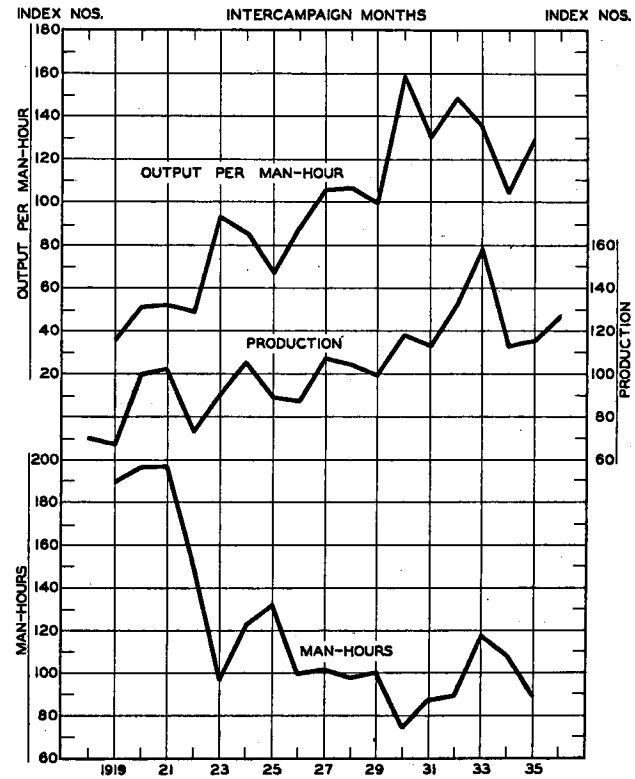
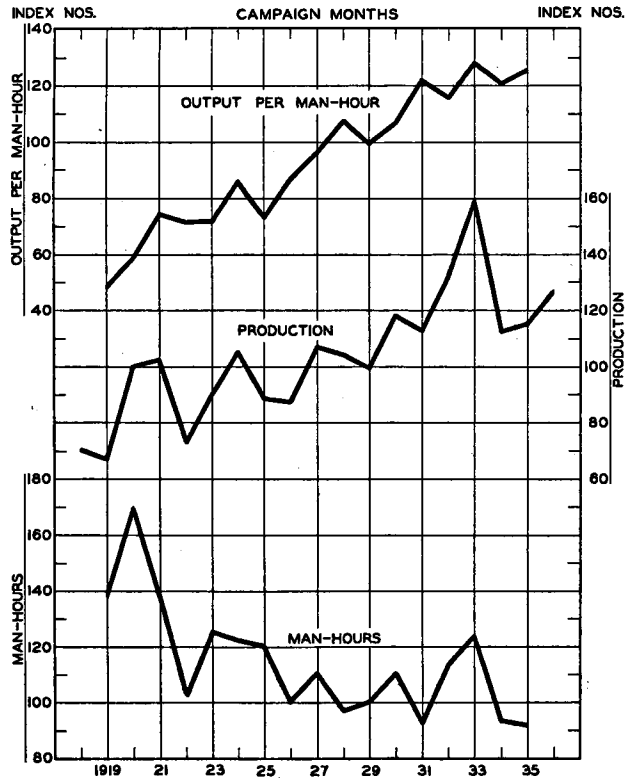


Figure 3.- SUMMARY INDEXES FOR THE BOOTS AND SHOES INDUSTRY: 1919-38

(1929 = 100)

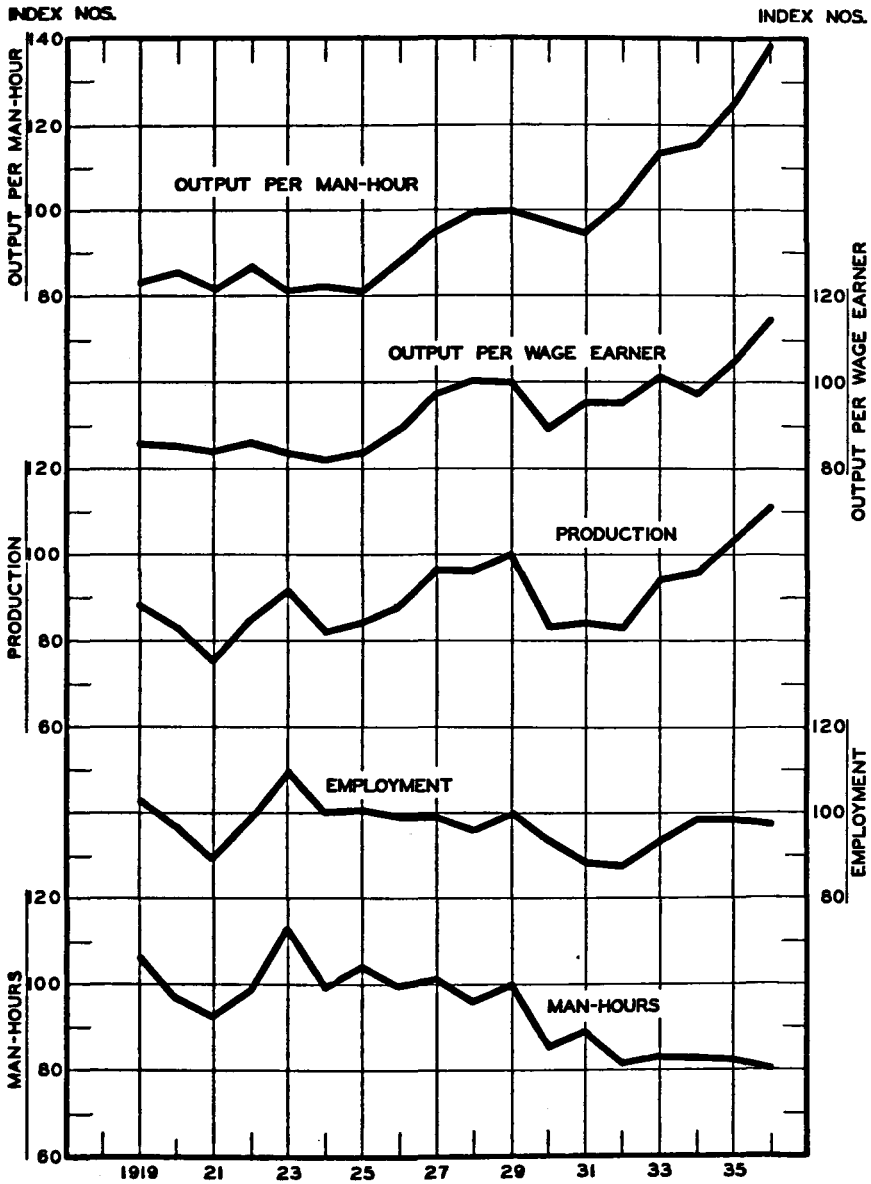
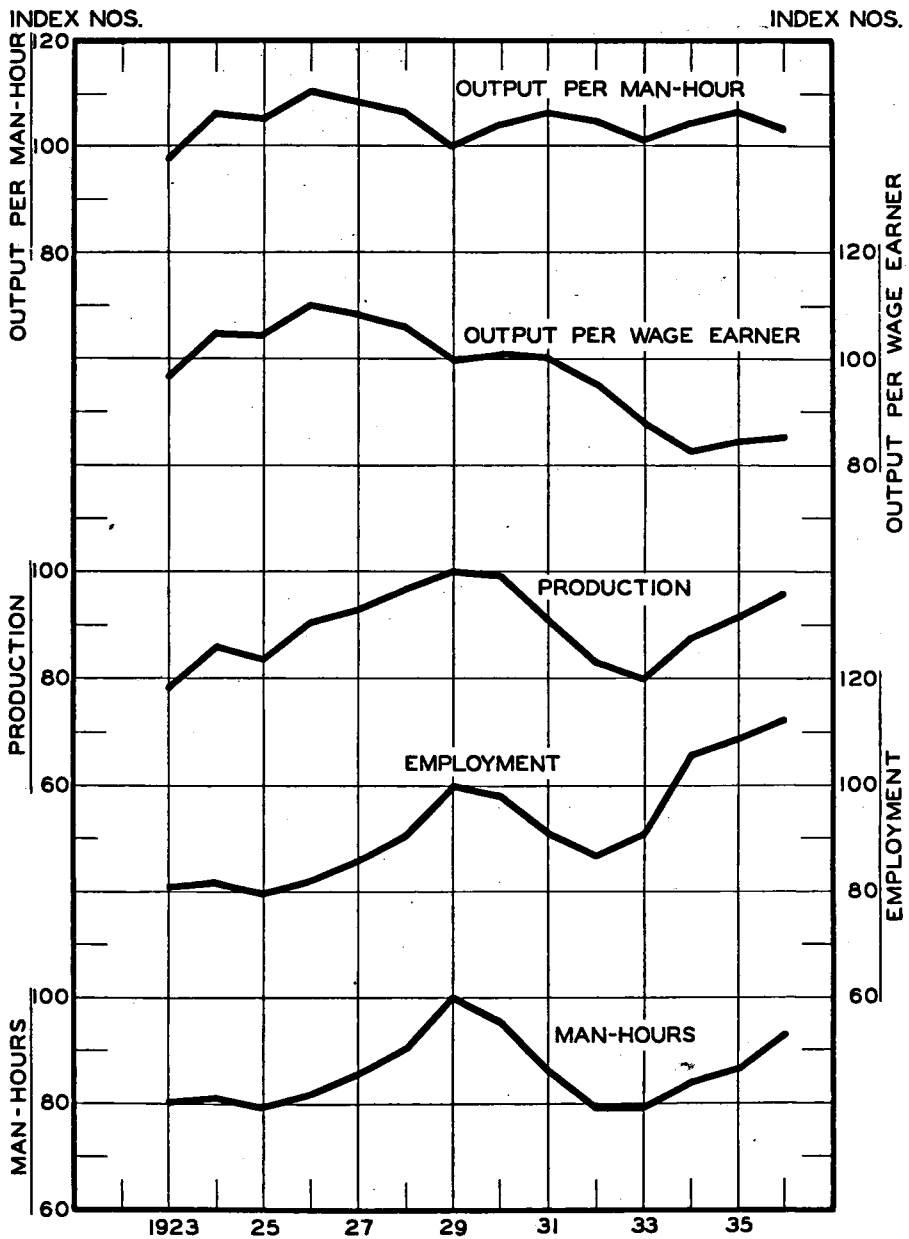


Figure 4.- SUMMARY INDEXES FOR THE BREAD AND OTHER BAKERY PRODUCTS INDUSTRY GROUP: 1923-38

(1929 = 100)



**Figure 5.- SUMMARY INDEXES FOR THE BISCUIT AND CRACKERS
INDUSTRY: 1923-36**

(1928 = 100)

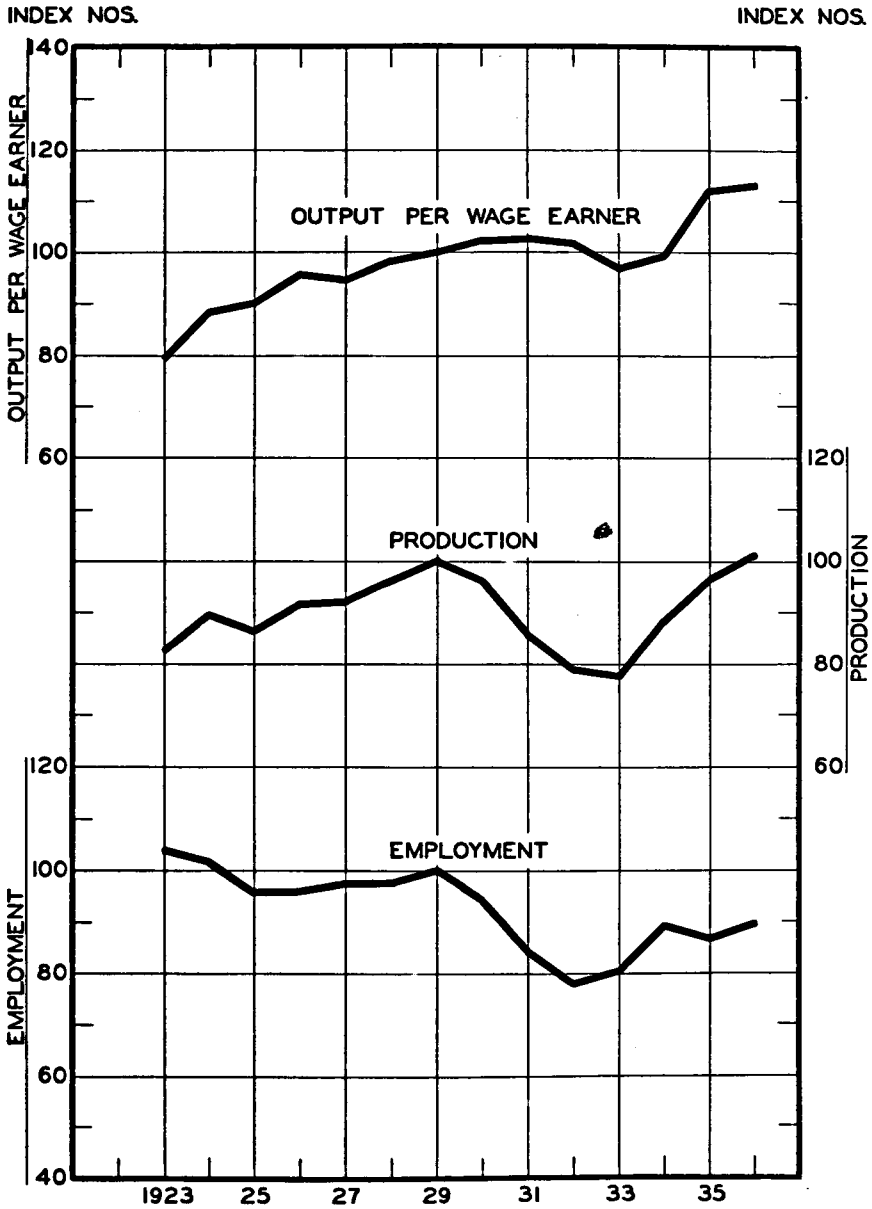


Figure 6. - SUMMARY INDEXES FOR THE BAKERY PRODUCTS OTHER THAN BISCUIT AND CRACKERS INDUSTRY: 1923-36

(1928 = 100)

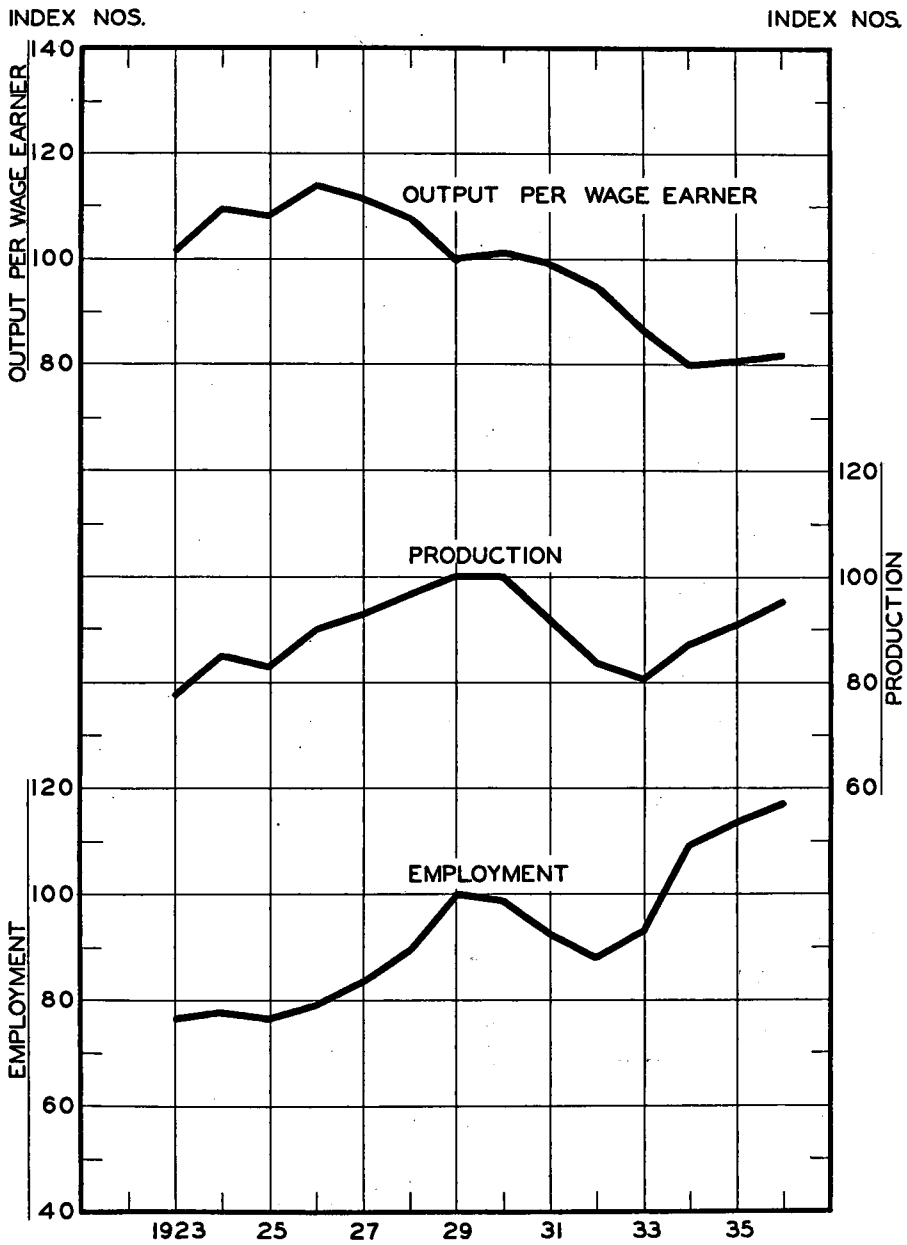
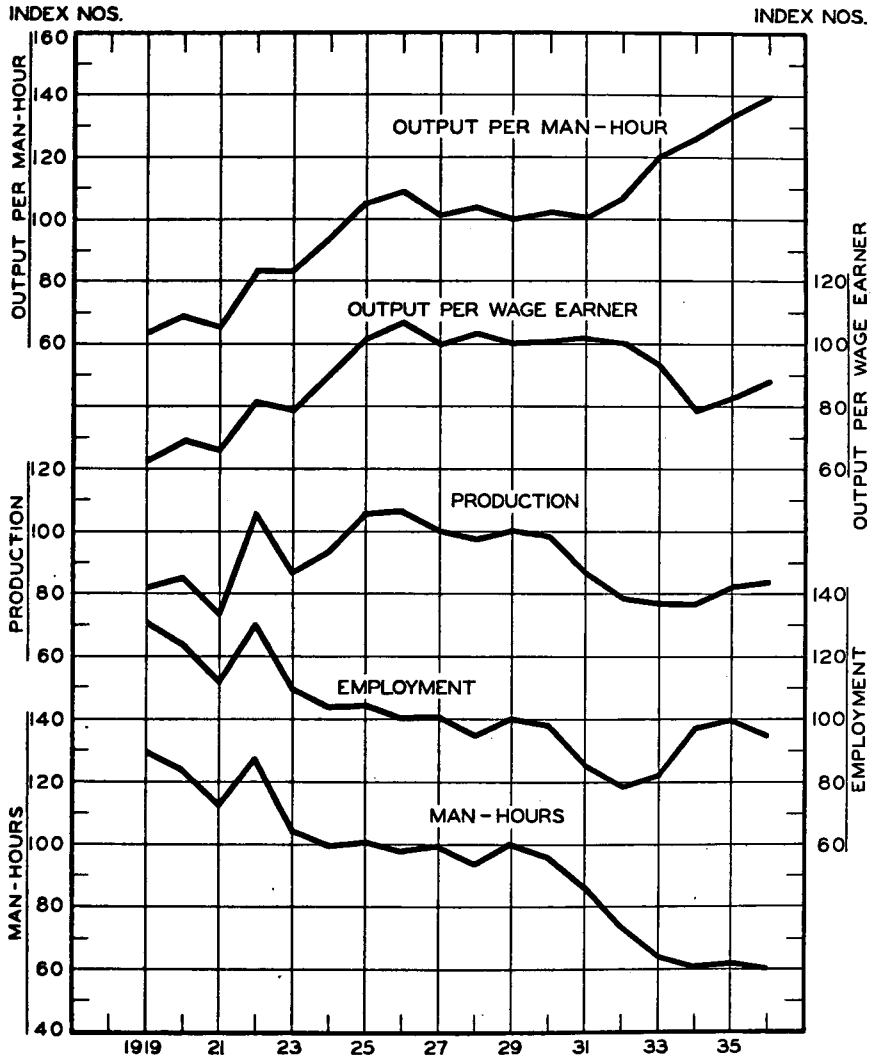


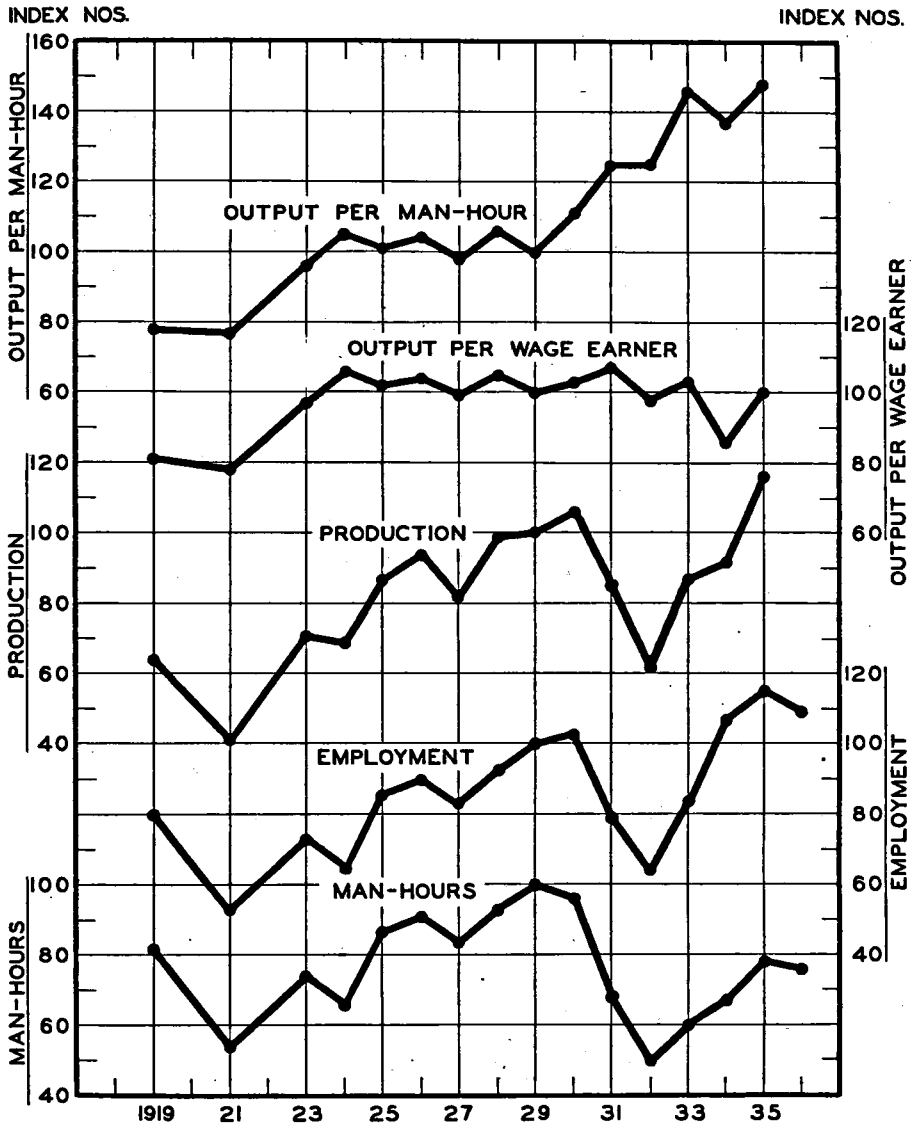
Figure 7.- SUMMARY INDEXES FOR THE CANE-SUGAR REFINING INDUSTRY: 1918-36

(1928 = 100)



**Figure 8.- SUMMARY INDEXES FOR THE CANNING AND PRESERVING
INDUSTRY GROUP: 1918-38**

(1929 = 100)



**Figure 8. - SUMMARY INDEXES FOR THE CANNED AND PRESERVED
FRUITS AND VEGETABLES INDUSTRY: 1919-36**

(1928 = 100)

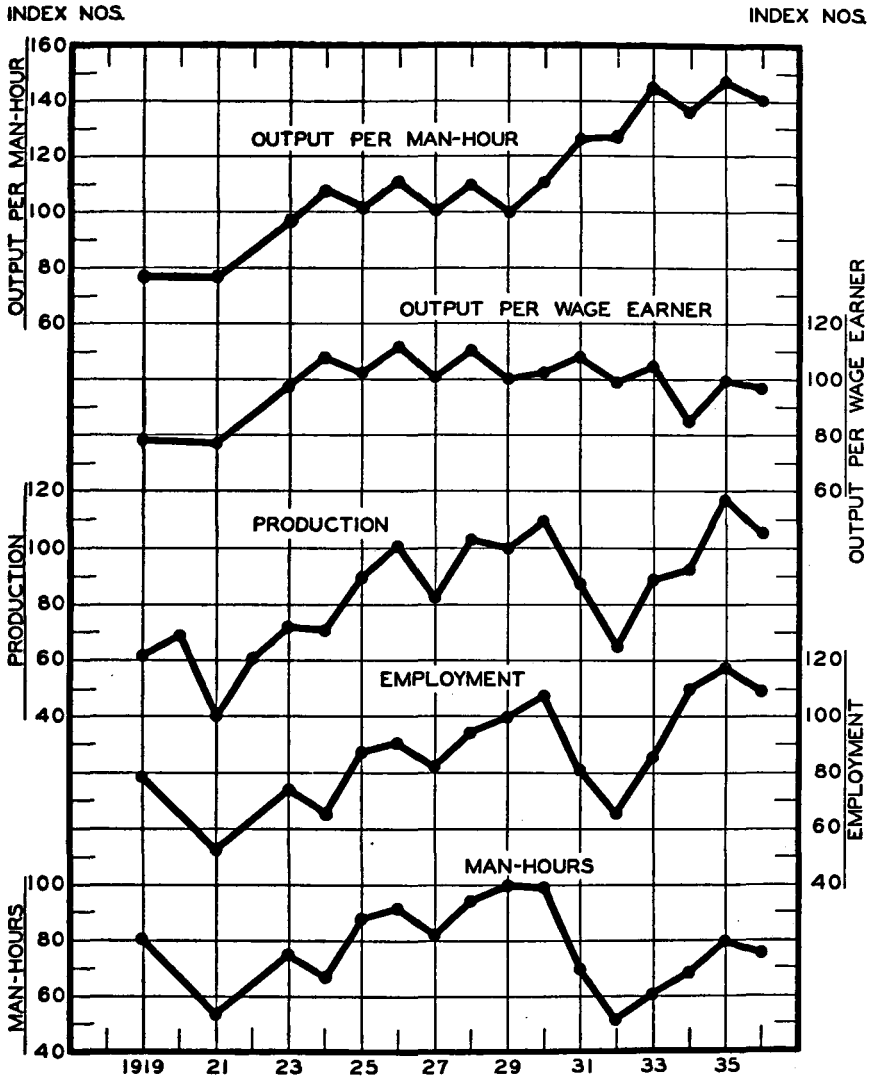


Figure 10.- SUMMARY INDEXES FOR THE CANNED AND CURED FISH INDUSTRY: 1919-36

(1929 = 100)

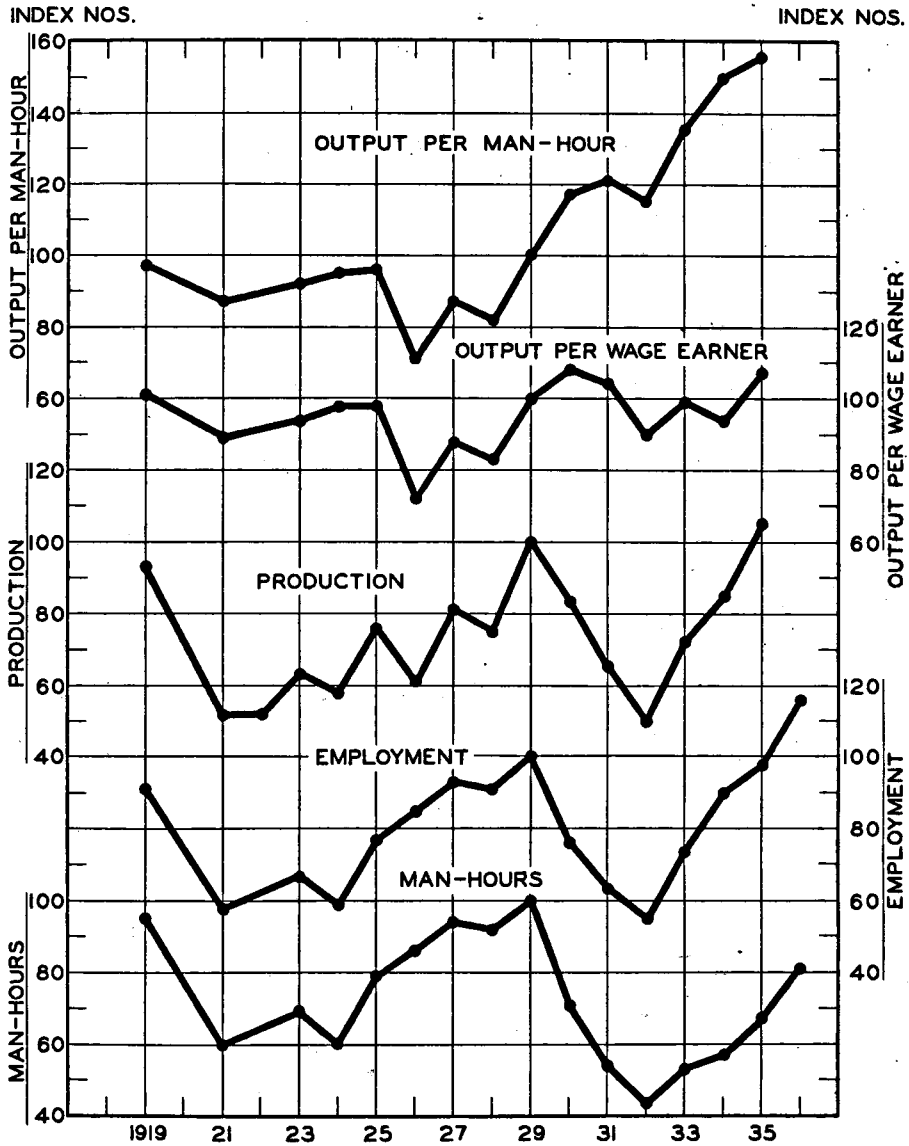


Figure 11.- SUMMARY INDEXES FOR THE CEMENT INDUSTRY: 1919-36

(1929 = 100)

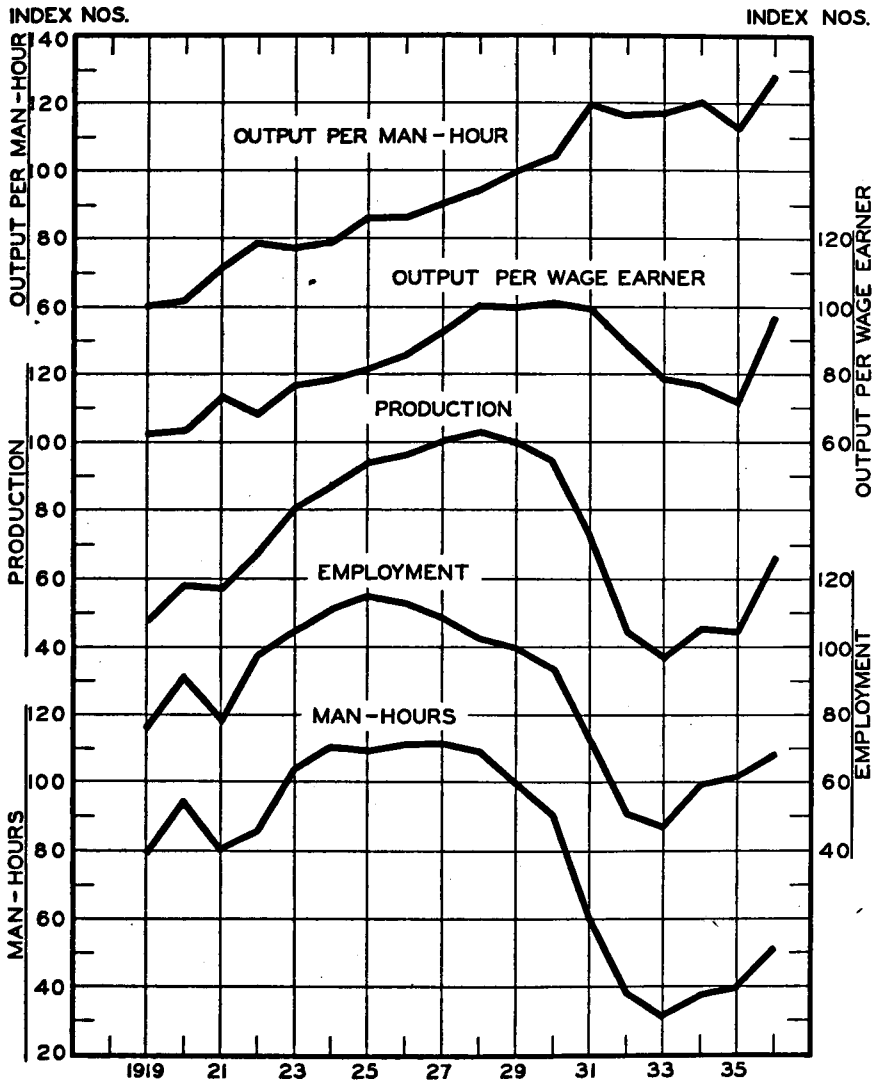
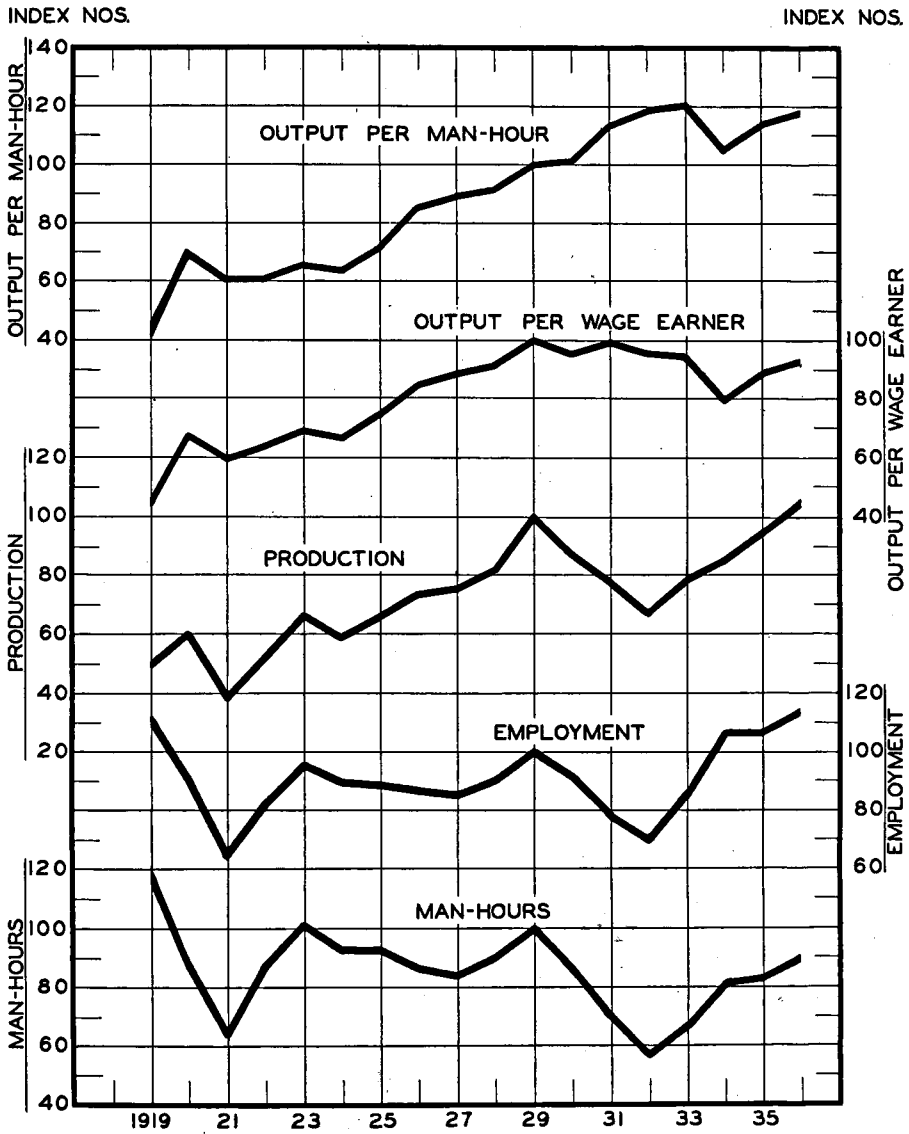


Figure 12.- SUMMARY INDEXES FOR THE CHEMICALS
INDUSTRY: 1919-36

(1929 = 100)



**Figure 13.- SUMMARY INDEXES FOR THE CLAY PRODUCTS
(OTHER THAN POTTERY) AND NONCLAY REFRACATORIES
INDUSTRY: 1919-36**

(1929 = 100)

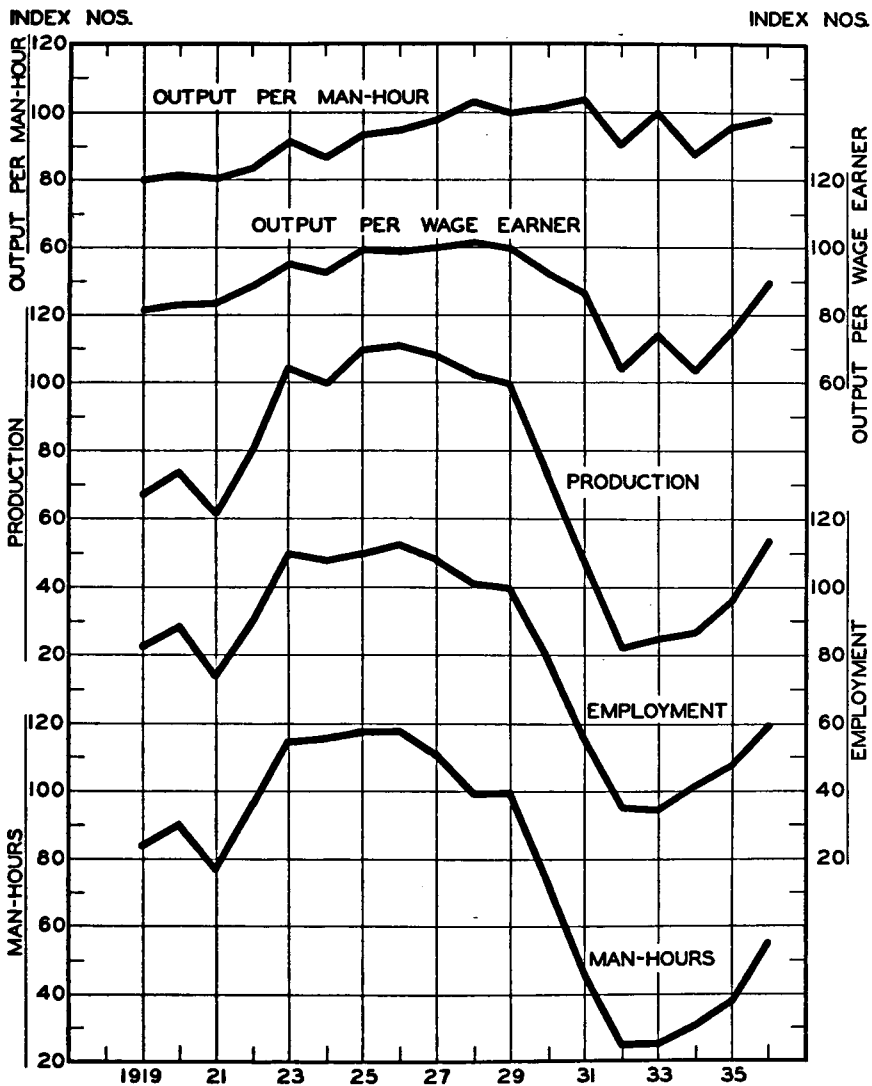


Figure 14.- SUMMARY INDEXES FOR THE COKE
INDUSTRY GROUP: 1919-36

(1929 = 100)

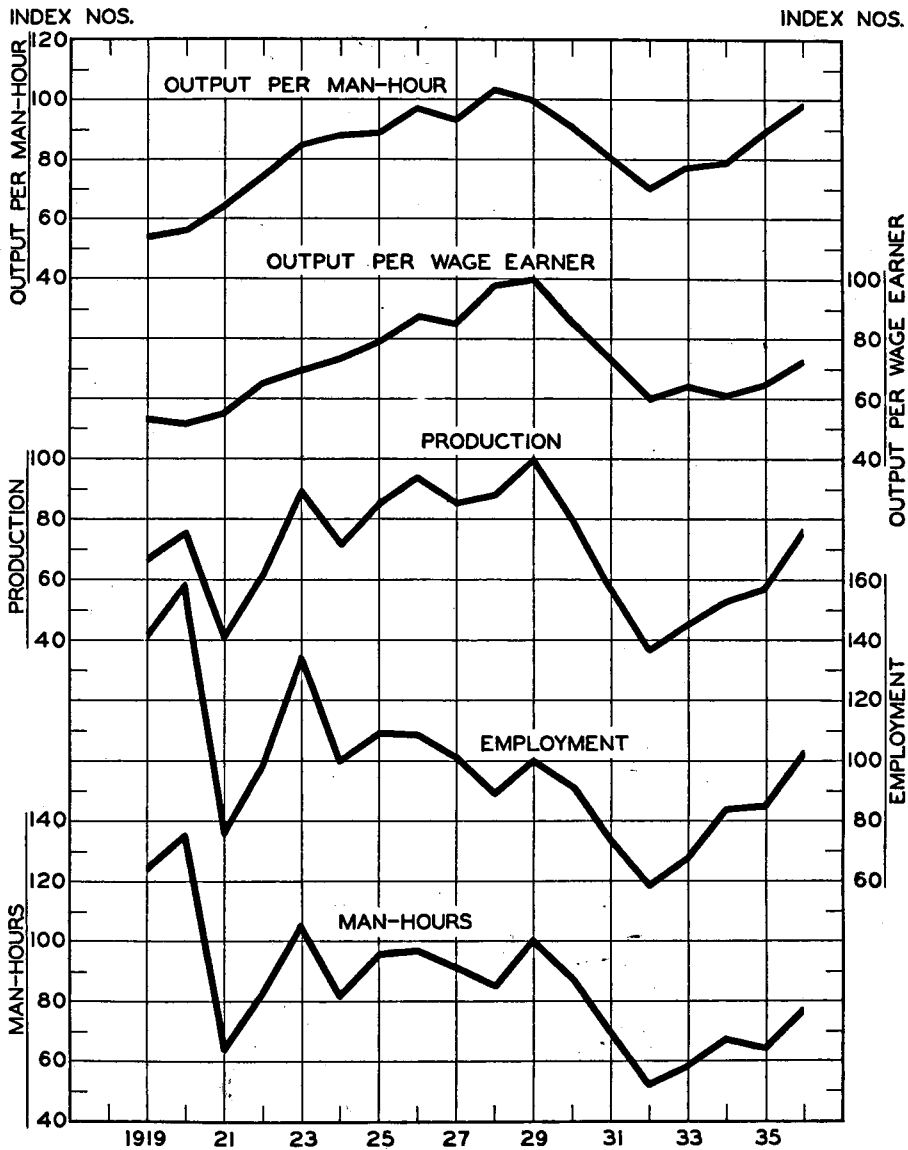
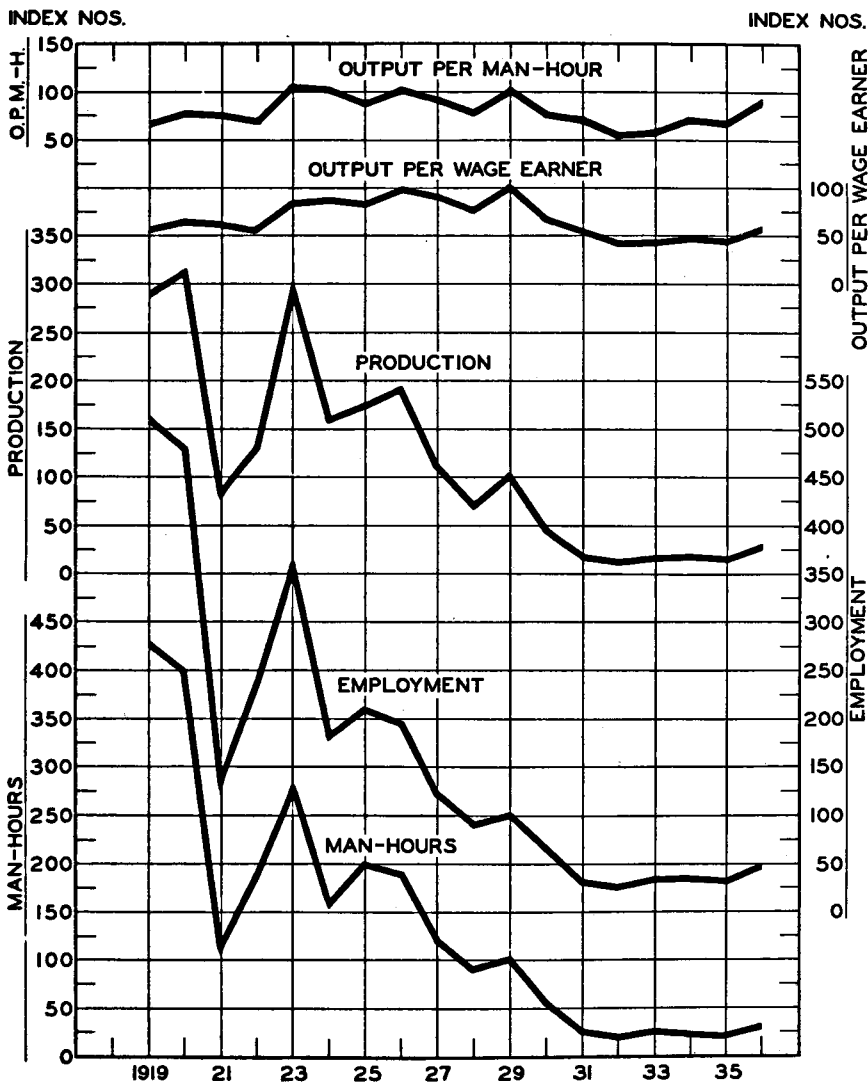


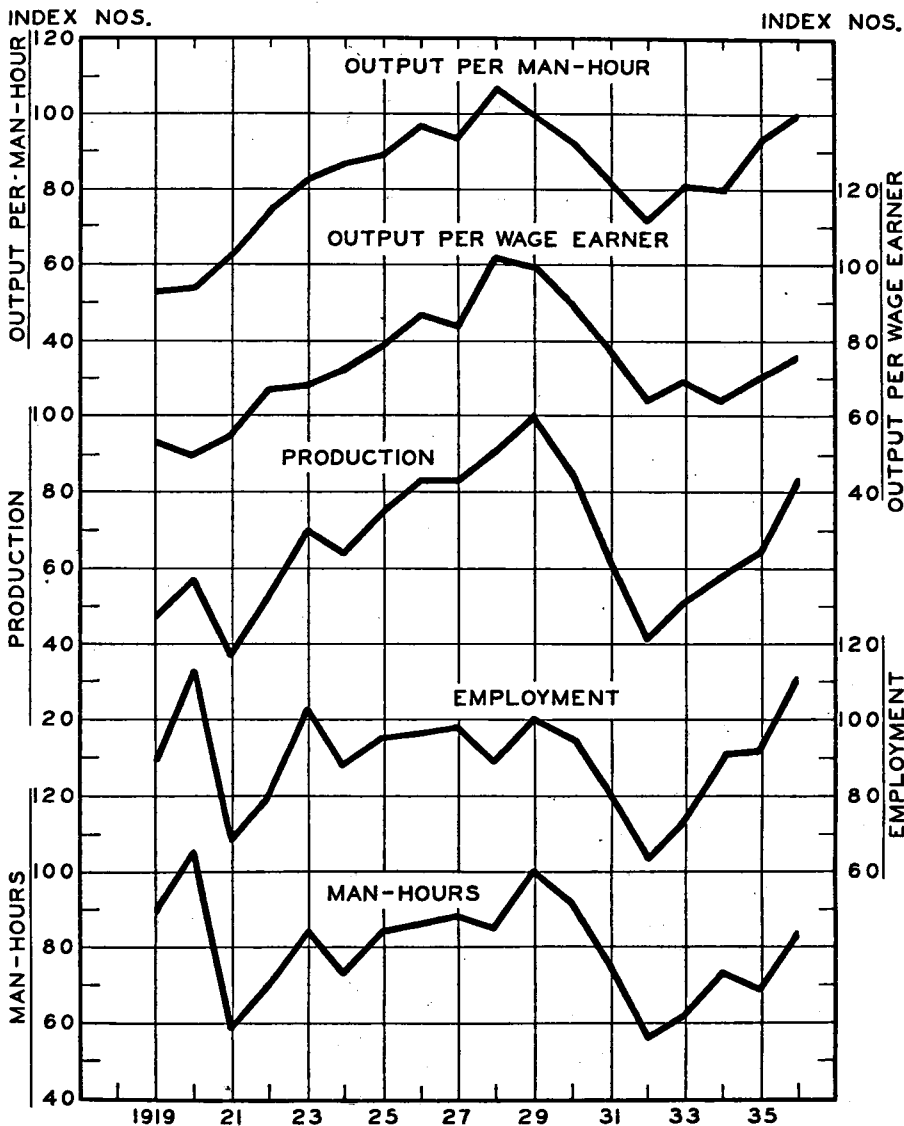
Figure 15.- SUMMARY INDEXES FOR THE BEEHIVE COKE
INDUSTRY: 1918-36

(1929 = 100)



**Figure 16.- SUMMARY INDEXES FOR THE BYPRODUCT COKE
INDUSTRY: 1918-38**

(1929 = 100)



**Figure 17.- SUMMARY INDEXES FOR THE CONFECTIONERY
INDUSTRY: 1925-36**

(1929 = 100)

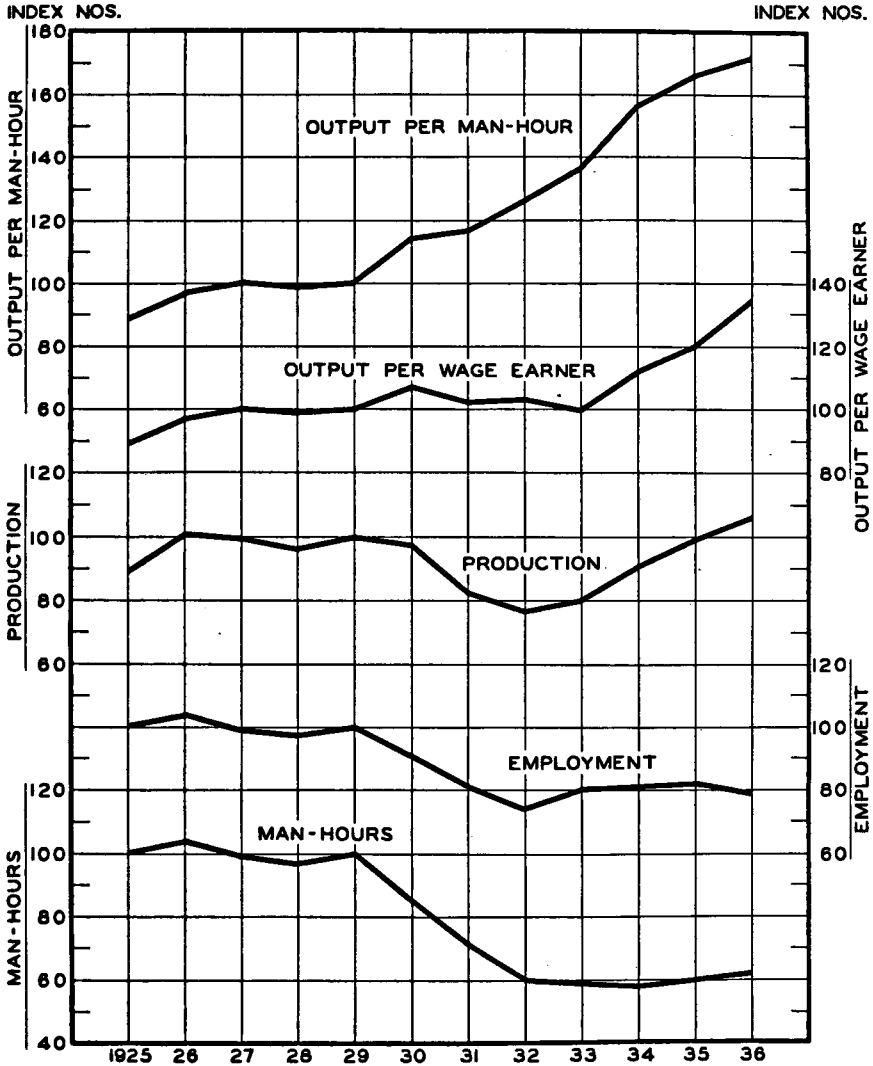


Figure 18a.- SUMMARY INDEXES FOR THE COTTON GOODS
INDUSTRY: 1919-38

(1928 = 100)

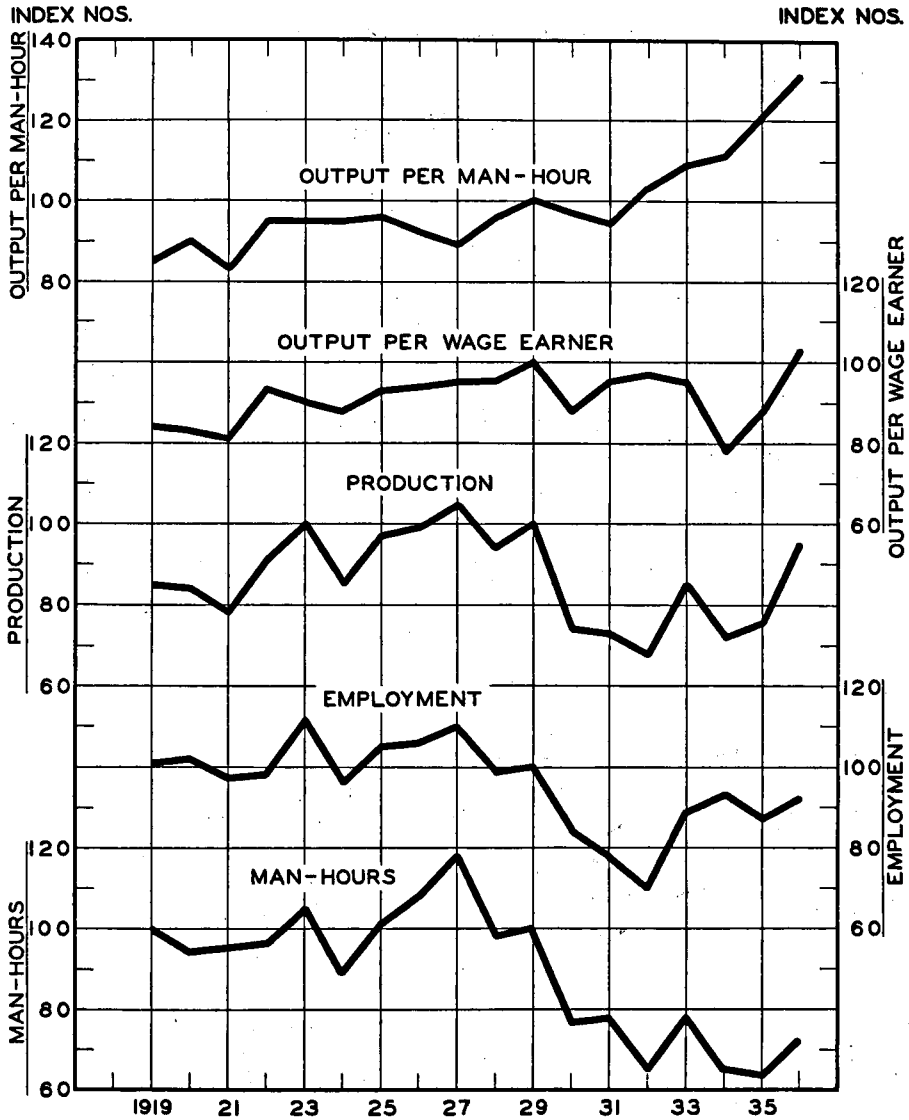


Figure 105.- SUMMARY INDEXES FOR THE COTTON GOODS INDUSTRY, BY REGION: CENSUS YEARS 1919-35
(1928 = 100)

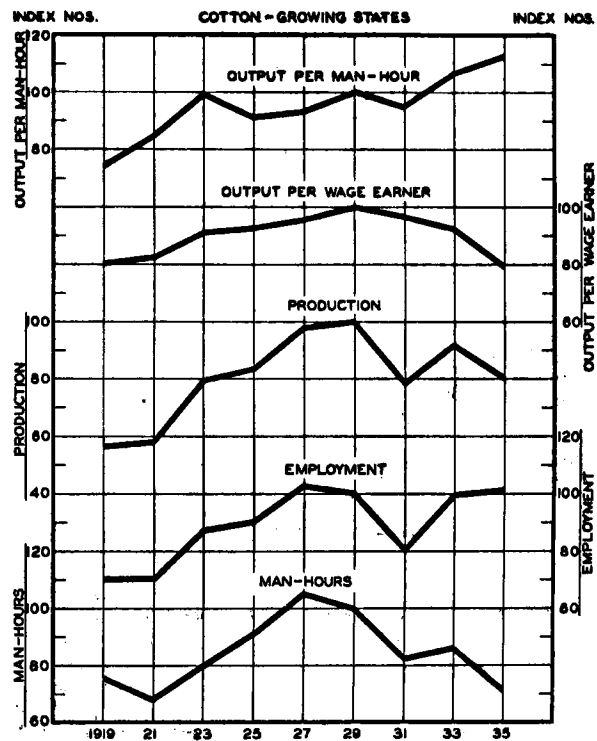
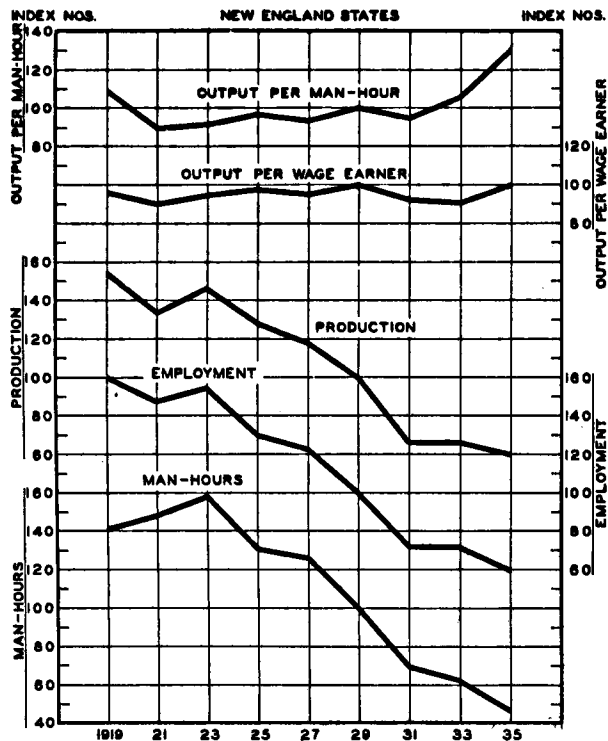
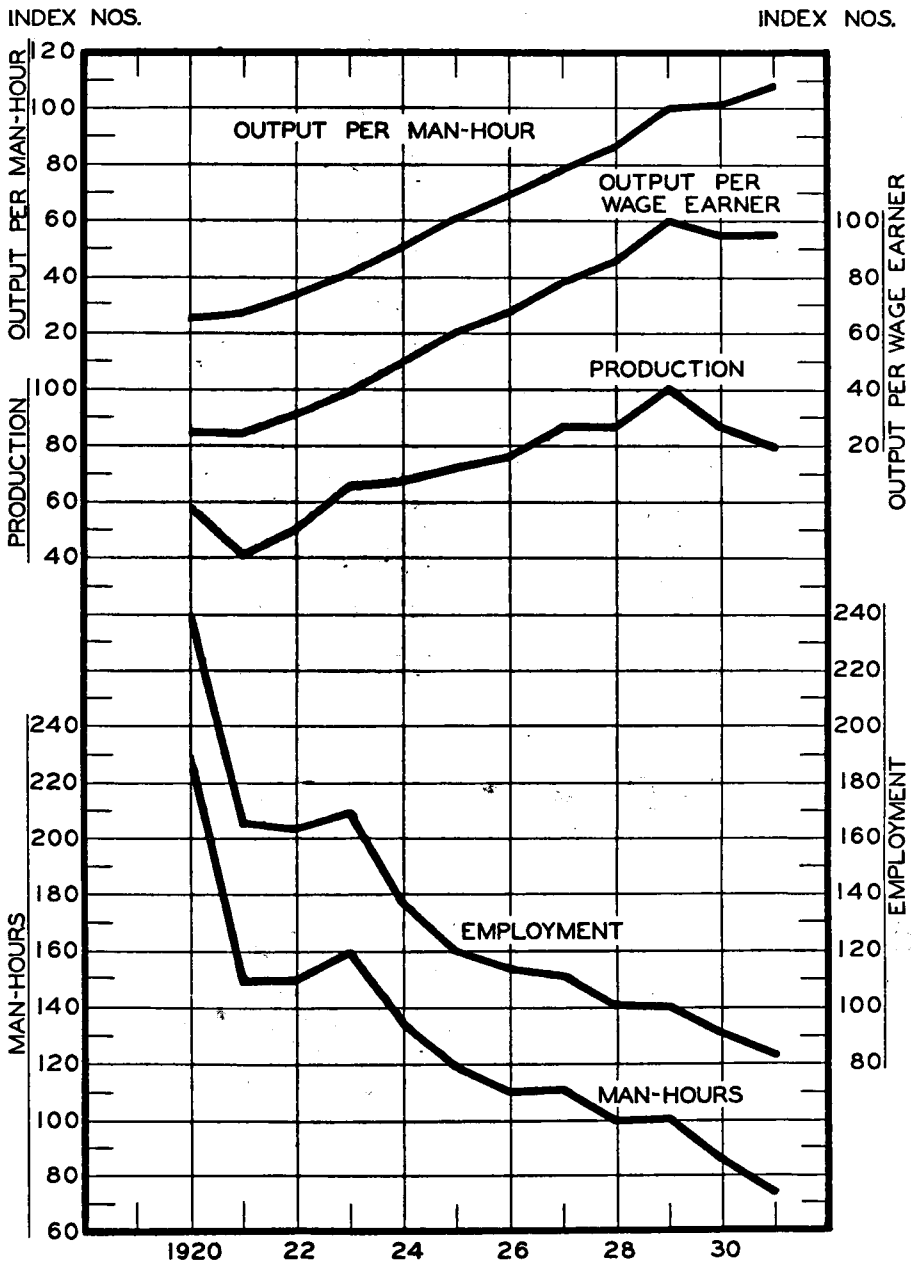


Figure 19.- SUMMARY INDEXES FOR THE ELECTRIC LAMPS INDUSTRY: 1920-31

(1928 = 100)



**Figure 20.- SUMMARY INDEXES FOR THE FERTILIZERS
INDUSTRY: 1919-38**

(1929 = 100)

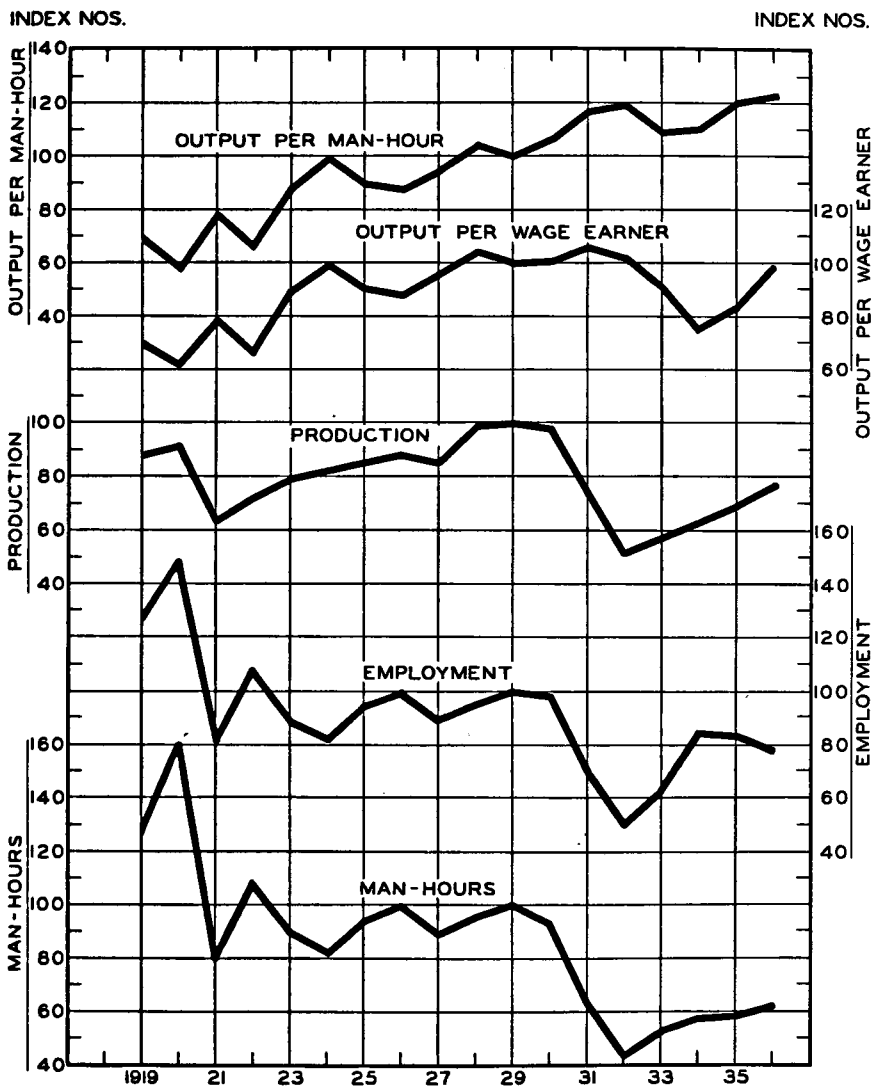


Figure 21.- SUMMARY INDEXES FOR THE FLOUR AND OTHER GRAIN-MILL PRODUCTS INDUSTRY: 1919-36

(1928 = 100)

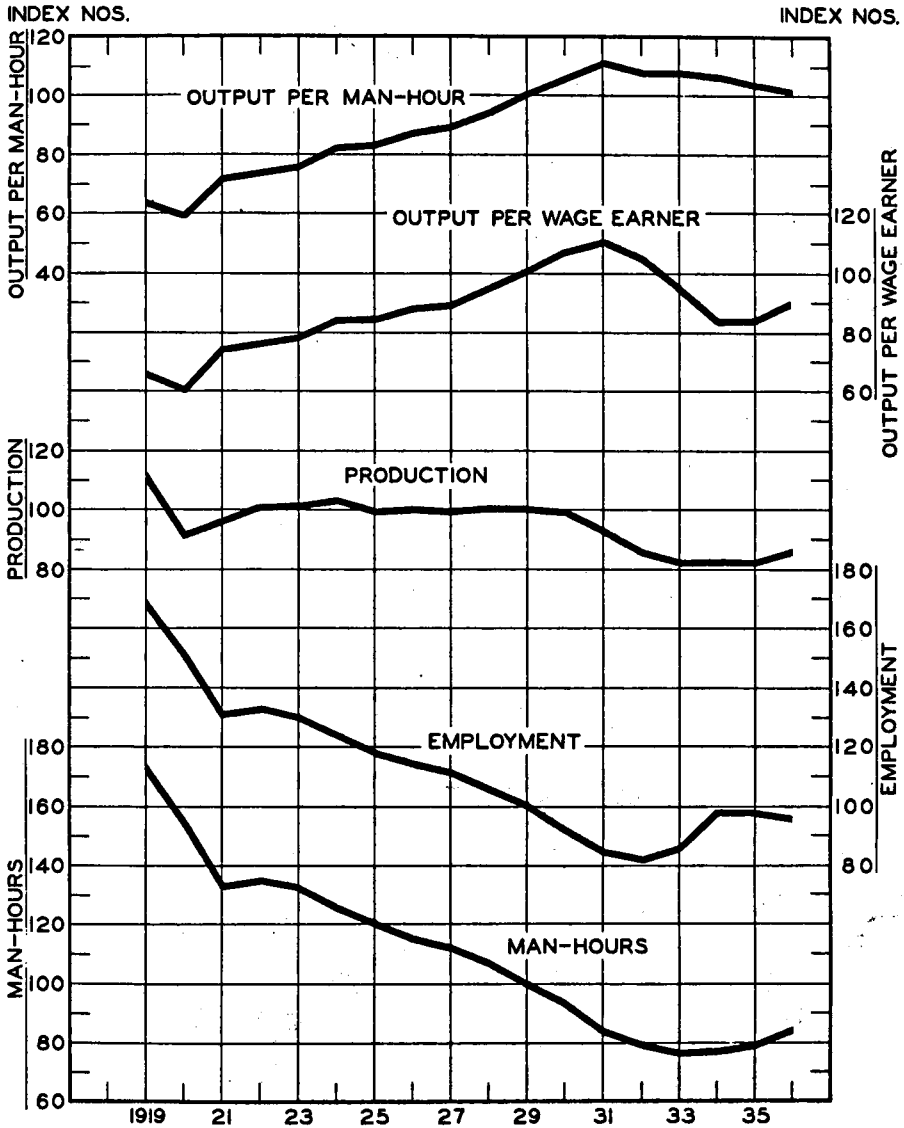


Figure 22.- SUMMARY INDEXES FOR THE FURNITURE INDUSTRY: 1918-38

(1928 = 100)

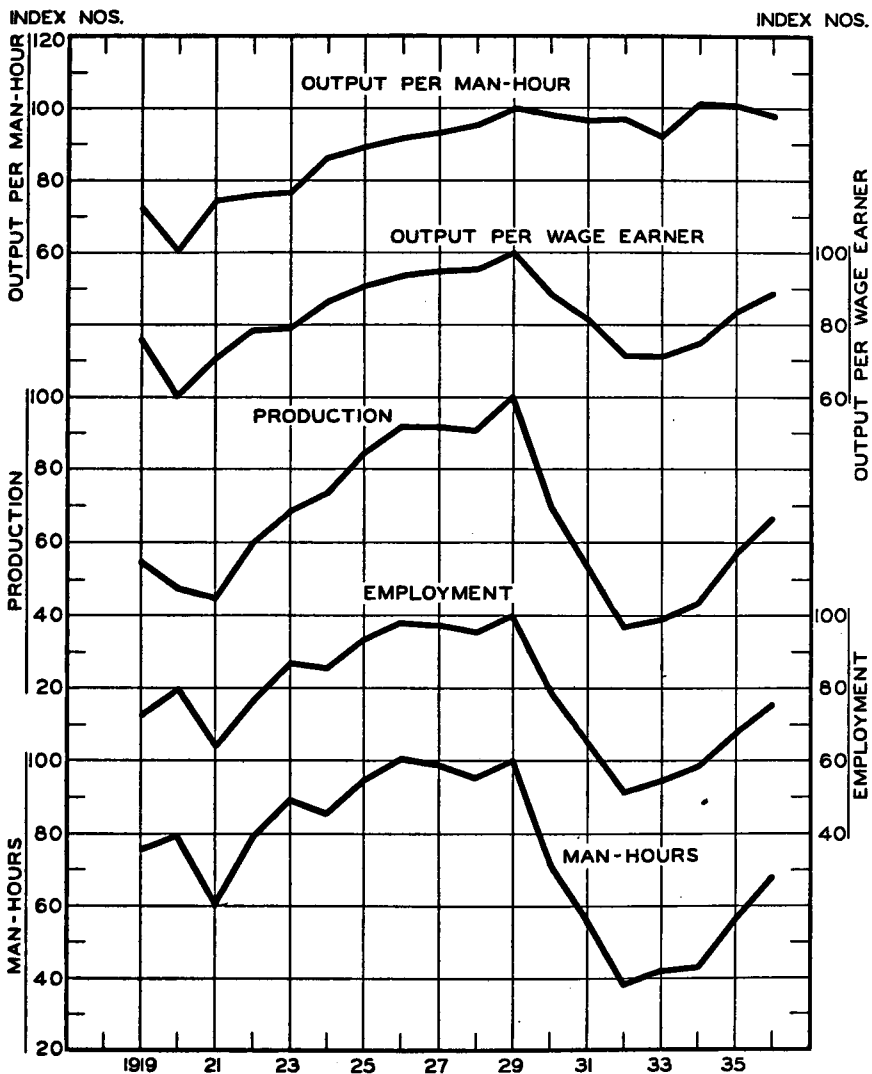


Figure 23.- SUMMARY INDEXES FOR THE GLASS
INDUSTRY GROUP: 1919-38

(1929 = 100)

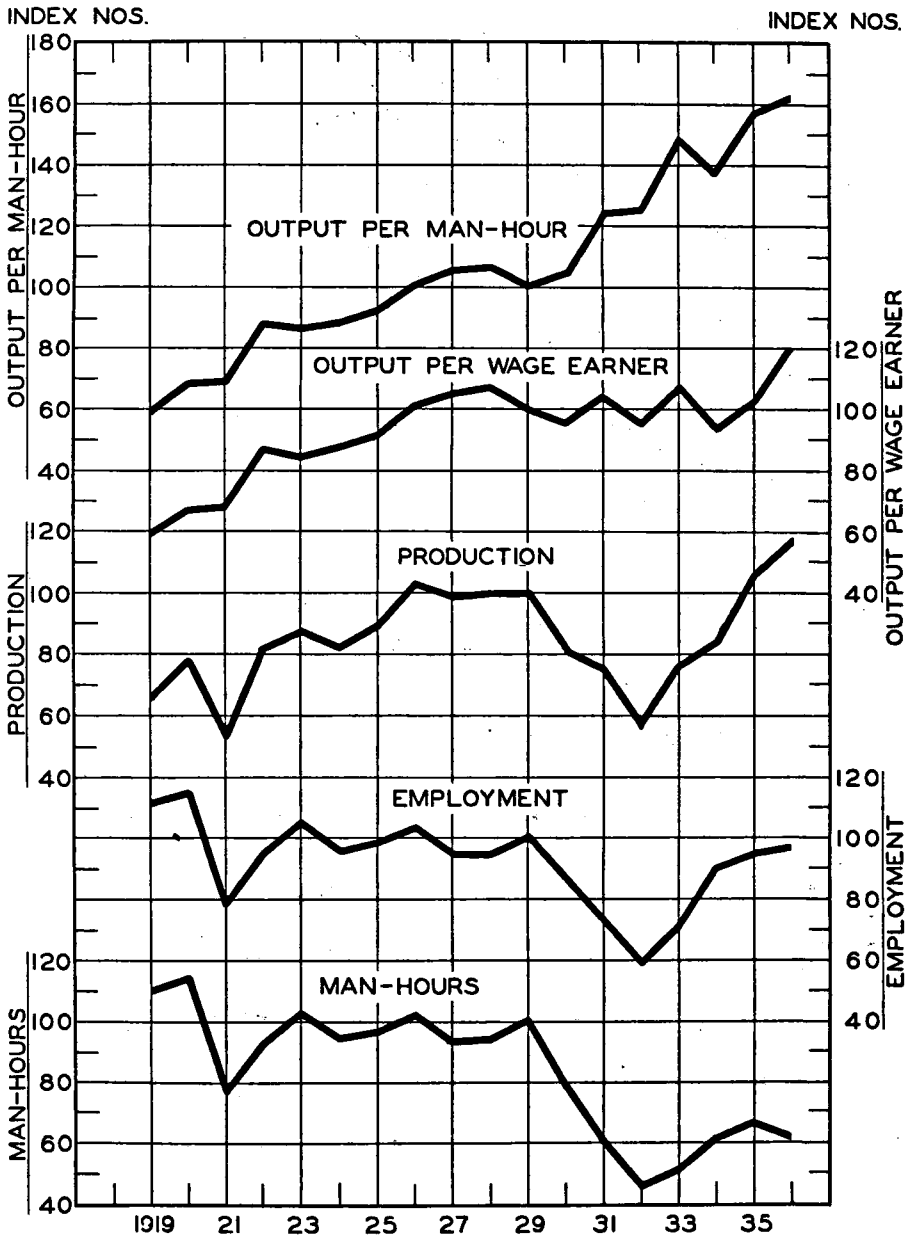


Figure 24.- SUMMARY INDEXES FOR THE WINDOW GLASS
INDUSTRY: 1919-36

(1929 = 100)

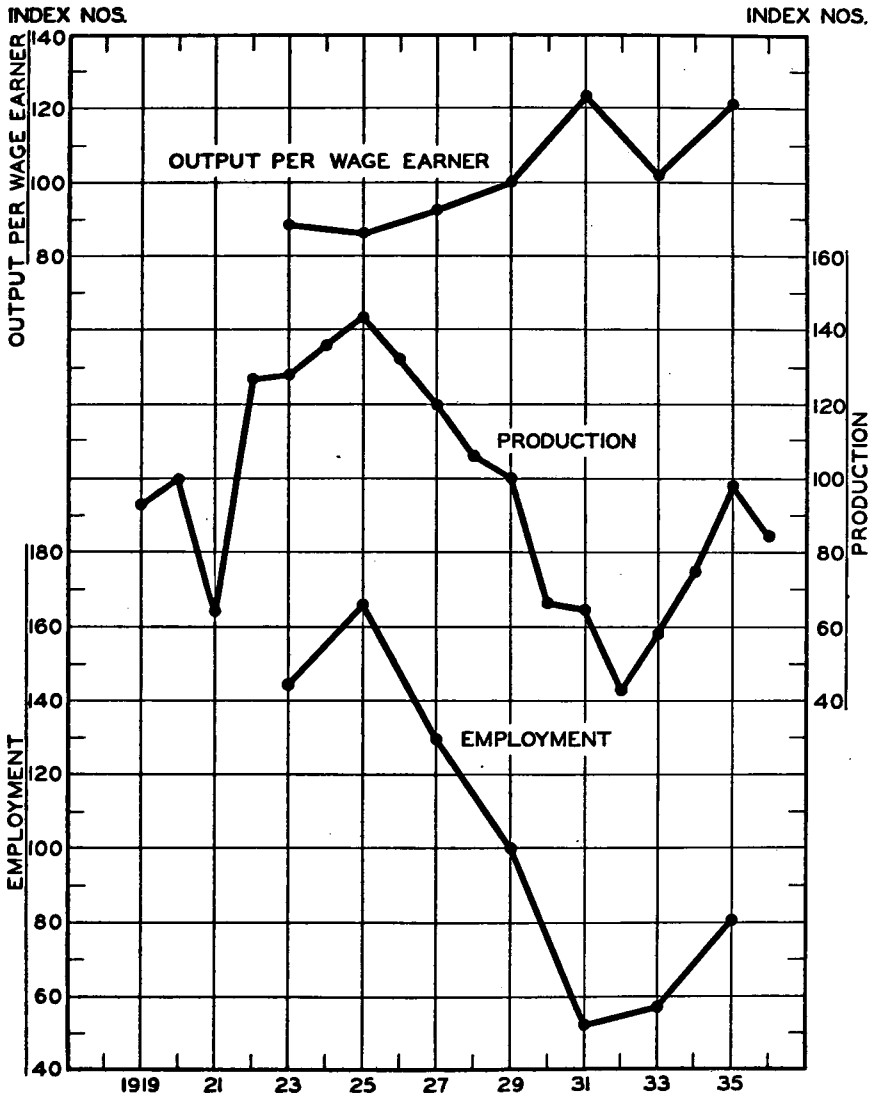


Figure 25.- SUMMARY INDEXES FOR THE PLATE GLASS INDUSTRY: 1919-36

(1929 = 100)

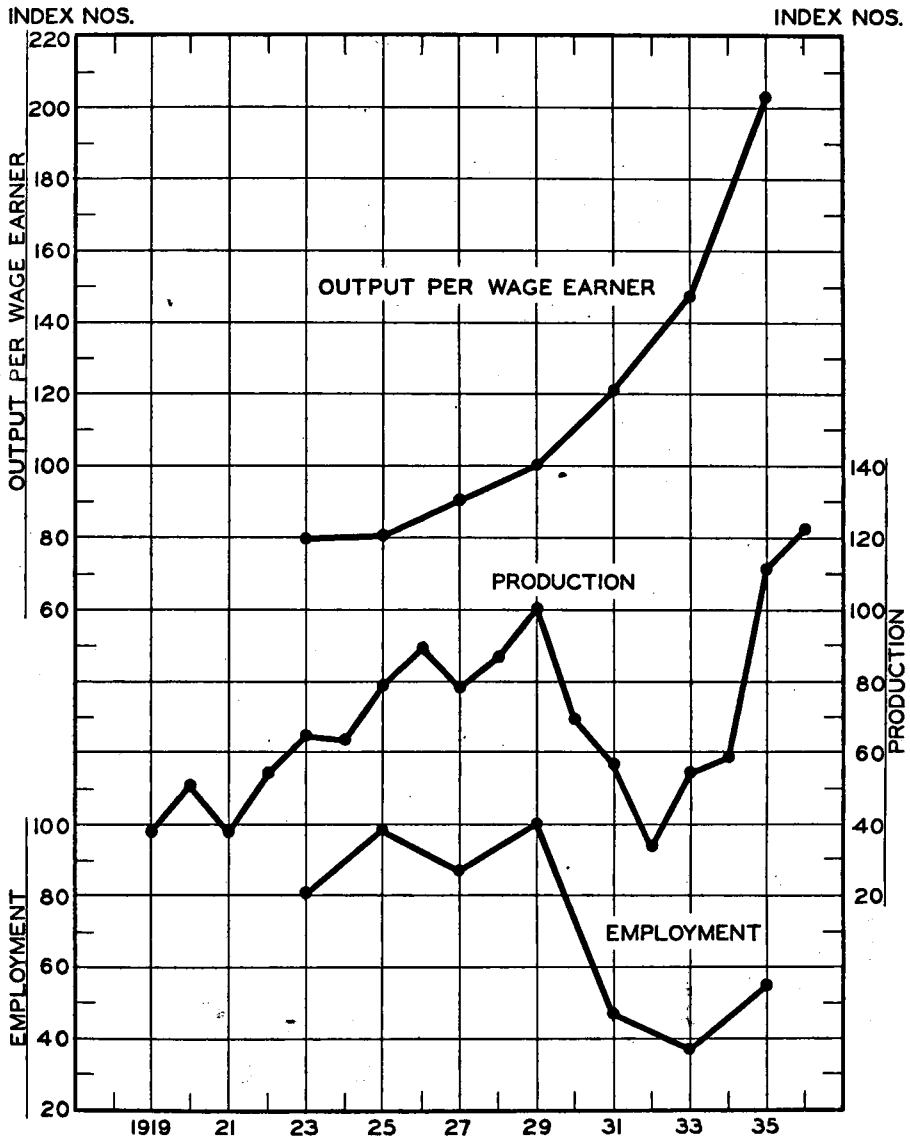


Figure 26.- SUMMARY INDEXES FOR THE GLASS CONTAINERS
INDUSTRY: 1919-36

(1929 = 100)

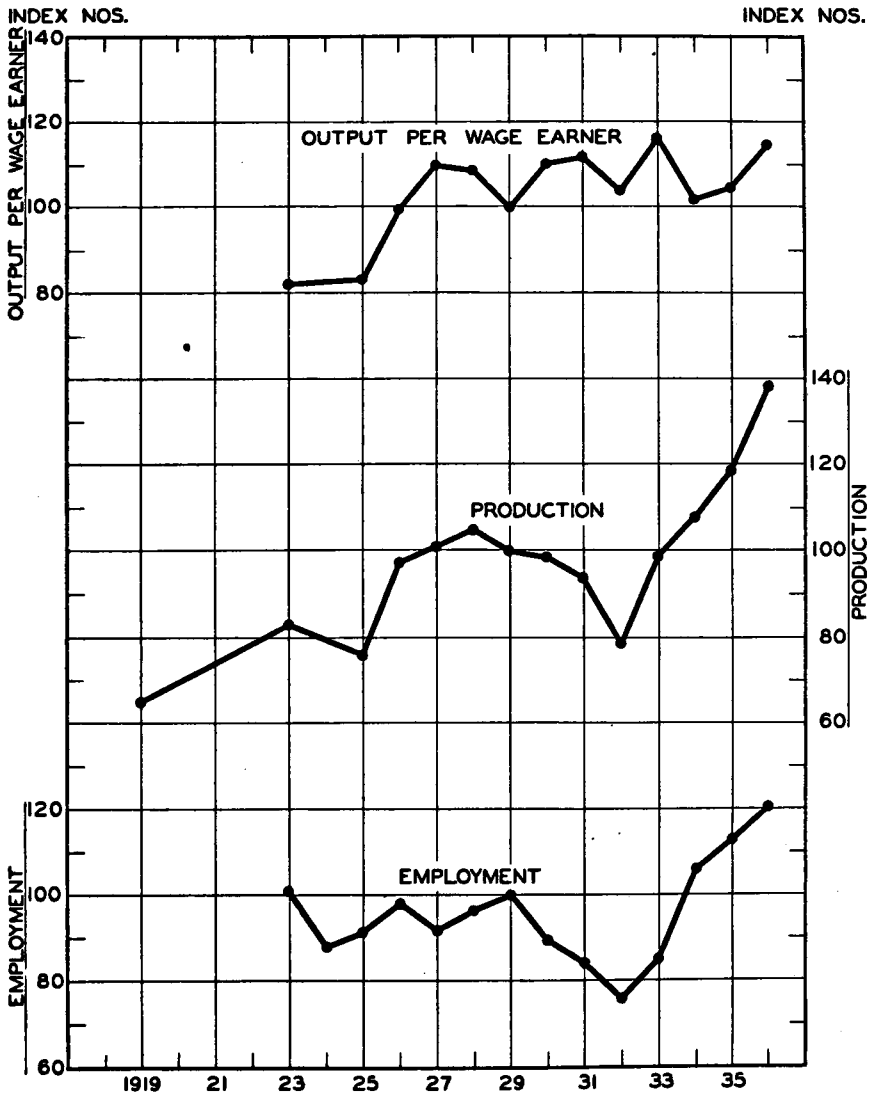


Figure 27.- SUMMARY INDEXES FOR THE PRESSED AND BLOWN WARE INDUSTRY: 1919-36

(1928 = 100)

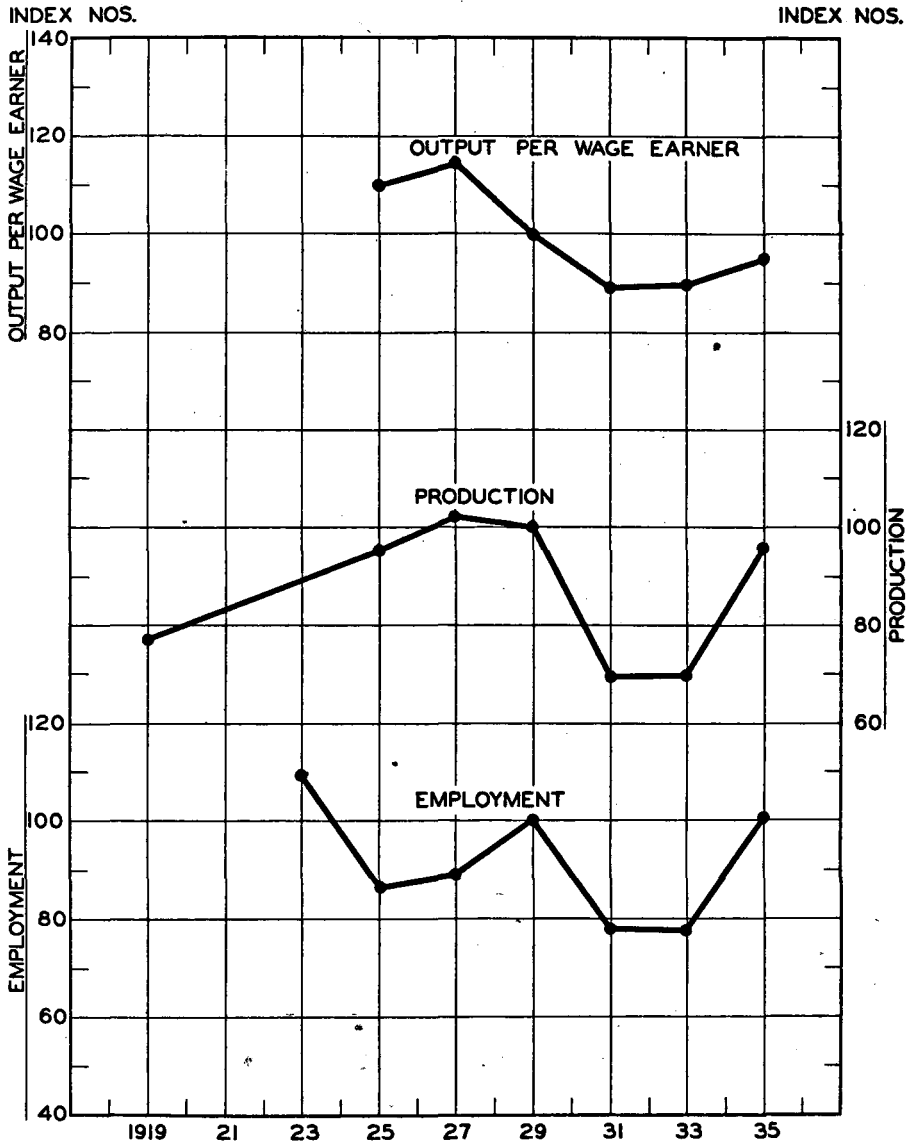


Figure 28.- SUMMARY INDEXES FOR THE ICE CREAM INDUSTRY: 1919-36

(1928 = 100)

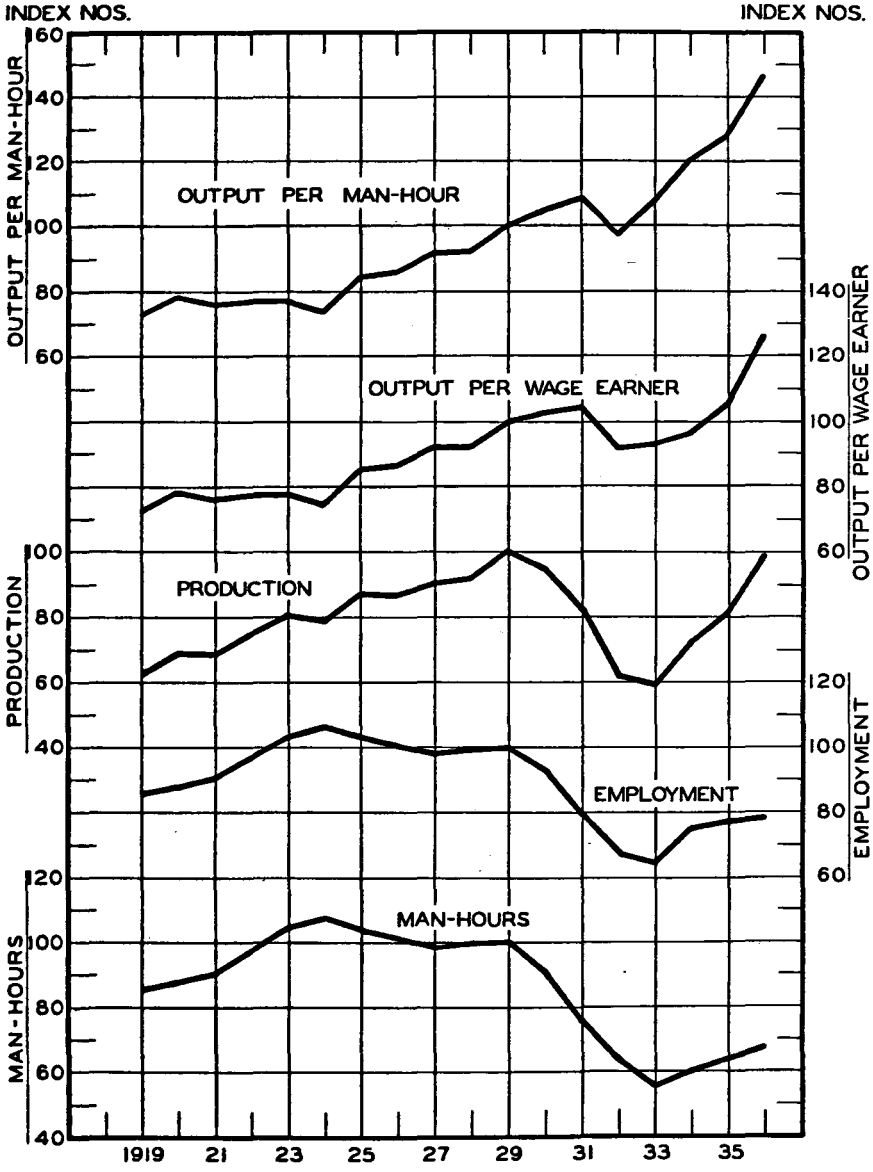


Figure 29.- SUMMARY INDEXES FOR THE IRON AND STEEL
INDUSTRY GROUP: 1919-36

(1929 = 100)

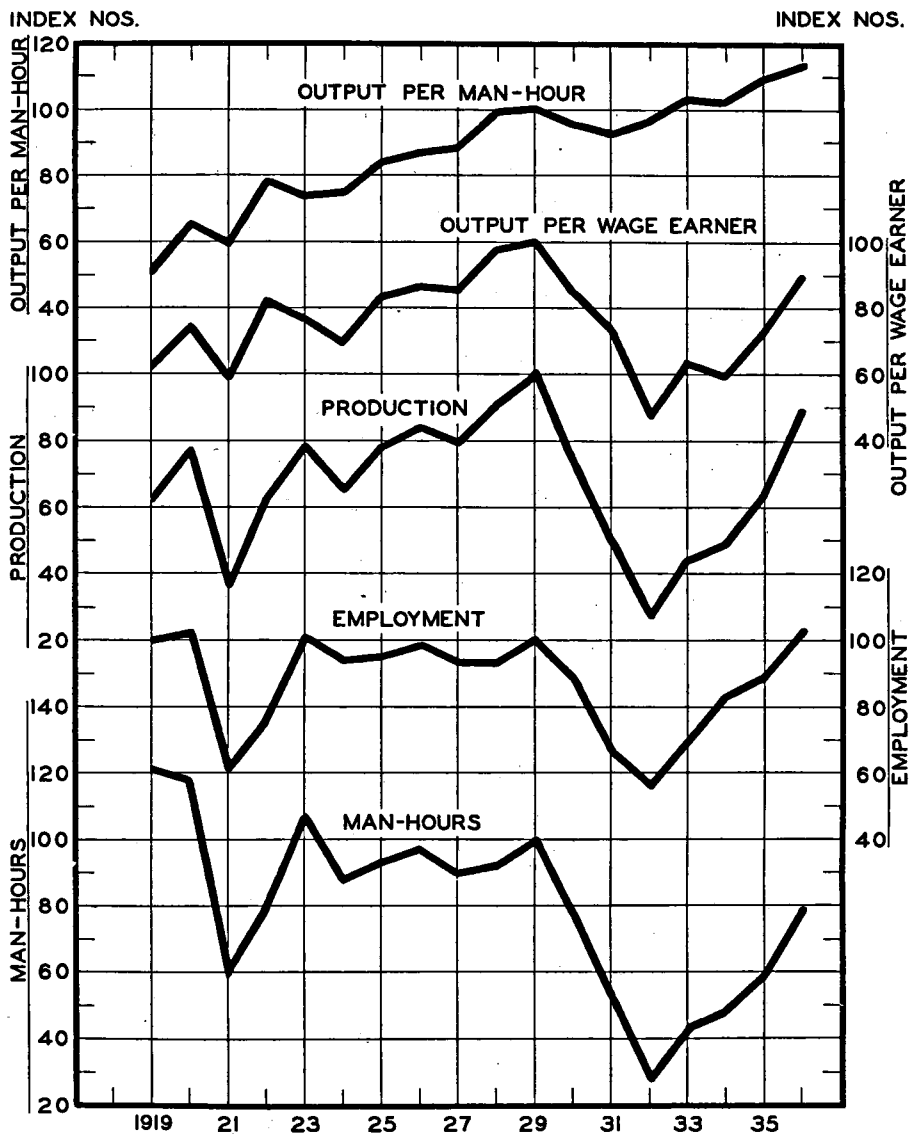


Figure 30.- SUMMARY INDEXES FOR BLAST FURNACES: 1919-36

(1929 = 100)

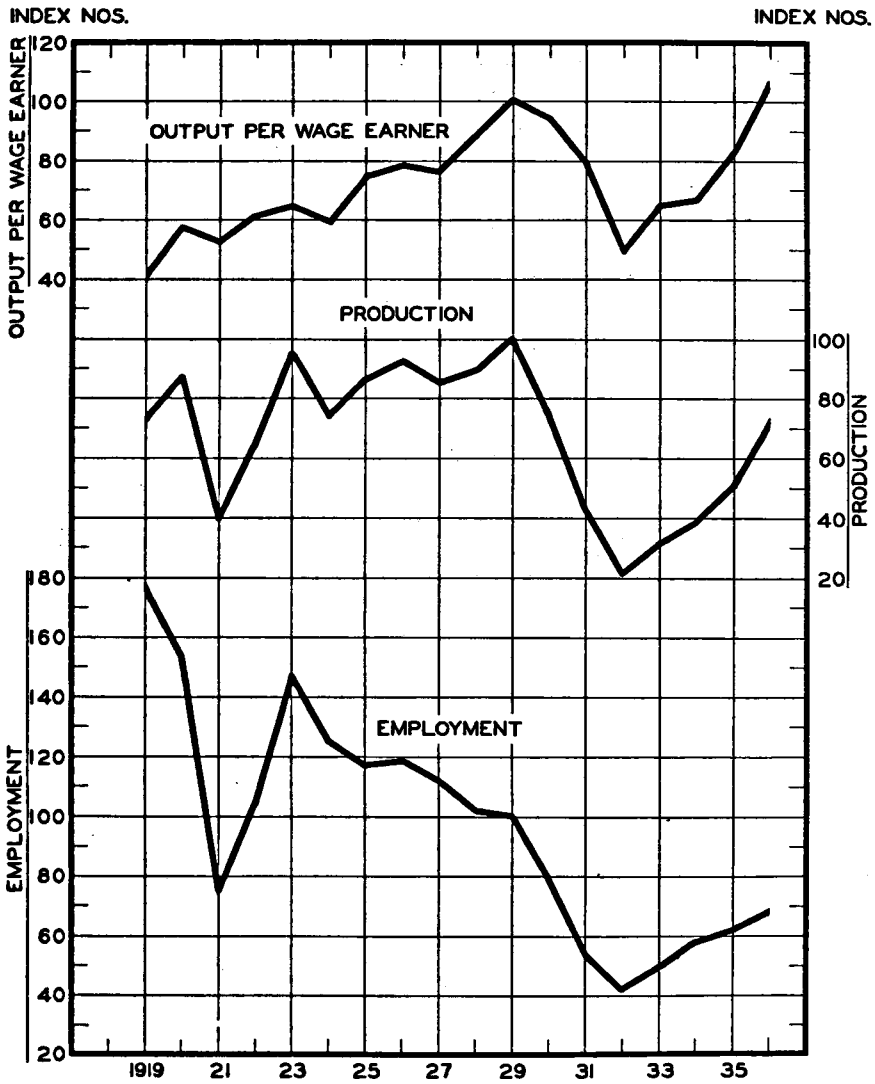


Figure 31.- SUMMARY INDEXES FOR STEEL WORKS AND ROLLING MILLS: 1919-36

(1929 = 100)

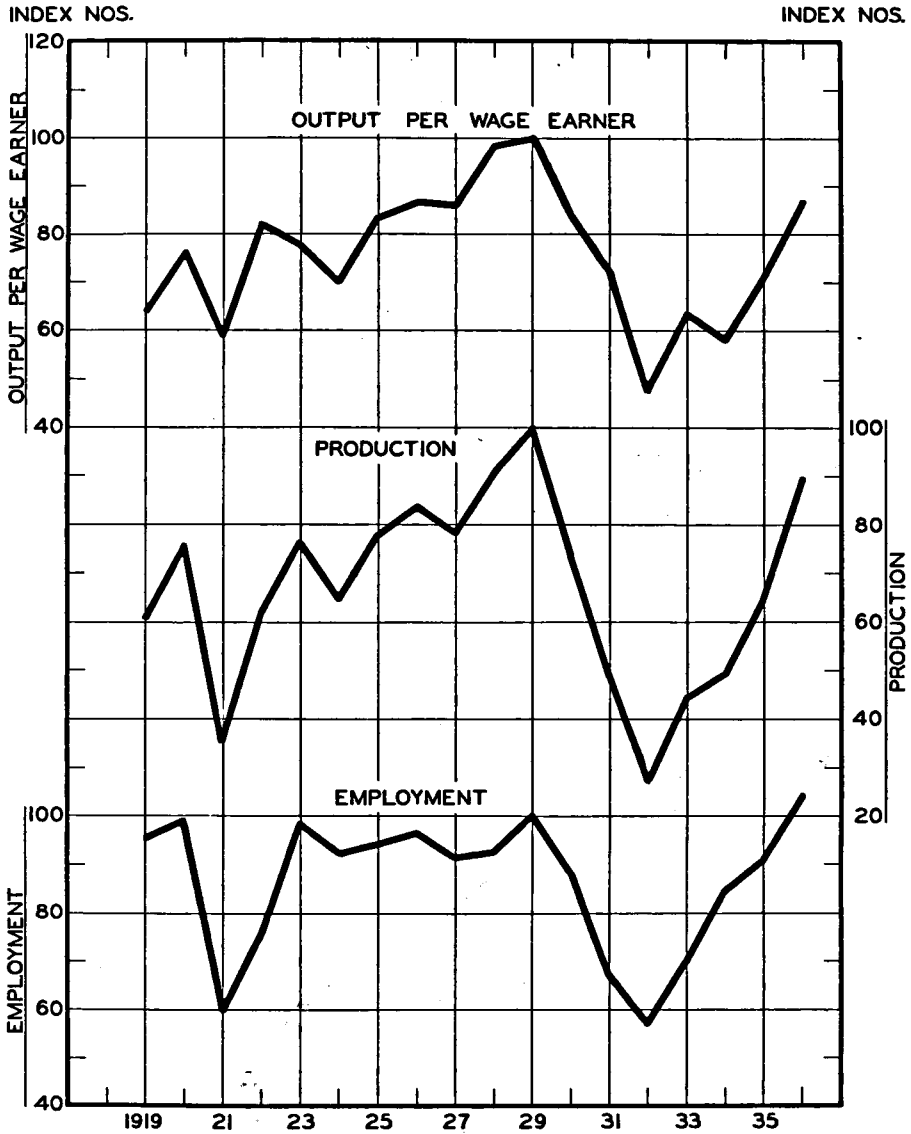
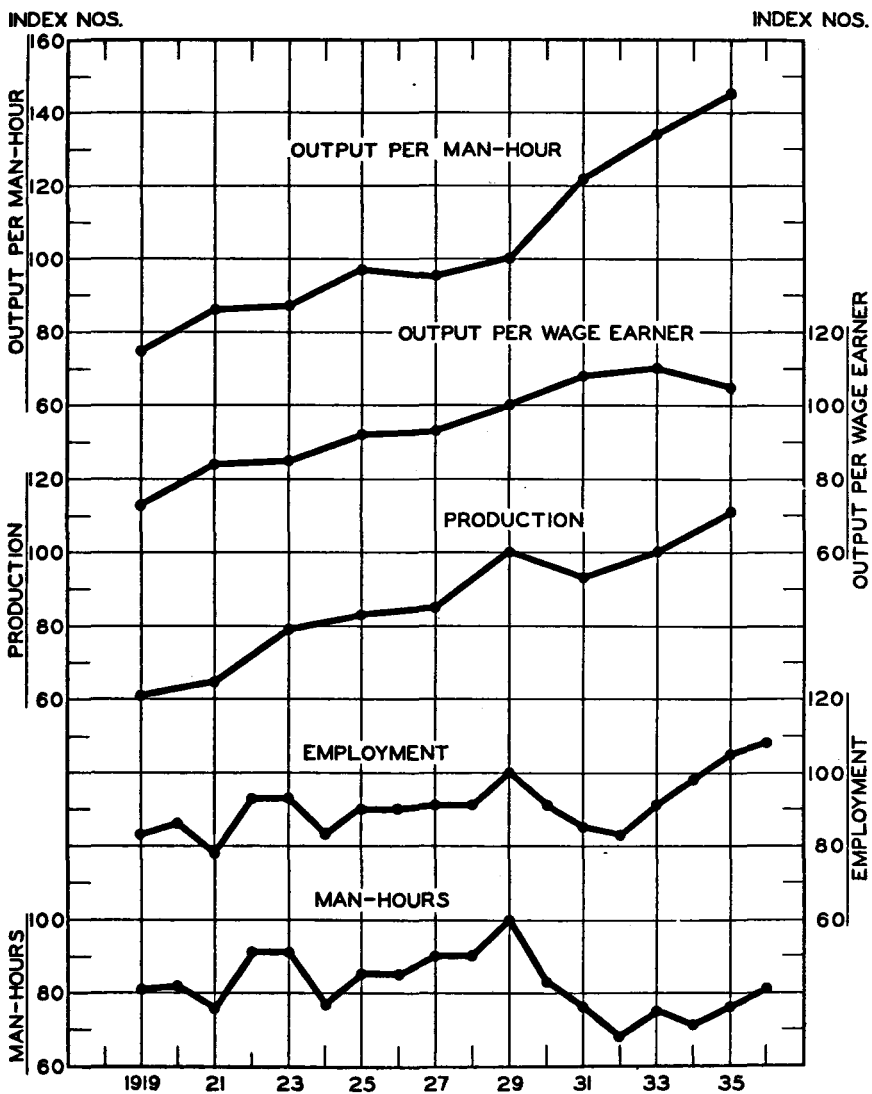


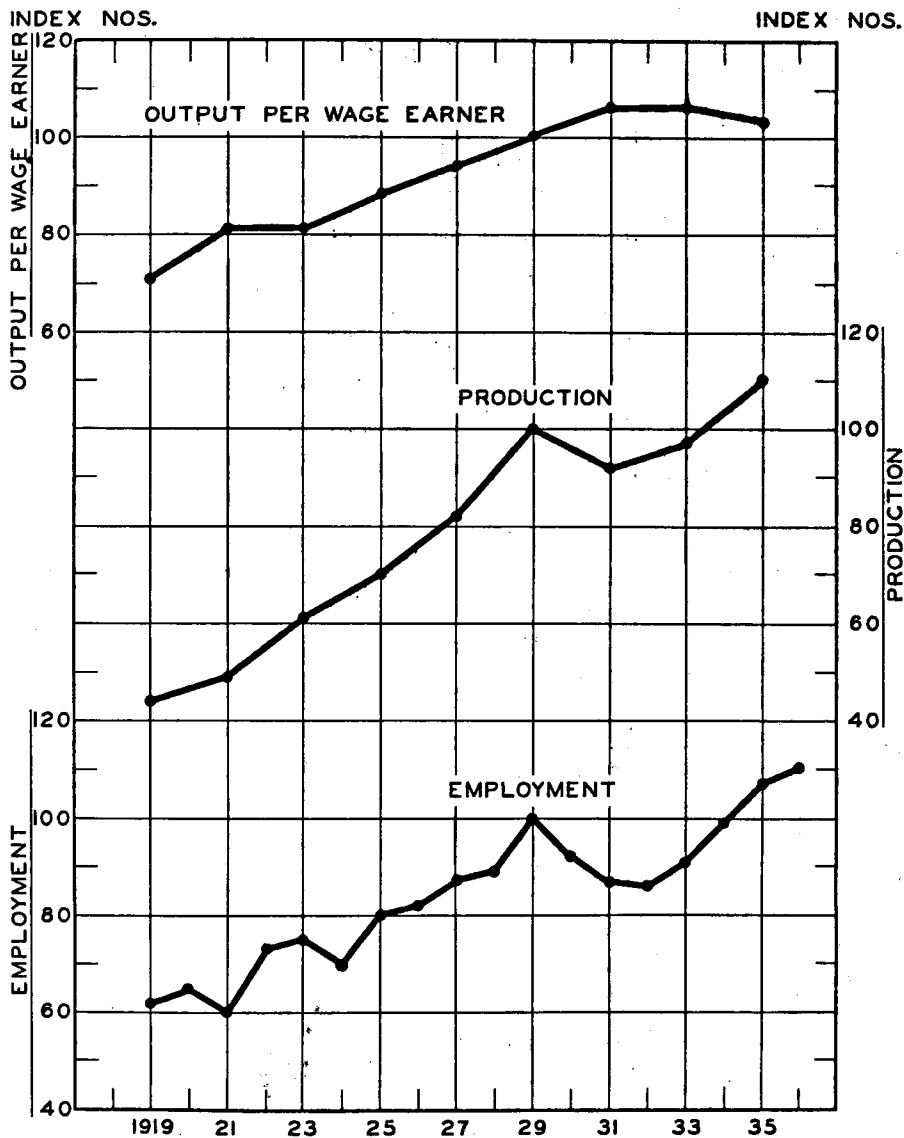
Figure 32.- SUMMARY INDEXES FOR THE KNIT GOODS
INDUSTRY GROUP: 1918-36

(1928 = 100)



**Figure 33.- SUMMARY INDEXES FOR THE ROBIERY
INDUSTRY: 1919-36**

(1929 = 100)



**Figure 34.- SUMMARY INDEXES FOR THE UNDERWEAR
INDUSTRY: 1919-36**

(1929 = 100)

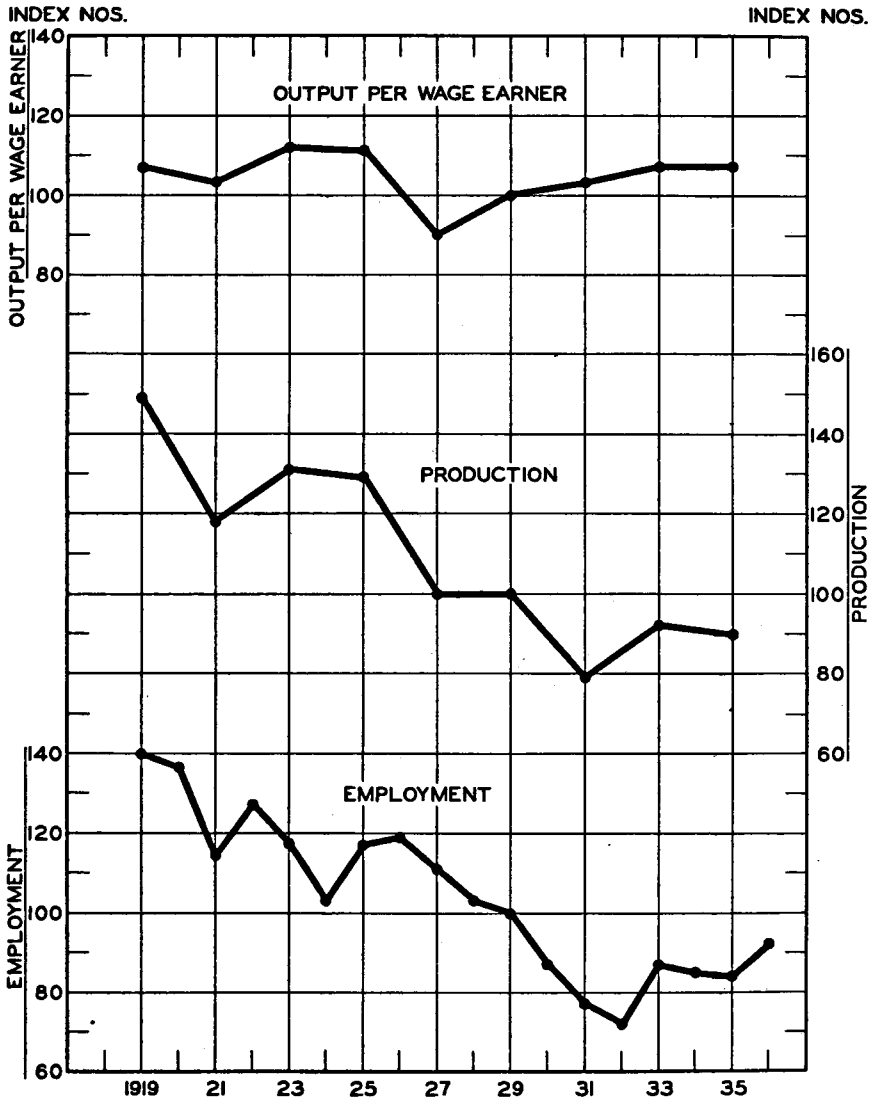
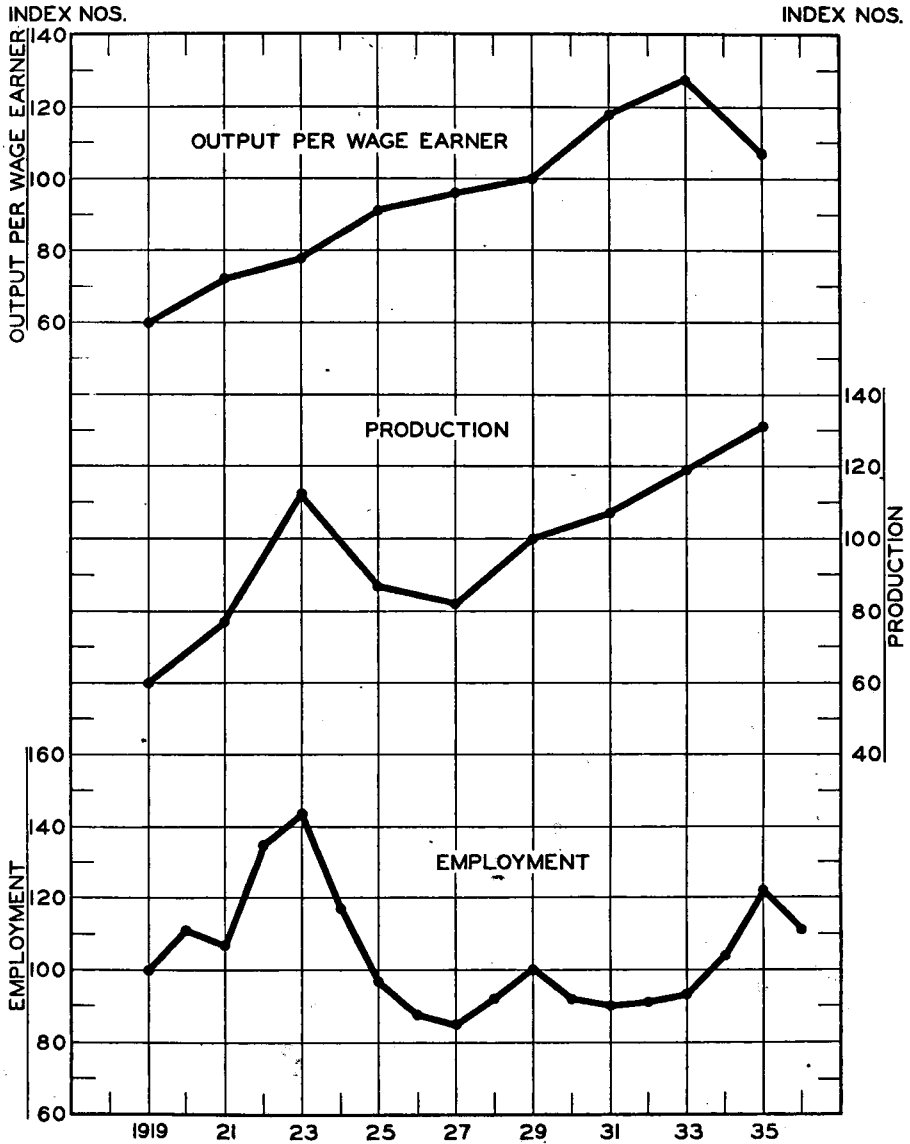


Figure 35.- SUMMARY INDEXES FOR THE OUTERWEAR
INDUSTRY: 1919-36

(1929 = 100)



**Figure 36.- SUMMARY INDEXES FOR THE KNIT CLOTH
INDUSTRY: 1919-36**

(1929 = 100)

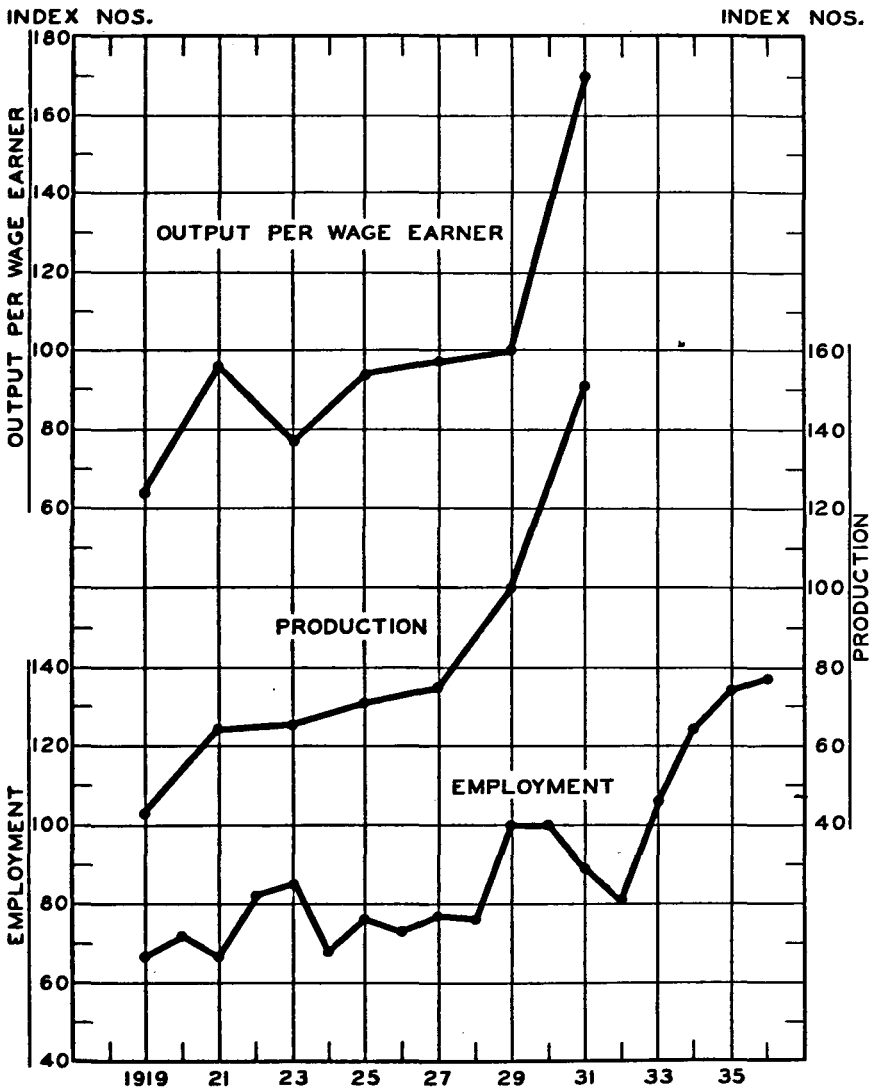


Figure 37.- SUMMARY INDEXES FOR THE LEATHER
INDUSTRY GROUP: 1918-36

(1929 = 100)

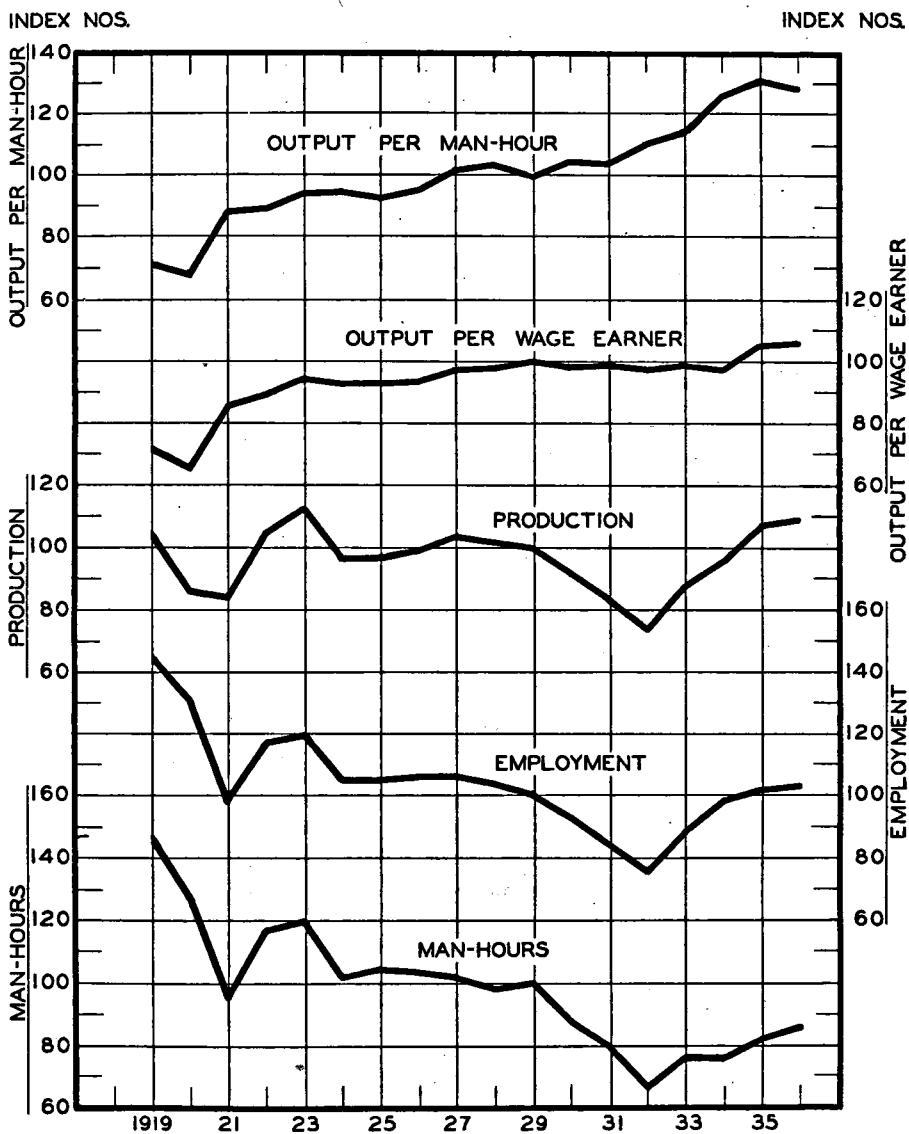


Figure 38.- SUMMARY INDEXES FOR THE SOLE AND HARNESS LEATHER INDUSTRY: 1919-38

(1929 = 100)

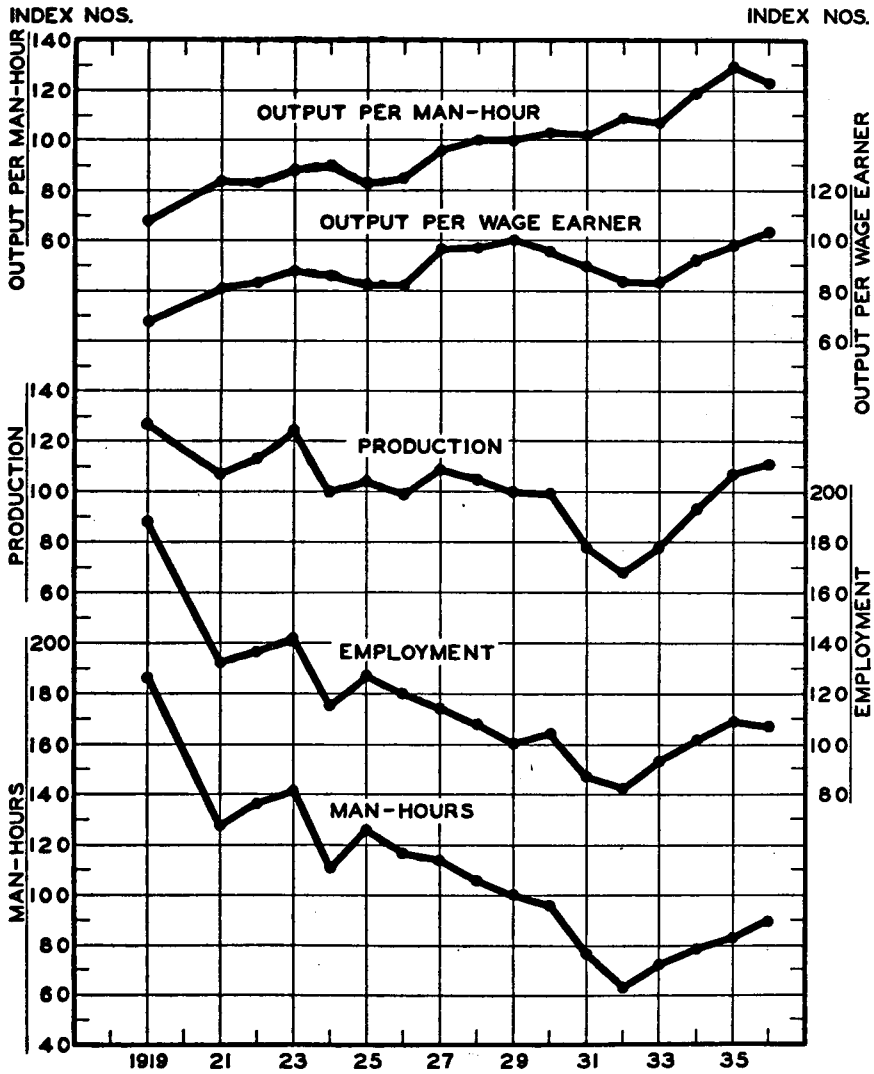


Figure 39.- SUMMARY INDEXES FOR THE SADDLE AND UPHOLSTERY LEATHER INDUSTRY: 1919-36

(1929 = 100)

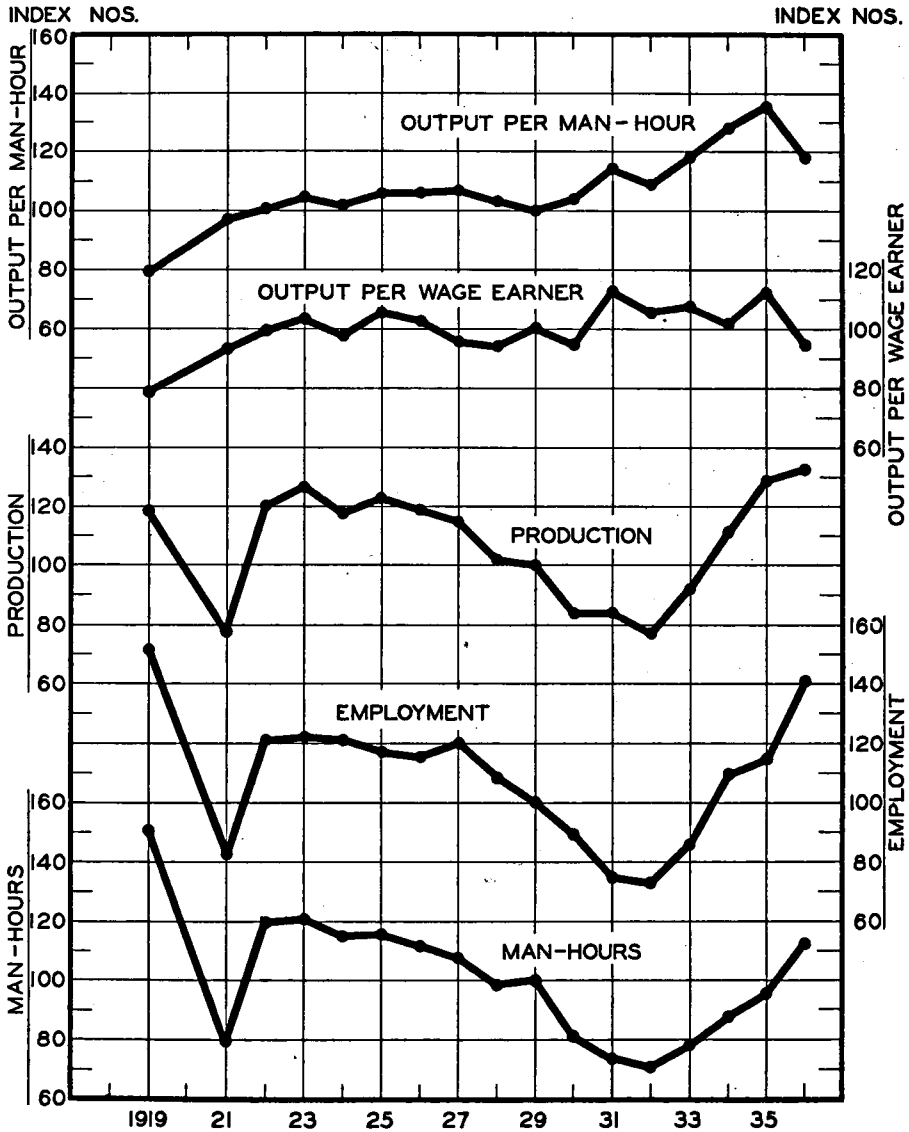


Figure 40.- SUMMARY INDEXES FOR THE CALFSKIN INDUSTRY: 1919-36

(1929 = 100)

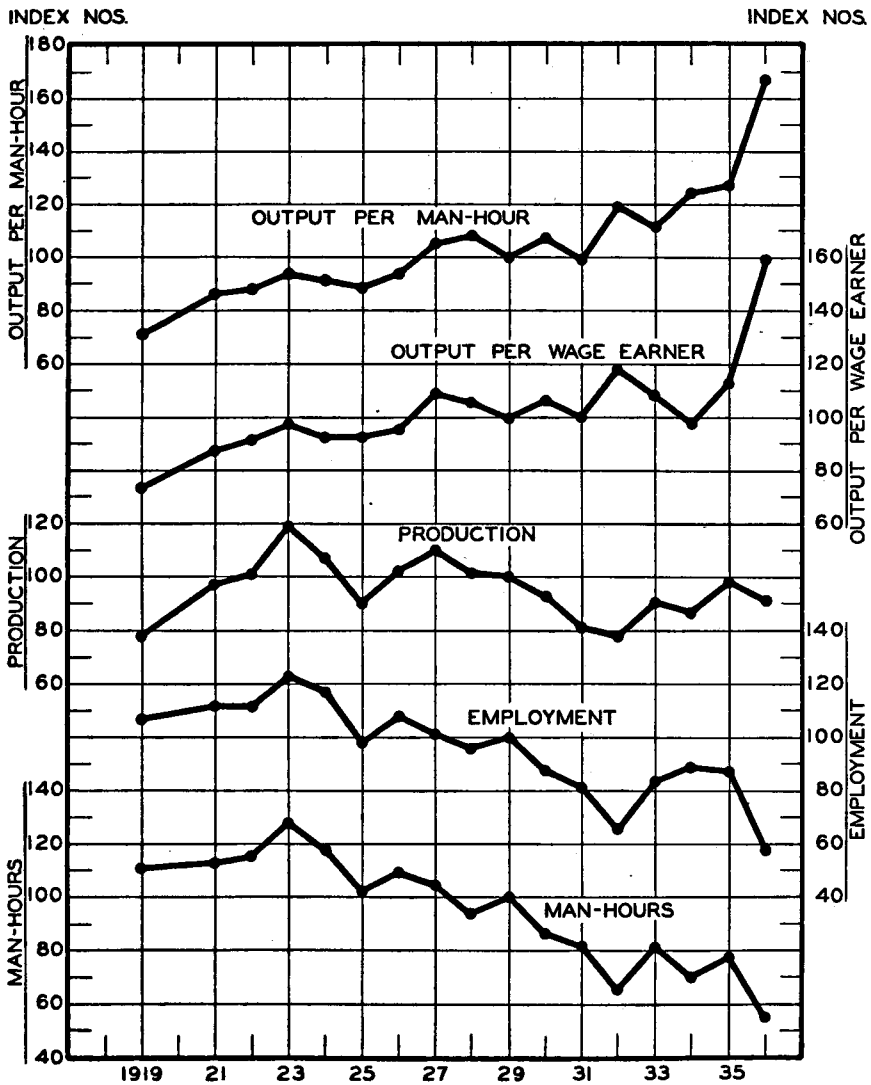


Figure 41.- SUMMARY INDEXES FOR THE KID LEATHER
INDUSTRY: 1919-36

(1929 = 100)

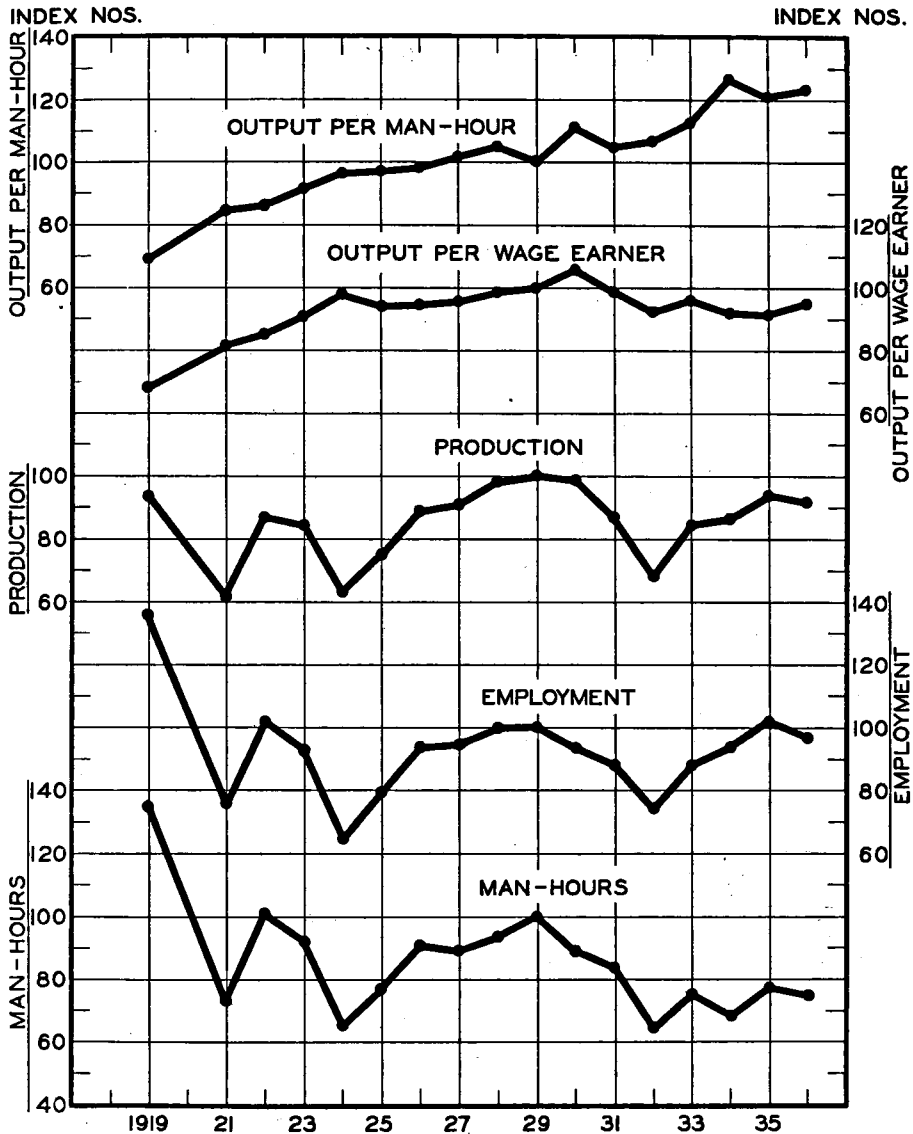


Figure 42.- SUMMARY INDEXES FOR THE SHEEP AND MISCELLANEOUS LEATHER INDUSTRY: 1919-36

(1929 = 100)

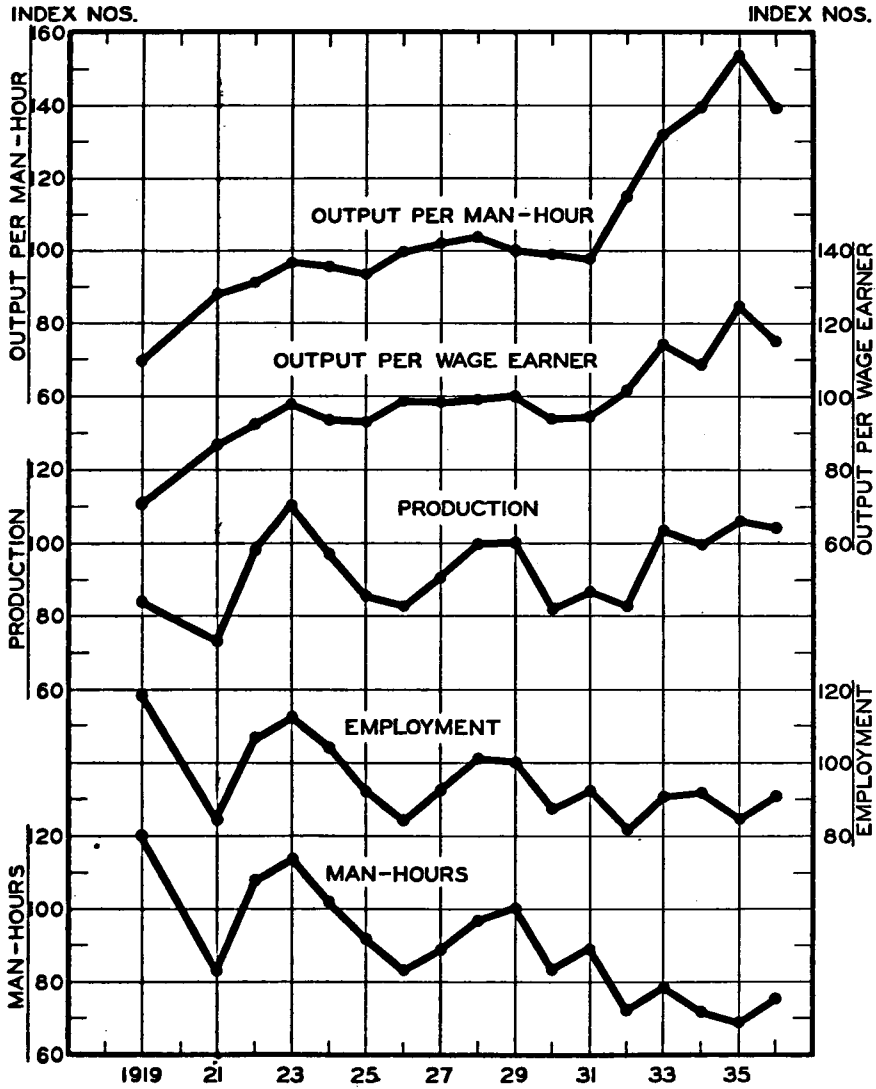


Figure 43.- SUMMARY INDEXES FOR THE LUMBER AND TIMBER PRODUCTS
INDUSTRY GROUP: 1919-36

(1929 = 100)

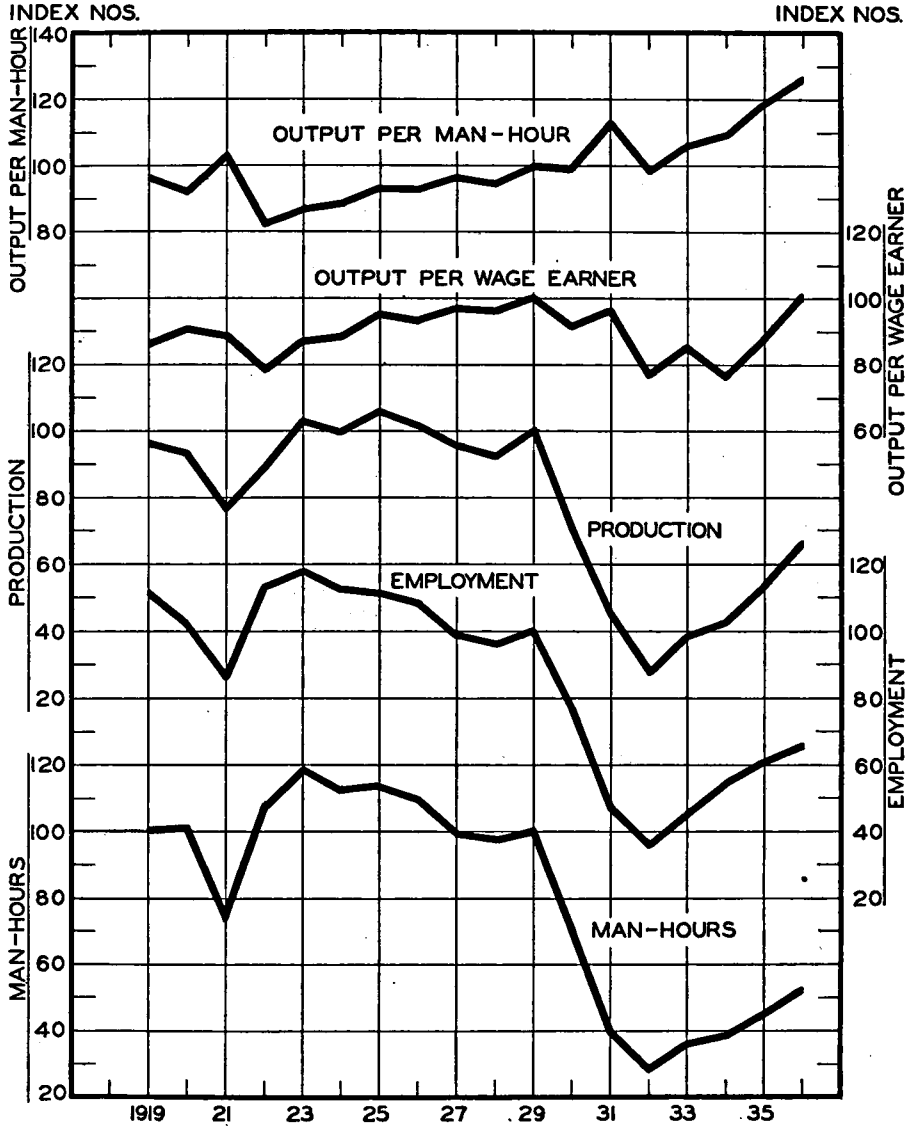


Figure 44.- SUMMARY INDEXES FOR LOGGING CAMPS: 1919-36

(1929 = 100)

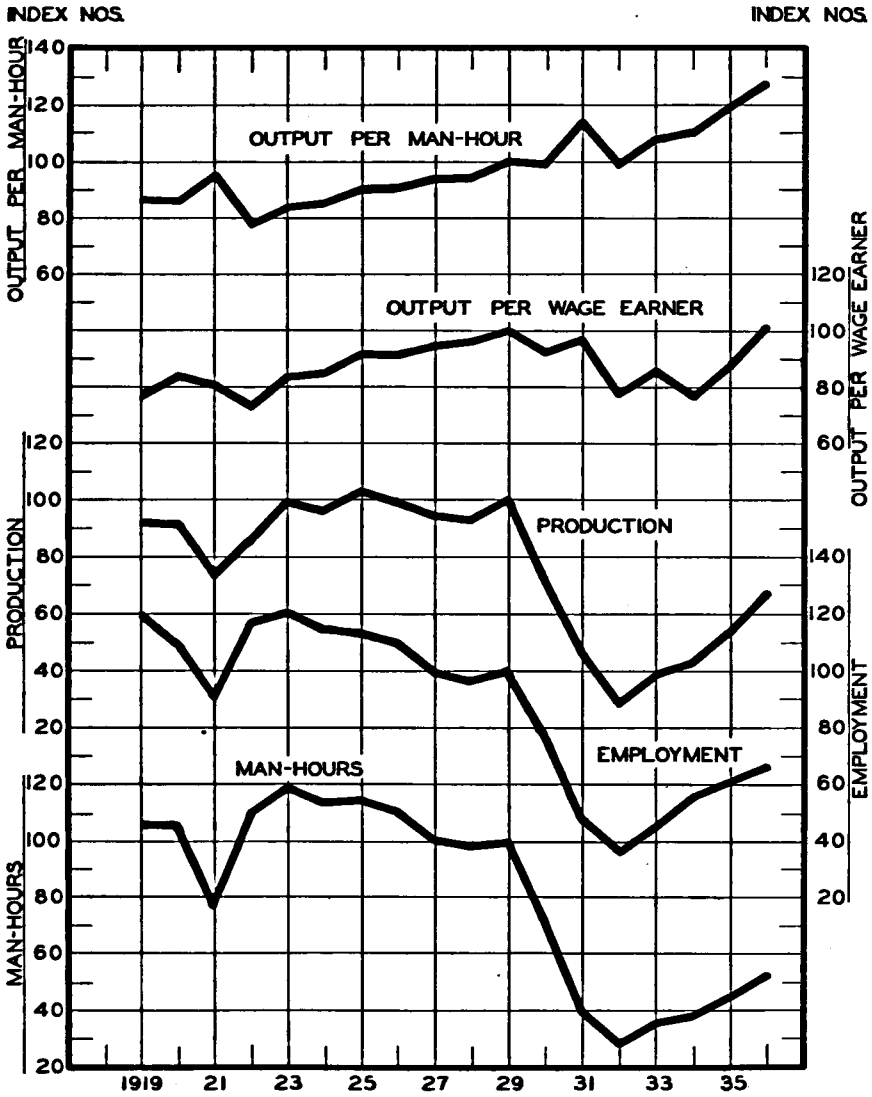


Figure 45. - SUMMARY INDEXES FOR SAWMILLS AND
SAW-PLANE MILLS: 1918-36

(1929 = 100)

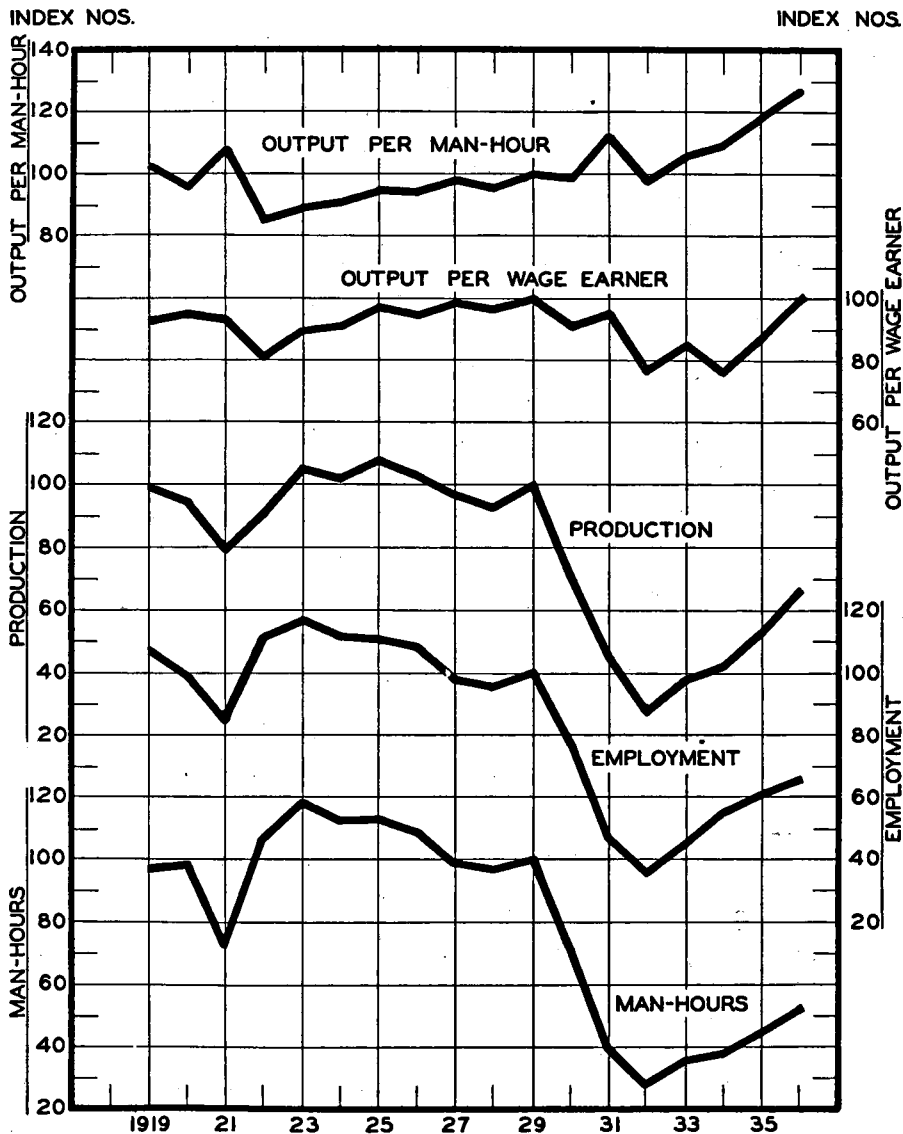


Figure 46.- SUMMARY INDEXES FOR THE MANUFACTURED GAS INDUSTRY: 1918-35

(1929 = 100)

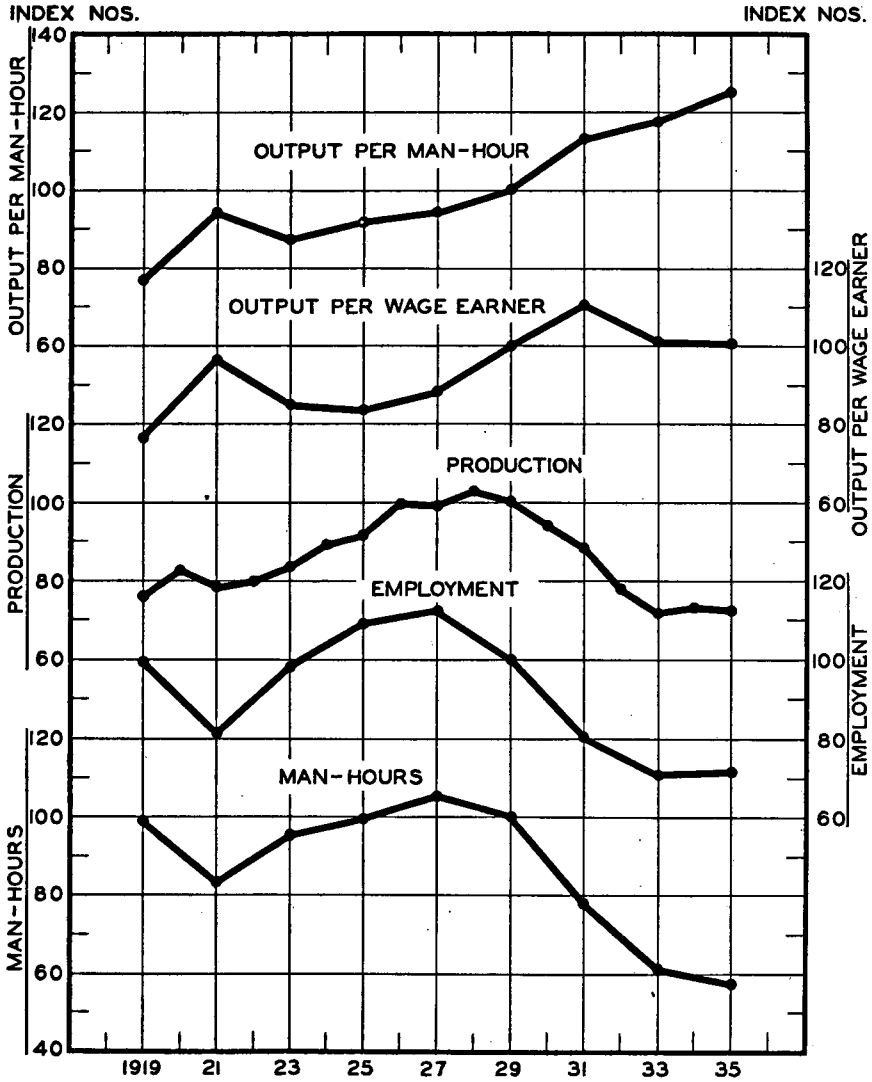


Figure 47.- SUMMARY INDEXES FOR THE MANUFACTURED ICE INDUSTRY: 1919-35

(1929 = 100)

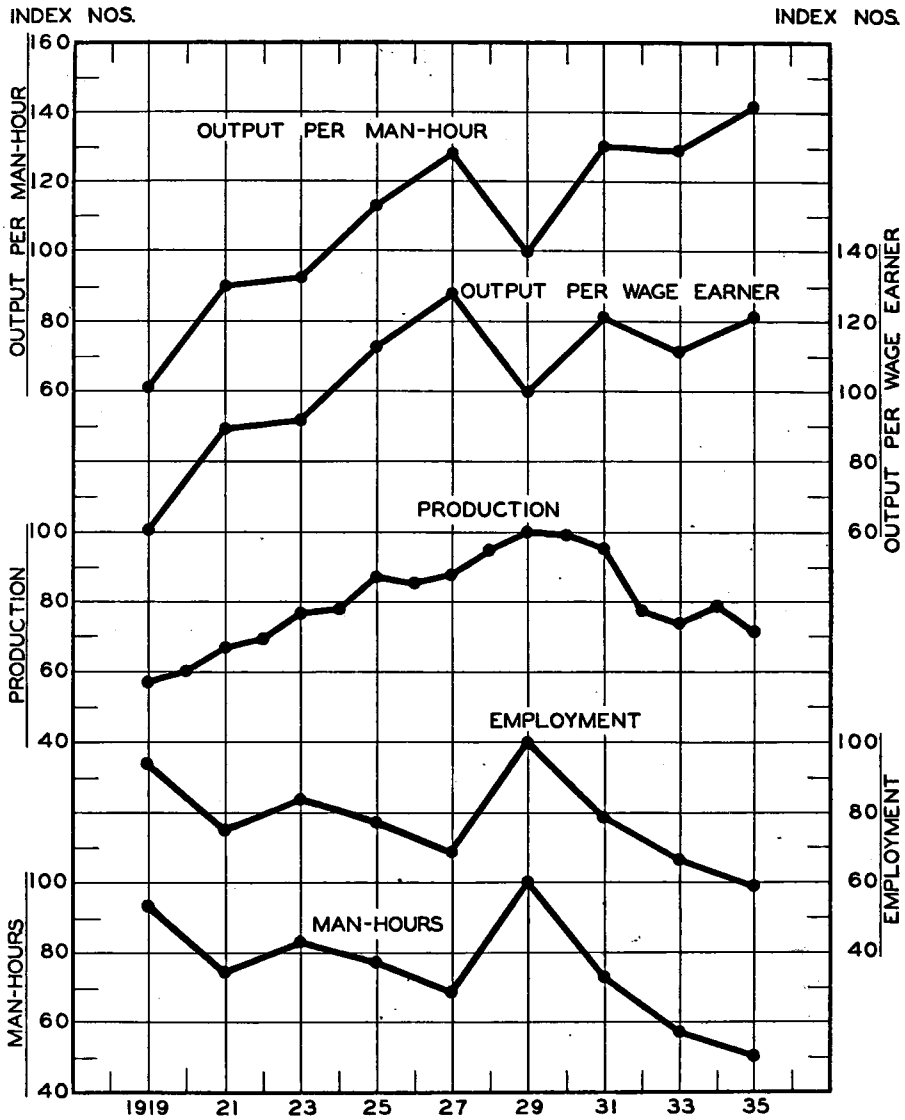


Figure 48.- SUMMARY INDEXES FOR THE MOTOR VEHICLES INDUSTRY: 1919-36

(1929 = 100)

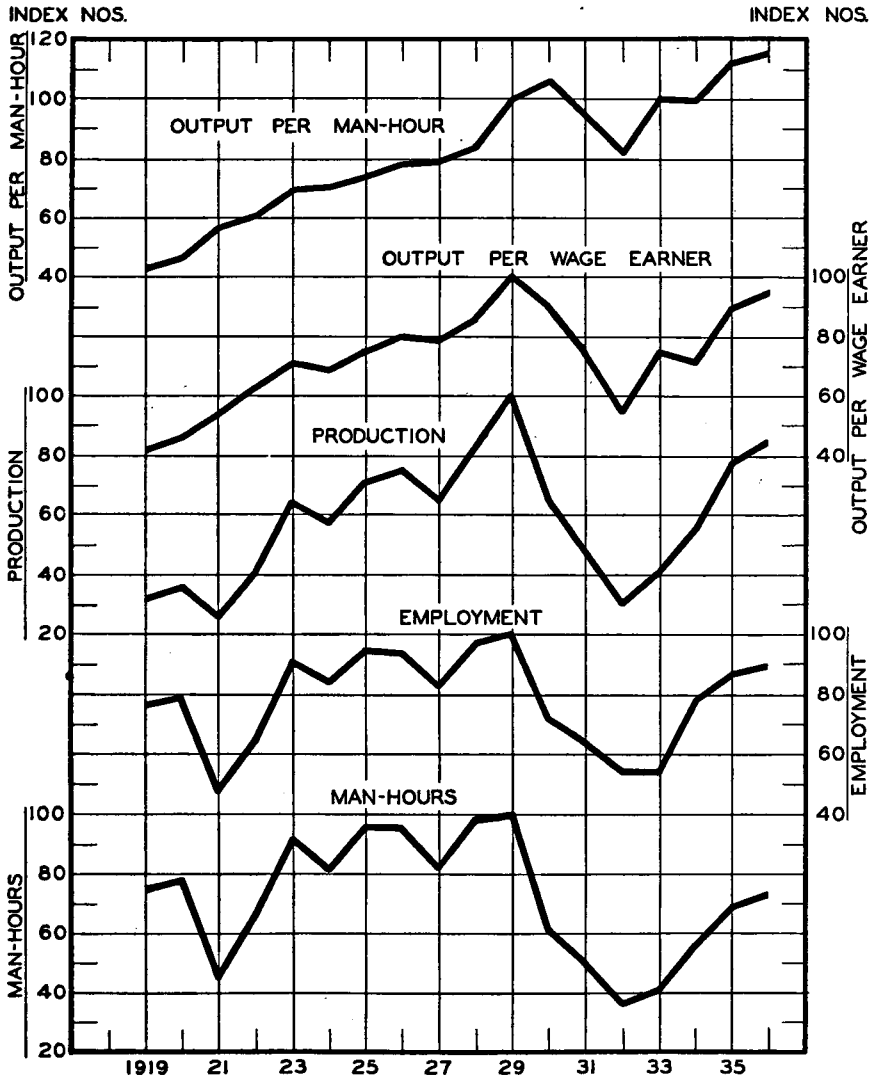
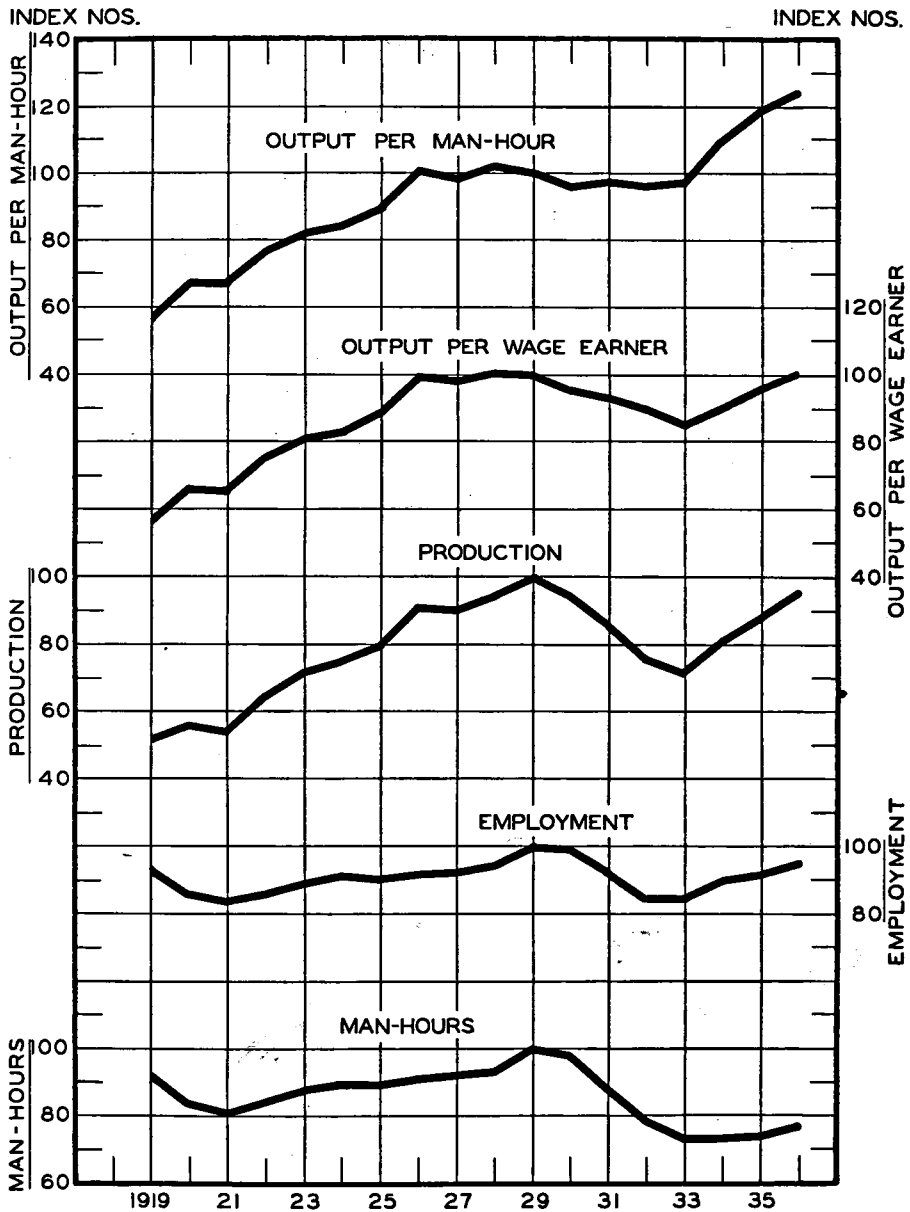


Figure 48.- SUMMARY INDEXES FOR THE NEWSPAPER AND PERIODICAL PRINTING AND PUBLISHING INDUSTRY: 1918-36

(1929 = 100)



**Figure 50.- SUMMARY INDEXES FOR THE NONFERROUS METALS
INDUSTRY GROUP: CENSUS YEARS 1919-35**

(1928 = 100)

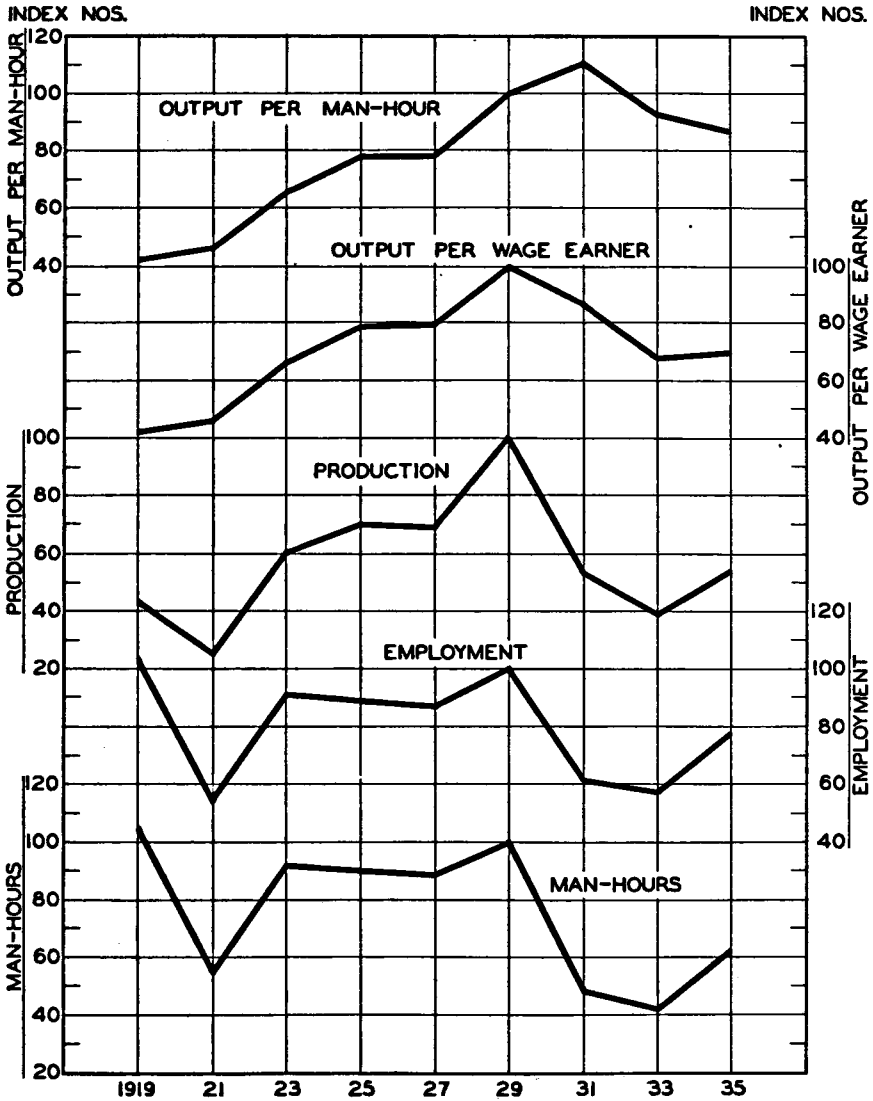


Figure 51.- SUMMARY INDEXES FOR PRIMARY SMELTERS AND REFINERIES: 1919-36

(1929 = 100)

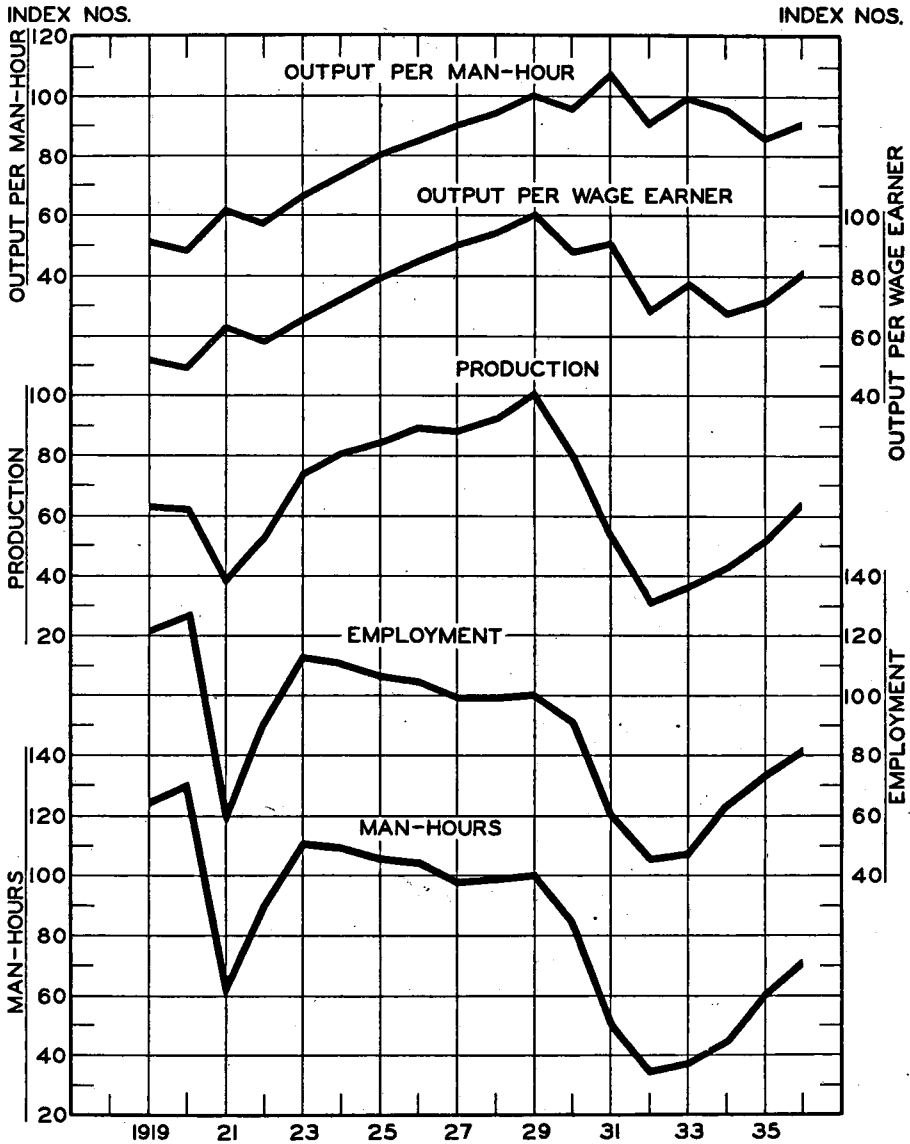


Figure 52.- SUMMARY INDEXES FOR SECONDARY SMELTERS AND REFINERIES: CENSUS YEARS 1919-35

(1929 = 100)

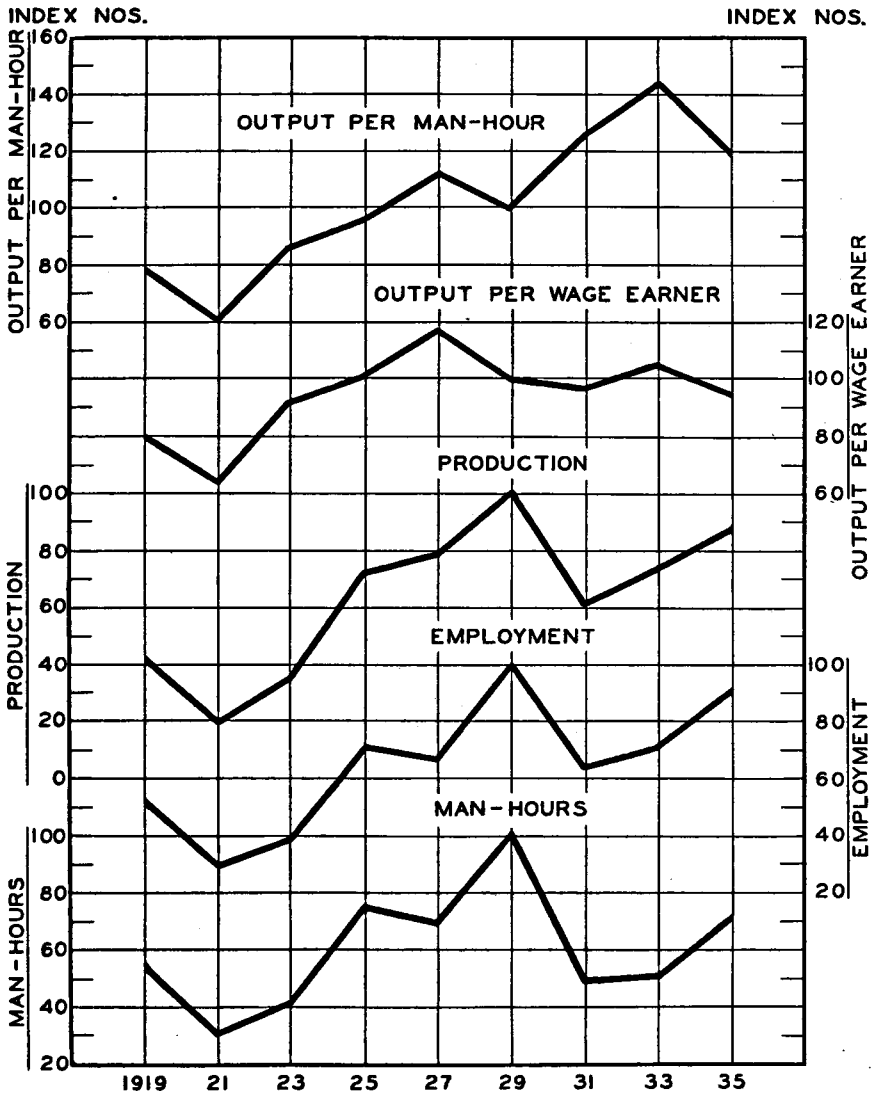


Figure 53.- SUMMARY INDEXES FOR ALLOYERS, ROLLING MILLS, AND FOUNDRIES: 1919-36

(1929 = 100)

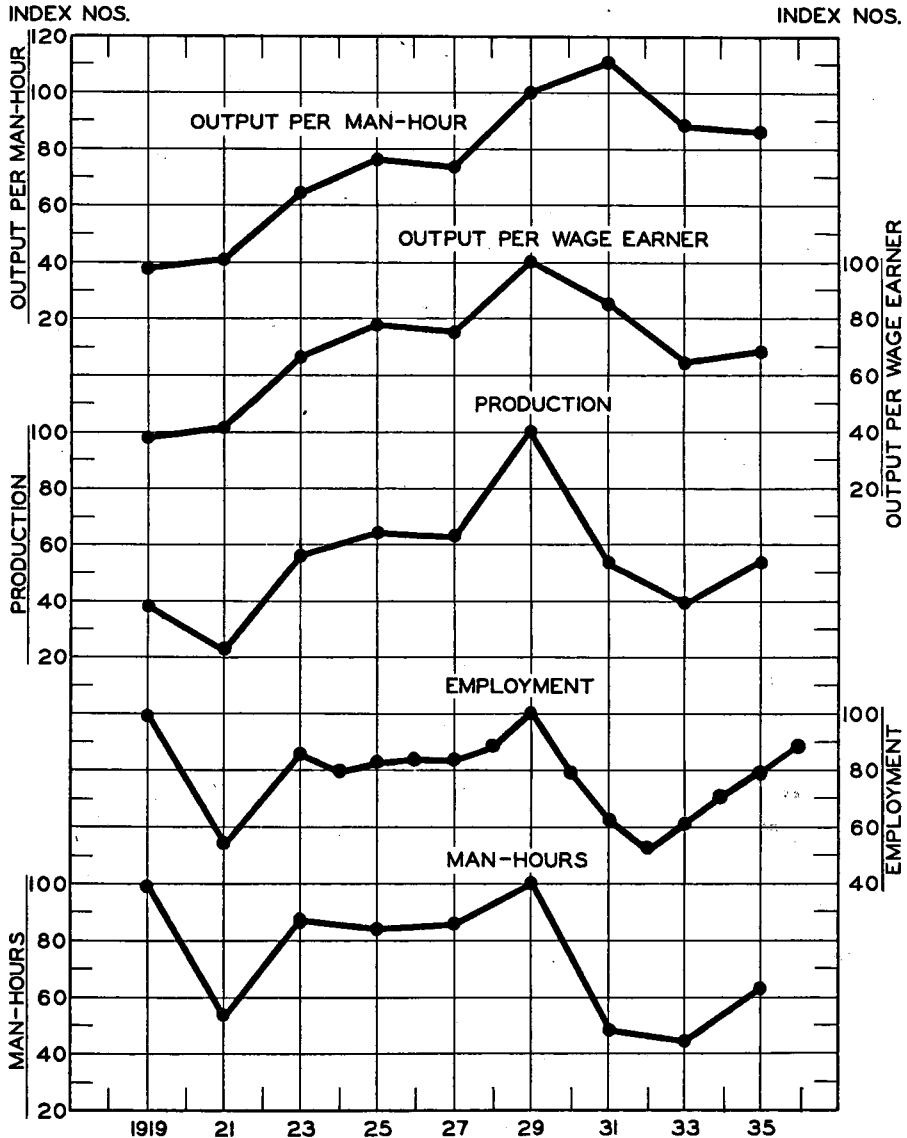


Figure 54.- SUMMARY INDEXES FOR THE PAINTS AND VARNISHES INDUSTRY: 1918-36

(1929 = 100)

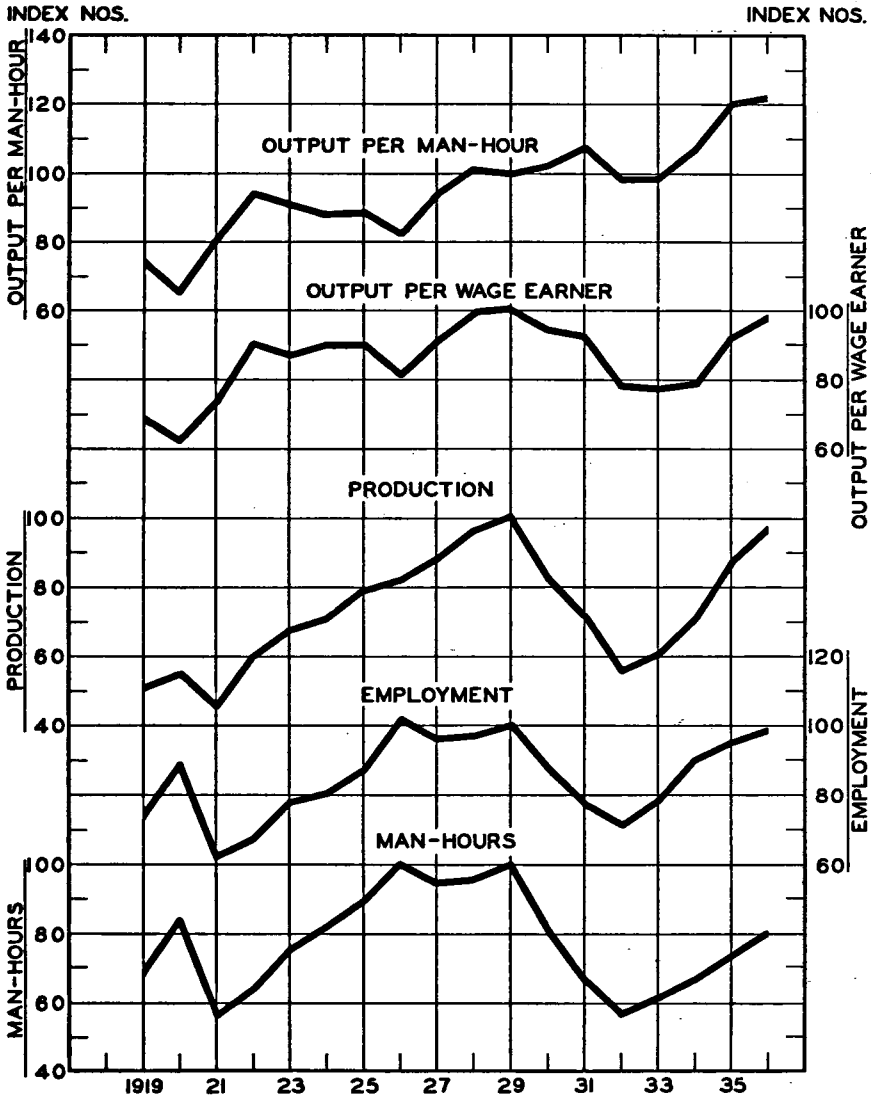


Figure 55.- SUMMARY INDEXES FOR THE PAPER AND PULP
INDUSTRY GROUP: 1919-36

(1929 = 100)

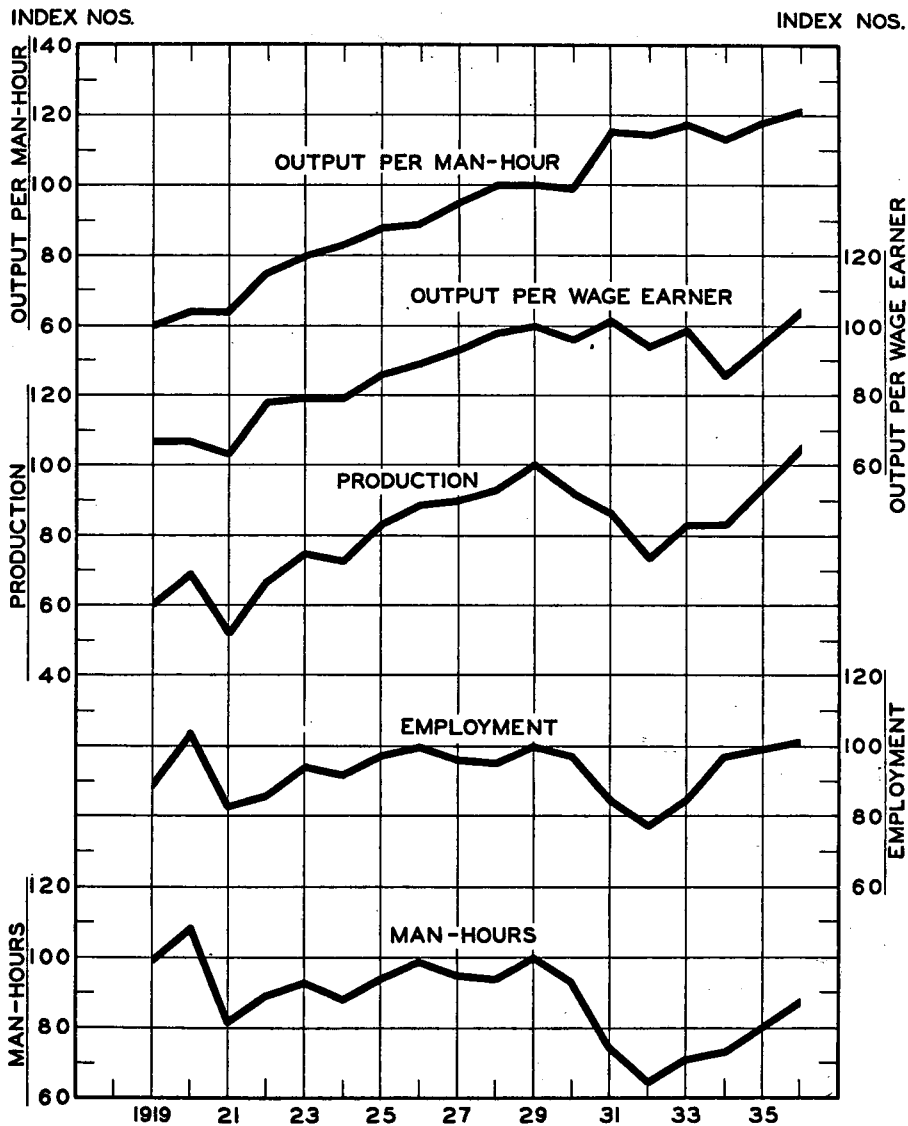


Figure 56.- SUMMARY INDEXES FOR THE PAPER INDUSTRY: 1918-39
(1929 = 100)

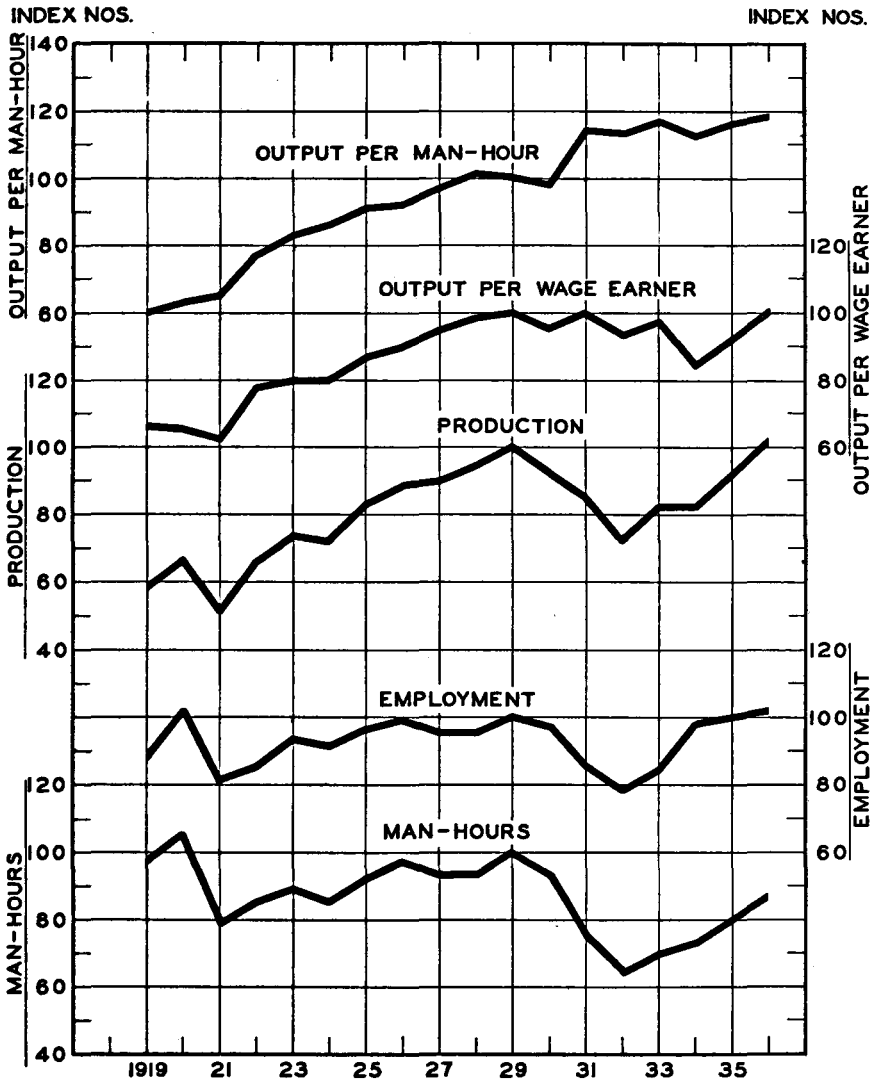
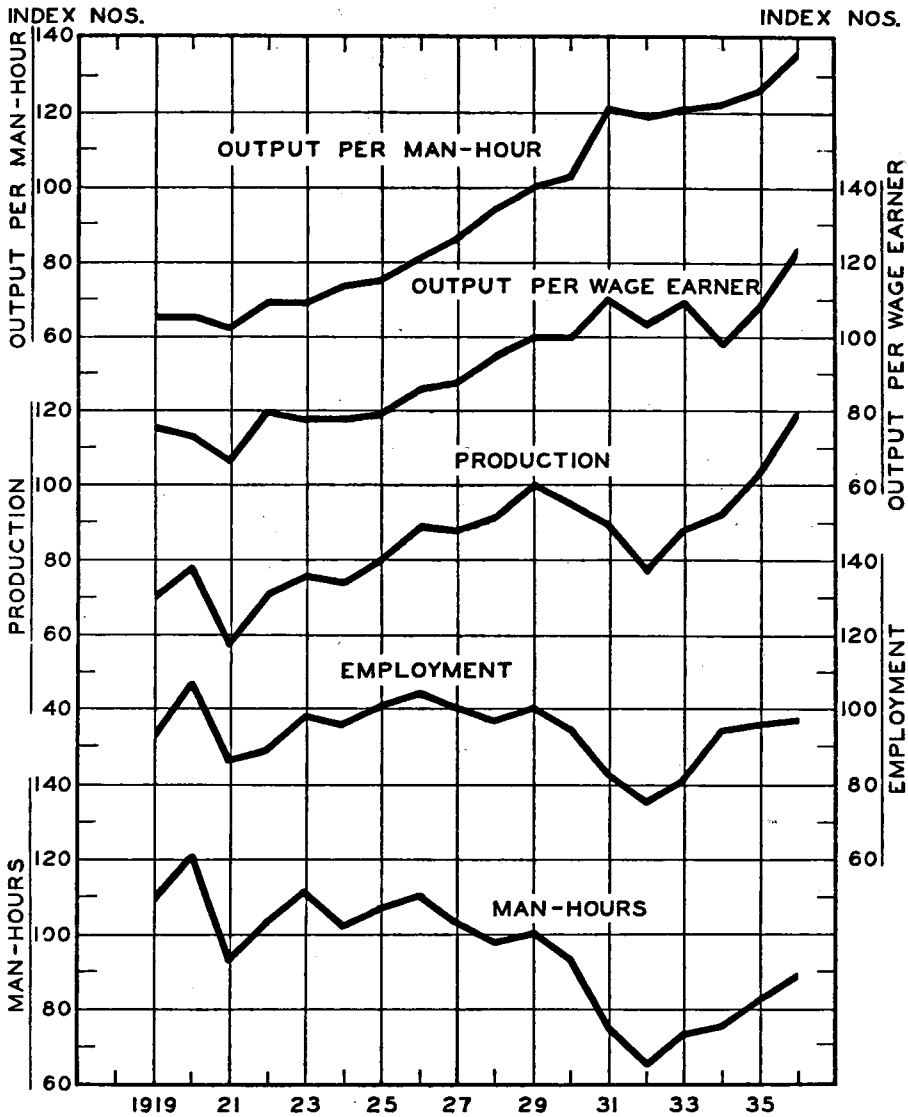


Figure 57.- SUMMARY INDEXES FOR THE PULP INDUSTRY: 1919-36

(1929 = 100)



**Figure 58.- SUMMARY INDEXES FOR THE PETROLEUM REFINING
INDUSTRY: 1918-38**

(1928 = 100)

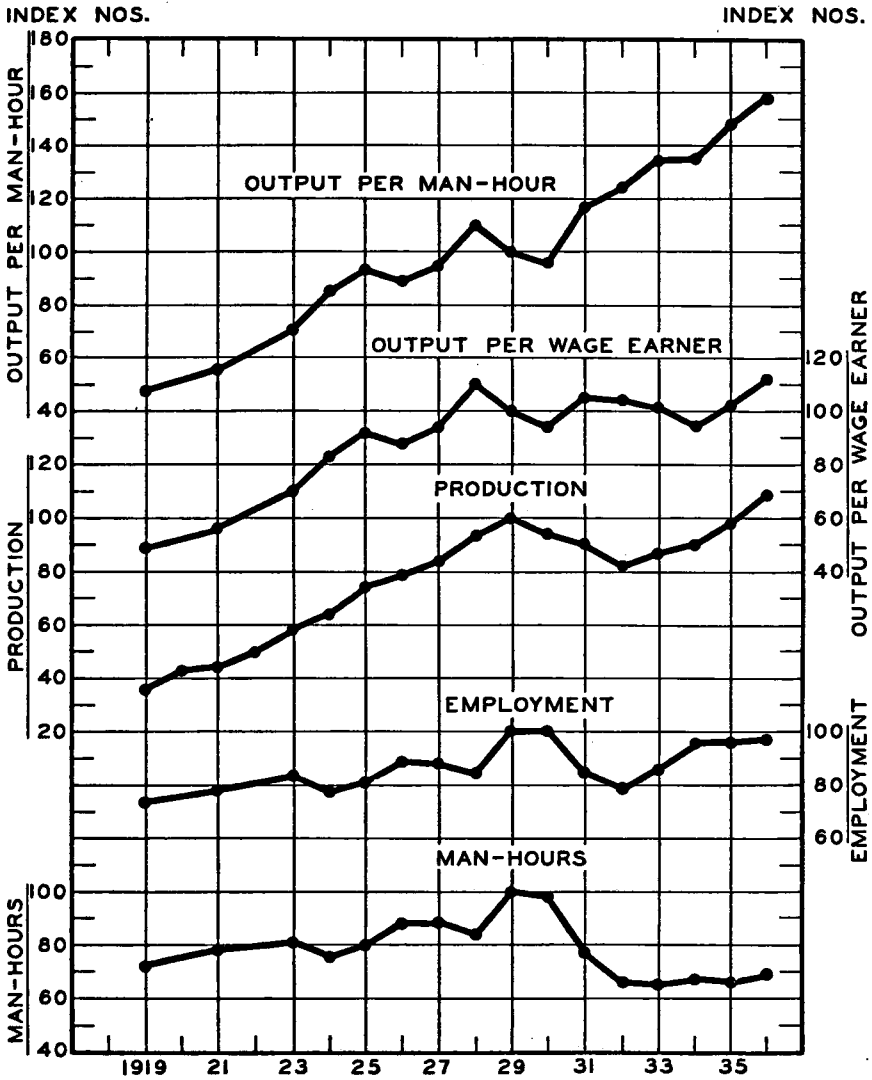


Figure 59.- SUMMARY INDEXES FOR THE PLANING-MILL PRODUCTS INDUSTRY: 1918-36

(1929 = 100)

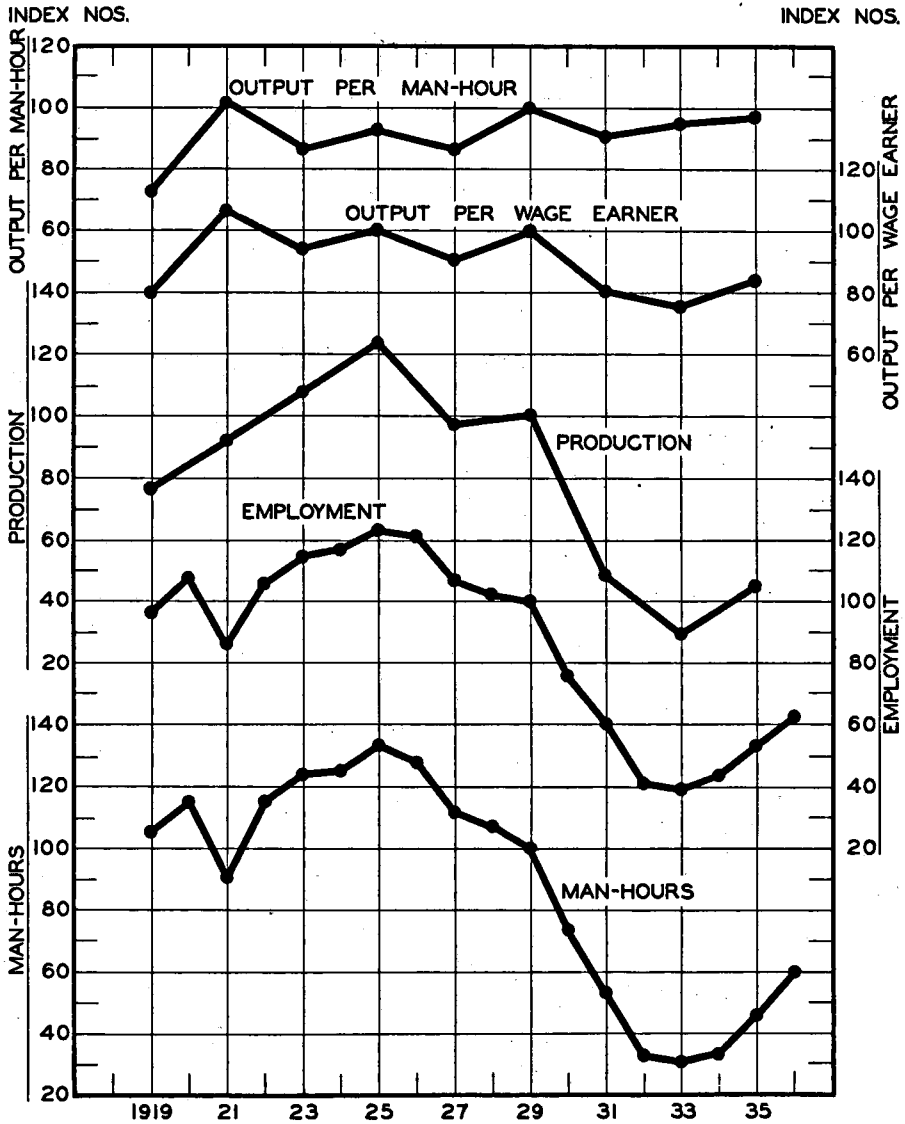


Figure 80.- SUMMARY INDEXES FOR THE RAYON INDUSTRY: 1919-37

(1929 = 100)

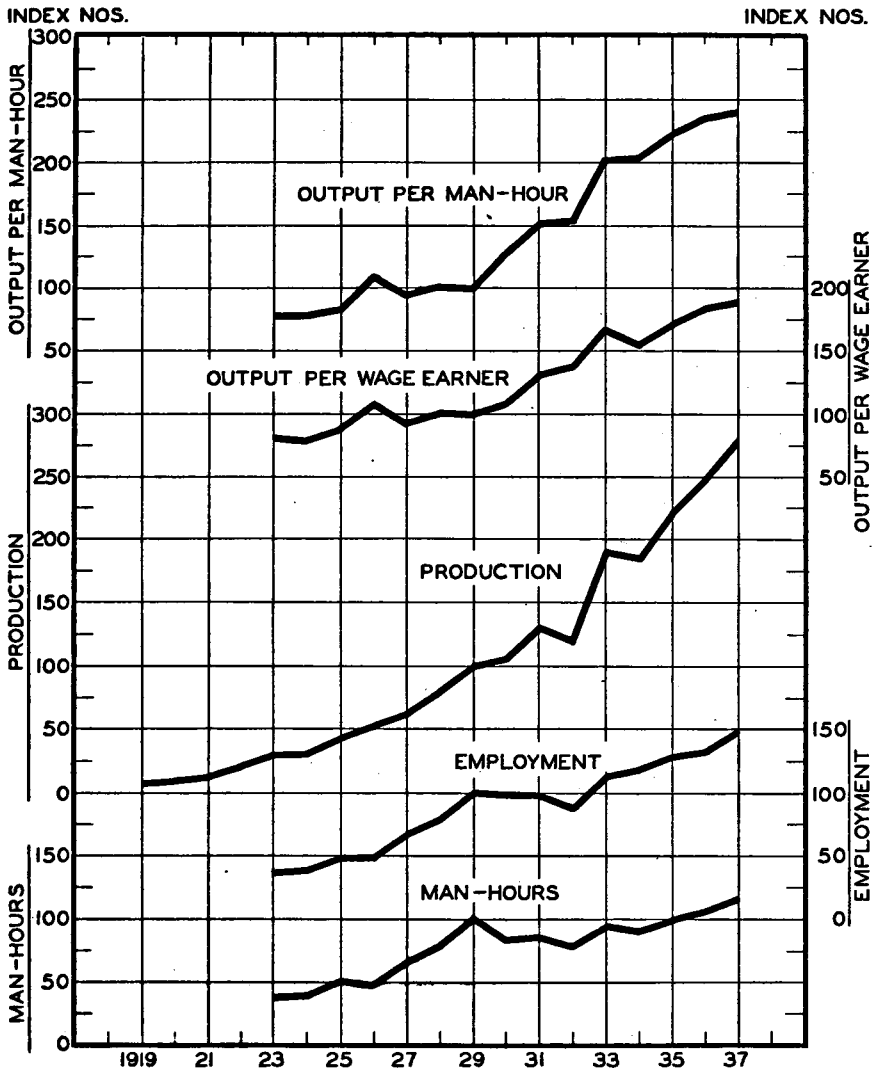
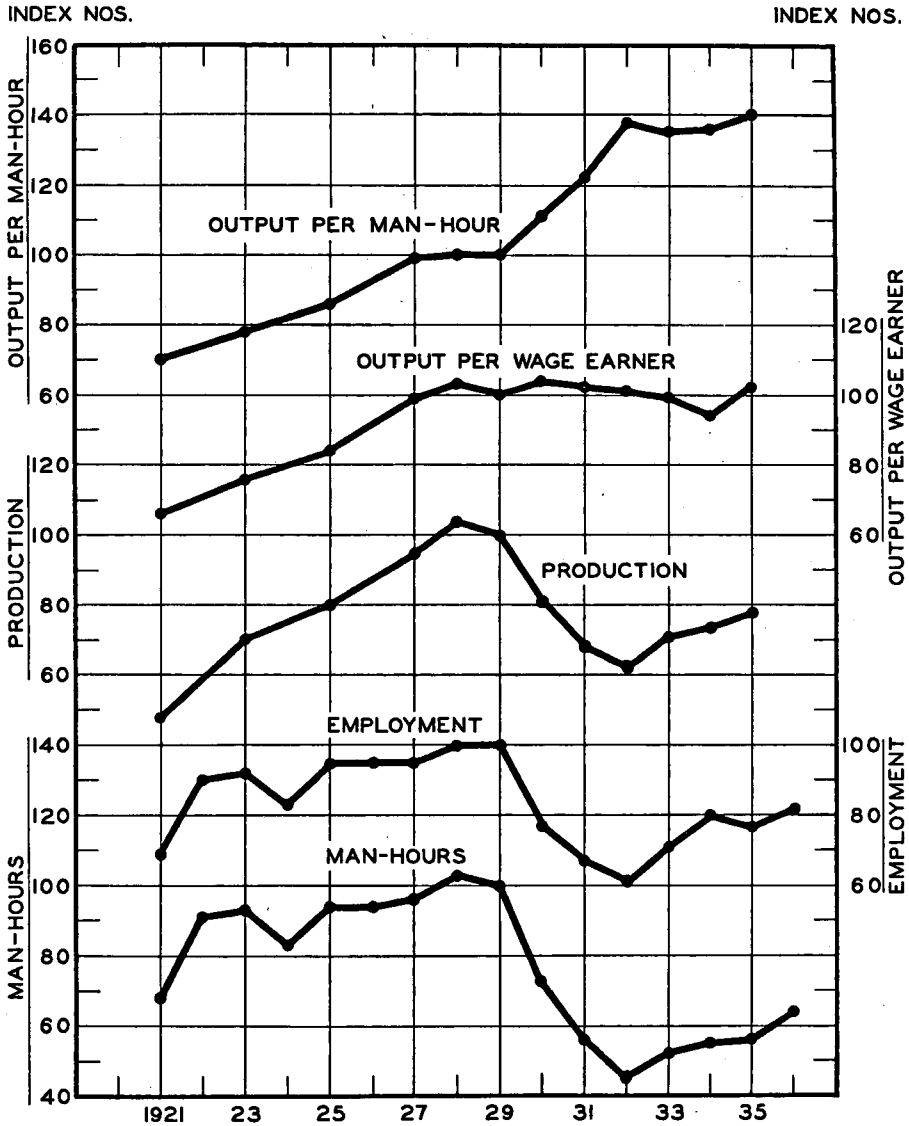


Figure 61.- SUMMARY INDEXES FOR THE RUBBER PRODUCTS
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(1929 = 100)



**Figure 82.- SUMMARY INDEXES FOR THE RUBBER TIRES AND
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(1928 = 100)

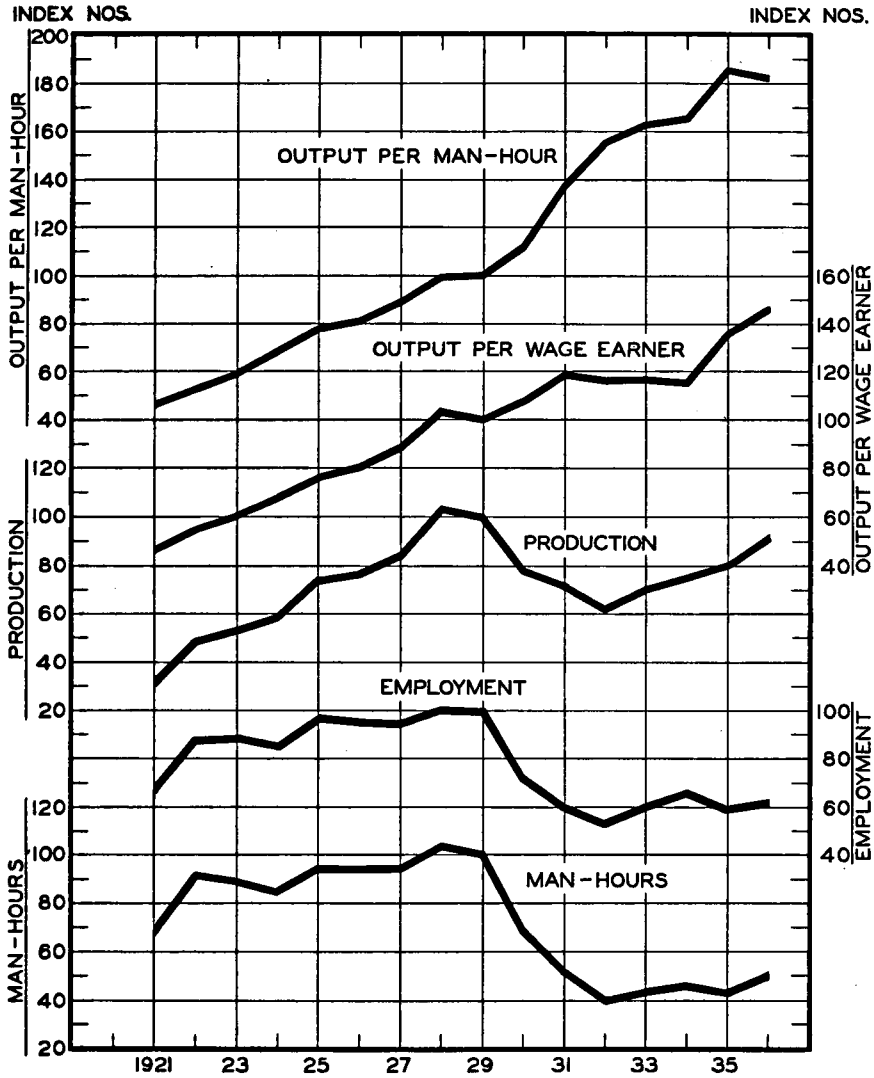
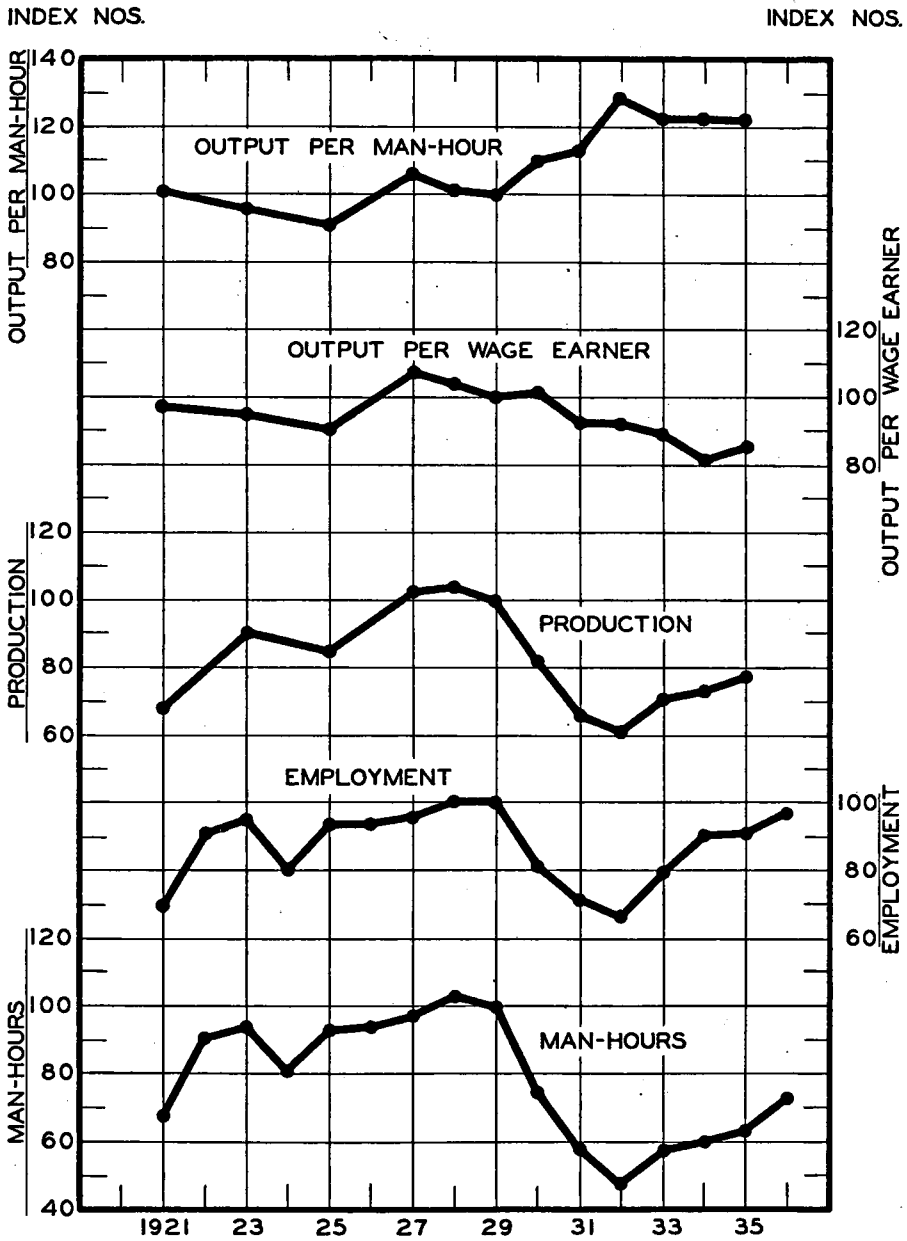


Figure 63.- SUMMARY INDEXES FOR THE OTHER RUBBER GOODS INDUSTRY: 1921-36

(1929 = 100)



**Figure 64.- SUMMARY INDEXES FOR THE SILK AND RAYON GOODS
INDUSTRY: 1919-36**

(1929 = 100)

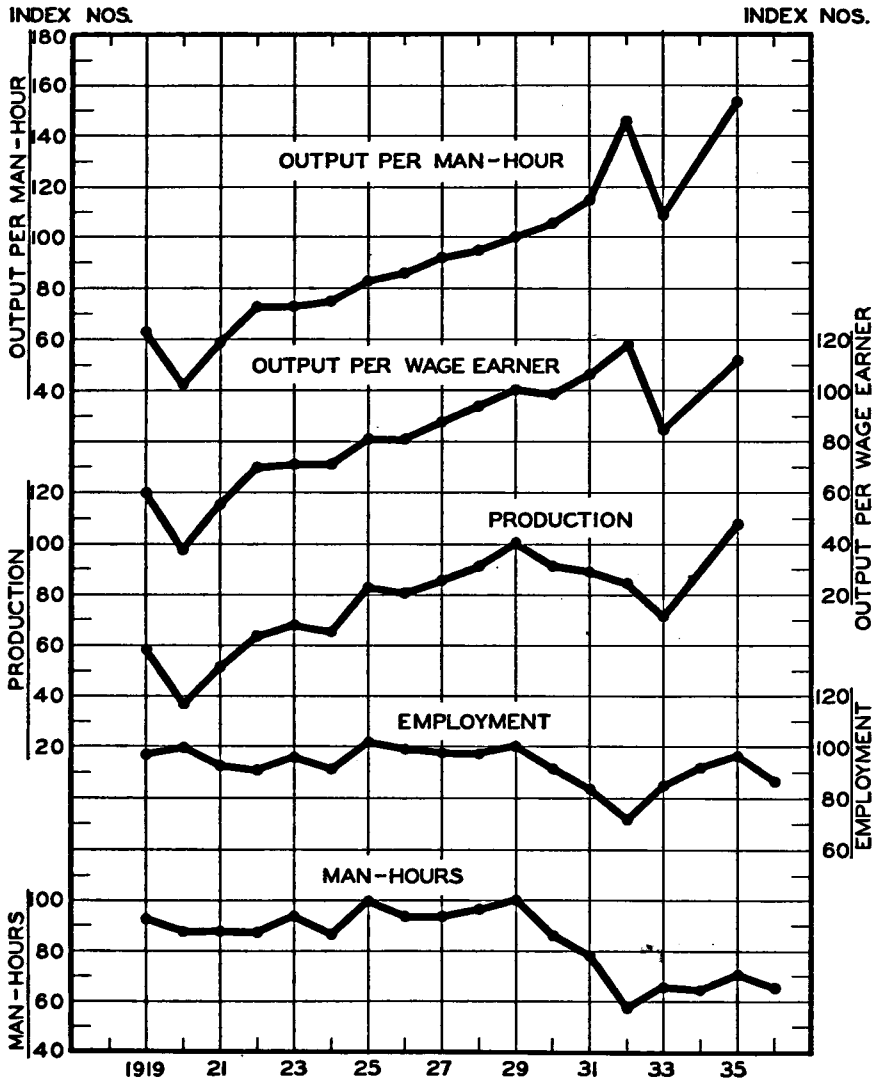
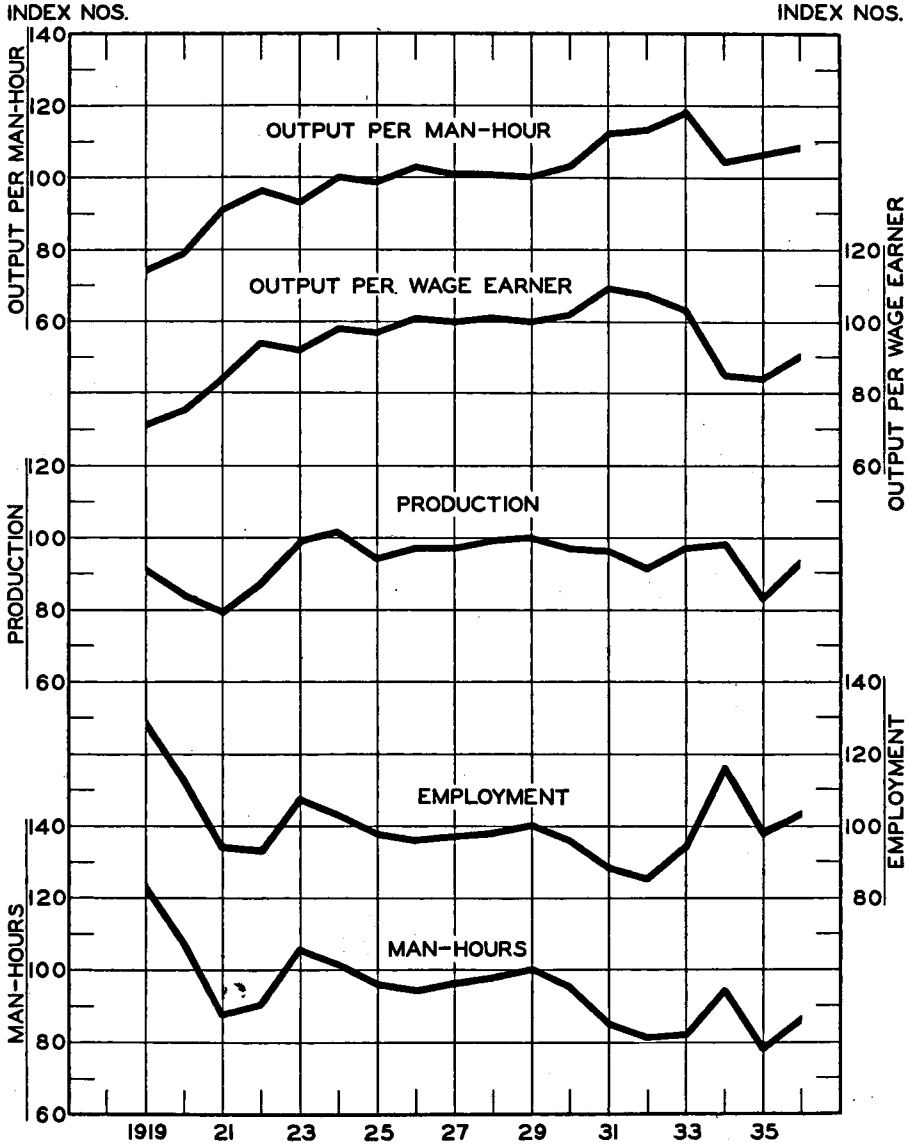


Figure 65.- SUMMARY INDEXES FOR THE SLAUGHTERING AND MEAT PACKING INDUSTRY: 1918-38

(1929 = 100)



**Figure 66.- SUMMARY INDEXES FOR THE TOBACCO PRODUCTS
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(1929 = 100)

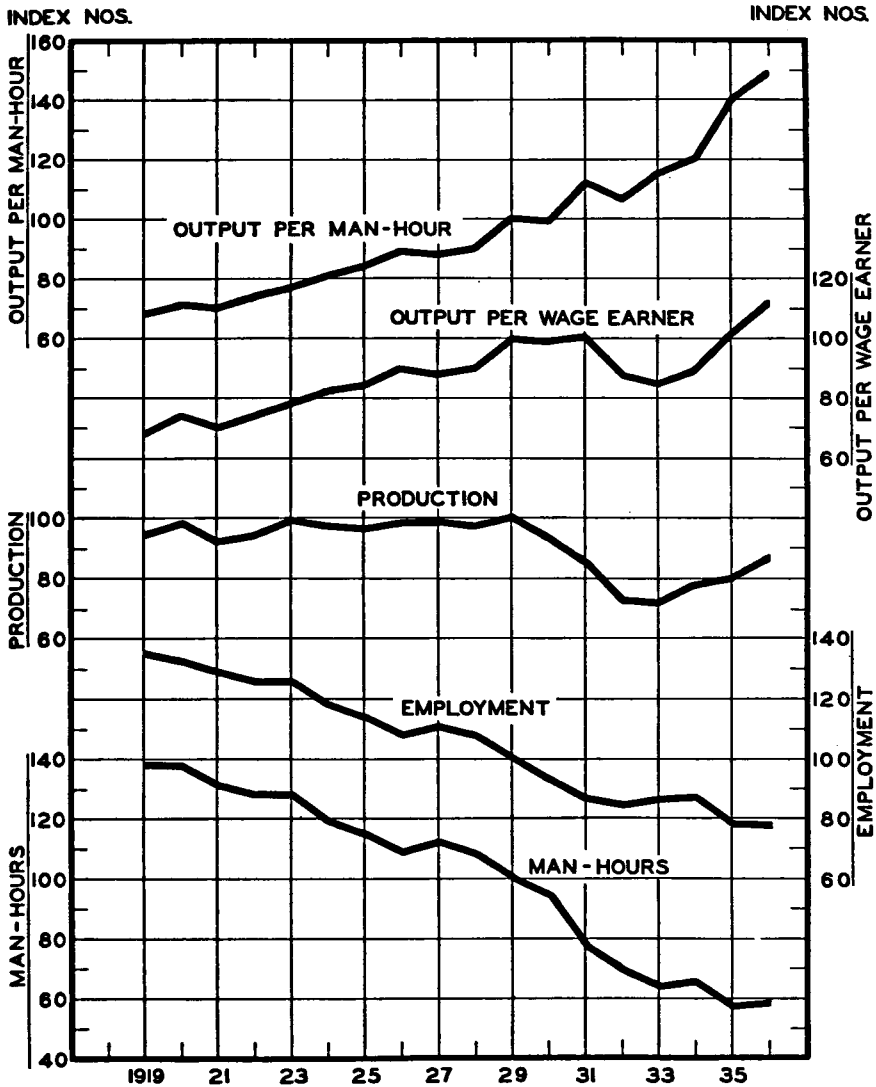


Figure 69.- SUMMARY INDEXES FOR THE CHEWING AND SMOKING TOBACCO AND SNUFF INDUSTRY: 1919-36

(1929 = 100)

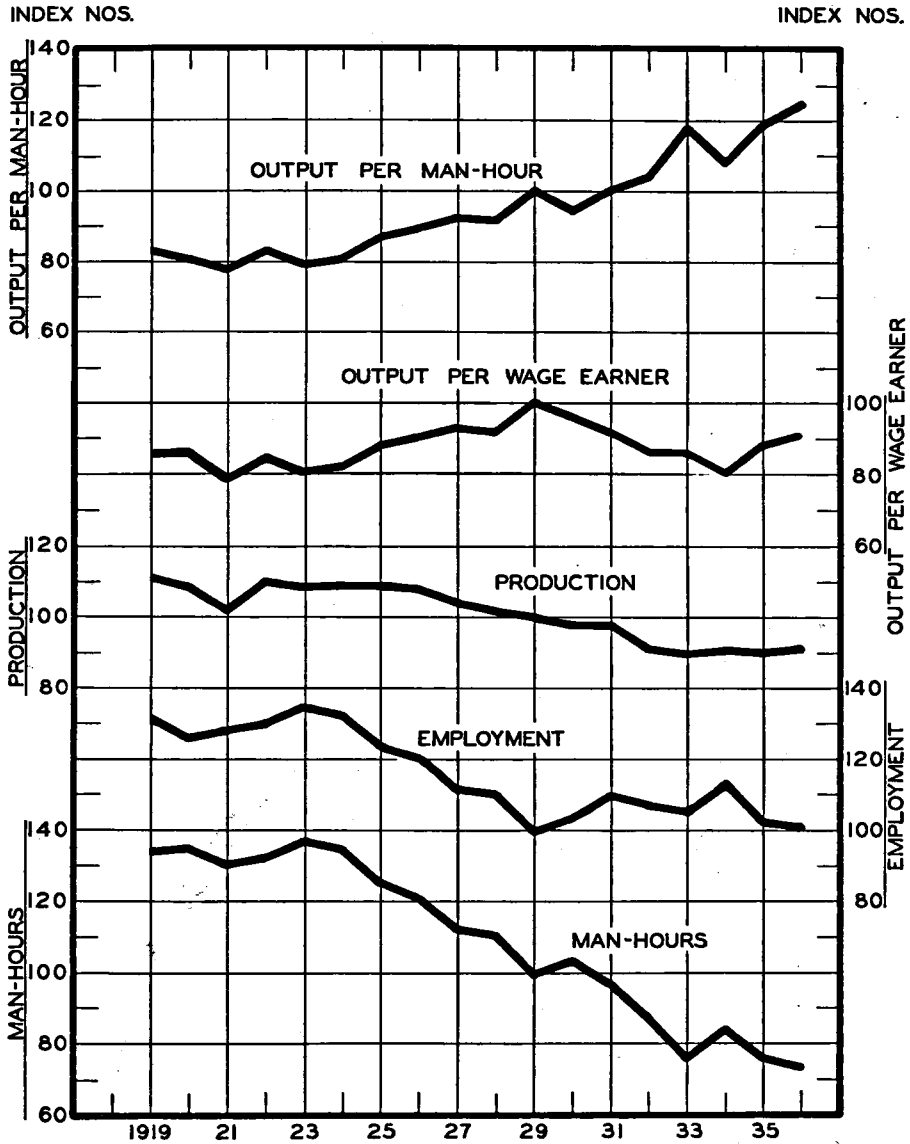


Figure 70.- SUMMARY INDEXES FOR THE WOOLEN AND WORSTED GOODS INDUSTRY GROUP: 1919-36

(1929 = 100)

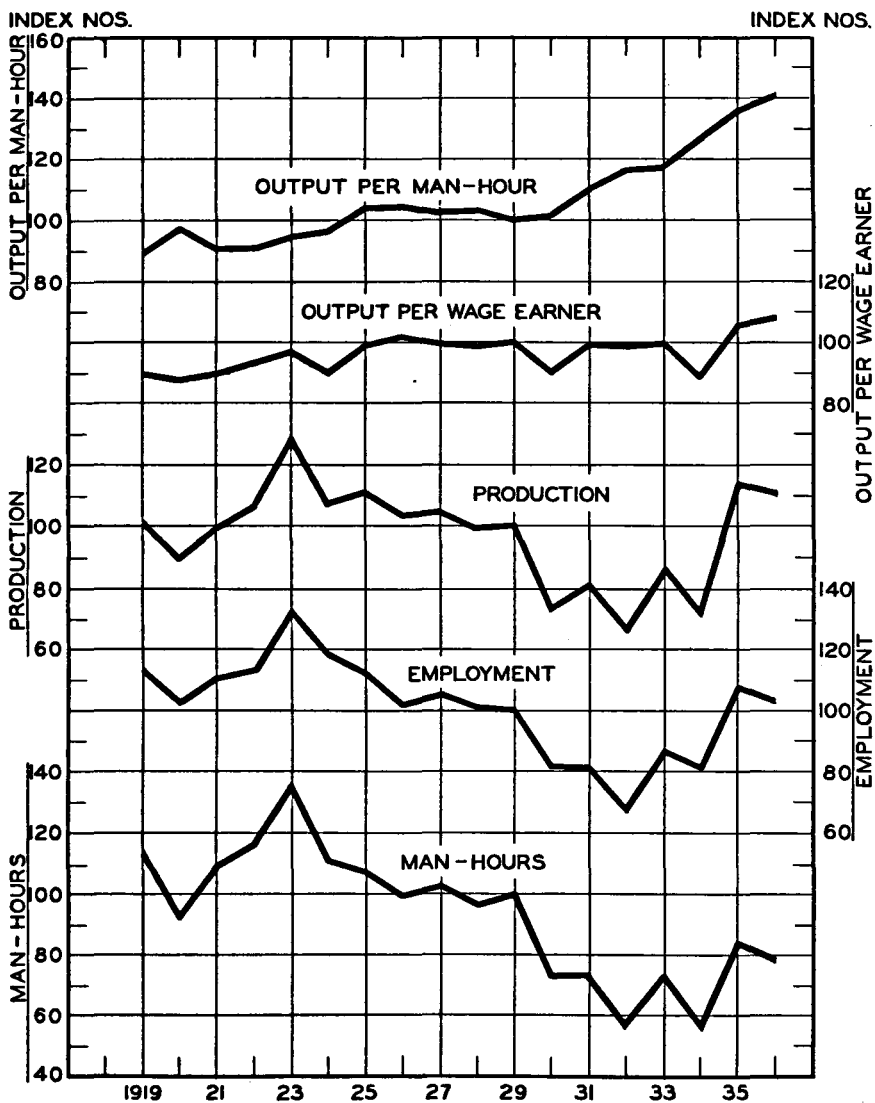
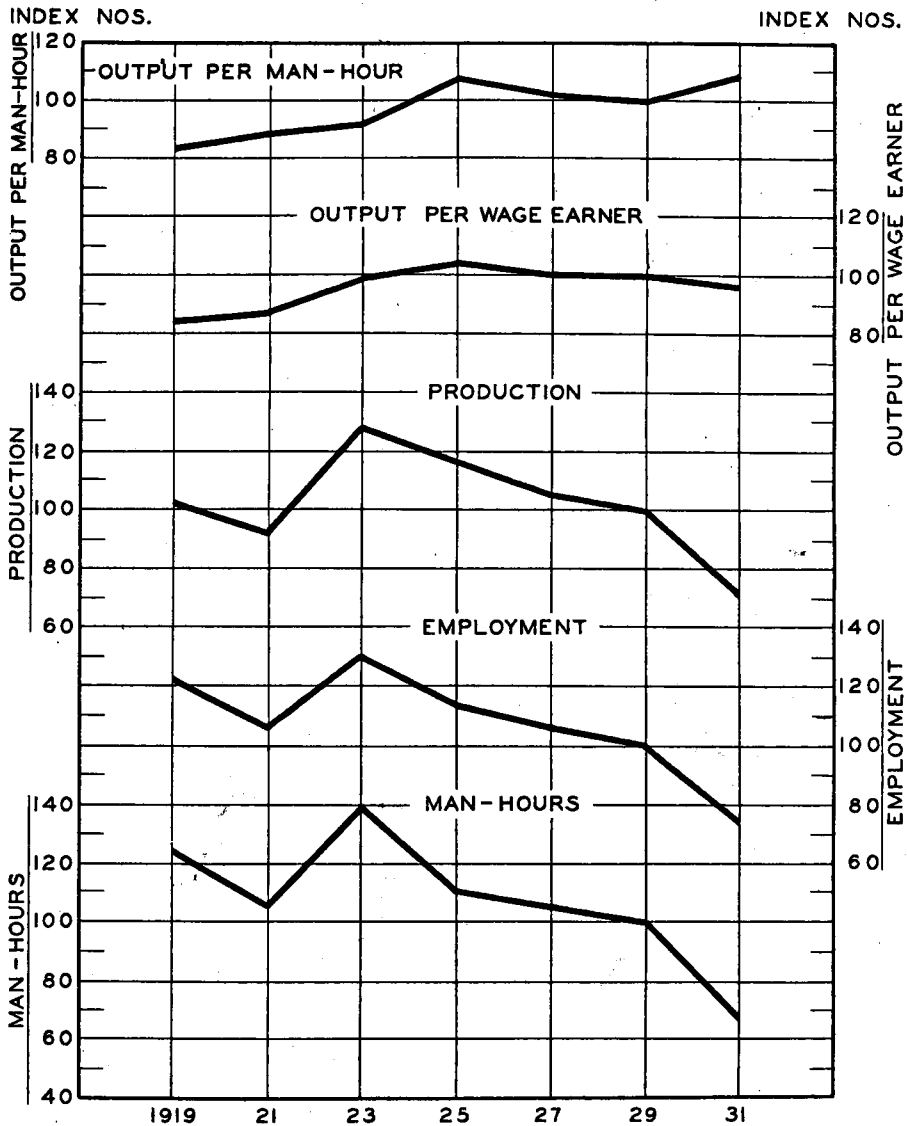


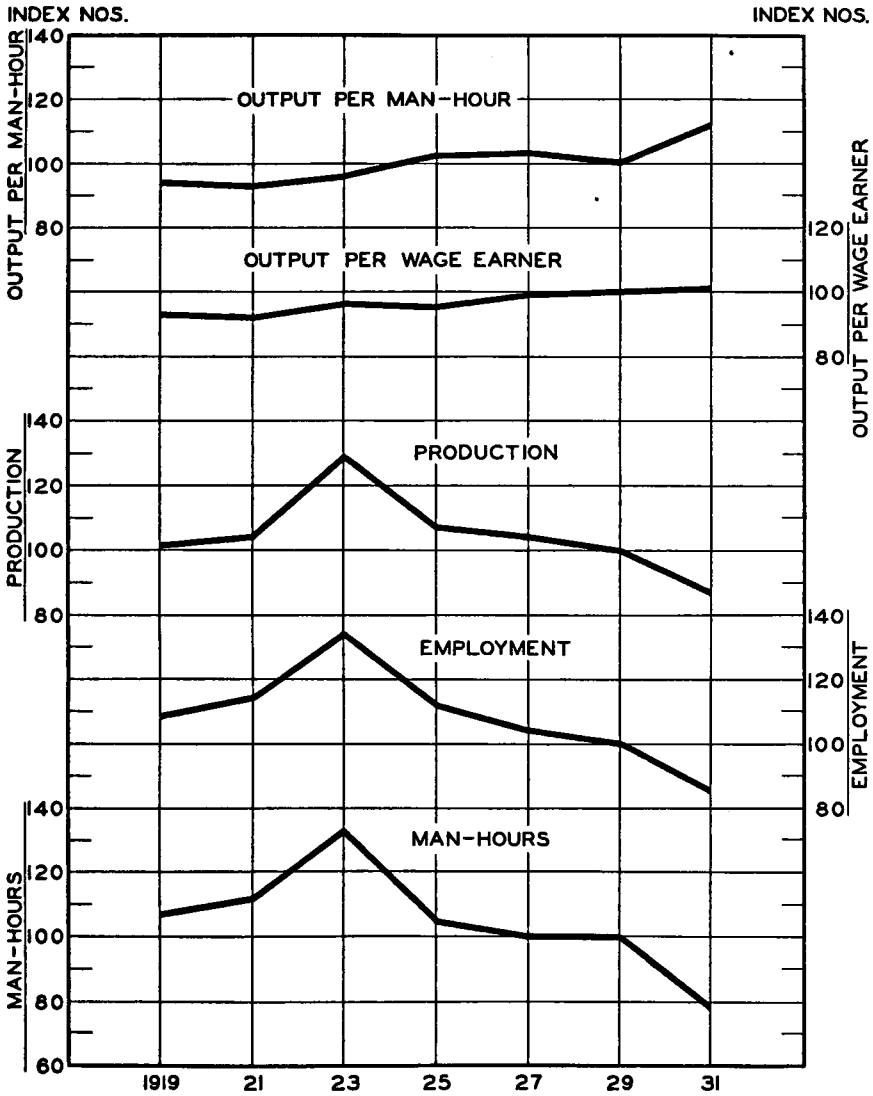
Figure 71.- SUMMARY INDEXES FOR THE WOOLEN GOODS
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(1929 = 100)



**Figure 72.- SUMMARY INDEXES FOR THE WORSTED GOODS
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(1929 = 100)



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PRODUCTION EMPLOYMENT AND PRODUCTIVITY IN 59 MANUFACTURING INDUSTRIES

PART TWO: INDEXES FOR INDIVIDUAL INDUSTRIES
AND METHODS OF CONSTRUCTION



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**Reemployment Opportunities and Recent Changes
in Industrial Techniques**

DAVID WEINTRAUB
Director

Studies of the Labor Supply, Productivity, and Production
Harry Magdoff, Statistician in Charge

**PRODUCTION, EMPLOYMENT, AND PRODUCTIVITY
IN 59 MANUFACTURING INDUSTRIES,
1919-36**

**With an Appendix on the Electric Light and Power
and Telephones Industries**

by

Harry Magdoff

and

Irving H. Siegel Milton B. Davis

**PART TWO: INDEXES FOR INDIVIDUAL INDUSTRIES
AND METHODS OF CONSTRUCTION**

WORKS PROGRESS ADMINISTRATION, NATIONAL RESEARCH PROJECT

Report No. S-1, Part Two

Philadelphia, Pennsylvania

May 1939

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**PART TWO: INDEXES FOR INDIVIDUAL INDUSTRIES
AND METHODS OF CONSTRUCTION**

This volume comprises 37 sections, of which 24 refer to individual industries and 13 to industry groups (these groups include the remaining 35 industries). Each section consists of a definition of the industry (or group), a description of the sources and methods used in the construction of the NRP indexes of production, employment, man-hours, and productivity, and a summary table (or tables) showing the NRP measures. The methodology for each industry or group should be considered in conjunction with the more general discussion in Part One, chapters I and II. The data from which the summary indexes have been computed will be found in Part Three, appendix A.

INDEXES FOR INDIVIDUAL INDUSTRIES AND METHODS OF CONSTRUCTION

1. AGRICULTURAL IMPLEMENTS

This industry, which employed almost 42,000 wage earners in 1929, includes all establishments whose principal products are classified in the following 8 groups:

1. Plows and listers
2. Harrows, rollers, pulverizers, and stalk cutters
3. Planting and fertilizing machinery
4. Cultivators and weeders
5. Harvesting machinery
6. Haying machinery
7. Machines for preparing crops for market or for use
8. Miscellaneous barnyard equipment and agricultural implements, such as hay forks, straw spreaders, and seed-potato cutters

In 1935 the manufacture of complete tractors, formerly included in the Engines, Turbines, Tractors, Water Wheels, and Windmills industry, was transferred by the Census to the Agricultural Implements industry. To make comparison with earlier years possible, however, the original Census definition was retained for 1935.

Production

Production statistics for items selected from the first 7 of the above-mentioned groups were obtained for 1920 from Department of Agriculture Circular 212;¹ for 1921-31 and 1933, from the *Census of Manufactures*; and for 1935 and 1936, from the annual Census reports on *Manufacture and Sale of Farm Equipment and Related Products*. No data were available for 1932 and 1934.

For the period 1920-31 series for 40 major products were used. Because of changes in classification, the relatives for 1933 and 1935-36 were based on 40² and 26 products, respectively. The weighted aggregates for these products were divided by comparable aggregates for 1929, the base year, to obtain the index numbers for these years. Each quantity series was weighted by its unit value in 1929.

A report of the Federal Trade Commission³ supplies a basis for the belief that unit values tend to be proportional to unit labor

¹H. R. Tolley and L. M. Church, *The Manufacture and Sale of Farm Equipment in 1920*.

²Not all of these 40 products are identical with those used for 1920-31.

³*Report on the Causes of High Prices of Farm Implements* (May 4, 1920).

2 PRODUCTION, EMPLOYMENT, AND PRODUCTIVITY

requirements. The stability of the ratio of "productive labor" cost to selling price for each of 22 products in 1916 and 1918 appears to be significant in view of the fact that the relationship between unit values in successive census years is also stable.

The products included in the index account for more than half of the total value of output of agricultural implements and un-assembled parts and attachments:⁴

Year	Coverage	Year	Coverage
1923	50.2	1929 ⁵	56.5
1924	57.4	1930	54.4
1925	55.2	1931	43.4
1926	60.6	1932	-
1927	59.4	1933	30.7
1928	60.6	1934	-
1929 ⁵	59.7	1935	50.9
1929 ⁵	59.2	1936	54.6

In 1931 and 1933 value coverage was considerably lower than in other years. An adjustment on the basis of value (which presumes a fixed relationship between the average price of the products in the sample and in the universe from year to year) was not made, however, since it is not clear from available information whether the lower coverage in 1931 and 1933 is attributable solely to the quantity factor rather than to both the price and quantity factors of the products included in, and excluded from, the index. Below are presented, for comparative purposes, the NRP production index and the series obtained by dividing it by an index of value coverage:

Year	NRP production index	Value-adjusted production index	
1923	57.0	67.8	
1924	52.0	54.1	
1925	56.2	60.8	
1926	79.3	78.1	
1927	76.2	76.6	[Con.]

⁴Though some data are available for 1920-22, the percentages which may be computed for these years (viz, 83.6, 56.1, 47.9) are unreliable because of the nature of the adjustments required.

Value coverage is affected considerably by the changing role of attachments and parts (for which the Census presents no quantity statistics) in the production pattern of the industry. Although in other years such auxiliary items comprise from 20.0 to 27.3 percent of total value of agricultural implements and parts, the percentage in 1922 was only 12.9, and in 1933, as high as 42.4.

⁵The 3 figures for 1929 are comparable, respectively, with 1930, 1931, and earlier years; with 1933; and with 1935 and 1936.

AGRICULTURAL IMPLEMENTS

3

[con.]	Year	NRP production index	Value-adjusted production index
	1928	87.2	85.9
	1929	100.0	100.0
	1930	74.2	81.4
	1931	24.3	33.4
	1932	n.a.	n.a.
	1933	7.1	13.8
	1934	n.a.	n.a.
	1935	43.0	50.4
	1936	72.7	79.5

It should be noted that the Census does not include the manufacture of tractors in the Agricultural Implements industry until 1935. However, because of their established position in agricultural operations and because some were produced by establishments within the industry,⁶ it is of interest to compare an index of tractor production⁷ with the NRP series:

Year	NRP pro- duction index (agricultural implements)	Index of tractor production
1923	57.0	40.5
1925	56.2	53.1
1927	76.2	67.4
1929	100.0	100.0
1931	24.3	22.7
1933	7.1	9.5
1935	43.0	70.1

Employment and Man-hours

The index of employment, which conforms to Census trend, was constructed by splicing the NICB index for the years 1920-23 and the BLS series for 1923-36. The latter, as used in this report, was adjusted to Census totals, except for 1935, when the manufacture of complete tractors was transferred by the Census to the Agricultural Implements industry.

The employment and production indexes are not strictly comparable in scope since some wage earners are engaged in the manufacture of such secondary products as carriages and wagons (excluded

⁶The Agricultural Implements industry contributed about 8 percent of the total number and 10 percent of the total value of tractors in 1921.

⁷This index was constructed from Census production series for wheel-type, track-laying-type, and garden tractors and motor cultivators, weighted by their respective unit values in 1929.

4 PRODUCTION, EMPLOYMENT, AND PRODUCTIVITY

from the industry by Census definition) and part of the output embraced by the production index is contributed from outside the industry. No adjustment in either of these indexes could be effected because the requisite statistics are not available.⁸ These 2 forms of noncomparability between the wage-earner and production statistics tend to offset each other, but it is not possible to determine the net effect.

The man-hours index was computed from the products of the BLS-NICB employment index and an annual series of average weekly hours obtained by splicing, in 1932, NICB figures for 1920-32 and BLS figures for 1932-36.

Table 1.- SUMMARY INDEXES FOR THE AGRICULTURAL IMPLEMENTS INDUSTRY: 1920-36

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1920	99.2	177.3	174.1	56.0	57.0
1921	51.1	78.1	61.0	69.9	83.8
1922	33.9	70.6	69.0	47.2	48.3
1923	57.0	74.4	74.3	76.6	76.7
1924	52.0	59.6	57.9	97.2	89.8
1925	56.2	68.9	69.3	81.6	81.1
1926	79.3	78.0	78.0	101.7	101.7
1927	76.2	80.1	79.5	95.1	95.8
1928	87.2	93.2	93.8	93.6	93.0
1929	100.0	100.0	100.0	100.0	100.0
1930	74.2	74.8	65.5	99.2	113.3
1931	24.3	42.1	30.1	57.7	60.7
1932	n. a.	24.9	16.5	-	-
1933	7.1	26.8	16.3	26.5	38.8
1934	n. a.	46.5	34.4	-	-
1935	43.0	67.7	54.2	63.5	79.3
1936	72.7	76.5	61.6	95.0	118.0

⁸ A rough indication of the significance of the lack of comparability is given by Census value data for 1931 and 1933. In these years, secondary production comprised 4.5 and 6.6 percent of the total value of the output of the industry, while agricultural implements made as secondary products in other industries accounted for 4.5 and 7.3 percent of the total value of agricultural implements.

2. BEET SUGAR

Establishments in the Beet Sugar industry are located in the beet-growing regions, particularly Colorado, Michigan, California, and Utah. The principal product, beet sugar, accounts for well over 90 percent of the value of the industry's output; its by-products, molasses and pulp, contribute the remainder.

The production of beet sugar is highly seasonal. Beets harvested each fall are washed, sliced, and processed 24 hours daily during the short, intensive "campaign" period, which usually extends from October–November through January. In the other months, the sugar produced in the preceding campaign is packed and shipped, and the plant is prepared for the next period of production. The average number of wage earners employed in the calendar year 1929 was about 7,500.

Production

The index of output is based on the quantities of beet sugar produced in the campaign periods beginning in calendar years 1918–36. Census statistics for 1918, 1920, 1922, 1924, 1926, 1928, 1931, 1933, and 1935 were supplemented by a continuous series which includes Department of Agriculture figures for 1918–34 and Lamborn and Company data for 1935–36.¹

Man-hours

Census and BLS employment data for calendar years are not usable for the ultimate purpose of computing meaningful indexes of productivity² since such a unit of time includes parts of 2 production (campaign) periods, each of which normally extends for 3 to 4 months from October–November of 1 year to January of the next. Thus, when the Census reports sugar production from beets harvested in the preceding year (for the period 1919–29), only 1 of the accompanying monthly employment figures – for January – refers to the proper campaign; and when the Census reports production from beets harvested in the same year (for the period

¹The Census and the Department of Agriculture cover the same number of establishments, presumably the whole industry. Since the production figures of the latter agency (published in *Yearbook of Agriculture and Agricultural Statistics*) and those shown in *Lamborn's Vest Pocket Sugar Data* (New York: Lamborn and Co., July 6, 1937) are in close agreement, they were chained without adjustment.

²Monthly wage-earner statistics published by the Census could, nevertheless, be used for significant periods of less than 1 year. (See discussion of derivation of intercampaign man-hours.)

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1931-35), only 2 or 3 of the monthly employment figures - for October-November and December - are relevant. BLS employment relatives are available monthly for only a few years; furthermore, they are adjusted to the trend of the Census calendar-year averages.³

The rejection of Census and BLS annual employment statistics did not, however, prevent the construction of a satisfactory man-hours index for either campaign seasons or annual periods embracing them. Data collected in an NRP-NBER field study⁴ were used to construct 3 indexes - 1 for a common fiscal year of the industry (March 1 to February 28) which includes 1 complete campaign; a second for the campaign only; and a third for the difference between the fiscal year and the campaign (viz, March to October-November and, in addition, the following February), which may be designated the "intercampaign."⁵ The procedure followed was to multiply national output by corresponding campaign and intercampaign man-hour-requirement ratios to obtain campaign and intercampaign man-hours and then to add these products to obtain the fiscal-year totals.

The continuous man-hour-requirement series selected to represent the trend for campaign periods in 1919-35 is based on a sample of 31 identical plants which represented 37 to 55 percent of total beet-sugar production.⁶ The ratio for each year was multiplied by corresponding total sugar output to estimate campaign man-hours.

Intercampaign man-hour requirements for sugar could not be determined for this same group of 31 plants, but a series for 27 plants including 21 of these 31 was available for 1928-35.⁶ This smaller group, which is composed of larger establishments, varied in coverage from 34 to 55 percent of total sugar production. To render the campaign and intercampaign ratios consistent in

³The required adjustments, moreover, are very great. In 1933 the BLS index had to be raised 26.7 percent and in 1935, 11.2 percent.

⁴The results of this survey are summarized in a report entitled *Productivity and Employment in Selected Industries: Beet Sugar* (WPA National Research Project in cooperation with National Bureau of Economic Research, Report No. N-1), by R. K. Adamson and M. E. West. The sample for 1918-35 includes 40 to 83 plants, or 47.1 to 76.8 percent of the total number of Census establishments. The range of total production covered by the sample is 58.2 to 79.1 percent.

⁵In the following discussion and in the tables showing the summary indexes, the year always takes its number from the calendar year in which the campaign begins.

⁶An identical-plants series minimizes the decline in average labor requirements for the industry as a whole since it is not affected by the opening of other large, relatively efficient plants and the closing of small, relatively inefficient ones.

level, the 27-plant series was adjusted on the assumption that the relationship between the intercampaign sugar-production and campaign beet-slicing ratios⁷ is the same in each year for the 27 plants as for the 31. Multiplication of these adjusted figures by national beet-sugar output yielded intercampaign man-hours for 1928-35.

The next problem was to extend intercampaign man-hours back to 1919. This was done for alternate years of the period 1919-27 by multiplying the average number of wage earners reported by the Census for 7 intercampaign months (March-September) by the number of intercampaign hours per man, and then linking the resulting products to the 1928-35 series on the basis of the 1929 relationship.⁸ Intercampaign hours per man were estimated by multiplying intercampaign weeks in each fiscal year by 44 hours;⁹ intercampaign weeks were derived, in turn, by dividing the number of intercampaign days by 7; and finally, intercampaign days were obtained by subtracting the number of days in the campaign period (as determined from the NRP-NBER sample) from 357, the probable number per fiscal year (365 minus 5 holidays and 3 for factory delays).

To complete the series of intercampaign man-hours for intercensal years 1920-26, estimates of beet-slicing man-hour requirements computed from sample data were employed. First, the man-hours as determined above for census years 1919-27 were divided by national tonnage of beets sliced;¹⁰ these ratios were then interpolated by means of a similar series for the 27-plant sample previously mentioned;¹¹ and, finally, the new intercensal-year ratios were multiplied by corresponding national totals of beets sliced.

⁷The beet-slicing ratio is the quotient of total plant man-hours and tonnage of (washed) beets sliced.

⁸Since the Census reports only annual employment for 1927, the average for the intercampaign months was obtained by applying the mean ratio of intercampaign to annual employment in 1925 and 1929 to the Census figure for 1927.

⁹On the basis of plant records studied by NRP-NBER, the prevailing intercampaign weekly hours were arbitrarily assumed at 44 in the earlier years. This assumption doubtless results in understatement of man-hours in the immediate post-war period.

¹⁰The beets-sliced series was constructed in a manner analogous to the sugar-production series from Census and Department of Agriculture data.

¹¹The interpolating series is based on an observed inverse correlation between the number of net campaign days and the magnitude of the intercampaign beet-slicing ratios for 27 plants in 1928-35. Such a series is adequate for interpolation but, if used for all the years, would preclude a trend in intercampaign productivity between 1919 and 1927.

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Table 2a.- SUMMARY INDEXES FOR THE BEET SUGAR INDUSTRY: 1918-36

(1929 = 100)

Year	Production	Man-hours	Output per man-hour
1918	70.3	n. a.	-
1919	86.9	158.6	42.7
1920	100.0	179.1	55.8
1921	102.2	158.6	64.4
1922	73.2	119.3	61.4
1923	90.3	115.5	78.2
1924	105.2	122.5	85.9
1925	88.6	124.6	71.1
1926	87.3	100.0	87.3
1927	107.0	107.5	99.5
1928	104.4	97.4	107.2
1929	100.0	100.0	100.0
1930	118.3	97.8	121.0
1931	113.0	90.6	124.7
1932	132.0	105.0	125.7
1933	158.9	121.8	130.5
1934	112.5	98.5	114.2
1935	115.2	90.7	127.0
1936	127.0	n. a.	-

Table 2b.- SUMMARY INDEXES FOR THE BEET SUGAR INDUSTRY: CAMPAIGN MONTHS, 1918-36

(1929 = 100)

Year	Production	Man-hours	Output per man-hour
1918	70.3	n. a.	-
1919	86.9	138.6	48.3
1920	100.0	169.6	59.0
1921	102.2	137.5	74.3
1922	73.2	102.2	71.6
1923	90.3	125.7	71.8
1924	105.2	122.4	85.9
1925	88.6	120.6	73.5
1926	87.3	100.2	87.1
1927	107.0	110.6	96.7
1928	104.4	97.1	107.5
1929	100.0	100.0	100.0
1930	118.3	110.8	106.8
1931	113.0	92.8	122.0
1932	132.0	113.8	116.0
1933	158.9	124.0	128.1
1934	112.5	93.3	120.6
1935	115.2	91.8	125.5
1936	127.0	n. a.	-

BEEET SUGAR

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Table 2a.- SUMMARY INDEXES FOR THE BEEET SUGAR INDUSTRY: INTERCAMPAIGN MONTHS, 1918-36

(1929 = 100)

Year	Production	Man-hours	Output per man-hour
1918	70.3	n. a.	-
1919	66.9	189.2	35.4
1920	100.0	196.3	50.9
1921	102.2	197.0	51.9
1922	73.2	150.5	48.6
1923	90.3	96.9	93.2
1924	105.2	122.6	85.8
1925	88.6	131.9	67.2
1926	87.3	99.6	87.7
1927	107.0	101.7	105.2
1928	104.4	98.1	106.4
1929	100.0	100.0	100.0
1930	118.3	74.2	159.4
1931	113.0	86.9	130.0
1932	132.0	89.0	148.3
1933	159.9	117.9	134.8
1934	112.5	108.0	104.2
1935	115.2	88.8	129.7
1936	127.0	n. a.	-

3. BOOTS AND SHOES

The principal products of the establishments in this industry are boots, shoes, sandals, slippers, moccasins, allied footwear, leggings, and overgaiters made chiefly of leather but also of canvas and other textile fabrics. Boots and shoes made of rubber, however, are considered a part of the output of the Rubber Products industry group.

The fact that most of the establishments in the Boots and Shoes industry do not own their equipment (in 1935, approximately 90 percent of all the shoemaking machinery and equipment in use was leased, mainly from the United and the Compo Shoe Machinery Corporations) facilitates plant migration and makes it possible for producers with meager resources to enter and leave the industry. The chief shifts in location since 1919 are reflected in the increased proportion of production in Missouri, New York, and Illinois and the relative decline in Massachusetts. There have also been many changes in location of plants within Massachusetts and in the other New England States.

In 1929, the Boots and Shoes industry employed almost 206,000 wage earners. It is interesting to note that division of labor in large establishments has been carried to the point where each of the 200 or 300 operations required to produce a single shoe is performed by a different employee.

Production

Output statistics for the following 5 classes of shoes are available in the *Census of Manufactures* for the odd-numbered years 1919-35 and for 1922 and 1924: Men's, boys' and youths', women's, misses' and children's, and slippers and all other footwear. These series, which account for the total production of boots and shoes, were completed for the even-numbered years 1926-36 by means of comparable statistics which are collected monthly by the Bureau of Census and published in the *Survey of Current Business*. No detailed quantity statistics were available for 1920. The 5 production series - for the years 1919 and 1921-36 - were weighted by their respective unit values in 1929 and combined in an aggregative index. The index number for the year 1920 was obtained by extrapolation on the basis of the Federal Reserve Board index of boot-and-shoe production for 1920 and 1921, which combines the 5 classes without weighting.

The relative unit values of 4 specific types of shoes in 1935 (welted and McKay men's and women's) compare as follows with their relative unit labor requirements in 1923 (men's welted shoes = 1.00):¹

Type of shoe	Relative unit value	Relative unit labor requirement
Men's		
Welted	1.00	1.00
McKay	0.58	0.67
Women's		
Welted	1.08	1.21
McKay	0.65	0.96

Indexes of production employing these 2 sets of weights are in close accord:

Year	Unit-value weights	Unit-labor-requirement weights
1919	90.5	86.2
1927	94.4	93.0
1929	100.0	100.0
1931	79.7	80.2
1933	78.6	77.6
1935	83.7	81.0

The NRP index takes account of quantity shifts among the several classes of shoes defined according to the age group and sex of the intended wearer. As might be expected, however, no serious shifts occurred among these groups over the period, for they reflect the age and sex distribution of the population.² An index based upon a much more detailed classification of shoes - not only by age and sex of intended wearer but also by type of material, specific use, and method of manufacture³ - is slightly higher than the NRP index before 1929 and lower thereafter:

¹The unit labor requirements were derived from a BLS study, *Time and Labor Costs in Manufacturing 100 Pairs of Shoes: 1923* (Bull. No. 360). Comparable Census unit values were available for 1935 only.

²The slight declines in the proportions of the total production accounted for by "boys' and youths' shoes" and by "misses' and children's shoes" reflect the decrease in the percentage of the population included in the lower age groups in recent years.

³This index, which could be constructed from Census data for only a few years, includes 36 different types of shoes weighted by unit values in 1935, the only year for which comparable value data are available. In order to avoid disclosing data for individual establishments, the Census, in some years, combined certain figures and withheld others from publication. This lack of comparability, however, exists only in the case of the less important types of shoes.

An even more detailed classification of products might result in a still lower index during the depression, when there was a shift to the cheaper lines. The relative unit values of the 5 broader classes of shoes, however, are stable in the census years 1919 and 1927-35, the only years for which they are available.

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Year	NRP production index	Production index based on more detailed classification
1919	88.0	93.4
1927	96.2	97.1
1929	100.0	100.0
1931	84.0	81.8
1933	94.1	92.5
1935	103.0	100.4

Employment and Man-hours

The index of employment, which conforms to Census trend, was constructed by BLS. The man-hours index was derived from this employment index and another for average weekly hours based, in all years except 1919 and 1922, on data published by NICB.

Average actual weekly hours in 1919 were estimated by applying to the prevailing-hours figure computed from Census data the average ratio of NICB actual to Census prevailing weekly hours in 1921 and 1923.

The weekly-hours figure for 1922 is an average of that published by NICB and another obtained by BLS in one of its biennial wage studies of the industry. NICB hours (an average for the last 6 months of the year) are considerably higher than those of BLS⁴ (based on data collected mainly in April and May). Since both production and employment were higher in the latter half of 1922 than in the earlier months, it is probable that NICB hours are somewhat inflated, while the BLS estimate is too low. The 2 were, therefore, averaged to obtain the final figure for 1922.

⁴NICB and BLS hours agree closely in other years, except 1930. In this year, the NICB figure, which is an average for 12 months, is lower than that of BLS, based on data collected in the first 3 months of the year. In view of the fact that production and employment were at a higher level in the first 3 months of 1930 than during the entire year, the NICB average appears to be more reliable.

In general, the weekly-hours statistics for this industry obtained as a result of the BLS biennial wage studies are less satisfactory for our purpose than those of NICB. The data refer to only 1 pay-roll period in each establishment in each year; the month in which the pay-roll period occurred varied from establishment to establishment and from study to study. Usually the canvass extended over a period of 4 or 5 months, and most of the data were collected in 2 of these. Finally, the various surveys did not necessarily cover the same establishments.

BOOTS AND SHOES

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Table 2.- SUMMARY INDEXES FOR THE BOOTS AND SHOES INDUSTRY: 1919-36

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	86.0	102.6	106.3	85.8	82.8
1920	82.7	96.7	96.5	85.5	85.7
1921	75.0	89.2	92.2	84.1	81.3
1922	85.1	98.7	98.5	86.2	86.4
1923	91.6	109.6	113.1	83.6	81.0
1924	82.1	100.0	99.8	82.1	82.3
1925	84.2	100.6	104.2	83.7	80.8
1926	87.9	98.9	99.8	88.9	88.1
1927	96.2	98.9	101.2	97.3	95.1
1928	96.0	95.9	96.1	100.1	99.9
1929	100.0	100.0	100.0	100.0	100.0
1930	83.1	93.3	85.3	89.1	97.4
1931	84.0	88.2	88.8	95.2	94.6
1932	83.1	87.4	81.3	95.1	102.2
1933	94.1	92.9	83.2	101.3	113.1
1934	95.6	98.3	83.0	97.3	115.2
1935	103.0	98.3	82.5	104.8	124.6
1936	111.1	97.2	80.1	114.3	138.7

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4. BREAD AND OTHER BAKERY PRODUCTS GROUP
5. BISCUIT AND CRACKERS
6. BAKERY PRODUCTS OTHER THAN BISCUIT AND CRACKERS

The Bread and Other Bakery Products group consists of 2 industries: (1) Biscuit and Crackers and (2) Bakery Products Other Than Biscuit and Crackers. Although the establishments in both of these generally manufacture the same classes of products, they are classified in one or the other according to the composition of their primary output.

The Biscuit and Crackers industry includes establishments which operate on a factory basis and manufacture principally biscuit, crackers, machine-made cookies, pretzels, and similar products packed in containers to retain palatability for an indefinite period. This industry employed almost 34,000 wage earners in 1929.

The Bakery Products Other Than Biscuit and Crackers industry (which in 1929 employed 167,000 wage earners and included more establishments than any other Census industry) comprises bakeries engaged mainly in the production of bread, cakes, pies, and other commodities intended for consumption within a few days and distributed locally or within the radius of quick delivery. Bakeries operated in connection with restaurants, chain stores, and similar enterprises are included by the Census whenever the segregation of the bakery business from the other business is possible or, if segregation is impossible, when it is obvious that the income derived from the bakery business constitutes the greater part of the total income. The value of secondary products of such bakeries, however, amounts to less than 1 percent of the total value of the industry's output.

A considerable amount of bread is still baked in the home. The proportion of the total which is manufactured commercially (mainly for urban consumption) is not known exactly but has been estimated at from 30 to 60 percent. The proportion probably declines in periods of depression, when more households produce their own bread.

The hours of work in the industry are very irregular. They are dependent upon such factors as the extent of unionization, the number of daily bakings, the methods of baking, the type of equipment used, and the character of the local market. The last-named factor also determines the nature of the products and the daily and weekly production pattern.

Production

The index of production for each component industry of the group was constructed for the odd-numbered years 1923-35 from Census statistics for the same 4 classes of products: (1) Biscuit, crackers, and cookies; (2) bread, rolls, and coffee cake; (3) pretzels; and (4) doughnuts, crullers, and other fried cakes. While the establishments in the 2 industries are engaged primarily in the manufacture of either the first or second of these classes, they also produce the remaining 3.¹ All 4 classes are therefore included in the index of production for each industry, which is composed of 3 segments (aggregative indexes with 1929 unit-value weights) spliced in common years. The first segment, for 1923-25, includes the output of the first 2 classes of products; the second, for 1925-29, the first 3 classes; and the third, for 1929-35, all 4 classes.²

Some of the establishments do not report their output in detail, hence Census quantity statistics refer to a varying proportion of total production. To include all establishments, therefore, the index for each industry was divided by an index of the percentage of total value of products accounted for by firms reporting in detail.³ Each index was then completed for the period 1923-36 by means of the composite index for the group.

The group production index for census years 1923-35 is a harmonic mean of the separate indexes for the 2 component industries weighted by wage earners in the given year. An almost identical

¹The significance of products of secondary importance is indicated by the percentages they comprise of the value of all production in each industry:

Year	Biscuit and Crackers	Other Bakery Products
1923	1.8	30.8
1925	2.7	28.7
1927	3.2	29.9
1929	5.6	32.1
1931	6.3	31.8
1933	8.2	25.1
1935	6.2	28.6

²The products included in the index for the Biscuit and Crackers industry comprise about 98 percent of the total value of this industry's output; value coverage for the other branch is about 75 percent. (These percentages were computed from the data for establishments reporting in detail.)

³In 1923 these percentages for the Biscuit and Crackers and the Bakery Products Other Than Biscuit and Crackers industries were 96.9 and 79.3, respectively. The detailed data for these years were adjusted by the Census to represent total production. The percentages for the Biscuit and Crackers industry were 99.8 in 1931 and 100 in all other years; those for the Bakery Products Other Than Biscuit and Crackers industry were:

1926	81.1	1931	88.6
1927	86.2	1933	81.4
1929	89.5	1935	93.7

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index is yielded by an arithmetic mean of the 2 industry indexes weighted by the number of wage earners in 1929:

Year	NRP production index	Weighted arithmetic mean of production indexes
1923	78.3	78.1
1925	83.5	83.4
1927	92.8	92.8
1929	100.0	100.0
1931	91.2	91.1
1933	79.9	79.9
1935	91.7	92.0

Interpolation for the intercensal years 1924-34 and extrapolation for 1936 were accomplished by use of a corresponding group index of wheat-flour consumption.

In constructing the consumption index, a Census series for wheat-flour production was first completed for the years 1923-36 by means of the index of wheat flour milled, which is published by the Board of Governors of the Federal Reserve System.⁴ The next step was to express wheat-flour consumption reported by the Census (adjusted for variable coverage)⁵ as a percentage of wheat-flour production. Percentages for the intercensal years 1924-34 and for 1933, when the Census did not report consumption data, were obtained by straight-line interpolation; the 1935 percentage was assumed to apply in 1936. Finally, multiplication of an index of these percentages by the index of wheat-flour production yielded the annual index of wheat-flour consumption, which compares as follows with the NRP composite production index:

Year	NRP production index	Wheat-flour- consumption index	
1923	78.3	79.5	
1925	83.5	85.1	[Con.]

⁴The original data upon which this index is based appear in *Russell's Commercial News and Northwestern Miller*.

⁵Wheat-flour consumption was reported by establishments whose combined value of products accounted for the following percentages of the total value of products of the industry:

1923	.... 80.6	1929	.... 90.8
1925	.... 86.4	1931	.... 85.3
1927	.... 87.6	1935	.... 86.2

No figures are available for 1933. The reported consumption was divided by these percentages to obtain estimates for all the establishments in the industry.

BREAD AND OTHER BAKERY PRODUCTS GROUP

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(con.)	Year	NRP production index	Wheat-flour- consumption index
	1927	92.8	94.7
	1929	100.0	100.0
	1931	91.2	95.8
	1933	79.9	87.9
	1935	91.7	91.9

The consumption series was not extended to the years prior to 1923 since the Census does not report the quantities consumed before that date and it is believed that figures obtained for the post-war years by extrapolation on the basis of the trend shown by the percentages for 1923 to 1935 would be extremely unreliable.

Employment and Man-hours

The employment index for the industry group, which conforms to Census trend, was constructed by BLS. Employment figures for the 2 component industries were available from the *Census of Manufactures* for odd-numbered years; intercensal-year estimates were made on the basis of BLS data for the group and averages of the ratio of employment in each industry to group employment in adjacent census years. The estimates for 1936 were made through the use of the 1935 ratios.

The man-hours index for the group was derived from the group employment index and from a comparable annual series of average weekly hours computed from Census data for prevailing hours in 1923 and 1929, BLS actual-hours statistics for 1932-36, and estimates for the remaining years obtained by straight-line interpolation.

Average weekly hours could not be ascertained for the 2 component industries. The average for the industry group is not applicable since the Biscuit and Crackers industry operates on a factory basis, while the Other Bakery Products industry includes many small shops, where the hours of work are long and irregular.

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Table 4.- SUMMARY INDEXES FOR THE BREAD AND OTHER BAKERY PRODUCTS
INDUSTRY GROUP: 1923-36

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1923	78.3	81.0	80.4	96.7	97.4
1924	86.0	81.8	81.3	105.1	105.8
1925	83.5	79.9	79.4	104.5	105.2
1926	90.4	82.0	81.7	110.2	110.6
1927	92.8	85.7	85.5	108.3	108.5
1928	96.4	90.8	90.6	106.2	106.4
1929	100.0	100.0	100.0	100.0	100.0
1930	99.4	98.3	95.6	101.1	104.0
1931	91.2	91.1	85.9	100.1	106.2
1932	82.7	86.4	79.1	95.7	104.6
1933	79.9	90.8	79.1	86.0	101.0
1934	87.3	105.7	83.9	82.6	104.1
1935	91.7	108.7	86.3	84.4	106.3
1936	96.0	112.4	93.2	85.4	103.0

Table 5.- SUMMARY INDEXES FOR THE BISCUIT AND CRACKERS INDUSTRY: 1923-36

(1929 = 100)

Year	Production	Employment	Output per wage earner
1923	82.2	103.7	79.3
1924	89.5	101.4	86.3
1925	86.2	95.6	90.2
1926	91.6	95.8	95.6
1927	92.2	97.4	94.7
1928	96.1	97.5	98.6
1929	100.0	100.0	100.0
1930	96.4	94.4	102.1
1931	85.7	83.8	102.3
1932	79.1	77.9	101.5
1933	77.8	80.2	97.0
1934	88.5	89.0	99.4
1935	96.6	86.3	111.9
1936	101.1	89.3	113.2

BREAD AND OTHER BAKERY PRODUCTS GROUP

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Table 8.- SUMMARY INDEXES FOR THE BAKERY PRODUCTS OTHER THAN BISCUIT AND CRACKERS INDUSTRY: 1923-36

(1929 = 100)

Year	Production	Employment	Output per wage earner
1923	77.3	76.4	101.2
1924	85.1	77.8	109.4
1925	82.8	76.7	108.0
1926	90.1	79.2	113.8
1927	92.9	83.3	111.5
1928	96.5	89.5	107.8
1929	100.0	100.0	100.0
1930	100.0	99.1	100.9
1931	92.2	92.7	99.5
1932	83.4	88.1	94.7
1933	80.3	93.0	86.3
1934	87.2	109.1	79.9
1935	91.1	113.3	80.4
1936	95.3	117.1	81.4

7. CANE-SUGAR REFINING

The establishments classified in this industry are engaged wholly or mainly in the refining of raw cane sugar, the greater part of which is imported. Almost 14,000 wage earners were employed in 1929.

Production

The index of production for the odd-numbered years 1921-35 is based upon the output of refined sugar, which accounts for about 99 percent of the total value of products of the industry.¹ A series for raw sugar melted,² which agrees with the trend of Census data for refined-sugar production, was used to complete the latter for the even-numbered years of the period 1919-36.

The 1919 Census figure for refined sugar produced was not used because it appeared to be an understatement.³ Although the ratio of refined sugar produced to raw sugar treated was over 0.93 in 1921 and subsequent odd-numbered years, it was only 0.82 in 1919. For this reason, the figures for 1919 and 1920 were obtained by extrapolation through the use of the series for raw sugar melted.

Employment and Man-hours

The index of employment, which conforms to Census trend, was constructed by BLS.

The man-hours index is composed of 2 segments which were linked in 1930. The first, for 1919-30, was derived by multiplying the employment series by an annual index of prevailing weekly hours computed from Census and BLS data. Census tabulations of prevailing hours were available for 1919, 1921, 1923, and 1929; a BLS study⁴ provided a similar figure for 1930; and estimates were made for the intervening years by straight-line interpolation.

¹Small amounts of sirup and molasses are obtained as byproducts of the refining process.

²Compiled by Willett and Grey's *Statistical Sugar Trade Journal* and published in the *Survey of Current Business*. The melting of raw sugar is one of the early stages of the refining process. The total quantity of raw sugar melted is very close in census years to the quantity of raw sugar treated, as reported by the Census.

³BLS estimates the understatement in 1919 at 500,000 tons ("Productivity of Labor in the Cement, Leather, Flour, and Sugar-Refining Industries, 1914 to 1925," *Monthly Labor Review*, October 1928, p. 19).

⁴*Wages and Hours of Labor in the Cane-Sugar Refining Industry: 1930* (Bull. No. 547). This bulletin summarizes the results of a survey of 21 refineries during a representative pay period in 1930. These refineries employed 11,890 wage earners, or about 87 percent of the estimated average for the whole industry in that year.

CANE-SUGAR REFINING

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For the years 1930 and 1932-36, the man-hours relatives were obtained by dividing the BLS wage index by an index of BLS average hourly earnings. Earnings for 1930 were determined from the special study already referred to;⁴ and for 1931, by straight-line interpolation between 1930 and 1932.⁵

Table 7.- SUMMARY INDEXES FOR THE CANE-SUGAR REFINING INDUSTRY: 1919-36
(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	82.2	131.3	129.3	62.6	63.6
1920	85.2	124.1	123.7	68.7	68.9
1921	73.7	111.9	112.7	65.9	65.4
1922	105.9	130.0	127.1	81.5	83.3
1923	86.6	109.7	104.0	78.9	83.3
1924	93.9	104.1	99.6	90.2	94.3
1925	105.8	104.3	100.6	101.4	105.2
1926	106.7	100.5	98.0	106.2	108.9
1927	100.2	100.6	98.9	99.6	101.3
1928	97.7	94.6	94.0	103.1	108.9
1929	100.0	100.0	100.0	100.0	100.0
1930	98.3	97.9	96.1	100.4	102.3
1931	86.6	85.2	86.5	101.6	100.1
1932	78.5	78.4	73.5	100.1	106.8
1933	77.0	82.6	64.1	93.2	120.1
1934	76.9	97.6	61.0	78.8	126.1
1935	82.3	99.4	61.9	82.8	133.0
1936	83.7	95.0	60.1	88.1	139.3

⁵ Man-hours for 1930 and subsequent years could also be estimated by a method analogous to that employed for the period before 1930, namely, by multiplying BLS employment by average actual weekly hours. The method adopted was preferred because it yielded an estimate of total man-hours which differed by only 0.5 percent from the actual total (reported by the *Census of Manufactures: 1933. "Man-hour Statistics for 32 Selected Industries"*), while the alternative method yielded a result which was about 6 percent higher.

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- 8. CANNING AND PRESERVING GROUP
- 9. CANNED AND PRESERVED FRUITS AND VEGETABLES
- 10. CANNED AND CURED FISH

The Canning and Preserving group is composed of 2 industries: (1) Canned and Preserved Fruits and Vegetables and (2) Canned and Cured Fish. The former, which employed almost 99,000 wage earners in 1929, includes establishments engaged primarily in the canning and preserving of fruits, vegetables, soups, preserves, jellies, fruit butters, pickles, and sauces. The latter, which employed about 13,600 wage earners in 1929, includes establishments engaged primarily in the canning and curing of fish, shrimp, oysters, clams, and other sea foods. The following activities fall outside the definition but may constitute part of the secondary business of the canneries in the group: Meat packing; the manufacture of condensed and evaporated milk, sweetening sirups, and peanut butter; the drying and packing of fruits on farms; and the shucking and shipment of fresh oysters in unsealed containers.

Seasonal variation in the Canned and Preserved Fruits and Vegetables industry is greater than in any other included in this study except Beet Sugar. The plants operate at capacity in but 3 months of each year, August to October, during which time employment may be 5 or 6 times as high as in the minimum month.

Production

Canning and Preserving Group. - The indexes of production for the Canning and Preserving group are harmonic means of the relatives for the component industries; one, with changing employment weights, was used in computing output per wage earner, and the other, with changing man-hour weights, was used in computing output per man-hour. These 2 composites are practically identical not only with each other but also with arithmetic means of relatives weighted by 1929 employment and man-hours:

Year	Index of production with -			
	Changing weights		Fixed weights (1929)	
	Employment	Man-hours	Employment	Man-hours
1919	64.3	64.2	65.1	64.9
1921	41.4	41.3	41.5	41.5
1923	70.7	70.7	70.7	70.8
1925	87.1	87.1	87.1	87.2
1927	82.2	82.2	82.2	82.2 [Con.]

[Con.] Year	Index of production with -			
	Changing weights		Fixed weights (1929)	
	Employment	Man-hours	Employment	Man-hours
1929	100.0	100.0	100.0	100.0
1931	84.4	84.5	84.5	84.7
1933	86.6	86.7	86.7	86.7
1935	115.6	115.7	115.5	115.6

Canned and Preserved Fruits and Vegetables.— The index for this industry was obtained by completing a series for odd-numbered years, which was derived from Census data, by means of another, which was constructed for the whole period 1919-36 from statistics published by the National Cannery Association. The Census index, consistently representing over 60 percent of the value of the industry's production, is composed in turn of 2 segments which were spliced in 1927, their first common year. One is based on the quantities of 19 products weighted by 1929 unit values; the other, available only since 1927, is based on 30 products similarly weighted. These 30 products consist of the original 19 and 11 additions (indicated by asterisks):

Dried fruits		Canned fruits
Apples	Beets	Apples
Apricots	Corn	Apricots
Peaches	*Hominy	Berries
Prunes	*Kraut	Cherries
Raisins	Peas	*Fruits for salad
Other dried fruits	*Pimentos	*Grapefruit
	*Pumpkin and squash	*Olives, ripe
Canned vegetables	*Spaghetti	Peaches
Asparagus	Spinach	Pears
Beans	*Tomato Sauce	*Plums
	Tomatoes	*Prunes

Prior to 1927 the output of canned products was reported by the Census in terms of both "actual" and "standard" cases; since then their quantities have been quoted in terms of "actual" cases only. An actual case may consist of a varying number of containers of unequal volume; a standard case includes a fixed number of cans of a given size. The effect of a difference in case unit is illustrated by the following measures of output (1925=100) based on the 13 canned products entering into the NRP index in all odd-numbered years:¹

¹The 13 canned products are shown above (all those without asterisks except dried fruits). The dried fruits present no problem because their quantities are consistently reported in pounds. The products in each illustrative index are weighted by comparable unit values (i. e., per actual or standard case) for 1925. The 1923 actual-case quantity for beans had to be adjusted (on the basis of the 1925 relationship) to include "baked beans."

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Year	Index of production	
	Actual cases	Standard cases
1919	66.2	70.1
1921	41.9	43.8
1923	74.7	81.0
1925	100.0	100.0

Standard-case quantities for these 13 products were used in constructing the NRP index for the census years prior to 1927; actual-case quantities for each product as reported thereafter were converted to standard-case equivalents on the basis of the average relationship between the 2 kinds of case totals in the earlier period.² Actual-case quantities for the 11 canned products included in the NRP index for the first time in 1927 could not be converted to standard-case units. Failure to do so, however, is not serious, for the 11 products are so unimportant in the weighted aggregates that they alter but slightly the index for the other 19:

Year	Index of production	
	30 products (NRP)	19 products
1927	82.3	84.8
1929	100.0	100.0
1931	87.1	87.9
1933	88.7	87.3
1935	117.0	115.7

The interpolating index, by means of which the census-year series was completed, was constructed by linking 4 sets of weighted aggregates - for 3 products, 1919-23; 10 products, 1923-25; 13 products, 1925-33; and 18 products, 1933-36.³ The quantity data were supplied by the National Cannery Association's publication, *Canned Food Pack Statistics: 1936* (Parts 1 and 2); the weights, 1929 unit values, were adapted from the *Census of Manufactures*. As in the index for odd-numbered years, an attempt was made here to utilize standard-case totals only; 6 products were so quoted,

²Despite variation in the distribution of actual cases of cans of different size, the ratios of actual-case to standard-case totals for each product remained fairly stable in the odd-numbered years 1919-25.

³The segments constructed from National Cannery Association statistics represent the following percentages of Census total value: 3 products, 12-17; 10 products, 26-31; 13 products, 30-35; and 18 products, 35. The 3 products available for all years are asparagus, corn, and peas; the 7 additional ones since 1923 are apricots, blackberries, cherries, peaches, pears, loganberries, and olives; the 3 additional ones since 1925 are green beans, wax beans, and beets; and the last 6 additions are apples, raspberries, spinach, prunes, and fruits for salad.

and 8 others could be converted on the assumption that the average ratio of standard to actual cases in 1933-36 was valid for earlier years.

Canned and Cured Fish.— Census quantity series for the following 8 classes of products, which constitute the entire output of the industry, were combined by means of 1929 unit-value weights into an aggregative index for all odd-numbered years for 1919-35, except 1933: Canned fish - clams, etc., oysters, salmon, sardines, shrimp, tuna, and all other canned fish - and cured fish. The lack of data for cured fish in 1933 necessitated the adjustment of the 7-product weighted aggregate for this year by the average ratio of the 8- to the 7-product weighted aggregate in 1931 and 1935. All canned fish are consistently reported in standard cases and cured fish in pounds.⁴

Interpolation was accomplished by means of a continuous index for 1921-35 constructed from 6 series in standard cases reported in the annual publication of the Bureau of Fisheries, *Fishery Industries in the United States*: Salmon, oysters, pilchard sardines, herring sardines, shrimp, and tuna and tuna-like fishes. The weights for these series are 1929 unit values computed from the same source.⁵

Employment

Canning and Preserving Group.— The composite employment index is based on the sum of the wage earners in the 2 industries. The wage-earner statistics for the odd-numbered years 1919-35 were supplied by the Census; those for 1926 and 1928 are sums of the interpolated figures for the 2 industries; and the relatives for 1924 and 1930-36 were derived from the BLS group index, which conforms to Census trend.

⁴ Pilchard and herring sardines, which had been reported together before 1935, were separated in that year. The quantities for 1933 and 1935, therefore, were combined in the ratio (1.92:1) of the weights of the standard cases of the 2 types. A similar adjustment was made for shrimp, which was reported in 4½ oz. cans before 1927 and in 5 and 5½ oz. cans thereafter. The quantities for the later years were multiplied by 1.265, the ratio of the average new-size can (5½ oz.) to the original. No adjustment, however, could be made for the inclusion of chowder with "soups" for 1919-23 and with "clams, etc." thereafter.

⁵ These unit values are higher than those computed from Census data for corresponding products because value reported by the Bureau of Fisheries represents the gross amount received by the packer without deductions for commissions or expenses. For this reason the coverage of the 8 products as measured in terms of Census total value - 65 to 76 percent - is definitely an overstatement.

Canned and Preserved Fruits and Vegetables.— The index for the Canned and Preserved Fruits and Vegetables industry is based on Census figures for the odd-numbered years; on an estimate for 1924 made by distributing the BLS group total in accordance with the average of the proportions in 1923 and 1925; and on estimates for the even-numbered years 1926-36 obtained by means of a continuous index for 3 States - New York, New Jersey, and California.⁶ The sample series for these States were first adjusted to conform to the movement of corresponding Census figures, which they already approximated fairly well, and then combined.⁷ After interpolation of the national census-year series by the 3-State index, the relatives for the even-numbered years 1930-36 were rendered consistent with the totals indicated by the BLS group index for the same period.⁸

Canned and Cured Fish.— The employment index for the Canned and Cured Fish industry is based on Census wage-earner statistics for the odd-numbered years; on an estimate for 1924 derived by distributing the BLS group total in the manner described in the discussion of the Canned and Preserved Fruits and Vegetables industry; and on estimates for the even-numbered years 1926-36

⁶Data for New York were obtained from *Course of Factory Employment in New York State From 1921 to 1930* (N. Y. State Dept. Labor, Div. Statistics and Information, Spec. Bull. No. 171) for January 1925-December 1930 and from January issues of *Industrial Bulletin* (N. Y. State Dept. Labor) for the remainder of the period; for New Jersey, from monthly issues of *Industrial Bulletin* (N. J. Dept. Labor) for January 1927-April 1932 and from *Employment and Wages in New Jersey* (N. J. Dept. Labor) for November 1933-December 1936; and for California, from monthly issues of *California Labor Market Bulletins* (Calif. Div. Labor Statistics and Law Enforcement) for January 1925-December 1936.

The New York sample accounts for about one-quarter of the wage earners indicated for that State by the Census; the New Jersey sample, over four-fifths; and the California sample, three-fifths. Together the 3 samples account for well over half the corresponding Census State totals. In turn, these State totals represent about two-fifths of national employment. The New York and New Jersey samples include a small number of wage earners (about 2 to 4 percent in the former State and probably less in the latter) engaged in fish canning; the former, moreover, includes some office labor.

⁷The weights used in combining the adjusted sample relatives (New York, 5; New Jersey, 1; and California, 8) were assigned so as to yield a composite resembling the national Census series. The original sample series were computed from monthly data (viz, relatives for a fixed group of establishments in New York, absolute figures for a changing group of establishments in New Jersey, and percentage changes between corresponding months in successive years and between successive months in 1925 in California) after adjustments had been made for minor discontinuities in the New Jersey and California series and for a serious change in the coverage of the former in 1935. The annual New Jersey series, available only since 1927, had to be extended back to 1925, the initial year of the other 2 series. For this purpose the relationship between the Census and sample figures in 1927 was assumed for 1925; the 1926 figure was then obtained by straight-line interpolation.

⁸The interpolated employment figures for each industry were adjusted in the same proportion - diminished by 3.0 and 5.5 percent in 1930 and 1932, respectively, and augmented by 5.6 and 3.8 percent in 1934 and 1936. Since the BLS group index is not available for 1926 and 1928, no adjustment can be made in the estimates for these years. The magnitude of the percentage error in 1926 and 1928 is probably of the same order as in the later years, but the direction of the error is not known.

obtained by successive interpolation of (1) Census data for California by means of a sample series for the same State and (2) national Census totals by means of the final California series.⁹ As in the case of Canned and Preserved Fruits and Vegetables, the national relatives for intercensal years 1930-36 were adjusted for consistency with the totals indicated by the BLS group index.⁸

The number of wage earners in the sample comprises about three-fifths of the State total; the latter, in turn, has progressed from 27 to 36 percent of the total for the industry.

Man-hours

The man-hours index for the group and for each industry was constructed from the products of paired series of wage earners and weekly hours. Each of the 3 weekly-hours series is based on Census prevailing hours for the component industries for 1919, 1921, 1923, and 1929; on BLS actual hours for the group for 1932-36; and on estimates for 1924-28 and 1930-31 obtained by straight-line interpolation. Prevailing hours for the group were estimated by combining the figures for the 2 components into weighted averages. Actual hours for the component industries were determined from the BLS group figures on the assumption that the mean relationship between the corresponding figures for prevailing hours in 1919, 1921, 1923, and 1929 was applicable.¹⁰

The production and labor indexes are not precisely comparable in scope. Some of the workers in Canning and Preserving establishments are engaged in the packing of meat and the canning of milk, products outside the compass of the group definition; on the other hand, workers outside the industry group contribute part of the production included in the detailed Census statistics. The effect on the NRP indexes is probably not significant, for secondary products account for about 2 to 8 percent of the total value of the output of the group, and canned and preserved products contributed from outside usually account for less than 2 percent of the total value of all such products.

⁹The source of the sample data is the same as for the California series for Canned Fruits and Vegetables (see ft. 6). Wage earners in intercensal years could also be estimated by subtracting the number indicated by the Fruits and Vegetables series from the total derived from a weighted composite for the industry group based on the New York, New Jersey, and 2 California Census-adjusted indexes. Since the saw-toothed movement of the residuals appears to be unreasonable, this method was not used to obtain the NRP index for Canned and Cured Fish.

¹⁰The ratios for Fish range from 0.945 to 0.963; for Fruits and Vegetables, from 1.006 to 1.008.

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Table 8.- SUMMARY INDEXES FOR THE CANNING AND PRESERVING INDUSTRY GROUP:
1919-36

(1929 = 100)

Year	Production (employ- ment weights)	Employment	Output per wage earner	Produc- tion (man-hour weights)	Man-hours	Output per man- hour
1919	64.3	79.9	80.5	64.2	81.9	78.4
1920	n. a.	n. a.	-	n. a.	n. a.	-
1921	41.4	53.1	78.0	41.3	53.6	77.1
1922	n. a.	n. a.	-	n. a.	n. a.	-
1923	70.7	72.6	97.4	70.7	73.7	95.9
1924	68.9	64.6	106.7	68.9	65.4	105.4
1925	87.1	85.8	101.5	87.1	86.7	100.5
1926	93.6	89.7	104.3	93.9	90.5	103.8
1927	82.2	83.2	98.8	82.2	83.5	98.4
1928	98.3	93.2	105.5	98.5	93.4	105.5
1929	100.0	100.0	100.0	100.0	100.0	100.0
1930	106.0	103.1	102.8	106.1	95.6	111.0
1931	84.4	78.9	107.0	84.5	67.1	125.9
1932	62.5	64.0	97.7	62.6	49.6	126.2
1933	86.6	83.8	103.3	86.7	60.3	143.8
1934	91.5	107.0	85.5	91.5	66.6	137.4
1935	115.6	115.2	100.3	115.7	78.2	148.0
1936	n. a.	109.4	-	n. a.	75.5	-

Table 9.- SUMMARY INDEXES FOR THE CANNED AND PRESERVED FRUITS AND VEGETABLES
INDUSTRY: 1919-36

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	61.3	78.4	80.1	78.2	76.5
1920	68.3	n. a.	n. a.	-	-
1921	40.1	52.3	52.8	76.7	75.9
1922	60.1	n. a.	n. a.	-	-
1923	71.7	73.4	74.3	97.7	96.5
1924	70.6	65.3	66.0	108.1	107.1
1925	88.7	86.9	87.7	102.1	101.1
1926	100.6	90.4	91.1	111.3	110.4
1927	82.3	81.9	82.2	100.5	100.1
1928	102.5	93.5	93.7	109.6	109.4
1929	100.0	100.0	100.0	100.0	100.0
1930	109.0	106.8	98.8	102.1	110.3
1931	87.1	81.1	68.8	107.4	126.6
1932	64.5	65.2	50.4	98.9	128.0
1933	88.7	85.2	61.2	104.1	144.9
1934	92.3	109.3	67.9	84.4	135.9
1935	117.0	117.6	79.7	99.5	146.8
1936	105.1	108.6	74.8	96.8	140.5

CANNING AND PRESERVING GROUP

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Table 10.- SUMMARY INDEXES FOR THE CANNED AND CURED FISH INDUSTRY: 1919-36
(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	92.5	91.4	95.2	101.2	97.2
1920	n. a.	n. a.	n. a.	-	-
1921	52.2	56.4	60.1	89.4	86.9
1922	51.9	n. a.	n. a.	-	-
1923	63.4	67.2	68.9	94.3	92.0
1924	57.5	59.0	60.3	97.5	95.4
1925	75.7	77.4	78.8	97.8	96.1
1926	60.7	64.5	65.7	71.8	70.8
1927	81.3	92.9	93.6	87.5	86.9
1928	75.4	91.3	91.7	82.6	82.2
1929	100.0	100.0	100.0	100.0	100.0
1930	82.8	76.4	70.9	108.4	116.8
1931	65.4	63.1	54.0	103.6	121.1
1932	49.6	55.1	43.2	90.0	114.8
1933	72.3	73.4	53.4	98.5	135.4
1934	84.9	90.0	56.7	94.3	149.7
1935	104.6	98.0	67.2	106.7	155.7
1936	n. a.	115.6	80.7	-	-

11. CEMENT

The establishments in this industry manufacture hydraulic cement from rock which they themselves usually quarry. The principal product is portland cement, which represents about 99 percent of the total volume of cement produced. Small quantities of natural, puzzolan, and masonry cements are also manufactured. Refractory cement, which is made by establishments classified in the Clay Products (Other Than Pottery) and Nonclay Refractories industry, is excluded from the industry. In 1929 the Cement industry employed about 33,000 wage earners.

Portland cement is made by grinding and burning a mixture of limestone, chalk, or marl; and clay, shale, or slag. It is a highly standardized product made under specifications approved by the American Society for Testing Materials. From 1920 to 1935 the quality of the product was improved, and the percentage of the total production that would pass through a 200-mesh sieve increased from about 82 to over 92.

Cement plants are almost unique among manufacturing establishments in that they usually extract their own principal raw materials. About 25 percent of the labor at cement plants is consumed in connection with quarrying operations. For this reason the production of cement is frequently considered an extractive rather than a manufacturing industry.

The rotary kilns of the Cement industry are among the largest pieces of moving machinery in all industry. In the period 1920-35 the maximum length of an installed kiln increased from about 260 to 400 feet; the average length, from 117 to 146 feet. Considerable power is required to grind the raw materials and the hard cement clinker. About half of the electric energy consumed is purchased, and the other half is generated at the plant, usually by means of waste-heat boilers attached to the kilns. In 1929 the rated horsepower capacity of prime movers and electric motors driven by purchased energy was higher per wage earner in the Cement industry than in any other manufacturing industry which reported to the Census, except Blast Furnaces.

Cement, like other building materials, is subject to a seasonal demand. To meet the production peak, which occurs in August, a large reserve of clinker is usually accumulated, beginning in the preceding fall. The seasonal demand accounts in part for

the large percentage of unused capacity characteristic of the industry.

Production

The index of production was constructed from Bureau of Mines data for the output of portland-cement clinker, finished portland cement, and finished masonry, natural, and puzzolan cements and for the shipments of portland and other cements. The basic statistics represent complete coverage.

Intermittent operation of a cement kiln is both difficult and costly, but portland-cement clinker may be stored and ground at the need or convenience of the operator. Finished cement may also be stored indefinitely before it is bagged or loaded in bulk and shipped. Consequently, the 3 series (portland-cement-clinker production, finished-portland-cement production, and portland-cement shipments) do not necessarily show the same movement from year to year. A measure of total portland-cement output (referred to below as "equivalent portland cement") was obtained by weighting the 3 series, which represent successive stages of production, by the estimated proportion of labor consumed in the operations associated with production of clinker, clinker grinding, and bagging and loading of cement, respectively. The weights used were 0.66 for portland-cement-clinker production, 0.15 for finished-portland-cement production, and 0.19 for portland-cement shipments. Since no data for clinker production were available for the years 1919-24, the output of finished cement was used to represent the production of both clinker and finished cement in these years and was assigned their combined weight.

The percentages utilized as weights in obtaining "equivalent portland cement" are averages of those computed from 2 studies of the industry, one by H. E. Hilts¹ for 1919 and the other by B. H. Topkis² for 1934 (the 2 labor distributions by departments are similar). The labor in the various departments of quarrying, processing, and shipping (maintenance and mill overhead labor, which accounted for about 33 percent of the total, could not be distributed) was assigned to the 3 series as follows:

¹"Shall the State Own and Operate Its Own Portland Cement Plant?" *Public Roads* (U. S. Dept. Agr., Bur. Public Roads), January 1921.

²"Labor Requirements in Cement Production," *Monthly Labor Review*, March 1936.

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Clinker production	Finished-cement production	Cement shipments
Quarrying	Clinker grinding	Shipping
Raw grinding	Power department ³	
Clinker burning		
Coal-mill department		
Power department ³		

The production of masonry, natural, and puzzolan cements⁴ was added to the output of "equivalent portland cement." This series, when converted into relatives, yielded the NRP production index.

In recent years there has been increasing emphasis upon the development of high-early-strength and other special cements with additional quick-setting, waterproofing, or color characteristics. The growing importance of these special cements may be gauged from the following tabulation, based on Bureau of Mines data, which shows the percentages that special cements were of all portland cement:

1927	1.8	1931	2.0
1928	1.4	1932	2.8
1929	3.0	1933	3.6
1930	3.1	1934	6.4

Additional burning or reburning and finer grinding are required to produce special cements. No data were available, however, from which estimates of the additional labor required to produce these cements could be made.

Employment

For odd-numbered years the employment index is based upon the average number of wage earners reported by the Census. This index was completed for the period 1919-36 through the use of the BLS index of employment.

The employment index is not strictly comparable with the production index since some wage earners are engaged in the manufacture of such secondary products as stone dust, crushed rock, fertilizer dust, limestone, hydrated lime, and concrete stones and blocks. In each of the census years 1923-29 the combined value of these

³Labor in the power department was allocated to clinker and finished-cement production in the ratio of 3:2 in accordance with the experience of cement manufacturers.

⁴Shipments were used to represent production of these cements for the years 1919-24.

products was less than 1.5 percent of the total value of products of the industry.⁵

Man-hours

The index of man-hours, unlike that for most other industries, was not constructed independently but was obtained by dividing the NRP production index by the index of output per man-hour, which is described in the following section.

Productivity

The index of output per wage earner is the quotient of the production and employment indexes.

The following 4 productivity studies of portland-cement plants provided the data for production and man-hours which were used to construct the index of output per man-hour:

Study	Available for-
H. E. Hilts ⁶	1919
American Engineering Council ⁷	1920-25
B. H. Topkis ⁸	1925-34
Bureau of Mines ⁹	1928-36

The basic data used by the American Engineering Council and B. H. Topkis were collected by the Portland Cement Association. Man-hours consumed in shipping (estimated in 1919 and 1934 at 12.7 and 13.2 percent of the total number of man-hours)¹⁰ are excluded from the Topkis study. Thus the productivity ratios in absolute units are not comparable with those computed from the other studies, but there is no reason to believe that the relative movement of these ratios from year to year is affected significantly by this omission. The Topkis output-per-man-hour index and the one computed from American Engineering Council and Bureau of Mines statistics follow:

⁵Comparable percentages could not be computed for other years. From fragmentary data it appears that secondary production comprised a higher percentage of the total value in 1919 and 1921.

⁶See fn. 1.

⁷*Safety and Production* (New York: Harper and Bros., 1928).

⁸See fn. 2.

⁹Data for 1928-33 are published in *Minerals Yearbook: 1935*. The figures for 1934-36 were furnished by Dr. O. E. Klessling of the U. S. Bureau of Mines.

¹⁰Total man-hours include maintenance and mill overhead labor, which could not be distributed in deriving the weights. These estimates are based upon data presented by Hilts and by Topkis.

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Year	AEC-Bureau of Mines	Topkis
1925	86.3	77.7
1928	94.8	94.8
1929	100.0	100.0
1930	104.0	105.7
1931	120.5	114.2
1932	116.2	110.4
1933	117.2	111.8
1934	119.7	114.7

The Bureau of Mines receives annual reports from cement manufacturers on 2 schedules, one calling for production data, the other for employment and accident statistics. In making this study, the Bureau of Mines matched these 2 schedules for individual plants. Prior to 1932 the schedules called for the average number of men employed in an active pay-roll period, average number of days worked, and average length of the working day, and, after 1928, total man-shifts. In 1932 and later years the schedules called for the total number of man-hours.

Productivity ratios were computed from the data of each study by dividing production of finished portland cement by man-hours worked. For the years 1919-25 and 1928-36 the ratios obtained from the first, second, and fourth studies were used. Estimates for 1926 and 1927 were made by means of the ratios computed from the Topkis study. The index of these ratios was adjusted for variations in the amounts of clinker production and finished-cement shipments by multiplication by an index of the percentage that "equivalent portland cement" is of finished portland cement.

Although the productivity ratios are derived from a changing sample, it is probable that they are representative of the industry as a whole because of the high percentage of total finished portland cement produced by the establishments canvassed:

Study	Years	Percentage
H. E. Hilts	1919	40.6
American Engineering Council	1920	63.5
	1921	77.1
	1922	74.0
	1923	73.8
	1924	79.8
	1925	89.4 [Con.]

CEMENT

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[Con.]	Study	Years	Percentage
	B. H. Topkis ¹¹	1934	74.8
	Bureau of Mines	1928	89.1
		1929	89.1
		1930	87.3
		1931	88.9
		1932	87.9
		1933	89.0
		1934	100.0
		1935	99.5
		1936	99.0

Table 11.- SUMMARY INDEXES FOR THE CEMENT INDUSTRY: 1919-36

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	47.9	76.5	79.6	62.6	60.2
1920	58.3	91.3	94.0	63.9	62.0
1921	57.5	78.6	80.5	73.2	71.4
1922	67.7	98.7	85.9	66.6	78.8
1923	60.7	105.2	104.1	76.7	77.5
1924	87.5	111.8	110.3	78.3	79.3
1925	94.1	115.2	109.4	81.7	86.0
1926	96.4	118.1	111.4	85.2	86.5
1927	100.7	108.9	111.6	92.5	90.2
1928	103.0	102.5	109.0	100.5	94.5
1929	100.0	100.0	100.0	100.0	100.0
1930	94.7	93.7	90.7	101.1	104.4
1931	72.6	72.9	60.8	99.6	119.4
1932	44.6	50.7	38.5	66.4	116.4
1933	37.2	47.4	31.6	78.5	117.7
1934	45.5	59.5	37.9	76.5	120.1
1935	44.6	62.0	39.5	71.9	112.9
1936	66.4	66.4	51.6	97.1	128.7

¹¹In the years other than 1934 only the productivity ratios are presented.

12. CHEMICALS

The Chemicals industry as here defined includes the 2 Census industries "Chemicals, Not Elsewhere Classified" and "Compressed and Liquefied Gases." The products of the former are distinguished from those of allied Census industries by the fact that, with few exceptions, they are compounds - not physical mixtures - manufactured principally for sale. Some of the exceptions are plastics, resins, aluminum abrasives, vitreous enamels, and ferro-alloys. Establishments in other industries (Explosives, Paper and Pulp, Soap, Fertilizers, Tanning Materials, etc.) may also produce some chemicals for sale, but the Census usually excludes their quantities and values from the corresponding figures for "Chemicals, Not Elsewhere Classified." An exception is glycerin made for sale by the Soap industry.

In 1929 the Chemicals industry as here defined employed 66,000 wage earners. In 1936 the number of wage earners, 74,000, was higher than in any other year since the World War.

Systematic research in the Chemicals industry plays an important role in the development of new processes and products. In 1937 research in inorganic chemistry consumed 2.25 percent of the sales dollar; and organic research, 4.30 percent. It is interesting to note in this connection that the coal-tar branch employs a greater percentage of technically trained employees than does any other manufacturing industry. In 1918 the percentage was 8.2; in 1930, 15.3.

Production

The index is based with few exceptions on production for sale or interplant transfer¹ of chemicals selected according to relative

¹The Census, source of statistics for all products but coal-tar dyes in odd-numbered years (see fn. 3), reports production for sale and transfer; the Tariff Commission, source of statistics for dyes and the organic chemicals entering into the interpolating index (see fn. 5), reports total production, which may differ from production for sale and transfer by including consumption for further fabrication in reporting establishments. For 3 organic products reported by both agencies (carbon tetrachloride, ether, and vanillin), however, the 2 kinds of production are usually close. For dyes, which are finished products with respect to both the company of origin and the industry, actual sales (also reported by the Tariff Commission) frequently approximate total production.

Year	Ratio of dye sales to total dye production	Ratio of total production to production for sale		
		Carbon tetrachloride	Ether	Vanillin
1923	0.92	1.15	1.03	1.18
1925	0.92	1.01	0.99	1.47
1927	1.02	0.97	0.95	1.00
1929	0.95	1.06	0.95	1.06
1931	n.a.	n.a.	n.a.	n.a.
1933	0.97	1.18	1.01	n.a.
1935	0.87	1.07	1.01	n.a.

[Con.]

value and industrial significance from the following mutually exclusive groups:²

1. Acids, organic and inorganic
2. Nitrogen and fixed-nitrogen compounds
3. Sodium compounds
4. Potassium compounds
5. Alums and other aluminum compounds
6. Coal-tar products
7. Plastics and pyroxylin products
8. Compressed and liquefied gases
9. Miscellaneous organic and inorganic compounds

The relatives for odd-numbered years of the period 1919-36 were derived from comparable weighted aggregates for 34 products from 1919 to 1923, for 38 products from 1923 to 1933, and for 37 products in 1929 and 1935.³ Before construction of these aggregates, adjustments were made in the reported quantities, whenever necessary and possible, in order to maintain chronological comparability.⁴ The products included in the index account for from 40 to 50 percent of the estimated value of all output for sale or transfer.

The weighting factor for each product except dyes is a simple average of the unit values of production for sale for as many of the census years of the period 1919-33 as each quantity series was available. For dyes the average of unit sales values was used.

¹[Continued]

Ultimately, however, the problem is not whether the Tariff Commission series may be regarded as representing production for sale or transfer but whether the NRP index corresponds in movement to total production. That such is the case is indicated by indexes (presented later) based on several chemicals for which the Census reports both kinds of production.

²Unless alternative or derivative products were of comparable importance or showed dissimilar trends, only 1 form (e. g., ammonia gas or aqua; crude or refined glycerin; sulphuric or mixed sulphuric-nitric acid; phosphoric acid or phosphates; and solid or gaseous carbon dioxide) was selected.

³Data for all products except coal-tar dyes (reported in the Tariff Commission publication usually entitled *Census of Dyes and of Other Synthetic Organic Chemicals*) were obtained from *Census of Manufactures*. Statistics were available in all odd-numbered years for the following 36 chemicals - except aluminum abrasives in 1935 and butyl acetate, carbon tetrachloride, ferro-alloys, and pyroxylin in 1919 and 1921: (1) Acetic (dilute), citric, hydrochloric, nitric, oleic, phosphoric, stearic, and sulphuric acids; (2) ammonia (anhydrous); (3) sodium bicarbonate, borate, chromate and bichromate, and silicate; niter cake, salt cake, caustic soda, and soda ash; (4) potassium bitartrate; (5) aluminum abrasives and aluminum sulphate; (6) coal-tar dyes; (7) pyroxylin; (8) acetylene, carbon dioxide, chlorine, and oxygen; and (9) butyl acetate, carbon bisulphide, calcium chloride, calcium phosphate, carbon tetrachloride, copper sulphate, ether, ethyl acetate, glycerin (refined), ferro-alloys, sulphur (refined), and vanillin.

⁴For example, the production in 1933 and 1935 of sulphuric acid in other industries, particularly Explosives and Fertilizers, had to be eliminated; the unit for ferro-alloys after 1929 had to be converted from long to short tons; the output of hydrochloric and nitric acid in 1919-27 had to be recomputed in terms of 100-percent equivalents; and since dye production was not reported in 1931, sales, which amounted to 95.2 percent of total production in 1929 and 97.3 percent in 1933 (see fn. 1), were substituted. No adjustment, however, could be made for the following: The Census' inclusion of ammonia-gas production of the Manufactured Gas industry in 1935; its inclusion of the calcium-chloride production of the Salt industry - at least in 1929 and 1933; and its failure to quote many chemicals (e. g., phosphoric acid and sodium silicate) in standard equivalents from year to year.

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The production index was completed for the even-numbered years by means of a series derived from comparable aggregates for 3 to 12 of a total of 15 products for which quantities are published by the Tariff Commission, *Chemical and Metallurgical Engineering*, and the Bureau of Mines.⁵ The 11 organic and 4 inorganic chemicals were weighted by averages of unit sales or production values and combined in varying numbers so as to yield relatives which approximated the final census-year series. By selection it was sought to overcome the qualitative bias of the available statistics, which are more complete for organic chemicals and not continuous for each product. The interpolating index compares as follows with the NRP index in common years:

Year	NRP production index	Interpolating production index
1919	49.1	50.8
1921	38.4	41.0
1923	65.9	64.4
1925	65.7	72.4
1927	74.8	79.2
1929	100.0	100.0
1931	77.9	80.3
1933	79.6	84.4
1935	93.9	97.4

Once the final production index was constructed, it was possible to develop several simpler ones which are also satisfactory for census years. It was found, for example, that the 11 products which dominate the final index are sufficient to approximate the movement revealed by more than 3 times their number;⁶ and that 9 group indexes, based on 27 products, yield a composite, when weighted by average group values, which is almost as close.⁷

⁵ Statistics were supplied by *Chemical and Metallurgical Engineering* for acetic acid, caustic soda, chlorine, soda ash, and sulphuric acid; by the Bureau of Mines' *Minerals Yearbook* for caustic soda in 1919-21; and by the Tariff Commission's *Census of Dyes and of Other Synthetic Organic Chemicals* for aniline oil, butyl acetate, carbon tetrachloride, dyes, ether, ethyl acetate, formaldehyde, hexamethylenetetramine, naphthalene, and vanillin. Except for acetic acid, the quantities obtained from the first 2 sources were adjusted to Census levels before combination.

⁶ The 11 products, weighted as in the original index, are acetylene, aluminum sulphate, ammonia (anhydrous), carbon dioxide, caustic soda, dyes, glycerin (refined), oleic acid, oxygen, soda ash, and sulphuric acid. In 1929 these chemicals represented almost 30 percent of the total value of the industry's production for sale or transfer while those in the original index accounted for about 50 percent.

⁷ The 27 chemicals are distributed among the groups as follows: (1) Hydrochloric, oleic, nitric, and sulphuric acids; (2) ammonia (anhydrous) and nitrous oxide; (3) sodium bicarbonate, borate, phosphates, (monobasic and dibasic), and sulphate (salt cake); caustic soda; and soda ash; (4) potassium bitartrate; (5) aluminum abrasives and aluminum sulphate; (6) coal-tar dyes; (7) pyroxylin plastics; (8) acetylene, chlorine, and oxygen; and (9) butyl acetate, calcium chloride, carbon tetrachloride, copper sulphate, ferro-alloys, glycerin (refined), and magnesium sulphate.

Year	NRP production index	11-product production index	9-group production index
1919	49.1	48.2	52.8
1921	38.4	37.1	41.6
1923	65.9	64.8	69.6
1925	65.7	67.6	67.2
1927	74.8	74.2	76.8
1929	100.0	100.0	100.0
1931	77.9	78.5	78.0
1933	79.6	82.9	78.7
1935	93.9	92.3	93.8

The adequacy of value weights, employed in all the series thus far presented, can be tested by the comparison of another pair of indexes which include 18 identical products for which both value and labor weights were available. The ratio of labor cost to value is low in general (about 10 percent) and varies from product to product.⁸ The distributions of unit values and unit labor requirements as percentages of their respective sums compare as follows:⁹

Product	Unit	Percentage distribution	
		Unit man-hour require- ments	Unit values
Total, all products	-	100.00	100.00
Acetic acid, dilute	lb.	0.03	0.01
Aluminum sulphate	ton	5.75	7.14
Ammonia, synthetic anhydrous	lb.	0.04	0.04
Carbon dioxide	lb.	0.003	0.02
Caustic soda	ton	13.80	13.28

[Con.]

⁸The following percentages of labor cost per dollar of sales were obtained from *Chemical and Metallurgical Engineering*, January 1932: Acetic acid (calcium acetate process), 3.7; aluminum sulphate, 7.4; caustic soda (lime process), 9.6; nitric acid (ammonia process), 5.0; nitric acid (niter process), 2.5; soda ash, 12.1; sulphuric acid (chamber process), 7.7; sulphuric acid (contact process), 8.5; and trisodium phosphate, 7.5.

⁹The unit-value weights were computed from Census statistics; the unit man-hour requirements were determined from *Chemical and Metallurgical Flow Sheets of Process Industries* (2d ed.; New York: McGraw-Hill Book Co., Inc.). The latter relate to direct labor only for all products but acetic acid and soda ash, in which cases they include maintenance and maintenance and repair labor, respectively. No indication is given of either the date of reference or the method of derivation of the basic yield and labor-time factors. The man-hour weights, based on specified processes, may not be strictly comparable with unit values, which are averages for all processes. Although several synthetic processes are in use, the labor requirements for ammonia and nitric acid refer to only 1; and the labor weights for caustic soda, carbon dioxide, and hydrochloric, phosphoric, and sulphuric acids are averages for more than 1 process weighted by estimated or reported production by each. Adjustments had to be made for the excluded byproducts of hydrochloric and stearic acids and vanillin. The weight for electrolytic chlorine was determined by distributing the total man-hours equally between the indicated yields of chlorine and caustic soda.

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[con.]

Product	Unit	Percentage distribution	
		Unit man-hour requirements	Unit values
Chlorine, electrolytic	lb.	0.02	0.01
Glycerin, refined	lb.	0.01	0.04
Hydrochloric acid	ton	14.95	16.16
Nitric acid, synthetic	ton	10.35	32.02
Oxygen	M cu. ft.	0.72	2.53
Phosphoric acid	lb.	0.003	0.02
Soda ash	ton	7.67	5.74
Sodium silicate	ton	11.50	3.67
Stearic acid	lb.	0.07	0.03
Sulphur dioxide	lb.	0.01	0.01
Sulphuric acid	ton	4.22	2.29
Trisodium phosphate	ton	30.67	15.46
Vanillin	lb.	0.19	1.53

Indexes constructed with the 2 sets of weights¹⁰ are not only very similar to each other but also resemble the NRP series in most years:

Year	NRP production index	18-product production index with -	
		Man-hour-requirement weights	Unit-value weights
1919	49.1	48.3	47.4
1921	38.4	38.4	37.9
1923	65.9	61.7	60.5
1925	65.7	67.9	66.8
1927	74.8	77.0	74.2
1929	100.0	100.0	100.0
1931	77.9	82.5	81.5
1933	79.6	85.1	84.1
1935	93.9	96.1	95.3

Two more indexes were constructed to test the relationship between total production and production for sale and transfer. These indexes, which were derived from comparable unit-value-

¹⁰The production of synthetic ammonia, synthetic nitric acid, and electrolytic chlorine had to be estimated from Census quantities, which embrace all processes. The first 2 were determined by application of the proportions of synthetic chemical nitrogen to all nitrogen as reported in the Tariff Commission's *Chemical Nitrogen* (Rep. No. 114, 2d series, 1937); the third, by the application of the ratio of joint chlorine and caustic-soda yields to the production of electrolytic caustic soda.

weighted aggregates of 6 to 14 important chemicals,¹¹ indicate that the NRP series closely represents the movement of total production although it is based on production for sale and transfer.

Year	Index of total production	Index of production for sale and transfer
1919	52.1	50.3
1921	38.5	39.0
1923	65.6	67.7
1925	71.4	72.6
1927	76.7	77.8
1929	100.0	100.0
1931	78.2	79.4
1933	90.1	89.5
1935	104.6	105.3

Despite the similarity of several of the indexes presented above, the various types of chemicals differ in movement. As might be expected, the heavy acids and bases, which occupy a strategic position in many industrial processes and in the manufacture of other chemicals, cluster about the summary production index; but other products, like gases, register a sharper rise over the period, while some, like pyroxylin, even decline. The most exceptional behavior, however, is exhibited by the synthetic substances. For example, the output (poundage) of synthetic or organic compounds of non-coal-tar origin - represented by butyl alcohol, butylacetate, carbon bisulphide, carbon tetrachloride, ether, ethyl acetate, etc. - multiplied almost 50 times between 1921 and 1935, while the composite increased but 1½ times;¹² in the same period the production of coal-tar resins, which are used in molded plastics, expanded even more rapidly.¹³

Product	Production relatives (1929=100)			
	1919	1921	1923	1935
Acids and bases				
Hydrochloric acid	76	49	79	87
Nitric acid	55	24	64	76
Sulphuric acid	53	48	80	76

[Con.]

¹¹The 14 products are dilute acetic acid, aqua ammonia, aniline oil, carbon bisulphide, caustic soda, chlorine, ether, hydrochloric acid, mixed sulphuric-nitric acid, naphthalene, nitric acid, phosphoric acid, soda ash, and sulphuric acid.

¹²Furthermore, sales of synthetic organic chemicals represented about 11 percent of the value of production for sale for the whole industry in 1933, although they accounted for but 1 percent in 1921.

Footnote 13 appears on following page.

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[Con.] Product	Production relatives (1929=100)			
	1919	1921	1923	1935
Caustic soda	42	32	59	99
Soda ash	57	43	69	103
Gases				
Acetylene	32	30	54	118
Carbon dioxide	44	40	37	64
Chlorine	12	20	26	143
Ammonia	15	12	14	80
Pyroxylin	n. a.	n. a.	141	79
Synthetic organic chemicals	n. a.	4	17	195
Synthetic coal-tar resins	9	5	30	275

Employment and Man-hours

Census wage-earner statistics were utilized in the derivation of employment relatives for odd-numbered years of the period 1919-35. Because of changes in industry definition the figures shown for "Chemicals, Not Elsewhere Classified" had to be adjusted to exclude rayon workers in 1919-23¹⁴ and to include the wage earners engaged in the manufacture of compressed and liquefied gases in 1927-35.¹⁵ The final Census employment relatives were then interpolated by means of the BLS index, which is available only for 1923-25 and 1929-36, and NICB segments for 1920-23 and 1925-29.

The man-hours index was computed from the products of the completed employment index and an annual series of average actual hours worked per week derived from 3 NICB publications: *Wages, Hours, and Employment in the United States: 1914-1936* for 1920-35, *Wartime Changes in Wages* for 1919, and the supplement to the monthly issues of the *Conference Board Service Letter* for 1936. Since there was reason to believe that the sample canvassed in the second study would give a more reliable estimate of hourly wages than of weekly hours, the latter figure was computed by successive division of Census total annual wages by NICB average hourly wages and of the resulting quotient (total annual man-hours) by 52 times the average number of wage earners.

¹³The tabulation is based on Census statistics for all products but synthetic organic chemicals and resins, the figures for which were obtained from the Tariff Commission's *Census of Dyes and of Other Synthetic Organic Chemicals*.

¹⁴The number of wage earners engaged in rayon production in 1923 was reported in *Commerce Yearbook: 1932* (U. S. Dept. Com., Bur. For. and Dom. Com.), I, p. 423, which cites the Census as source. Estimates for 1919 and 1921 were made on the assumption of the average biennial rate of change in output per wage earner for the period 1923-29.

¹⁵The Census itself made a third necessary adjustment - the addition of wage earners in the Sulphuric, Nitric, and Mixed Acids industry in 1919-25.

The production and labor indexes are not precisely comparable in scope. The former includes the quantities of various chemicals made as secondary products of other industries (about 7 to 10 percent of the estimated value of all chemicals made for sale or transfer); the latter include wage earners and man-hours devoted to the production of secondary nonchemical products of the Chemicals industry (about 3 to 8 percent of the estimated total value of the industry's output for sale or transfer).

Table 12.- SUMMARY INDEXES FOR THE CHEMICALS INDUSTRY: 1919-36
(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	49.1	111.2	118.2	44.2	41.5
1920	60.5	90.0	87.9	67.2	68.8
1921	38.4	64.2	63.7	59.8	60.3
1922	52.3	82.1	86.7	63.7	60.3
1923	65.9	95.8	101.2	68.8	65.1
1924	58.9	89.3	92.5	66.0	63.7
1925	65.7	88.3	92.5	74.4	71.0
1926	72.9	86.3	86.0	84.5	84.8
1927	74.8	84.7	84.0	88.3	89.0
1928	81.8	90.0	89.5	90.9	91.4
1929	100.0	100.0	100.0	100.0	100.0
1930	86.7	91.4	86.1	94.9	100.7
1931	77.9	78.3	69.1	99.5	112.7
1932	66.9	69.7	56.3	96.0	118.8
1933	79.6	85.3	66.2	93.3	120.2
1934	85.8	106.2	81.1	80.8	105.8
1935	93.9	106.2	82.8	88.4	113.4
1936	106.0	113.3	89.7	93.6	118.2

13. CLAY PRODUCTS (OTHER THAN POTTERY)
AND NONCLAY REFRACTORIES¹

This industry, which employed about 93,000 wage earners in 1929, embraces establishments engaged primarily in the production of brick, draintile and other tile, sewer pipe, stove lining, terra-cotta products, and other refractories, both clay and non-clay. Most of these establishments are located near claypits and extract the clay they consume in manufacture.

In the period 1919-29 this industry had a higher ratio of wages to value of production - about 37 percent - than any other included in this study. During the recent depression, however, it was surpassed by a few others, though its ratio still ranged from 29 to 35 percent.

Production

The measure of production is composed of 3 segments, each of which is an aggregative index computed from annual Census quantity statistics and 1929 unit-value weights.² The first segment, containing 15 classes of products, extends from 1919 to 1923; the second, 21 classes (the preceding 15 with 6 additions), from 1923 to 1933;³ and the last, 20 classes (the preceding 21 with the omission of "enameled brick"), from 1933 to 1936. The items entering into the first 2 segments are, respectively, the first 15 and all 21 of the following:

Common brick	Enameled brick
Fire brick and clay brick, block, or tile	Draintile
Face brick	Vitrified brick or block (for paving)
Sewer pipe	Roofing tile
Hollow building tile	Floor tile
Silica brick	Ceramic mosaic
Architectural terra cotta	Vitrified brick or block (other than for paving)
Wall tile	

¹This industry will, for brevity, be designated "Clay Products." It should not be confused, however, with the Census subgroup of the same name which includes pottery. This short title will also be applied to the industry's products.

²In even-numbered years the Census apparently covers only production in the Clay Products industry; but in the remaining years, it includes secondary clay-product output of other industries. The effect on comparability is negligible, for secondary production in odd-numbered years accounted consistently for less than 1 percent of the value of clay products.

The data for even-numbered years are republished in the biennial *Census of Manufactures* from the Census Bureau's annual *Clay Products (Including Pottery), Nonclay Refractories, and Sand-Lime Brick: Production and Stocks*.

³The 21-product index is almost identical with a 26-product index of only slightly higher value coverage which could be constructed for the period 1927-33.

Enameled and faience tile	Stove lining
Clay sold (raw or prepared)	Magnesite and chrome brick
Aluminum brick	Refractory cement

Labor expense in this industry comprises about one-third of the value of production. The magnitude of this ratio and, in addition, the similarity of raw materials and processes for the various products favor the assumption that unit-value weights are proportional to unit labor requirements. That this is actually so is indicated by the results of a BLS study of man-hour requirements and by Census wage-earner, value, and quantity statistics for establishments classified according to major product. Unit values and unit wage-earner and man-hour requirements - expressed as percentages of their respective totals - show strikingly similar distributions. The tabulation based on Census material follows:⁴

Establishments whose major product was -	Percent of total					
	1925		1927		1929	
	Wage earn- ers per unit	Value per unit	Wage earn- ers per unit	Value per unit	Wage earn- ers per unit	Value per unit
Common brick	6.0	5.2	6.1	5.6	6.4	5.6
Face brick	9.5	8.2	10.3	8.7	10.5	8.9
Terra cotta	51.3	55.7	49.3	53.4	47.5	54.4
Hollow building tile	3.1	3.0	3.4	3.3	3.9	3.9
Roofing tile	7.0	7.9	6.6	7.5	6.6	5.6
Floor, ceramic-mosaic, enameled, faience, and wall tile	0.2	0.1	0.1	0.2	0.2	0.2
Vitrified brick or block	11.0	10.3	11.5	10.8	11.2	10.8
Drain tile	4.7	3.3	4.7	3.8	4.7	3.9
Sewer pipe	7.2	6.2	7.9	6.9	9.1	6.6

BLS man-hour requirements, which relate to 1935, have a distribution pattern (percent of total) similar to Census unit-value weights despite differences in scope:⁵

⁴Although the quantity units for the various products differ (e.g., thousands, tons, and square feet), they remain identical for each product in all 3 years.

⁵The 7 products covered by the BLS study (B. H. Topkis, "Labor Requirements in the Production of Clay Products," *Monthly Labor Review*, December 1937, pp. 1391-1410) account for about 40 percent of the output of the Clay Products industry. The BLS survey includes all departments from clay digging to loading but excludes delivery. The Census probably includes truckers when reported on the pay roll. BLS shows separate labor requirements for machine-molded and hand-molded face brick, but since most are probably of the former variety, the ratio for machine-molded brick only was considered equivalent to the Census figure. Again, the BLS ratio for paving brick refers to but 1 variety, 10-pound, while the Census figure is an average for all. The method used by BLS in allocating man-hours to different products in plants making more than 1 product, if any such plants were surveyed, is not clear from the published article.

Product	Percent of total		
	Man-hours per unit in 1935	Value per unit in -	
		1929	1935
Common brick	9.2	8.2	9.1
Face brick	12.7	13.0	13.3
Paving brick	16.7	16.8	21.6
Structural tile	4.4	5.5	5.4
Floor tile	20.4	18.3	13.0
Wall tile	23.7	28.5	26.0
Sewer pipe, wall coping, flue lining	12.7	9.6	11.6

The items in the production index comprise from 83 to 97 percent of the value of all clay products. The percentage tends to diminish, particularly after 1929, but this tendency may reflect not only an increase in output of products excluded from the index (e. g., "fire-clay special shapes", "other clay products", and "other nonclay refractories") but also a relative contraction of the average unit value of the included products.⁶ Adjustment of the production index by division by an index of value coverage - which attributes the whole decline in coverage solely to a rise in the volume of excluded output - would ultimately result in somewhat higher estimates of productivity after 1929:

Year	NRP produc- tion index	Value- adjusted production index	Year	NRP produc- tion index	Value- adjusted production index
1919	67.1	65.5	1928	102.6	101.3
1920	73.6	71.0	1929	100.0	100.0
1921	61.6	60.2	1930	72.9	73.2
1922	80.3	79.5	1931	47.6	48.8
1923	104.4	100.0	1932	32.3	23.4
1924	99.7	97.0	1933	25.3	27.1
1925	109.8	106.5	1934	26.8	28.6
1926	111.2	108.7	1935	35.9	40.0
1927	108.3	106.9	1936	54.1	58.9

Employment and Man-hours

The employment index is based on the BIS series for 1923-36, on the Census wage-earner totals for 1919 and 1921, and on in-

⁶Although the relative unit values of the included products are stable, the same may not be true for all products of the industry. The general upward movement of the value of excluded products, coupled with the decline in the production index, appears, nevertheless, to represent largely an expansion of output.

terpolation by means of the BLS index for the Stone, Clay, and Glass group for 1920 and 1922.⁷

The man-hours index was obtained by the deflation of pay rolls by average hourly earnings. The former series was constructed from the BLS pay-rolls index for 1923-36, from Census wages for 1919 and 1921, and from the products of value and interpolated ratios of wages to value in 1920 and 1922.⁸

The earnings series is based largely on average hourly earnings computed from data collected by NRP in cooperation with NBER from about 80 brick and tile plants.⁹ A national average was computed for odd-numbered years by dividing the median of average plant earnings¹⁰ in each of 5 regions (which together comprised about one-third of the 48 States) into corresponding regional pay rolls cumulated from Census (State) wages and then dividing the aggregated quotients into the sum of the regional pay rolls. It should be noted that this procedure is consistent with the fact that hourly rates vary by region rather than by product.

The next problem was to complete the earnings series. The first step was to determine the ratio, in each odd-numbered year, of the simple average of regional medians to the computed national average described above; the ratios for the even-numbered years were then obtained by straight-line interpolation; and finally, the interpolated ratios were applied to the simple averages of regional medians in intercensal years.

The earnings series, now continuous, was adjusted to the level of the BLS figures for the whole industry on the basis of the

⁷In 1931 the Census combined the Crucibles and Clay Products industries. (The value of products of the former is not more than 1 percent of the total for both.) Because of the small number of wage earners in the Crucibles industry (e. g., only 321 in 1929, or 0.3 percent of the combined total), an adjustment for internal comparability would have altered the employment index (to the nearest unit) in but 1 year, 1919.

⁸The ratios in census years 1919-27 were remarkably stable. The large wage content of value, which has already been mentioned, makes such a basis for interpolation dependable.

⁹The results of the NRP-NBER survey are summarized in a report by M. E. West, *Productivity and Employment in Selected Industries: Brick and Tile* (WPA National Research Project in cooperation with National Bureau of Economic Research, Report No. N-2, 1939). The survey was confined to 5 products, which are shown here with the percentages of national production of each represented by the sample: Common brick, 5-13; face brick, 2-8; vitrified brick, less than .2 to 1925 and over 20 thereafter; draintile, 2-5; and hollow tile, 0.1 from 1919 to 1927 and about 7 thereafter.

The earnings sample includes about 70 plants in 1929 and later years but only 18 in 1919, 34 in 1925, and 56 in 1928. In 1935 the plants in the sample contributed about 5 percent of the estimated total man-hours in the industry as defined by the Census.

¹⁰In 1 region the sudden increase in the size of the sample from 1928 to 1929 necessitated an adjustment of the earlier medians to the level indicated by the larger sample. Since the number of plants canvassed increased gradually in other regions, similar adjustments were not required.

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average relationship between the 2 series in 1932-35.¹¹ Although the absolute BLS earnings are greater, the relationship is so stable that the trends of the 2 series in these years are practically identical.

It is of interest to compare the NRP man-hours index with another obtained without resort to field-survey data. The latter is based on the NRP employment series; adjusted Census prevailing weekly hours for 1919, 1921, 1923, and 1929;¹² and BLS actual weekly hours for 1932-36:

Year	NRP man-hours index	Man-hours index based on employment and adjusted weekly hours	Year	NRP man-hours index	Man-hours index based on employment and adjusted weekly hours
1919	84.1	80.9	1928	99.7	101.3
1920	90.4	86.7	1929	100.0	100.0
1921	76.8	71.6	1930	72.3	70.5
1922	96.1	93.0	1931	45.9	43.3
1923	114.3	112.5	1932	24.7	23.7
1924	115.3	110.0	1933	25.3	23.6
1925	117.5	111.8	1934	30.6	28.7
1926	117.9	114.0	1935	37.6	36.7
1927	111.0	109.2	1936	55.1	53.9

Productivity

Separate Census data for 9 branches of the industry permitted the construction of subindexes of wage-earner productivity for comparison with the NRP composite in the period 1925-29. In computing these relatives, the assumption was made that all the labor expended in each branch could be imputed solely to the fabrication of the major product; the errors resulting from this oversimplification are believed to be negligible.

¹¹Absolute average hourly earnings computed from BLS Bull. No. 265 and No. 356 compare as follows with the adjusted NRP figures for 1919 and 1922:

Year	BLS	NRP
1919	\$0.460	\$0.456
1922	.430	.465

(The 2 figures for 1919 refer to brick and tile establishments. In this year the selected full-time pay rolls examined by BLS included 1,773 workers, or about 2 percent of the total. The BLS canvass in 1922 was restricted to common-brick plants which employed 5,076 wage earners.)

¹²After completion of the prevailing-hours series by straight-line interpolation, the figures for 1919-21 and for 1922-29, respectively, were reduced to actual hours by multiplication by 0.84 and 0.89, ratios computed from BLS Bull. No. 265 and No. 356 (see fn. 11). The ratio for 1919 is based on BLS actual and Census prevailing hours; for 1922, on BLS data only. In the latter year BLS prevailing hours were higher than interpolated Census prevailing hours. The ratio 0.84 is doubtless too high in view of the fact that the 1919 study excluded part-time pay rolls.

CLAY PRODUCTS

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Branch	Index of output per wage earner (1929=100)	
	1925	1927
	Entire industry (NRP)	99.7
Common brick	101.8	105.3
Face brick	105.0	101.4
Floor, ceramic, and wall tile	118.5	117.9
Hollow building tile	116.1	113.2
Sewer pipe	118.6	114.9
Terra cotta	87.1	96.8
Vitrified brick	95.4	96.9
Drain tile	93.3	99.7
Roofing tile	89.1	100.0

Table 13.- SUMMARY INDEXES FOR THE CLAY PRODUCTS (OTHER THAN POTTERY)
AND NONCLAY REFRACTORIES INDUSTRY: 1919-36

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	67.1	82.4	84.1	81.4	79.8
1920	73.6	88.6	90.4	83.1	81.4
1921	81.6	73.7	76.8	83.6	80.2
1922	80.3	90.5	96.1	88.7	83.6
1923	104.4	109.9	114.3	95.0	91.3
1924	99.7	107.9	115.3	92.4	86.5
1925	108.8	110.1	117.5	99.7	93.4
1926	111.2	112.5	117.9	98.8	94.3
1927	108.8	108.2	111.0	100.1	97.6
1928	102.6	100.9	99.7	101.7	102.9
1929	100.0	100.0	100.0	100.0	100.0
1930	72.9	78.9	72.3	92.4	100.8
1931	47.6	54.8	45.9	86.7	103.7
1932	22.9	34.8	24.7	64.1	90.3
1933	25.3	34.2	25.3	74.0	100.0
1934	26.8	42.1	30.6	63.7	87.6
1935	35.9	47.8	37.6	75.1	95.5
1936	54.1	60.0	55.1	90.2	98.2

14. COKE GROUP
 15. BEEHIVE COKE
 16. BYPRODUCT COKE

The Coke group, which employed 21,700 wage earners in 1929, includes all establishments engaged in the high-temperature carbonization of coal in beehive or byproduct coke ovens. In conformity with the practice of the Bureau of Mines, these establishments, which produced about 95 percent of the total tonnage of coke, are classified in the Beehive Coke industry or the Byproduct Coke industry according to the type of oven they operate. The Coke group, as here defined, includes the Census industry "Coke, Not Including Gas-House Coke" and the byproduct plants of city gas companies, which are classified by the Census in the Manufactured Gas industry.¹

A complete reversal in the relative importance of the Beehive Coke and Byproduct Coke industries has taken place since 1900. In that year the former accounted for 95 percent of the group's coke production and the latter for 5 percent; in 1919 the percentages were 43 and 57, respectively, and by 1935, 3 and 97. The Beehive Coke industry employed 45 percent of the group total of 30,600 wage earners in 1919, 12 percent of the group total of 21,700 in 1929, and only 5 percent of the 18,400 in the group in 1935. The number of beehive ovens, furthermore, declined from almost 83,000 in 1919 to about 13,000 in 1936, while the number of byproduct ovens rose from 10,000 to almost 13,000. In the same interval, the production of byproduct coke advanced 77 percent and the output of beehive coke declined 91 percent.

Production

Coke Group.— The 2 NRP production indexes for the Coke group are harmonic means of the relatives for the component industries. One of these indexes, with changing employment weights, was used in determining output per wage earner; the other, with changing man-hour weights, was used in determining output per man-hour. The NRP indexes compare as follows with arithmetic means of the

¹City gas plants have accounted for the following percentages of the total output of byproduct-oven coke:

1919	4.9	1929	6.1
1922	2.3	1932	14.6
1925	2.8	1936	8.1

production relatives for the component industries weighted by 1929 employment and man-hours:

Year	Index of production with -			
	Changing weights		Fixed weights (1929)	
	Employment	Man-hours	Employment	Man-hours
1919	75.1	66.6	76.7	71.7
1921	42.1	41.1	42.7	41.8
1923	93.7	89.0	98.0	93.3
1925	86.3	85.1	86.9	84.9
1927	85.7	85.4	85.9	85.4
1929	100.0	100.0	100.0	100.0
1931	54.3	56.3	56.1	57.0
1933	43.7	45.4	46.1	46.9
1935	54.9	57.3	57.9	59.0

Beehive Coke.— The index of production for this industry is based on the aggregate quantities of coke produced and the coke equivalent of recovered breeze (i. e., the difference between breeze production and waste); these 2 products represent the total output of the industry. The Bureau of Mines reports annual statistics of coke and breeze production for the period 1919-36 and of breeze waste for the period 1922-36;² the quantity of breeze waste prior to 1922 was estimated on the basis of the ratio in this year between breeze waste and breeze production. The amounts of recovered breeze were converted to coke equivalents by means of the ratio (0.877) between the thermal values of a ton of breeze and a ton of coke.³ In no year of the period 1919-36 did the coke equivalent of recovered breeze exceed 4.5 percent of the aggregate tonnage of coke and coke equivalent.

Byproduct Coke.— The index of production for this industry is based on the aggregate quantities of coke produced and the coke equivalents of recovered breeze, recovered coke-oven gas (i. e., the difference between gas production - including consumption in heating ovens - and waste), tar, and light oil; these products represent about 95 percent of the value of the industry's output. The Bureau of Mines provided the necessary statistics for all years of the period 1919-36 except for breeze waste for 1919 and

²The Bureau of Mines series are published in annual issues of *Mineral Resources of the United States*, Part II (1919-31) and *Minerals Yearbook* (1932-37). Breeze consists of screenings and pulverized substandard coke which contains ash and other impurities.

³The Bureau of Mines considers 20,000,000 B. t. u. the typical thermal content of a ton of breeze; the thermal content of a ton of coke was fixed at 22,800,000 B. t. u. after a study of various published and unpublished statistics.

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1920;² the quantities of such waste were estimated for these 2 years on the assumption that the 1921 ratio of breeze waste to breeze production was applicable. The coke equivalents of the several byproducts were determined in the same manner as the equivalent of breeze produced in the Beehive Coke industry.⁴

Because of the predominance of coke over its byproducts and the stability of the relative yields,⁵ an index of coke production alone adequately indicates the movement of the Byproduct Coke industry's output. Such an index never differs by more than 1 unit from the NRP series:

Year	NRP production index	Index of byproduct-coke output
1919	46.8	47.1
1921	36.9	37.0
1923	70.2	70.4
1925	74.7	74.7
1927	82.5	82.2
1929	100.0	100.0
1931	61.6	60.6
1933	50.6	49.9
1935	64.2	64.1

An aggregative index including the same products as the NRP index but with average unit-value weights (1919-36)⁶ is even closer; the maximum difference is only 0.3 units:

Year	NRP production index	Value-weighted production index
1919	46.8	47.1
1921	36.9	37.0
1923	70.2	70.1
1925	74.7	74.7
1927	82.5	82.5

[Con.]

⁴The thermal values assumed for coke and coke breeze are shown in ft. 3. The B. t. u. values of the other products are reported by the Bureau of Mines as follows: Coke-oven gas, 550 per cubic foot; tar, 150,000 per gallon; and light oil, 130,000 per gallon.

⁵The yields of coke and its byproducts are as follows:

Product	Yield per ton of coal charge		
	1919	1929	1936
Coke, lbs.	1,402	1,392	1,409
Breeze, lbs.	103	126	113
Gas, cu. ft.	1,159	1,098	1,108
Tar, gals.	8.06	8.87	8.86
Light oil, gals.	2.58	2.61	2.69
Ammonia (sulphate and equivalent), lbs.	20.82	22.31	22.14

⁶The weights, like the production series, were derived from Bureau of Mines data.

[con.]	Year	NRP production index	Value-weighted production index
	1929	100.0	100.0
	1931	61.6	61.6
	1933	50.6	50.5
	1935	64.2	64.5

Employment and Man-hours

The NRP group indexes of employment and man-hours are based on the corresponding totals for the 2 component industries.

The employment index for the Beehive Coke industry was computed for the odd-numbered years 1919-31 from Census wage-earner statistics for beehive ovens;⁷ it was completed for the period 1919-36 by means of relatives of man-shifts reported by the Bureau of Mines.⁸

The wage-earners index for the Byproduct Coke industry was computed for the odd-numbered years 1919-31 from Census statistics for byproduct ovens⁷ after adjustment to include employment at the byproduct ovens owned by city gas companies; the adjustment was made on the assumption that the output (in terms of aggregate coke equivalents) per wage earner in the entire industry is the same as at the byproduct ovens represented in the Census statistics. Employment in 1933 and 1935 was computed by subtracting the estimates for the Beehive Coke industry (based on the NRP index and the 1929 Census figure) from the Census totals for byproduct and beehive ovens and then adjusting the differences (on the assumption stated above) to include wage earners at byproduct ovens operated by city gas companies. The employment series was completed for the period 1919-36 by means of comparable Bureau of Mines figures for man-shifts.⁸

The NRP indexes of man-hours for the Beehive Coke and Byproduct Coke industries are relatives of the corresponding Bureau of Mines figures, which are based on plant reports of man-hours, man-shifts, and prevailing hours per shift.⁹

⁷The Census of Manufactures provides separate employment figures for the 2 branches of the Coke, Not Including Gas-House Coke industry - viz, beehive ovens and byproduct ovens - for the odd-numbered years 1919-31 only.

⁸Statistics for man-shifts worked by all the wage earners in each of the 2 industries are published in *Coke-Oven Accidents in the United States* (annual series, 1930-34) and in *Accidents at Coke Ovens During 1936*.

⁹The 2 man-hours series are published in *Accidents at Coke Ovens During 1936*.

Table 14.- SUMMARY INDEXES FOR THE COKE INDUSTRY GROUP: 1919-38

(1929 = 100)

Year	Production (employment weights)	Employment	Output per wage earner	Production (man-hour weights)	Man-hours	Output per man- hour
1919	75.1	140.8	53.3	66.6	124.1	53.7
1920	82.0	158.4	51.8	75.6	135.2	55.9
1921	42.1	76.1	55.3	41.1	63.9	64.3
1922	64.1	97.9	65.5	61.3	82.6	74.2
1923	93.7	134.2	69.8	89.0	104.7	85.0
1924	73.4	99.8	73.5	72.0	81.6	88.2
1925	86.3	109.1	79.1	85.1	95.8	88.8
1926	95.1	108.4	87.7	93.9	96.8	97.0
1927	85.7	101.0	84.9	85.4	91.5	93.3
1928	87.4	89.3	97.9	87.9	85.1	103.3
1929	100.0	100.0	100.0	100.0	100.0	100.0
1930	78.6	91.5	85.9	80.1	87.9	91.1
1931	54.3	74.0	73.4	56.3	70.0	80.4
1932	35.1	58.3	60.2	36.5	52.2	69.9
1933	43.7	67.9	64.4	45.4	58.5	77.6
1934	51.1	83.6	61.1	53.1	67.4	78.8
1935	54.9	84.7	64.8	57.3	64.3	89.1
1936	74.0	101.9	72.6	76.4	77.5	98.6

Table 15.- SUMMARY INDEXES FOR THE BEEHIVE COKE INDUSTRY: 1919-38

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	286.9	508.7	426.8	56.4	67.2
1920	310.7	477.6	397.9	65.1	78.1
1921	83.8	135.1	111.8	62.0	75.0
1922	129.8	234.6	188.7	55.3	68.8
1923	293.3	354.7	281.1	82.7	104.3
1924	157.6	181.2	155.5	87.0	101.4
1925	172.8	207.6	199.3	83.2	86.7
1926	190.2	193.6	189.1	98.1	100.6
1927	110.1	121.4	120.0	90.7	91.8
1928	69.0	89.5	89.7	77.1	76.9
1929	100.0	100.0	100.0	100.0	100.0
1930	42.8	64.2	56.4	66.7	75.9
1931	17.2	31.1	24.4	55.3	70.5
1932	10.3	24.5	19.0	42.0	54.2
1933	14.1	53.0	24.8	42.7	56.9
1934	15.8	34.0	22.4	46.5	70.5
1935	14.0	32.0	20.8	43.8	67.3
1936	26.1	45.5	29.5	57.4	88.5

COKE GROUP

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Table 16.- SUMMARY INDEXES FOR THE BYPRODUCT COKE INDUSTRY: 1919-38
(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	46.8	86.5	89.1	52.9	52.5
1920	56.8	113.0	104.9	50.3	54.1
1921	36.9	67.7	58.4	54.5	63.2
1922	52.7	78.5	70.4	67.1	74.9
1923	70.2	102.6	84.3	66.3	63.3
1924	63.5	86.2	73.1	72.0	66.9
1925	74.7	95.1	83.6	78.5	69.1
1926	83.2	96.2	86.2	80.5	90.5
1927	82.5	96.1	86.2	84.1	93.5
1928	90.9	89.3	84.5	101.8	107.6
1929	100.0	100.0	100.0	100.0	100.0
1930	85.4	95.4	91.6	89.5	93.2
1931	61.6	80.1	75.3	76.9	61.6
1932	40.5	63.1	56.0	64.2	72.3
1933	50.6	72.9	62.3	69.4	61.2
1934	56.0	90.7	72.6	63.9	79.9
1935	64.2	92.2	69.3	69.6	92.6
1936	82.9	109.9	63.0	75.4	99.9

17. CONFECTIONERY

The establishments in this industry, which employed 63,500 wage earners in 1929, are engaged primarily in the manufacture of candy, confections, popcorn balls and cakes, salted nuts, stuffed dates, and similar products. The industry excludes establishments manufacturing chewing gum or chocolate.¹

Production

Census statistics for the following 11 products (accounting for over 75 percent of the value of all confectionery production) were weighted by their respective unit values in 1929 and combined into an aggregative index for the odd-numbered years of the period 1927-35:

Chocolates ¹	*Hard candy
*Fancy	Caramels and chewing
*Bulk	candy
Count	Gum work
Bars	*Pan work
*Chocolate-covered	Marshmallows
*Other kinds	Lozenges

The index number for 1925 was derived from comparable aggregates in 1925 and 1927 for 6 of the above products (indicated by asterisks). No Census data are available for years prior to 1925.

Census quantity statistics represent confectionery production in all industries, except in 1925 and 1927, when not only was the canvass restricted to the Confectionery industry, but some establishments failed to report in detail. An internally comparable biennial series for the period 1925-35 was obtained by adjusting the aggregates of the weighted quantities for 1925 and 1927 on the basis of the proportion of the total value of confectionery made in all industries produced by establishments reporting in detail.

Figures collected and published by the Bureau of Foreign and Domestic Commerce were used to complete the production series for 1925-36 (except 1932).² The Bureau tabulated the quantity

¹Chocolates (i. e., chocolate-covered candies other than chocolate-covered bars) are normal products of the Confectionery industry and should not be confused with chocolate, which is manufactured in the Chocolate and Cocoa Products industry. The latter classification also includes the chocolate departments operated by confectionery manufacturers for the production of coatings for their own use.

²The statistics, collected "in cooperation with the National Confectioners' Association, the National Wholesale Confectioners' Association, the Associated Retail Confectioners of the United States, local confectionery associations, and the trade press", are published in *Confectionery Distribution in the United States*.

and value of 9 types of "candy"³ sold by identical establishments⁴ within each of the following series of years: 1925-28, 1927-29, 1929-30, 1933-34, 1934-35, and 1935-36. Since the number of establishments canvassed by the Bureau of Foreign and Domestic Commerce varied from survey to survey, it was necessary to construct a chain (aggregative) index of the physical volume of sales. Each product was weighted by its value per pound in 1929. The resulting sales series for 1925-30 and 1933-36, which compared favorably in trend with the index for census years, was used to complete the latter.

The index number for 1932 was interpolated by means of estimates of total poundage of confectionery output reported by the Corn Industries Research Foundation.⁵

Employment and Man-hours

The index of employment, which conforms to Census trend, was constructed by BLS. The man-hours index was obtained from the product of this employment series and an index of average weekly hours based on Census prevailing hours for 1923 and 1929, on BLS actual hours for 1932-36, and on estimates for the remaining years obtained by straight-line interpolation.

It will be recalled that the production index refers to confectionery made in all industries. Employment and man-hours, on the other hand, correspond only to production within the Confectionery industry - and even some of this labor is devoted to secondary products. The resulting lack of comparability, however, is negligible.

³"Candy" includes certain items classified by the Census in the Chocolate and Cocoa Products industry; "confectionery" as defined by the Census includes certain specialty goods not considered in the sales surveys.

The 9 types of "candy" are: Plain package goods, fancy package goods, chocolate bulk candy, other bulk candy, molded chocolate candy bars, chocolate-covered candy bars, other candy bars, 5- and 10-cent packages, and penny goods. Subsequent to the first survey, some of the items which had been included under "chocolate-covered bars" were classified as "molded bars."

⁴These establishments, evidently the larger ones in the industry, contributed approximately the following percentages of the total value of "commercial production":

1925-28	80	1933-34	75-80
1927-29	87	1934-35	75
1929-30	86	1935-36	70

⁵*International Confectioner*, March 1937, p. 22. The totals for 1931 and 1933 were read from a bar graph; the actual total was shown for 1932.

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Table 17.- SUMMARY INDEXES FOR THE CONFECTIONERY INDUSTRY: 1925-36

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1925	88.7	100.1	100.1	88.6	88.6
1926	100.8	104.0	104.0	98.9	96.9
1927	99.8	99.4	99.4	100.4	100.4
1928	95.9	97.2	97.2	98.7	98.7
1929	100.0	100.0	100.0	100.0	100.0
1930	96.8	90.6	85.1	106.8	113.7
1931	82.2	80.6	70.7	102.0	116.3
1932	75.7	73.5	60.0	103.0	126.2
1933	79.6	79.6	58.5	100.0	136.1
1934	90.5	81.2	58.2	111.5	155.5
1935	98.6	82.0	59.5	120.2	165.7
1936	106.3	79.3	61.9	134.0	171.7

18. COTTON GOODS

The Cotton Goods industry, which employed about 425,000 wage earners in 1929, embraces mills engaged primarily in any of the processes preparatory to the spinning, or in the actual spinning, of cotton yarn and in the weaving of cotton piece goods over 12 inches in width. Cotton goods of smaller width and cotton knit goods are treated by the Census as the principal products of other industries and hence are outside our definition.

Most of the national output is contributed by 2 regions, New England and the Cotton-growing States.¹ Since the war the former has been declining; the latter, however, has advanced steadily. In 1919 the 2 regions were practically equal in wage-earner employment and value of products; by 1935 the Cotton-growing States were thrice as important as New England in each respect. The regional shift in the production of woven goods (over 12 inches in width) is equally striking: in 1919 New England produced 45 percent of the national total and the Cotton-growing States 51; by 1935 the former contributed but 19 percent and the latter 78.

Production

The NRP index of national production was computed for the odd-numbered years of the period 1919-35 from weighted aggregates for the following 30 Census products in 1919-33 and for 26 of these (the 4 omissions are indicated by asterisks) in 1933-35; the weight for each is its unit value in 1929:

*Batting, wadding, and mattress felts	Lawns, nainsooks, cambrics, and similar muslins
*Bedspreads and quilts	*Mosquito netting and tarlatan
*Blankets	Napped fabrics
Corduroys	Numbered duck (except tire)
Cottonades and cotton worsteds	Ounce duck (except tire)
Cotton card laps, sliver, and roving produced for sale	Pillow tubing
Cotton table damask	Plushes, velvets, and velveteens
Cotton waste produced for sale	Print cloth
Cotton yarns produced for sale	Sheetings
Denims	Shirtings
Drills	Tapestries
Ginghams	Thread

¹The 6 New England States are Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont; the 14 Cotton-growing States are Alabama, Arkansas, California, Georgia, Kentucky, Louisiana, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia.

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Tickings	Towels, towelings, and wash cloths
Tire fabrics	Twills and sateens
Tobacco, cheese, butter, bunting, and bandage cloths	Twine

This index, which accounts for about 80 to 90 percent of the value of cotton goods, yarns, etc. made in all industries,² was completed for the even-numbered years of the period 1919-36 by means of the Federal Reserve index of raw-cotton consumption.

In an analogous manner, regional indexes for the New England and Cotton-growing States were also constructed from less detailed Census statistics for the odd-numbered years of the same period. The products entering into these 2 indexes account for about 70 to 85 percent of the value of cotton goods, yarns, etc. made in all industries. The 12 classes included in the main segment, 1919-33, were weighted by their respective unit values in 1929; and the 5 available for the shorter interval, 1933-35 (the reduction in the number of series represents consolidation, not a change in coverage), by average unit values for 1933 and 1935:

1919-33	1933-35
Woven goods (over 12 inches in width)	Woven goods (over 12 inches in width)
Sheetings	Cotton yarns produced for sale
Print cloth	Cotton waste produced for sale
Lawns, nainsooks, cambrics, and similar muslins	Cotton twine
Shirtings	Cotton cordage and rope
Twills and sateens	
Denims	
Napped fabrics	
Tire fabrics	
Bedspreads and quilts	
Other woven goods ³	
Cotton yarns produced for sale	
Cotton waste produced for sale	

Three other indexes of national production were constructed for comparison with the NRP series. Two of these are means of the

²Value coverage declined throughout the period, probably reflecting, in part, a decline in quantity coverage, too. The latter could not be appraised in any year, nor could any compensatory adjustment be made in the index, which may consequently overstate production somewhat in years prior to 1929 and understate it somewhat thereafter.

³In addition to other items, this class includes the following: Tobacco, cheese, butter, bunting, and bandage cloths; gingham; mosquito netting and tarlatan; drills; ounce duck (except tire); numbered duck (except tire); plushes, velvets, and velveteens; tapestries; corduroys; cotton table damask; draperies (except velvets and plushes); voiles; pajama checks, dimities, and similar fabrics; crepes; rugs (except bath mats); pillow tubing; bath mats; and terry-woven fabrics (except towels, towelings, wash cloths, and bath mats).

regional indexes - one harmonic with changing man-hour weights, the other arithmetic with 1929 man-hour weights. The third, which has about the same value coverage as the NRP national index and also employs 1929 unit values as weights, is based on a less refined classification (18 classes of products).⁴

Year	Index of production			
	NRP	Regional composite		18 products
		Harmonic mean	Arithmetic mean	
1919	85.2	81.6	89.4	80.5
1921	78.3	82.3	83.3	76.2
1923	99.6	102.9	101.8	97.0
1925	97.3	97.6	98.2	94.6
1927	104.9	104.8	104.8	102.5
1929	100.0	100.0	100.0	100.0
1931	73.4	74.1	74.1	74.8
1933	85.1	83.1	83.2	84.2
1935	76.7	74.4	73.8	75.2

Employment and Man-hours

The wage-earner indexes for the United States and for the 2 principal regions were computed for the odd-numbered years from Census statistics. The first of these was interpolated and extended to 1936 by means of the BLS employment index, but the other 2 were not completed for the even-numbered years since satisfactory regional series were not available.⁵ Each relative for 1935 (and hence for 1934 and 1936) is too low as a result of the Census' transfer of workers in dyeing and finishing departments of cotton mills (except those engaged in dyeing raw stock and yarn for use in the same plant) to the newly established

⁴The 17 products, in addition to "Other woven goods" (see fn. 3), are: Sheetings; print cloth; tire fabrics; shirtings; napped fabrics; twills and sateens; denims; plushes, velvets, and velveteens; towels, toweling, and wash cloths; drills; gingham; lawns, nainsooks, cambrics, and similar muslins; tickings; cottonades and cotton worsteds; cotton table damask; cotton yarns produced for sale; and cotton waste produced for sale.

⁵Annual NICB employment indexes are available for the North and the South (the latter only through 1929), but unlike the BLS index for the whole country, they do not conform to Census trend. Furthermore, the NICB and Census regions do not correspond precisely: The North includes 5 of the New England States, 3 Middle Atlantic States, and Illinois, while the South includes Maryland and 8 of the 14 Cotton-growing States. The NICB employment indexes compare as follows with those computed from Census statistics:

Year	North (NICB)	New England (Census)	South (NICB)	Cotton-growing States (Census)
1921	136	147	91	71
1923	149	154	108	87
1925	128	130	104	90
1927	121	123	115	103

industry category Dyeing and Finishing Cotton, Rayon, and Silk.⁶ Productivity, conversely, is overstated in each of these years by an indeterminable percentage.

The 3 man-hours indexes are, with the exception of 1919, relatives of the quotients of pay rolls and average hourly earnings. Like employment, wages were determined for the odd-numbered years 1919-35 from the *Census of Manufactures*; and, again, only the national series was completed by means of a BLS index.⁷

Average hourly earnings for the United States were supplied for the even-numbered years of the period 1920-30 by BLS studies;⁸ the figures for the odd-numbered years 1921-31 are unpublished BLS estimates based on the same studies and on supplementary information; and those for 1932-36 were furnished by the regular BLS canvass. The number of man-hours for 1919 was determined by multiplying national employment by estimated average actual weekly hours per man (i. e., by Census prevailing hours for 1919 adjusted by the average of the ratios for 1921 and 1923 of BLS-NICB actual to Census prevailing hours)⁹ and by the estimated average number of weeks in the year (i. e., by the average quotient for 1920-36 of NRP annual man-hours totals and corresponding weekly man-hours computed from Census employment and BLS-NICB actual hours per man per week).¹⁰

⁶An adjustment, however, was made for a minor lack of comparability - viz. the inclusion in the regional statistics for 1935 of workers in the Cotton Narrow Fabrics industry.

The total number of wage earners engaged in dyeing and finishing cotton fabrics in 1935 (48,319) could not be distributed between cotton mills and independent dyeing and finishing establishments. The uncorrected employment figure for the Cotton Goods industry is 569,062. As a consequence of this understatement in employment, relative output per wage earner for the United States as a whole is overstated in 1935 by not more than 11.8 percent.

⁷See ftn. 5. The pay-rolls indexes, like the employment series, are not in accord with those based on Census data (1929=100):

Year	North (NICB)	New England (Census)	South (NICB)	Cotton- growing States (Census)
1921	118	146	97	68
1923	157	187	121	87
1925	127	133	104	88
1927	122	130	120	106

⁸The results of the biennial BLS surveys are summarized in *Wages and Hours of Labor in Cotton-Goods Manufacturing: 1910 to 1930* (Bull. No. 539), p. 2. The number of wage earners covered by the several surveys varies from 14 to 25 percent of the total in the industry.

⁹The 2 ratios are 0.853 and 0.877. See ftn. 10 for description of BLS-NICB series.

¹⁰The average number of weeks is 50.6. The BLS-NICB average weekly hours series includes estimates for the even-numbered years 1920-30 derived from data in the BLS report (see ftn. 8), estimates for the odd-numbered years 1921-31 obtained by interpolation of these BLS figures by averages of NICB hours for the North and South weighted by employment in corresponding States (see following paragraph in text and ftn. 5), and figures for 1932-36 furnished by the regular BLS surveys.

The regional earnings, supplied by NICB for roughly comparable areas, were considered adequate for the purpose of computing man-hours indexes for census years.¹¹ The discontinuance of the NICB series for the South in 1929, however, necessitated the use of another method to estimate man-hours for this region in later years: Man-hours for the 2 regions combined were first determined on the assumption that their average relationship to the national totals for 1919-29¹² was applicable thereafter; the computed man-hours for New England were then deducted from the estimated regional sums. Man-hours for 1919 were computed in a manner similar to that employed in the derivation of the national figure for the same year.¹³

Productivity

In addition to the final productivity indexes it was possible to compute absolute output and input (consumption) per man-hour in the 2 chief regions:

Year	Output (lbs.) of woven goods, yarns for sale, and cotton waste per man-hour		Consumption (lbs.) of raw cotton, purchased cotton waste, and yarns per man-hour	
	Cotton-growing States	New England States	Cotton-growing States	New England States
1919	3.8	2.5	4.0	2.8
1921	3.9	2.1	n.a.	n.a.
1923	4.5	2.2	n.a.	n.a.
1925	4.1	2.3	4.3	2.6
1927	4.4	2.4	4.6	2.7
1929	4.7	2.6	4.9	2.8
1931	4.4	2.5	n.a.	n.a.
1933	5.0	2.8	n.a.	n.a.
1935 ¹⁴	5.4	3.1	n.a.	n.a.

¹¹NICB hourly earnings, being averages, should be more reliable than the NICB regional employment and pay-roll figures, which are totals; they should be influenced less by the size of the sample. In any case, other regional statistics (see *Monthly Labor Review*, May 1935 and January 1938) are less satisfactory since they are not continuous and refer only to the even-numbered years 1920-32 and to some selected months thereafter (the NRP regional indexes refer only to the odd-numbered years).

¹²The ratios ranged from 0.80 to 0.87.

¹³The weekly man-hours figures for each region are products of Census employment and NICB weekly hours for every year except 1919. In this year weekly man-hours for the North and South combined were distributed between the 2 regions on the basis of the 1921 proportions.

¹⁴Not precisely comparable with rates for preceding years.

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In interpreting these rates, cognizance must be taken of the differences in quality of the regional products. The higher rates for the South reflect the fact that it produces principally coarse- and medium-yarn fabrics, which, as staple commodities, may be made under mass-production conditions, while New England specializes in fine and style fabrics. Census statistics indicate that in 1935, for example, the Cotton-growing States produced 93 percent of the total number of square yards of "narrow sheetings and other coarse and medium yarn fabrics", while New England contributed 73 percent of the total square yardage of "fine cotton goods."

Table 18a.- SUMMARY INDEXES FOR THE COTTON GOODS INDUSTRY: 1919-36
(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	85.2	101.4	100.2	84.0	85.0
1920	84.3	101.8	94.1	82.8	89.6
1921	78.3	97.0	94.5	80.7	82.9
1922	90.8	97.7	95.6	92.9	95.0
1923	99.6	111.0	104.8	89.7	95.0
1924	84.5	96.3	88.7	87.7	95.3
1925	97.3	104.8	101.0	92.8	96.3
1926	99.3	105.9	108.1	93.8	91.9
1927	104.9	110.0	117.8	95.4	89.0
1928	94.0	99.4	98.2	94.6	95.7
1929	100.0	100.0	100.0	100.0	100.0
1930	74.3	84.1	76.8	88.3	96.7
1931	73.4	77.7	78.1	94.5	94.0
1932	67.6	69.9	66.0	97.0	102.7
1933	85.1	89.3	78.0	95.3	109.1
1934	73.3	92.5	64.6	79.2	113.5
1935	76.7	86.9	62.8	88.3	122.1
1936	95.6	92.0	72.1	103.9	132.6

COTTON GOODS

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Table 18b.- SUMMARY INDEXES FOR THE COTTON GOODS INDUSTRY, BY REGION:
CENSUS YEARS 1919-35

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
New England States					
1919	154.3	160.3	141.1	96.3	109.4
1921	132.9	147.2	147.9	90.3	89.9
1923	145.8	154.2	158.1	94.6	92.2
1925	127.5	129.8	130.9	98.2	97.4
1927	118.1	122.5	126.1	96.4	93.7
1929	100.0	100.0	100.0	100.0	100.0
1931	85.8	71.6	69.4	91.9	94.8
1933	85.9	72.1	62.3	91.4	105.8
1935	60.4	60.9	46.1	100.2	131.0
Cotton-growing States					
1919	56.4	70.4	75.8	80.1	74.4
1921	58.0	70.5	68.5	82.3	84.7
1923	79.4	87.2	80.0	91.1	99.3
1925	83.8	90.0	91.3	92.6	91.2
1927	98.0	102.5	105.4	95.6	93.0
1929	100.0	100.0	100.0	100.0	100.0
1931	78.4	80.9	82.3	96.9	95.3
1933	92.0	99.5	85.8	92.5	107.2
1935	80.8	101.4	71.1	79.5	113.4

19. ELECTRIC LAMPS

The establishments in this industry employed about 8,700 workers in 1929 in the manufacture of parts (such as bases, lead-in wires, filaments, and bulbs) and in the assembly of lamps. Two important technological advances have been made in this industry in the present century: (1) The development of the group or unit system of manufacture, which synchronizes the operations in the assembly process so that the flow from raw materials to finished product is continuous; and (2) the supplanting of manual labor by such automatic devices as the Ohio bulb machine (introduced in 1930), which turns out as many as 4 dozen bulbs in each revolution.

Production

Annual quantity statistics for 5 items - bases, large and miniature glass bulbs, and large and miniature lamps - are available for 1920-31 from a BLS study.¹ Relatives of these 5 series were combined into 2 production indexes, both of which are harmonic means. The first, with changing employment weights, was used in determining output per wage earner; the second, with changing man-hour weights, was used in determining output per man-hour. These 2 indexes are not only almost identical with each other but also with arithmetic means of the 5 series of production relatives weighted by employment and man-hours in 1929. The 4 production indexes are shown below:

Year	Index of production with -			
	Changing weights		Fixed weights (1929)	
	Employment	Man-hours	Employment	Man-hours
1920	58.3	58.2	57.8	58.3
1921	39.8	40.3	39.8	39.2
1922	50.0	49.9	50.5	51.1
1923	64.7	64.7	64.6	65.0
1924	67.1	67.0	66.9	66.9
1925	71.9	72.0	71.8	72.0
1926	75.9	75.9	75.6	75.8
1927	86.3	86.3	86.1	86.6
1928	86.2	86.2	86.2	86.1
1929	100.0	100.0	100.0	100.0
1930	86.1	86.5	86.5	86.9
1931	78.8	79.1	79.7	80.3

¹*Technological Changes and Employment in the Electric-Lamp Industry* (Bull. No. 593) by W. Bowden provides the only comparable production and labor statistics for this industry. Series for a few other minor products (such as lead-in wires) were also available, but these were not used since the labor engaged in their manufacture is negligible.

It is also of interest to compare the component series. As might be expected, the production relatives for large bulbs and large lamps are similar, as are also those for miniature bulbs and miniature lamps:

Year	Index of production of -				
	Bases	Large bulbs	Miniature bulbs	Large lamps	Miniature lamps
1920	60.5	65.9	43.4	64.7	45.3
1921	26.3	51.5	26.6	44.6	28.8
1922	48.9	66.4	35.5	56.8	37.4
1923	62.0	79.5	54.1	68.4	55.4
1924	61.1	62.9	64.3	69.4	65.2
1925	64.9	77.2	64.9	75.5	65.9
1926	68.4	84.4	70.0	77.6	71.4
1927	79.2	97.4	72.0	93.9	72.6
1928	80.3	86.3	86.2	86.4	86.6
1929	100.0	100.0	100.0	100.0	100.0
1930	78.3	92.9	76.3	92.3	77.6
1931	71.9	89.7	62.3	90.0	62.9

The Census classifies the manufacture of bulbs in the Glass industry² and the assembly of lamps in the Electrical Machinery, Apparatus, and Supplies industry, but it does not segregate the corresponding employment. The quantities of large and miniature lamps reported by the Census compare favorably with BLS totals:³

Year	Ratio of BLS to Census production	
	Large lamps	Miniature lamps
1921	1.043	0.945
1923	1.067	1.044
1925	1.029	1.025
1927	1.018	1.081
1929	1.030	1.033
1931	1.021	1.066

The relatives of these quantities are, of course, also similar. It may be remarked that by 1935 the production of large lamps and hence probably of large bulbs, too, had risen above the 1929 level by 10 percent:

²The production of bulbs, included by the Census with "pressed and blown ware", amounted in 1925 (the only year since 1919 for which it is reported separately) to 30,109 thousand dozen, as compared with 39,546 thousand dozen according to the BLS study.

³The differences are partly accounted for by the fact that the Census series does not include carbon-filament lamps, which in 1923, their peak year, constituted less than 2 percent of the total.

Year	Index of production of large lamps		Index of production of miniature lamps	
	BLS	Census	BLS	Census
1921	44.6	44.0	28.8	31.5
1923	68.4	66.1	55.4	54.9
1925	75.5	75.6	65.9	66.4
1927	93.9	95.0	72.6	69.4
1929	100.0	100.0	100.0	100.0
1931	90.0	90.8	82.9	60.9
1933	n. a.	86.8	n. a.	n. a.
1935	n. a.	110.1	n. a.	n. a.

Employment, Man-hours, and Productivity

The BLS study which supplied the production data also provided the only employment and man-hours series for the industry. Consequently the indexes of employment, man-hours, and productivity could not be extended beyond 1931.

The employment and man-hours indexes are relatives of the total number of wage earners and man-hours consumed in the manufacture of bases and bulbs and in the assembly of lamps.⁴

The indexes of output per wage earner and per man-hour were obtained by dividing the proper summary-production indexes by the employment and man-hours series.

Man-hour productivity was also determined for each of the 5 products. The series for large and miniature lamps closely approximate the composite until 1929:

Year	Index of output per man-hour					
	NRP (composite)	Bases	Large bulbs	Miniature bulbs	Large lamps	Miniature lamps
1920	25.4	59.4	20.1	23.3	25.9	24.4
1921	27.0	42.8	16.6	26.1	28.6	28.6
1922	33.4	69.7	39.7	38.4	34.8	27.4
1923	40.5	74.0	55.2	48.9	37.4	39.1
1924	50.0	70.2	49.7	46.8	49.2	49.1
1925	60.9	82.8	79.7	53.7	58.4	58.1
1926	69.3	87.6	68.6	67.0	68.1	69.4
1927	78.0	99.2	83.2	72.9	78.6	73.2
1928	87.1	100.2	85.2	83.2	88.1	84.2
1929	100.0	100.0	100.0	100.0	100.0	100.0
1930	100.8	98.7	89.7	86.3	109.4	93.5
1931	108.2	112.7	97.7	99.4	120.8	94.6

⁴The employment statistics, which refer mainly to wage earners, are partly estimated by BLS on the basis of "manufacturing methods" and other information. Furthermore, "in some of the minor details, the figures are not comparable for the entire period. For example, in the volume of labor employed in lamp-assembly plants there is included a small amount of labor used in making miniature bulbs before this work was completely transferred to separate plants." (Bowden, *op. cit.*, p. 33.)

ELECTRIC LAMPS

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Table 18. - SUMMARY INDEXES FOR THE ELECTRIC LAMPS INDUSTRY: 1920-31

(1929 = 100)

Year	Production (employ- ment weights)	Employment	Output per wage earner	Produc- tion (man-hour weights)	Man-hours	Output per man- hour
1920	58.3	240.0	24.3	58.2	229.4	25.4
1921	39.8	165.6	24.0	40.3	149.4	27.0
1922	50.0	162.6	30.8	49.9	149.4	33.4
1923	64.7	169.0	38.3	64.7	159.8	40.5
1924	67.1	136.6	49.1	67.0	134.1	50.0
1925	71.9	119.9	60.0	72.0	118.3	60.9
1926	75.9	113.2	67.0	75.9	109.5	69.3
1927	86.3	110.8	77.9	86.3	110.6	78.0
1928	86.2	100.2	86.0	86.2	99.0	87.1
1929	100.0	100.0	100.0	100.0	100.0	100.0
1930	86.1	91.0	94.6	86.5	85.8	100.8
1931	78.6	83.2	94.7	79.1	73.1	108.2

20. FERTILIZERS

This industry, which in 1929 employed about 21,000 wage earners, is confined to the manufacture of commercial fertilizers, the principal classes of which are superphosphates and so-called mixed or complete fertilizers (combinations of superphosphates, potash, and ammoniates in various proportions). It does not include the merchandising of fertilizing materials for use in the natural state or of tankage from slaughtering and meat-packing establishments for use without remanufacture.

The plants included in the industry show 3 distinct levels of integration. One group manufactures its own sulphuric acid, superphosphates, and mixed fertilizers; another purchases sulphuric acid to make superphosphates; and the "dry-mixing" plants, the largest group, purchase all the materials which go into the complete fertilizer. In 1935, for example, there were 100 plants of the first type, 96 of the second, and 772 of the third. The relative quantities of sulphuric acid, superphosphates, and complete fertilizers produced in the industry did not change significantly during the period of interest.

Production

Census quantity statistics embracing all commercial-fertilizer production in 4 groups - complete fertilizers;^{1, 2} superphosphates produced for sale; fish scrap; and potash superphosphates,² bone meal, and other fertilizers - were combined into an aggregative index with 1929 unit-value weights. These statistics referred to the odd-numbered years of the period 1919-25. In 1925 and subsequent census years separate statistics were reported for the 3 indicated components of the fourth group; a 6-group index with 1929 unit-value weights was therefore constructed for odd-numbered years of the period 1925-35. The 2 indexes were linked in 1925 and completed for the even-numbered years by means of a series of relatives of total tonnage of fertilizer consumption as estimated in the *Fertilizer Review* of the National Fertilizer Association.³

¹To make the 1919 figure for "complete fertilizers" comparable with those for later years, the estimated amount of "ammoniated fertilizers" included by the Census was deducted and transferred to "other fertilizers."

²No correction was made for the small year-to-year changes in the percentages of nitrogen (NH₃), phosphorus (P₂O₅), and potassium (K₂O) in complete fertilizers and of phosphorus and potassium in potash superphosphate.

³The consumption series includes not only commercial fertilizers, to which Census production statistics are restricted, but also fertilizer materials, a considerable quantity of which is imported. Nevertheless, the 2 indexes are in close accord in census years.

It is of interest to compare this index with another which, in addition to the same products in census years, includes sulphuric acid produced for sale. Although this secondary product represented little more than 2 percent of the value of all output of the industry in 1929, it was more important than 3 of the primary products included in the NRP index (viz, fish scrap, potash superphosphate, and bone meal). The expanded index (the quantity of sulphuric acid had to be estimated for 1933 and 1935)⁴ is so close to the NRP index that the latter may be regarded as uniformly including sulphuric acid for sale:

Year	NRP production index	Index of production including sulphuric acid for sale
1919	87.5	86.6
1921	82.7	82.0
1923	79.2	78.4
1925	84.8	85.3
1927	84.9	85.8
1929	100.0	100.0
1931	73.8	74.3
1933	56.8	57.7
1935	69.3	71.0

A second comparative index includes the total output of 3 groups of products - complete fertilizers, superphosphates, and sulphuric acid - each of which is weighted by the estimated number of man-hours of direct labor required per unit in the departments or plants devoted specifically to its manufacture.⁵ Although such an index is logically preferable to the NRP series, the computed man-hour weights are crude and are available for a less-detailed

⁴To estimate production for sale, total production in the industry was determined first by means of a similar series for a group of 64 to 75 superphosphate manufacturers, published in the *Survey of Current Business*; the quantity produced for sale was then segregated from the estimated totals by the application of extrapolated percentages derived by means of a series of ratios of shipments (also published in the *Survey of Current Business*) to production for the same group of superphosphate manufacturers.

⁵The weights were derived by dividing the total number of direct man-hours worked in the sulphuric-acid, superphosphate, and dry-mixing departments of 363 firms in January-June 1929 by the total output (Census) in 1929 of sulphuric acid, superphosphates, and complete fertilizers, respectively. The sample firms, comprising 57 percent of the total number of establishments in 1929, accounted for 75 percent of production. The first half of the year is said to represent about 90 percent of the annual fertilizer "movement." The basic data, compiled by the National Fertilizer Association, are incorporated in NRA code records for the Fertilizer industry.

For this index the definition of complete fertilizers was extended to include potash superphosphate. The tonnage of the latter was segregated from "other fertilizers" in 1919-23 on the basis of the 1925 relationship. Sulphuric-acid production in 1933 and 1935 was estimated by the use of statistics published in the *Survey of Current Business* (see fn. 4).

classification of products.⁶ This index is several units below the NRP series before 1925, reflecting the preponderance of the weight assigned to complete fertilizers, and slightly higher after 1929, in which period the output of superphosphates for sale represents a declining proportion of the total for sale and consumption:

Year	NRP production index	Index of production with man-hour weights
1919	87.5	82.5
1921	62.7	56.8
1923	79.2	75.1
1925	84.8	85.3
1927	84.9	87.5
1929	100.0	100.0
1931	73.8	76.7
1933	56.8	57.7
1935	69.3	72.7

Employment and Man-hours

The index of employment for the years 1923-36 was computed by BLS. Census wage-earner statistics yielded the relatives for 1919 and 1921. Estimates for the remaining years, 1920 and 1922, were made by means of the NICB employment series.

The index of man-hours was derived from the employment series and an annual index of average actual hours per week, which includes adjusted Census prevailing hours for 1919 and 1929, NICB and BLS actual hours for 1920-24 and 1932-36, respectively, and estimates made by straight-line interpolation for 1925-28 and 1930-31. Prevailing hours for 1919 and 1929 were reduced to actual by application of the average ratio of NICB actual to Census prevailing hours for 1921 and 1923.

The production and labor indexes differ somewhat in scope. The former includes fertilizers made in other industries; the latter include secondary activities not accounted for in the production index. The value of fertilizers produced in other

⁶Unit values are not satisfactory as weights for total production when some of the output is consumed in further fabrication and the number of products is small. Such weights tend to be too high for the products of the later stages (superphosphates and complete fertilizers) in relation to the first product (sulphuric acid) and to introduce duplication into the weighted aggregates. Unit value-added weights are preferable, but they cannot be computed from available statistics. In the NRP index the use of unit value weights results in little duplication, if any, because the quantities represent production for sale.

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industries ranges from 4 to 9 percent of the total; the value of secondary products has advanced from 6.5 percent of the total for the industry's output to about 18 percent.⁷ The omission of sulphuric acid for sale as a secondary product - it was pointed out in the preceding section that the NRP production index may be regarded as including it - would not appreciably reduce these percentages.

Table 20. - SUMMARY INDEXES FOR THE FERTILIZERS INDUSTRY: 1919-36

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	87.5	125.5	126.5	69.7	69.2
1920	92.1	149.0	159.9	61.8	57.6
1921	62.7	80.6	80.1	77.8	78.3
1922	71.5	108.2	107.8	66.1	66.3
1923	79.2	86.6	90.0	89.4	88.0
1924	81.5	82.1	82.4	99.3	98.9
1925	84.8	93.8	94.2	90.4	90.0
1926	87.8	99.5	99.7	88.2	88.1
1927	84.9	86.9	89.1	95.5	95.3
1928	98.9	94.9	94.9	104.2	104.2
1929	100.0	100.0	100.0	100.0	100.0
1930	98.4	97.9	93.3	100.5	105.5
1931	73.8	69.5	63.0	106.2	117.1
1932	50.7	49.8	42.8	101.8	118.5
1933	56.8	62.3	52.0	91.2	109.2
1934	63.2	84.3	57.4	75.0	110.1
1935	69.3	83.4	57.8	83.1	119.9
1936	76.0	77.5	62.2	98.1	122.2

⁷ The extent of the lack of comparability between the production and labor indexes may not be reflected adequately in these value percentages, which constitute the only measure available for the whole period. According to other Census statistics, the fertilizer output of other industries in terms of relative value is greater than in terms of relative tonnage - at least in 1929, 1933, and 1935:

Year	Percent by -	
	Weight	Value
1929	6.3	9.4
1933	4.8	7.1
1935	3.7	4.3

In 1935, furthermore, three-fifths of the value of secondary products represented not production but merely goods sold in condition in which purchased, presumably natural fertilizers and similar materials excluded by the Census from the definition of the industry.

21. FLOUR AND OTHER GRAIN-MILL PRODUCTS

This industry is confined to establishments engaged primarily in the manufacture of flour, meal, and feed for livestock, from wheat, corn, and other grains. Mills engaged principally in the production of cereal preparations (breakfast foods, prepared flour, etc.) or prepared feed for livestock and poultry are classified in other industries.

The Census restricts its canvass to "merchant" mills, which purchase and grind the grain and sell the resulting flour and byproducts. "Custom" or "grist" mills, which are engaged solely in milling grain owned by others, are not considered part of the industry; such mills accounted for only 5.9 and 4.4 percent of the combined output of merchant and custom mills in 1909 and 1919, respectively. Establishments which do both merchant and custom grinding are classed as merchant mills even if the latter is their major activity.

Production and employment in the Flour and Other Grain-Mill Products industry have been declining since the end of the war. The number of wage earners in 1919 was 45,000; by 1929 it was only 27,000 and by 1936, 26,000.

Production

An aggregative production index with 1929 unit-value weights was constructed for the odd-numbered years 1919-35 from Census statistics for 6 classes of products: Wheat flour;¹ bran and middlings; feed, screenings, etc.;² rye flour; corn meal and corn flour; and buckwheat flour. These account for over 99 percent of the value of products normally belonging to the industry. Wheat flour alone represents from 70 to 80 percent.

Production in intercensal years was estimated through the medium of an annual wheat-consumption series (bushels of wheat ground), which is the equivalent of a series of unweighted aggregates of wheat flour and its byproducts, except for milling losses. The basic data (viz, monthly wheat-flour production of custom and merchant mills in 1925-36, semiannual production in 1919-21 and

¹Includes some self-rising or prepared flour. Although mills classified elsewhere are engaged chiefly in the manufacture of such flour, establishments in the Flour and Other Grain-Mill Products industry have consistently accounted for half or more of the total output.

²To make the "feed and screenings" series internally comparable, it was necessary to estimate and deduct the tonnage of prepared feed for livestock and poultry in 1919 and 1921. For this purpose, the percentage which prepared feed comprised of the tonnage of feed and screenings in 1923 was assumed to be typical of the earlier years. See fn. 8.

1924, annual production in 1923, and average wheat requirements per barrel of flour for each crop year since 1918-19) were obtained from various issues of *Wheat Studies*, a publication of the Leland-Stanford Food Research Institute.³

Wheat consumption was estimated for every year except 1922 by multiplying wheat flour milled by the corresponding wheat-requirement ratio. The Federal Reserve Board index of wheat flour milled⁴ for 1921-23 was used in making the estimate for 1922.

The consumption series closely resembles the value-weighted index of grain-mill production. The reason for the similarity is twofold: (1) Wheat flour and its concomitant byproducts dominate the output index; and (2) since the joint yields of wheat and its byproducts are fairly proportional from year to year,⁵ weighted and unweighted aggregates of these products are similar in movement.

The unit-value weights for the principal kinds of flour - wheat, rye, and corn - could be compared with corresponding man-hour weights (ignoring byproducts).⁶ Although labor expense constitutes only 3 to 4 percent of the value of the industry's products and unit values are fixed by indirect means,⁷ the 2 weighting

³The Food Research Institute's estimates of total flour production, which presumably include the output of all merchant and custom mills, are based on the *Census of Manufactures* and the *Census* quarterly, *Wheat Ground and Wheat-Milling Products: Merchant and Other Mills*; its wheat-requirement ratios were derived from the latter source.

⁴*Federal Reserve Index of Industrial Production* (mimeo., Apr. 1936), pp. 19-20. Relatives of Food Research Institute consumption and FRB production agree closely in both 1921 and 1923. The FRB index is based on monthly data from the *Census* quarterly (see fn. 3) as adjusted by *Russell's Commercial News* and supplemented by material from *Northwestern Miller*.

⁵The wheat actually ground since the end of the war has been so homogeneous that it may be considered a uniform grade, the products of which are in invariant proportion. According to *Wheat Studies*, the number of bushels of wheat per barrel of flour averaged 4.6 in 16 crop years, 4.7 in only 2, and 4.5 in only 1 of the 19 from 1918-19 to 1936-37. Ever since 1922-23 the wheat-requirement ratio to the nearest tenth-bushel has been 4.6.

Changes in the relative amounts of wheat flour and its byproducts indicated by statistics in the *Census of Manufactures* reflect largely the lack of uniform terminology and the absence of sufficiently defined standards in general. Each mill has its own "patent" flour, and the line of demarcation between low-grade flour and high-grade middlings, for example, is tenuous and unstable.

⁶Relative labor requirements were determined from estimates made in the course of a field study of flour mills, the results of which are summarized in a report (in preparation) by R. T. Bowman, *Productivity and Employment in Selected Industries: Wheat Flour* (WPA National Research Project in cooperation with National Bureau of Economic Research). See fn. 10.

⁷The cost-accounting practice is to determine the net cost of a barrel of flour by deducting from the gross cost per barrel (estimated on the assumption that the total grain, elevator, milling, selling, and administrative cost is to be borne only by the principal product - high-grade flour) the probable sales yield of the concomitant byproducts. To the remainder, the miller adds packaging cost and profit to find the value of flour at the mill - the figure which, apparently, is multiplied by the total number of barrels produced to obtain the total value reported to the *Census*. See J. A. Dohr, H. A. Ingraham, and A. J. Love, *Cost Accounting Principles and Practice* (2nd ed.; New York: Ronald Press, 1935), pp. 453-6.

systems (wheat flour = 1.00) are similar enough to yield indexes which are substantially the same:

Flour	Man-hours per ton	Value per ton
Wheat	1.00	1.00
Rye	1.00	0.89
Corn	0.80	0.82

Employment and Man-hours

The employment index, which conforms to Census trend, was constructed by BLS.⁸ The man-hours index is based on this employment series and on an index of average annual hours. The average-annual-hours series is composed of 2 segments which were spliced in 1926. The first, 1919-26, was rendered continuous by straight-line interpolation of Census prevailing hours (weekly hours times $51\frac{1}{3}$)⁹ for 1919, 1921, 1923, and 1929. The second, 1926-36, was derived from BLS actual weekly hours for 1932-36 and the results of a field study of wheat-flour establishments made by the National Research Project in cooperation with the National Bureau of Economic Research.¹⁰ This study furnished a series of average annual hours worked in a sample of 15 to 35 establishments during the decade 1926-35. BLS average weekly hours for 1932-36 were raised to annual totals by multiplication by $51\frac{1}{3}$;¹¹ the sample series for 1926-31 was then adjusted to the BLS level by multiplication by the average relationship between the 2 annual-hours series in 1932-35.¹²

The production and employment indexes differ somewhat in scope. Some of the output included in the Census totals (less than 5 percent by value) is contributed from outside the industry. On

⁸No adjustment was required in the number of wage earners for 1919-23 since the separation of prepared feed for animals from feed, screenings, etc. after 1923 (see ftn. 2) was merely a change in classification, not in industry definition. Even before 1926, prepared feed normally belonged to another industry.

⁹The usual number of weeks in the flour-milling year, according to the NRP-NBER field survey (see ftns. 6 and 10).

¹⁰The 56 establishments covered by the study (see ftn. 6) in 1929 comprised less than 2 percent of the total number in the industry. Nevertheless, during the period for which the hours data are used, the total sample accounted for a minimum of 14.4 percent (1927) of the value of products of the industry and a maximum of 32.9 percent (1933).

¹¹The product of the 1933 estimate of annual hours per man and the Census number of wage earners is 51,686,754 or 97.8 percent of the man-hour total (52,828,761) computed from *Census of Manufactures: 1933, "Man-Hour Statistics for 32 Selected Industries."*

¹²The ratios of the unadjusted NRP-NBER average annual hours to the (computed) BLS figures are:

1932	1.026	1934	1.033
1933	1.028	1935	1.055

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the other hand, some of the workers in flour mills are engaged in the manufacture of secondary products (about 6 percent of the value of total output), which are not included in the production index.

Table 21.- SUMMARY INDEXES FOR THE FLOUR AND OTHER GRAIN-MILL PRODUCTS INDUSTRY: 1919-36

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	110.9	167.5	172.5	66.2	64.3
1920	91.2	151.0	154.9	60.4	58.9
1921	96.3	130.6	133.3	73.7	72.2
1922	100.3	132.6	135.4	75.6	74.1
1923	101.1	130.1	132.8	77.7	76.1
1924	103.4	123.7	125.8	83.6	82.2
1925	99.2	118.4	119.8	83.8	82.6
1926	100.2	113.9	114.8	88.0	87.3
1927	99.2	110.9	111.8	89.4	88.7
1928	100.3	106.1	107.2	94.5	93.6
1929	100.0	100.0	100.0	100.0	100.0
1930	98.7	91.7	93.5	107.6	105.6
1931	93.1	84.5	83.7	110.2	111.2
1932	85.9	81.5	79.4	105.4	106.2
1933	81.5	85.9	75.8	94.9	107.5
1934	82.4	98.4	77.2	83.7	106.7
1935	81.9	98.0	78.5	83.6	104.3
1936	86.1	95.7	85.3	90.0	100.9

22. FURNITURE

The Furniture industry, which employed more than 193,000 wage earners in 1929, includes establishments engaged primarily in the manufacture of household furniture; furniture and fixtures for offices and stores; professional, laboratory, hospital, barber, and beauty-parlor chairs, tables, and cots; and furniture for public buildings. Plants manufacturing mattresses, bedsprings, and refrigerators are classified in other industries.

Production

Since no quantity data are available, the production index was obtained by deflating a value series for furniture made in the Furniture industry (exclusive of secondary products and contract, custom, and repair work) by an index of wholesale prices. The small amount of furniture made in other industries, about 4 percent of the total value of all furniture, was omitted in order to achieve maximum comparability between the production and employment series.

The value data for odd-numbered years of the period 1919-35 were supplied by the Census.¹ Estimates of value for intercensal years and for 1936 were made by means of the continuous BLS index of wages.² Such an interpolating medium should give reliable results since (1) it is based on a large sample, (2) wages correspond to production in geographic distribution, and (3) wages constitute as much as 26 percent of the value of all products of the industry. The following tabulation shows the movement of wages and value relatives computed from Census data:

Year	Wages	Value	
1919	59.0	61.1	
1921	59.4	58.0	
1923	84.2	81.8	[Con.]

¹The value of secondary products and of contract, custom, and repair work (estimated on the basis of their proportion of the total in 1923 - 3.9 percent) had to be excluded from the value figures for 1919 and 1921. Adjustments were also made, when possible, for minor changes in the Census definition of the industry.

²The BLS wages and employment series were adjusted for revisions in industry definition (see fn. 1). Another interpolating medium, based on the value of furniture produced in Pennsylvania and Massachusetts through 1931 and in Massachusetts alone thereafter, was also available (from annual issues of the *Report on the Productive Industries, Public Utilities and Miscellaneous Statistics for the Commonwealth of Pennsylvania* by the Dept. of Internal Affairs and the *Annual Report of the Department of Labor and Industries of Massachusetts*). This series, however, covered only about 10 percent of the total through 1931 and only about 5 percent thereafter. The wages index, moreover, gives a better approximation to the trend of Census values.

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[con.]	Year	Wages	Value
	1925	92.8	90.2
	1927	98.1	93.0
	1929	100.0	100.0
	1931	51.9	50.6
	1933	31.5	31.4
	1935	46.9	45.5

The wholesale-price index was constructed by splicing 3 series of weighted averages of BLS relatives - one for 10 products from 1919 to 1936, the second for 12 products from 1925 to 1936, and the third for 17 products from 1926 to 1936. The weight for each relative is the 1929 value estimated from the *Census of Manufactures*. The 3 series are almost identical in coterminous periods.

Employment and Man-hours

The NRP employment index is the BLS series adjusted to conform to revised Census wage-earner totals. This index is not identical in scope with the deflated value series since it includes wage earners engaged in the manufacture of secondary products and in custom, contract, and repair work. The number of such wage earners could not be ascertained, but the effect of their inclusion on the comparability of the production and employment indexes is probably small since the value of their output constitutes only about 4 percent of the total.

The man-hours series was derived from the employment index and from an annual series of average actual weekly hours based on adjusted Census prevailing hours for 1919, on NICB actual hours for 1920-31, and on similar BLS statistics for 1932-36. The correction factor applied to the Census figure for 1919 is the 1923 ratio of actual to prevailing hours.

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Table 22.- SUMMARY INDEXES FOR THE FURNITURE INDUSTRY: 1919-36

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	55.1	72.5	75.8	76.0	72.7
1920	48.0	80.0	79.8	60.0	60.2
1921	45.1	84.3	80.9	70.1	74.1
1922	59.9	76.4	78.8	78.4	76.0
1923	68.7	86.9	89.3	79.1	76.9
1924	73.8	85.2	85.5	86.6	86.3
1925	84.9	93.6	94.8	90.7	89.6
1926	92.2	98.2	100.5	93.9	91.7
1927	92.2	97.3	99.0	94.8	93.1
1928	90.8	95.4	95.2	95.2	95.4
1929	100.0	100.0	100.0	100.0	100.0
1930	70.3	79.5	71.9	88.4	97.8
1931	59.8	65.9	55.9	81.6	96.2
1932	36.6	51.3	37.8	71.3	96.8
1933	38.8	54.5	42.1	71.2	92.2
1934	43.5	58.2	43.0	74.7	101.2
1935	56.5	67.6	56.0	83.6	100.9
1936	66.5	75.2	68.0	88.4	97.8

- 23. GLASS GROUP
- 24. WINDOW GLASS
- 25. PLATE GLASS
- 26. GLASS CONTAINERS
- 27. PRESSED AND BLOWN WARE

The Glass group, as here defined, is restricted to the output of the following classes of products: (1) Windowglass (including obscured glass); (2) plate glass (including polished plate and rough and polished wire glass); (3) glass containers; and (4) pressed and blown ware (e. g., tableware, ovenware, tumblers, lenses, lamps, and bulbs for electric lamps). The 4 industries in the Glass group correspond to the total output of these 4 classes of products.

The Glass group is a modification of the Census "Glass" industry, which includes establishments engaged primarily in the manufacture of glass and glass products from raw materials but not those engaged primarily in the production of glassware from purchased "blanks." In 1929 the Glass group employed about 65,700 wage earners, or 97 percent of the total reported for the Census industry. In this year Window Glass accounted for about one-tenth of the wage earners in the group, Plate Glass for about two-tenths, Glass Containers for about three-tenths, and Pressed and Blown Ware for about four-tenths.

Significant technological progress has been made in all these industries since the beginning of the century. The Lubber (semi-automatic) cylinder machine for making windowglass was introduced in 1905; it was followed by the Colburn (automatic) cylinder machine in 1917 and the Fourcault (automatic) sheet machine in 1921. By 1926 only 2 percent of the total output of window glass was still produced by the old hand process. Many of the operations in the Plate Glass industry were completely mechanized early in the century; the most important innovation, the continuous process (from casting to grinding and polishing), was made in 1921. Semiautomatic machines were substituted for the hand-blowing of wide-mouth glass containers as early as 1898; between 1905 and 1917 these machines and similar ones for small-mouth ware were superseded by the Owens automatic machines. Between 1917 and 1924 feed-and-flow devices were installed. Semiautomatic and feed-and-flow devices are used in pressed-ware production, although extensive mechanization has been impeded by the multiplicity of products. In the manufacture of blown ware, however, the processes have been mechanized to a greater degree. For

example, prior to 1917 the hand process was used exclusively in making electric-light bulbs, but as a consequence of the introduction of the Empire E (semiautomatic) and the Empire F and Westlake (automatic) machines the hand process was almost completely displaced by 1929.

Production

Glass Group.— The group production index, which includes about 80 percent of the value of the group's output, was constructed in the following manner from relatives for the 4 component industries: First, the indexes of production for the 4 industries for 1919 and the odd-numbered years 1925-35 were combined in a harmonic mean with changing employment weights; the resulting series was then rendered continuous for the period 1919-36 by the use of an annual index which is a similarly weighted harmonic mean of relatives for the Window Glass, Plate Glass, and Glass Containers industries for 1919, 1923, and 1925-36 interpolated by a harmonic mean for the first 2 of these industries.

The NRP group index compares as follows with an arithmetic mean of the 4 component series weighted by employment in 1929:

Year	Index of production with -	
	Changing weights	Fixed weights (1929)
1919	65.1	67.3
1925	89.4	90.2
1927	98.6	99.0
1929	100.0	100.0
1931	74.9	75.0
1933	75.6	75.7
1935	105.7	106.4

Window Glass.— The index for this industry was computed for the odd-numbered years 1919-35 from Census series for window and obscured glass, which were weighted by averages of unit values for the same years.¹ It was completed by means of statistics supplied by H. Jerome for the years 1919-23 and 1925,² figures

¹Obscured and wire glass (the latter is a primary product of the Plate Glass industry), reported in combination in 1933, were separated on the basis of their 1931 proportions.

²The data were collected in the course of preparation of *Mechanization in Industry* (New York: National Bureau of Economic Research, 1934).

reported by the U. S. Tariff Commission for 1926-36,³ and an estimate for 1924 obtained by straight-line interpolation. The products included in the index for census years represent the total output of the industry.

Plate Glass.— The index for this industry was constructed for the odd-numbered years 1919-35 from Census series for polished plate glass and for rough and polished wire glass weighted by averages of unit values for 1919-35.⁴ It was completed by means of a continuous plate-glass-production series compiled by the Plate Glass Manufacturers of America and published by the U. S. Tariff Commission (1919-20)⁵ and the *Survey of Current Business* (1921-36). The products included in this index in each odd-numbered year represent the total output of the industry.

Glass Containers.— The index for Glass Containers for the odd-numbered years 1927-35 includes series for the following 9 classes of products weighted by averages of unit values in the same years:⁶

Containers for medical and toilet preparations	Narrow-neck bottles Nonpressure ware
Fruit jars	Pressed ware (packers')
General-purpose containers	Pressure ware
Milk bottles	Wide-mouth bottles

The relatives for 1919, 1923, and 1925 were obtained by splicing this index and a series for the unweighted total number of glass containers⁷ in their first common year, 1927; the relatives for the remaining years, except 1920-22 and 1924, were estimated by the use of 2 other unweighted series (compiled by the Glass Container Association and published in the *Survey of Current*

³*Flat Glass and Related Glass Products* (Rep. No. 123, 2d ser., 1937), p. 144. The figures for 1926-30 were obtained by the Tariff Commission from manufacturers' records; those for later years, from the Window Glass Manufacturers Association.

⁴The quantity of polished plate glass for 1933 was interpolated by means of the plate-glass series published in the *Survey of Current Business*; its value was segregated from the total for "plate glass and other glass products" by application of the 1931 ratio to the corresponding total. For the 1933 estimates of the value and production of wire glass, see fn. 1.

⁵*Cast Polished Plate Glass* (1929), p. 3.

⁶The quantities and values of some of these products were reported in combination in several years; in such instances they were separated in accordance with their proportions in the preceding census year.

⁷This series of totals, compiled by the Census, was reported in a BLS study by B. Stern, *Productivity of Labor in the Glass Industry* (Bull. No. 441), p. 15.

The unweighted and weighted indexes compare as follows:

Year	Weighted (NRP)	Unweighted
1927	100.8	98.8
1929	100.0	100.0
1931	93.9	89.5
1933	98.8	97.8
1935	118.4	114.8

Business), one for a sample of 31 manufacturers for 1926-33 and the other for 42 manufacturers for 1933-36.⁸ As in the indexes for the 2 preceding industries, the series entering into this index in the odd-numbered years represent the total value of the industry's output.

Pressed and Blown Ware.— The production index for this industry was constructed for 1919 and the odd-numbered years 1925-35 from 5 series weighted by averages of unit values.⁹ Four of these series - for chimneys, lantern globes, tubing, and pressed tumblers and goblets - were obtained from the *Census of Manufactures*; the fifth, for electric-lamp bulbs, was obtained from a BLS survey (for 1925-31), from the *Census of Manufactures* (for 1919), and by extrapolation (for 1933 and 1935).¹⁰ In contrast with the production series for the other industries of the group, the index for Pressed and Blown Ware includes only about one-third of the total value of the industry's output.

Employment

The NRP employment series for the 4 component industries (and hence for the group also) correspond exactly in scope to the production indexes. They do not include wage earners engaged in the manufacture of either secondary products or of "other glass products" which, reported only in terms of total value, could not be distributed.

The first step in determining the number of wage earners in each industry of the group was to make preliminary estimates which include workers producing secondary and "other" glass products. For the odd-numbered years 1929-35 use was made of detailed statistics supplied to NRP in a special Census tabulation; for 1923

⁸According to the *Survey of Current Business*, the 31 manufacturers represented 83 percent of the total productive capacity; the 42 accounted for 95 percent of all glass-container output in 1933.

⁹The average unit values refer to the odd-numbered years 1925-35 for all but 1 product (electric-lamp bulbs), the unit value for which could be computed for 1925 only. The quantity and value of pressed tumblers and goblets were estimated for 1935 from totals which also included blown tumblers, goblets, and barware on the basis of the 1931 value ratio. No unit-value figures could be computed for 1919 since value statistics were not available.

¹⁰The BLS study, *Technological Changes and Employment in the Electric-Lamp Industry* (Bull. No. 593), by W. Bowden, reports annual production and labor statistics for lamps and parts for the period 1920-31. Extrapolation to 1933 and 1935 was accomplished by means of a series for incandescent-filament lamps (included by the Census as a normal product of the Electrical Machinery, Apparatus, and Supplies industry); the incandescent-filament lamp figures for these 2 years were multiplied by the average of the ratios in the odd-numbered years 1921-31 of the BLS to the Census series.

and 1925 similar data were obtained from a BLS bulletin;¹¹ and for 1927 the total reported in the *Census of Manufactures* was distributed in accordance with averages of the proportions in 1925 and 1929. In order to render these 4 preliminary series comparable with the corresponding production indexes, an adjustment was made to exclude the employment associated with secondary and "other" glass output. This adjustment was made on the assumption that for each of the component industries the value of output per wage earner was the same for (1) products not normally belonging to the industry, (2) primary products made within the industry, and (3) primary products made in other industries. The adjustment factors applied to each series are ratios of (a) the value reported by the Census for the primary products of the industry of the same name, wherever manufactured, to (b) the total value of the industry's output as indicated in the special Census tabulation. These ratios were computed for each of the odd-numbered years 1929-35; their average was used for the odd-numbered years 1923-27. The employment index for Glass Containers was then completed for the even-numbered years of the period 1923-36 by means of an employment series supplied in a special BLS tabulation; no satisfactory data were available for the completion of the employment indexes for the other 3 industries.¹²

The group employment index was obtained by interpolating and extending relatives of the total number of wage earners in the 4 component industries for the odd-numbered years 1923-35 by means of a continuous BLS index.¹³

Man-hours

The index of man-hours for the group was derived from the employment index and a series for average weekly hours based on

¹¹B. Stern, *op. cit.*, p. 15. The Census is cited as the source of the data. The figures for the Window Glass and Plate Glass industries were raised in the 2 years to include employment for obscured and wire glass, respectively. The number of wage earners for each product was estimated by distributing the difference between the Census total for the "Glass" industry and the total for the 4 components (as reported in this bulletin) in accordance with the ratio of the value of each product to their combined value.

¹²Statistics were also furnished for the Window Glass and Plate Glass industries in the special BLS tabulation, but the derived indexes were not used because of the magnitude of the adjustments required to conform them to the trends of the NRP relatives for the odd-numbered years.

Although none of the employment indexes could be rendered continuous for the entire period, percentage distributions for all years were nevertheless computed for use as weights in the group production index. The 1923 percentages were assumed for 1919-22. The differences between the group totals and the figures for the Glass Containers industry in the remaining intercensal years were distributed among the other 3 industries in accordance with averages of the proportions in adjacent census years (the 1935 proportions were assumed for 1936).

¹³The BLS index had to be adjusted for 1919-21 to conform to the movement of employment in the Census "Glass" industry.

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Census prevailing hours for 1919, 1921, 1923, and 1929; on BLS actual hours for 1932-36; and on estimates for the remaining years obtained by straight-line interpolation.

Only fragmentary man-hours series could be computed for 3 of the 4 component industries and none for the fourth (index numbers, 1933=100):

Year	Window Glass	Plate Glass	Glass Containers
1932	68.3	n. a.	101.9
1933	100.0	100.0	100.0
1934	102.2	n. a.	116.1
1935	108.4	150.5	127.8
1936	102.4	n. a.	143.9

These estimates are relatives of the quotients of pay rolls and average hourly earnings provided in the special Census and BLS tabulations.¹⁴

Table 23.- SUMMARY INDEXES FOR THE GLASS INDUSTRY GROUP: 1919-36

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	65.1	110.7	109.8	58.8	59.3
1920	77.7	115.3	114.1	67.4	68.1
1921	53.3	78.2	77.3	68.2	69.0
1922	81.9	94.6	93.3	66.6	67.8
1923	88.4	104.7	102.8	84.4	86.0
1924	82.2	94.8	93.5	86.7	87.9
1925	89.4	98.2	97.0	91.0	92.2
1926	103.3	102.8	102.0	100.5	101.3
1927	98.6	93.6	93.0	105.3	106.0
1928	100.2	93.9	93.7	106.7	106.9
1929	100.0	100.0	100.0	100.0	100.0
1930	81.3	85.5	78.3	95.1	103.8
1931	74.9	71.8	59.8	104.3	125.3
1932	56.2	59.4	44.5	94.6	128.3
1933	75.6	70.6	50.9	107.1	148.5
1934	83.6	90.2	61.2	92.7	136.6
1935	105.7	94.5	67.2	111.9	157.3
1936	118.1	96.8	71.5	119.9	162.4

¹⁴Census pay-roll statistics for the Window Glass and Glass Containers industries for 1933 and 1935 were extended by means of corresponding BLS series. The hourly earnings are averages of the quotients of BLS monthly pay-rolls and man-hours figures for sample establishments.

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Table 24.- SUMMARY INDEXES FOR THE WINDOW GLASS INDUSTRY: 1919-36
(1929 = 100)

Year	Production	Employment	Output per wage earner
1919	92.6	n. a.	-
1920	99.4	n. a.	-
1921	84.1	n. a.	-
1922	126.4	n. a.	-
1923	127.9	144.4	88.6
1924	135.6	n. a.	-
1925	143.2	165.8	86.4
1926	132.0	n. a.	-
1927	119.7	129.4	92.5
1928	105.7	n. a.	-
1929	100.0	100.0	100.0
1930	86.3	n. a.	-
1931	84.2	52.1	123.2
1932	43.0	n. a.	-
1933	58.0	57.0	101.8
1934	74.8	n. a.	-
1935	97.4	80.5	121.0
1936	84.5	n. a.	-

Table 25.- SUMMARY INDEXES FOR THE PLATE GLASS INDUSTRY: 1919-36
(1929 = 100)

Year	Production	Employment	Output per wage earner
1919	38.1	n. a.	-
1920	50.4	n. a.	-
1921	37.8	n. a.	-
1922	54.7	n. a.	-
1923	64.5	81.0	79.6
1924	63.5	n. a.	-
1925	78.7	98.2	80.1
1926	89.0	n. a.	-
1927	78.4	87.0	90.1
1928	86.6	n. a.	-
1929	100.0	100.0	100.0
1930	69.5	n. a.	-
1931	56.5	48.8	120.7
1932	33.5	n. a.	-
1933	54.3	36.9	147.2
1934	58.9	n. a.	-
1935	110.8	84.6	202.9
1936	122.0	n. a.	-

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Table 26.- SUMMARY INDEXES FOR THE GLASS CONTAINERS INDUSTRY: 1919-36

(1929 = 100)

Year	Production	Employment	Output per wage earner
1919	64.9	n. a.	-
1920	n. a.	n. a.	-
1921	n. a.	n. a.	-
1922	n. a.	n. a.	-
1923	82.7	101.0	81.9
1924	n. a.	87.9	-
1925	75.8	91.3	83.0
1926	97.2	97.9	99.3
1927	100.6	91.7	109.7
1928	104.6	96.3	108.6
1929	100.0	100.0	100.0
1930	98.4	89.5	109.9
1931	93.9	84.2	111.5
1932	78.7	75.9	103.7
1933	98.8	85.1	116.1
1934	107.7	106.2	101.4
1935	118.4	113.2	104.6
1936	138.1	120.5	114.6

Table 27.- SUMMARY INDEXES FOR THE PRESSED AND BLOWN WARE INDUSTRY: 1919-36

(1929 = 100)

Year	Production	Employment	Output per wage earner
1919	77.1	n. a.	-
1920	n. a.	n. a.	-
1921	n. a.	n. a.	-
1922	n. a.	n. a.	-
1923	n. a.	109.4	-
1924	n. a.	n. a.	-
1925	95.0	86.5	109.8
1926	n. a.	n. a.	-
1927	102.2	89.2	114.6
1928	n. a.	n. a.	-
1929	100.0	100.0	100.0
1930	n. a.	n. a.	-
1931	69.5	77.9	69.2
1932	n. a.	n. a.	-
1933	69.7	77.6	69.8
1934	n. a.	n. a.	-
1935	95.6	100.6	95.0
1936	n. a.	n. a.	-

28. ICE CREAM

The establishments included in this industry are engaged primarily in the manufacture of ice cream, ices, and related specialties. The manufacture of these products by hotels, restaurants, and retailers for use in their soda fountains is not considered part of this industry. The number of wage earners employed in the Ice Cream industry in 1929 was over 22,000.

Production

The index of production for the odd-numbered years 1923-35 is based on the total number of gallons, reported by the Census, of ice cream, ices, and specialties made in all industries; it was completed for the even-numbered years of the period 1919-36 by means of a production series for ice cream compiled by the Bureau of Agricultural Economics. The latter agrees closely with Census statistics for the same product and concurs with the relatives of the unweighted aggregates for all 3.

Employment and Man-hours

The index of employment, which conforms to Census trend, is based on BLS series for 1923-36, Census wage-earner statistics for 1919 and 1921, and estimates for 1920 and 1922 obtained by straight-line interpolation.

The man-hours index was computed from this employment series and a series of average weekly hours. The latter includes Census prevailing hours for 1919,¹ 1921,¹ 1923, and 1929; BLS actual hours for 1932-36; and estimates for intervening years derived by straight-line interpolation.

The labor and production indexes are not strictly comparable in scope since some of the wage earners in the industry are engaged in the manufacture of secondary products while others outside the industry are engaged in the production of ice cream, ices, and specialties. The only indication of the extent to which this situation prevails is given by (1) the percentage which secondary products constitute of the total value of the industry's output and (2) the percentage which ice cream, ices, and specialties made outside the industry comprise of the value of such production in all industries:

¹Prevailing hours for these years were estimated from combined statistics for the Confectionery and Ice Cream industries on the basis of the relationship between the figures for each industry in later years.

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Year	Secondary production in industry	Production of ice cream, etc. outside industry
1923	8.6	11.7
1925	8.3	10.5
1927	8.3	9.5
1929	8.9	7.9
1931	5.8	6.2
1933	7.7	9.0
1935	8.0	10.2

A crude adjustment of the employment and man-hours indexes may be attempted on the basis of the above percentages. Such an adjustment implies that value productivity is the same not only for products included in the production index, wherever manufactured, but also for secondary products of the Ice Cream industry:

Year	Employment index		Man-hours index	
	NRP	Value- adjusted	NRP	Value- adjusted
1919	85.5	89.5	85.1	89.1
1921	90.2	94.4	90.4	94.6
1923	103.3	108.1	104.4	109.3
1925	102.9	106.5	103.6	107.2
1927	97.9	100.2	98.3	100.6
1929	100.0	100.0	100.0	100.0
1931	79.2	78.8	75.9	75.5
1933	64.2	64.5	55.3	55.6
1935	77.3	78.4	63.5	64.4

It is apparent that the value-adjusted labor series would yield lower index numbers of productivity for years prior to 1929 but almost identical ones thereafter.

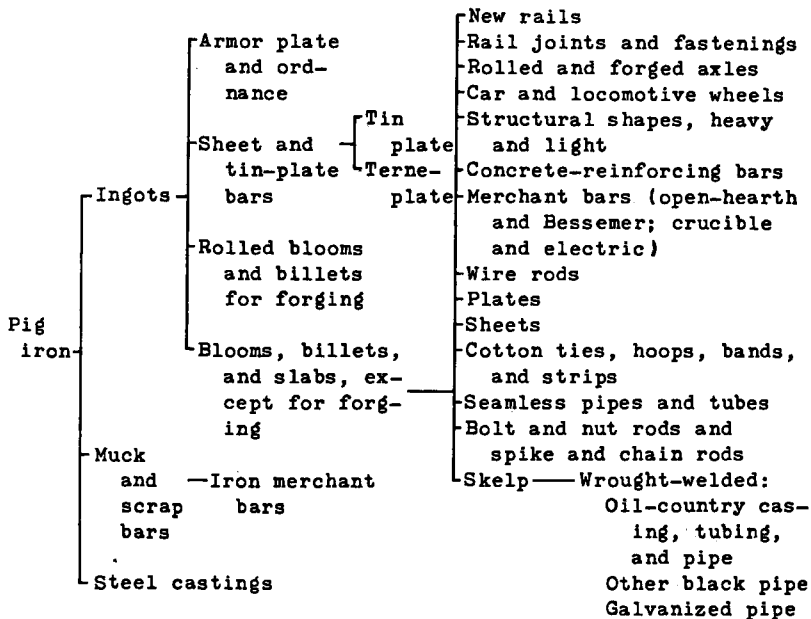
ICE CREAM

Table 28.- SUMMARY INDEXES FOR THE ICE CREAM INDUSTRY: 1919-38
(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	61.6	85.5	85.1	72.3	72.6
1920	66.7	87.9	87.7	76.2	76.3
1921	66.6	90.2	90.4	76.1	75.9
1922	75.0	96.8	97.5	77.5	76.9
1923	80.4	103.3	104.4	77.8	77.0
1924	79.1	106.3	107.3	74.4	73.7
1925	87.2	102.9	103.6	84.7	84.2
1926	86.5	100.3	100.8	86.2	85.8
1927	90.2	97.9	98.3	92.1	91.8
1928	91.7	99.5	99.7	92.2	92.0
1929	100.0	100.0	100.0	100.0	100.0
1930	95.1	92.7	90.8	102.6	104.7
1931	82.5	79.2	75.9	104.2	108.7
1932	61.5	67.3	63.1	91.4	97.5
1933	59.5	64.2	55.3	92.7	107.6
1934	72.5	75.2	60.1	96.4	120.6
1935	81.3	77.3	63.5	105.2	129.0
1936	99.0	76.5	67.4	126.1	146.9

29. IRON AND STEEL GROUP
 30. BLAST FURNACES
 31. STEEL WORKS AND ROLLING MILLS

Establishments in the Iron and Steel group, which in 1929 employed almost 420,000 wage earners, are classified by the Census in 2 industries: (1) Blast Furnaces and (2) Steel Works and Rolling Mills. Blast Furnaces, which employed about 25,000 wage earners in 1929, produce pig iron, ferro-alloys, and various byproducts from ore and scrap. Steel Works and Rolling Mills, which employed 395,000 wage earners in 1929, make raw (ingot), semifinished, and finished steel. The following diagram represents a simplified scheme of the flow of products:¹



Production

Iron and Steel Group.— The composite index for the Iron and Steel group is a harmonic mean of the production relatives for the 2 industries with changing employment weights. This index is almost identical with an arithmetic mean of relatives weighted

¹Adapted from C. R. Daugherty, M. G. deChazeau, and S. S. Stratton, *The Economics of the Iron and Steel Industry* (New York: McGraw-Hill Book Co., Inc., 1937), I, 12; and J. M. Camp and C. B. Francis, *Making, Shaping and Treating of Steel* (Pittsburgh, Pa.: Carnegie Steel Co., 1925), p. 479.

by 1929 employment because of the comparative insignificance in all years of the number of Blast Furnace wage earners (less than 10 percent of the group total):

Year	Index of production with -	
	Changing weights	Fixed weights (1929)
1919	61.6	61.2
1921	35.4	35.3
1923	78.0	77.8
1925	78.6	78.6
1927	79.0	79.0
1929	100.0	100.0
1931	48.1	48.1
1933	43.7	43.7
1935	64.1	64.0

Blast Furnaces.— The index for this industry is based on the aggregate tonnage of pig iron and ferro-alloys, which together represent about 97 percent of the value of products. Census data for the odd-numbered years of the period 1919-35 were interpolated and extended to 1936 by means of a continuous tonnage series obtained from the American Iron and Steel Institute's *Annual Statistical Report*. In no census year did the difference between these 2 series exceed 1 percent.

Since the Census treats blast-furnace operations of steel works and rolling mills separately, the reported quantities of pig iron and ferro-alloys represent total production regardless of changes in integration.²

Steel Works and Rolling Mills.— The index for the odd-numbered years 1919-35 is based on weighted aggregates for 31 products which represent about 70 percent of the total value of this

² Changes in integration in recent years are illustrated by the following tabulation (Daugherty *et al.*, *op. cit.*, I, 382):

Year	Percent of pig iron produced by -	
	Merchant blast furnaces	Integrated companies
1929	16.1	84.9
1931	12.4	87.6
1933	7.8	92.2

There are 4 types of companies in the Iron and Steel group: Merchant blast-furnace, integrated, semi-integrated, and nonintegrated. A merchant blast-furnace company operates only blast furnaces. An integrated company has blast furnaces, steel furnaces, and rolling mills. A semi-integrated company has steel furnaces and rolling mills but no blast furnaces. A nonintegrated company has only rolling-mill capacity.

industry's output.³ The weight for each product is the average of the estimated values added per unit for the census years 1921-35. This index was completed by means of another, which is a weighted aggregative index for 21 of the 31 products;⁴ each of the 21 series was rendered continuous by the use of comparable American Iron and Steel Institute data. The 21- and 31-product indexes compare as follows:

Year	Index of production of -	
	31 products (NRP)	21 products
1919	60.5	56.7
1921	35.1	33.7
1923	76.7	76.2
1925	78.1	77.8
1927	78.6	78.8
1929	100.0	100.0
1931	48.4	48.4
1933	44.5	45.0
1935	64.9	65.5

The quantities of each product represent total output, i. e., the sum of production for sale, interplant transfer, and consumption on premises. There are a few exceptions in the reported statistics, however, but adjustments were made wherever possible.⁵

It was appropriate to use unit-value-added weights since products of steel-rolling mills are obtained by shaping others made at earlier stages and almost every series represents total output. The estimates of unit value added, which were obtained by taking the differences between unit values at successive stages, are subject to a number of limitations arising from the defects of the basic statistics. It is believed that these computed weights,

³These products are: Ingots; steel castings; rails - new and rerolled; rail joints and fastenings; structural shapes - heavy and light; concrete-reinforcing bars; merchant bars - iron, open-hearth and Bessemer, and crucible and electric; wire rods; plates; sheets; skelp; cotton ties, hoops, bands, and strips; oil-country casing, tubing, and pipe (wrought-welded); other black pipe (wrought-welded); galvanized pipe (wrought-welded); tin plate; seamless pipe and tube; blooms, billets, and slabs, except for forging; rolled blooms and billets for forging; sheet and tin-plate bars; bolt and nut rods and spike and chain rods; muck and scrap bars; axles, rolled or forged; car and locomotive wheels; armor plate and ordnance; scrap iron and steel; and terneplate.

⁴These are the first 21 listed in the preceding footnote.

⁵For example, production of each of 2 types of merchant bars ("open-hearth and Bessemer" and "crucible and electric") was estimated for 1925-35 from combined total production and the respective amounts produced for sale and transfer; and since total production in 1935 was not reported separately for stainless-steel plates and sheets, their combined tonnage was distributed in accordance with the 1933 proportions. On the other hand, no adjustment could be made for the exclusion of consumption in the same establishment from the quantities reported for rerolled rails nor for the restriction of the statistics for armor plate and ordnance to production for sale.

nevertheless, yield a more satisfactory index than would unit-value weights used in conjunction with production for sale. The limitations of the computed value-added weights may be summarized as follows:

- (1) Census value data correspond to production for sale and interplant transfer, not total production.
- (2) The values per ton at 2 successive stages are not strictly comparable as a consequence of losses from scale formation, spoilage, cropping, etc. Indeed, it has been estimated that an ingot yields only about 70 percent of its weight in finished product.⁶
- (3) The difference between successive unit values still includes the cost of fuel, electric energy, and any additional raw materials consumed in the manufacture of the more highly fabricated product.⁷
- (4) There may be a lack of strict correspondence between successive product classes. For example, since stainless-steel bars are rolled from expensive stainless-steel billets, blooms, or slabs, subtraction of the unit value of all billets, blooms, and slabs - the only figure which can be computed from Census data - from the unit value of stainless-steel bars yields an excessive estimate of value added per ton.⁸
- (5) Many other factors, such as disproportionate changes in the price structure and differences in pricing systems, may distort the relationship between unit values at successive stages.

⁶Daugherty *et al.*, *op. cit.*, I, 322; *Picture Story of Iron and Steel* (New York: American Iron and Steel Institute), p. 21; and "Yearbook of Industry," *Steel* (Jan. 6, 1936), p. 206 make similar estimates.

⁷Although additional raw materials are introduced almost exclusively in the pig-iron and ingot stages of production, the manufacture of tin plate and terno-plate requires coating metal. Furthermore, acid baths are used at some stages to remove scale.

⁸That a similar problem arises in other cases is evidenced by the fact that negative unit values added were obtained in 1921, 1933, and 1935, for "blooms, billets, and slabs, except for forging" and for "sheet and tin-plate bars." Such a result seems to be due to the unrepresentativeness of Census data for ingots for sale and interplant transfer (about 1 percent of the total production), which refer almost exclusively to the more expensive alloy- or special-steel ingots. The remaining 99 percent, which consists primarily of relatively inexpensive carbon-steel ingots (cf. prices filed by manufacturers with the NRA Steel Code Authority and cited by *Iron Age*), is consumed within reporting companies and hence is assigned no value in Census returns. An attempt was made to minimize the exaggeration by using the ingot unit values for interplant transfers, which are lower than those referring to production for sale. Negative unit-values added were, nevertheless, obtained for the 2 products in 1921, 1933, and 1935. (The weight for each product - an average for 1921-35 - is, of course, positive.)

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Strict proportionality between unit-value-added weights and unit labor requirements is not to be expected in view of the low labor content of value and value added⁹ and the limitations noted above. A comparison of the 2 sets of weights for 15 categories of products follows:¹⁰

Product	Average value added per gross ton (1921-35)		Man-hours added per gross ton	
	Dollars	Percent-age dis-tribution	Man-hours	Percent-age dis-tribution
Total, all products	-	100.0	-	100.0
Steel ingots	10.77	2.6	3.00	1.5
Billets and slabs	3.09	0.7	5.65	2.8
Wire rods	10.26	2.4	4.39	2.2
Structural shapes, rolled	9.44	2.3	2.27	1.1
Plates, sheared and universal	12.03	2.9	1.93	0.9
Concrete-reinforcing bars	11.34	2.7	4.28	2.1
Standard rails and fastenings	11.39	2.7	4.52	2.2
Bar steel	23.53	5.6	5.09	2.5
Sheets, all grades	39.00	9.3	18.50	9.1
Hoops and bands	22.46	5.4	7.64	3.8
Pipes and tubing	56.72	13.5	22.45	11.0
Steel car wheels	67.59	16.2	20.83	10.3
Railroad axles	45.75	10.9	18.52	9.1
Fabricated structural work	21.93	5.2	43.74	21.5
Tin plate and terneplate	73.64	17.6	40.34	19.9

Indexes computed with these 2 sets of weights are similar. This resemblance, however, may not reflect the influence of the weights so much as the predominance of steel ingots and of billets and slabs in the weighted aggregates:

⁹Wages in 1929, for example, constituted 26 and 5 percent, respectively, of value added and value of products of Blast Furnaces. The corresponding percentages for Steel Works and Rolling Mills are 47 and 20.

¹⁰The man-hour ratios were computed from cumulative data for an undefined but recent period shown in B. H. Topkis and H. O. Rogers, "Man-Hours of Labor per Unit of Output in Steel Manufacture," *Monthly Labor Review*, May 1935, pp. 1158-9. Census products were regrouped to secure a comparable classification. In the computation of man-hours added, account was taken of conversion losses.

These figures, which refer to 55-60 percent of capacity utilization, may not be typical since utilization varies widely not only from product to product at any given time but also from year to year. (Cf. Daugherty *et al.*, *op. cit.*, II, 717.)

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Index of production with -

Year	Average value- added weights (1921-35)	Man-hours- added weights	Value-added weights (ingots, billets, and slabs)
1921	34.9	35.7	34.7
1923	79.0	80.7	80.8
1925	79.7	80.7	80.9
1927	80.3	80.7	79.6
1929	100.0	100.0	100.0
1931	46.7	47.2	46.7
1933	42.5	43.3	41.8
1935	64.1	66.0	62.3

Employment and Man-hours

The index of wage-earner employment for the industry group conforms to the trend of Census totals. It was constructed by extending the BLS index for the period 1923-36 back to 1919 by the use of month-to-month link relatives also supplied by BLS (*Monthly Labor Review*).

The wage-earner indexes for the component industries were derived from Census statistics¹¹ for the odd-numbered years and estimates for the even-numbered years made by distributing the group totals through the use of averages of the proportions in adjacent census years.

The man-hours index for the industry group was constructed from the employment index and an annual series of average weekly hours. The latter is based on estimated actual hours for 1919, the NICB series for 1920-31, and BLS hours for 1932-36. The estimate for 1919 was made by assuming the same percentage change in actual hours between 1919 and 1920 as was indicated by average prevailing hours for selected occupations.¹² Separate man-hours series could not be constructed for the component industries.

¹¹Despite changes in integration, employment in Blast Furnaces is comparable with production since the Census combines blast-furnace employment and production of integrated companies with the corresponding statistics for merchant blast furnaces.

¹²Data for selected occupations were published in *Wages and Hours of Labor in the Iron and Steel Industry: 1909 to 1920* (BLS Bull. No. 305). The computed hours for 1919 are 63.7.

Several alternative estimates were rejected because they appeared to be unreasonably low in the light of known facts. For example, an estimate of 46.4 hours, based on statistics presented in *Industrial Survey in Selected Industries in the United States: 1919* (BLS Bull. No. 265) is obviously an understatement since (1) the 8-hour day was not introduced until 1924, (2) the data refer to selected full-time pay rolls, and (3) the 1919 steel strike probably depressed average employment rather than average hours per week for the year. Another estimate, 51.4 hours, was obtained by dividing total

[Continued]

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Productivity¹³

Blast Furnaces.— Some productivity statistics are available by region, capacity of furnace, and type of company. From the following table, it may be seen, for example, that the pig-iron and ferro-alloy labor-requirement ratio for Chicago was about half as large as the one for Birmingham in 1929, despite the similarity of the rates of operation:¹⁴

District	1929		1931		1933	
	Percent of capacity operation	Man-hours per ton	Percent of capacity operation	Man-hours per ton	Percent of capacity operation	Man-hours per ton
Eastern	70.0	1.65	36.9	1.59	26.6	1.48
Pittsburgh	76.3	1.87	28.9	1.87	22.2	1.82
Youngstown	80.8	1.59	31.2	1.83	32.6	1.88
Cleveland	88.4	1.80	40.7	2.00	34.0	2.11
Detroit-Toledo	104.1	2.40	58.2	2.49	32.2	2.33
Chicago	82.9	1.38	35.0	1.56	22.1	1.44
Birmingham	79.5	2.72	59.8	2.35	31.3	2.35

Furnaces of less than 500 gross tons daily capacity have 2 to 3 times the labor requirements of higher-capacity groups. Furthermore, integrated companies require only about half as much direct labor per ton of pig-iron as do merchant producers.¹⁵

Capacity (gross tons per day)	Man-hours of direct labor per ton, 1933
1-500	5.5
501-1,000	1.8
1,001-1,500	2.5
1,501-2,000	1.9
2,001-3,000	1.6
3,001-5,000	-
5,001-7,500	2.0
7,501 or over	1.5
All companies	1.7
Integrated companies	1.6
Merchant producers	3.0

¹²[Continued]

(Census) wages by average hourly earnings (BLS). Such earnings, however, are probably not adequate since only half of the workers (all mechanical and maintenance) are paid hourly wage rates, while the other half (all production) are paid on a tonnage or piece-work basis and may, in addition, earn bonuses.

¹³This discussion is confined to Blast Furnaces since available statistics for Steel Works and Rolling Mills were presented in the "Production" section in the form of labor-requirement ratios.

¹⁴Daugherty *et al.*, *op. cit.*, I, 400-1. Computed by Bureau of Business Research (University of Pittsburgh) from special tabulations supplied by the Census and *Iron Age*.

¹⁵*Ibid.*, p. 23.

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Table 29.- SUMMARY INDEXES FOR THE IRON AND STEEL INDUSTRY GROUP: 1919-36

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	61.6	99.9	120.8	61.7	51.0
1920	76.5	102.3	117.8	74.8	64.9
1921	35.4	80.6	59.7	58.4	59.3
1922	62.1	77.4	82.0	80.2	75.7
1923	76.0	101.3	106.5	77.0	73.2
1924	65.3	94.1	87.9	69.4	74.3
1925	76.6	95.3	93.1	82.5	84.4
1926	84.2	97.8	96.9	86.1	86.9
1927	79.0	92.8	89.8	85.1	86.0
1928	91.0	93.2	91.6	97.6	99.3
1929	100.0	100.0	100.0	100.0	100.0
1930	73.6	87.5	77.9	84.1	94.5
1931	46.1	66.3	52.4	72.5	91.8
1932	26.5	56.0	27.7	47.3	95.7
1933	43.7	66.9	42.5	63.4	102.8
1934	46.8	82.8	47.9	58.9	101.9
1935	64.1	89.3	59.1	71.6	108.5
1936	89.1	101.8	79.0	87.5	112.8

Table 30.- SUMMARY INDEXES FOR BLAST FURNACES: 1919-36

(1929 = 100)

Year	Production	Employment	Output per wage earner
1919	72.7	176.3	41.2
1920	86.6	153.0	56.6
1921	39.1	74.9	52.2
1922	63.8	104.1	61.3
1923	94.5	147.1	64.2
1924	73.5	124.9	58.8
1925	85.9	116.9	73.5
1926	92.0	118.4	77.7
1927	85.3	112.0	76.2
1928	89.3	101.8	87.7
1929	100.0	100.0	100.0
1930	74.4	79.4	93.7
1931	43.0	54.4	79.0
1932	20.5	42.3	46.5
1933	31.2	46.5	64.3
1934	37.7	57.1	66.0
1935	49.8	60.8	81.9
1936	72.3	68.4	105.7

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Table 31.- SUMMARY INDEXES FOR STEEL WORKS AND ROLLING MILLS: 1919-38

(1929 = 100)

Year	Production	Employment	Output per wage earner
1919	60.5	95.1	63.6
1920	75.6	99.1	76.3
1921	35.1	59.7	58.8
1922	62.0	75.7	81.9
1923	76.7	96.4	77.9
1924	64.7	92.1	70.2
1925	78.1	94.0	83.1
1926	83.6	96.5	86.6
1927	78.6	91.6	85.8
1928	91.1	92.6	98.4
1929	100.0	100.0	100.0
1930	73.6	88.0	83.6
1931	48.4	67.1	72.1
1932	28.9	56.9	47.3
1933	44.5	70.2	63.4
1934	49.4	84.5	58.5
1935	64.9	91.1	71.2
1936	90.0	103.9	86.6

- 32. KNIT GOODS GROUP
- 33. HOSIERY
- 34. UNDERWEAR
- 35. OUTERWEAR
- 36. KNIT CLOTH

The Knit Goods group, which employed over 208,000 wage earners in 1929, embraces establishments whose principal products are knit by machine from various yarns, such as cotton, wool, silk, and rayon. The 4 component industries are named in accordance with the nature of their primary products. The approximate number of wage earners employed in each in 1929 was as follows:

Hosiery	130,000	Outerwear	29,000
Underwear	41,500	Knit Cloth	8,500

Production

Knit Goods Group.—The production index for the group was constructed in the following manner: First, a harmonic mean of relatives for the 4 component industries was computed for the odd-numbered years 1919-31 with changing employment weights; this mean was then extended to 1933 and 1935 through the use of a similar average of relatives for Hosiery, Underwear, and Outerwear.¹

The NRP index agrees closely, except in 1919, with an arithmetic mean of the 4 series of production relatives weighted by the number of wage earners in 1929:

Year	Index of production with -	
	Changing employment weights	Fixed employment weights (1929)
1919	60.8	66.9
1921	65.2	67.2
1923	79.2	81.9
1925	82.5	84.4
1927	85.2	85.0
1929	100.0	100.0
1931	92.6	93.7

The disparity of the 2 index numbers for 1919 is a reflection of the great difference in level between the production and

¹Production relatives comparable with those for earlier years could not be obtained for Knit Cloth for 1933 and 1935 (see fn. 15). The NRP group index number for 1935 (1933=100), however, differs by only 0.5 percent from an index number based on production relatives for all 4 industries. In any case, the NRP group index differs by a maximum of only 1.6 units from a harmonic mean of relatives for Hosiery, Underwear, and Outerwear in the period 1919-31.

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productivity relatives for the Underwear industry and those for the other 3 components of the group.

Hosiery.— The Hosiery production index was computed for the odd-numbered years 1919-35 from Census data representing about 99 percent of the value of all hosiery output;² it comprises 3 segments, each of which is an aggregative index with unit-value weights. The first segment, for the odd-numbered years 1919-25, includes the following 19 products (indicated by x) weighted by averages of unit values for the same years:

Type of yarn	Hose		Half-hose	
	Full-fash- ioned	Seam- less ³	Full-fash- ioned	Seam- less
All-cotton	x	x	— x —	
All-wool	x	x	— x —	
Cotton-wool mixed	x	x		x
Silk	x	x	x	x
Rayon		x		x
Silk or rayon mixed with other fibers	x	x	x	x

The second segment, for the years 1925 and 1927, includes the same products classified in 6 categories according to type of yarn; these 6 series were weighted by averages of unit values for the same 2 years. The third segment, for the odd-numbered years 1927-35, includes 30 series weighted by 1929 unit values; these series (indicated by x) are comparable in scope with those in the preceding segments, except for minor omissions which have a negligible effect on value coverage:

Type of yarn	Men's		Women's		Boys', misses', and children's (princi- pally seamless)	Infants' (princi- pally seamless)
	Full-fash- ioned	Seam- less ³	Full-fash- ioned	Seam- less		
All-cotton	x	x	x	x	x	x
All pure-thread silk		|	x	x		
Pure-thread silk with lisle or cotton tops, heels, and toes	— x —	|				
			x	x		[con.]

Footnotes 2 and 3 appear on following page.

[con.]

Type of yarn	Men's		Women's		Boys', misses', and children's (princi- pally seamless)	Infants' (princi- pally seamless)
	Full- fash- ioned	Seam- less ³	Full- fash- ioned	Seam- less		
All-rayon		x	|	|	|	
Rayon with cot- ton tops, heels, and toes	— x —		|	|	|	
All wool	— x —		|	|		
Cotton and wool	x		— x —		x	
Silk and rayon	x		|			
Rayon and wool	x					x
Rayon and cotton	x				x	x
Other		x ⁴	— x ⁵ —		x ⁶	x ⁷

No satisfactory data were available for completing the index for the Hosiery industry for the even-numbered years.⁸

Underwear.— The production index for Underwear was computed from Census data for the odd-numbered years 1919-35; it comprises 2 segments, each of which is an aggregative index with 1929 unit-value weights. The first segment, for the odd-numbered years

²Before 1929 the detailed Census quantity statistics refer only to the output of establishments in the Knit Goods group; in 1929 and subsequent years, however, they refer to the output of establishments in all industries.

³Principally seamless (i. e., includes some full-fashioned), except for all-cotton.

⁴Includes silk and cotton, silk and wool (except for 1935), and triple mixtures.

⁵Includes silk and cotton, silk and wool, silk and rayon, rayon and cotton, and triple mixtures.

⁶Includes silk and cotton; silk and wool; silk and rayon; rayon and wool; pure-thread silk with lisle or cotton tops, heels, and toes; all pure-thread silk; and triple mixtures.

⁷Includes all-wool; all pure-thread silk; pure-thread silk with lisle or cotton tops, heels, and toes; all-rayon; rayon with cotton tops, heels, and toes; cotton and wool; silk and rayon; silk and cotton; silk and wool; and triple mixtures.

⁸Two unweighted indexes of hosiery output, which could be computed for several years from sample statistics, did not concur with the NRP index. One of these, for the years 1923-30, is based on data compiled by the Census and published in *Survey of Current Business*, "1931 Annual Supplement," pp. 130-1.

The other, compiled by the NRA Code Authority, is published in W. A. Gill, F. Pouder, W. H. Ray, and A. H. Barenboim, *The Knitting Industries* (NRA, Division of Review, Work Materials No. 80, Mar. 1936).

Year	Index (1929=100)		
	NRP	SCB	NRA
1923	60.6	106.8	n.a.
1925	70.3	106.2	n.a.
1927	81.4	104.5	104.5
1929	100.0	100.0	100.0
1931	91.7	n.a.	86.5
1933	96.8	n.a.	90.2
1935	110.0	n.a.	94.2

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1919-27, includes 8 products (indicated by asterisks in the following list) which represent about 98 percent of the value of underwear made in the Knit Goods group; the second segment, for the odd-numbered years 1927-35, includes 15 series (for all the products listed below) which represent about 93 percent of the value of underwear made in all industries.⁹

Shirts and drawers	Union suits	Bloomers and step-ins
*All-cotton	*All-cotton	All-cotton
*All-wool	*All-wool	Silk
*Cotton and wool	*Cotton and wool	Rayon
mixed	mixed	Other ¹²
Rayon	Rayon	
*Other ¹⁰	*Other ¹¹	Slips and petticoats

Available data were not considered satisfactory for interpolating or extending the NRP index.¹³

Outerwear.- The production index for Outerwear, computed from Census data for the odd-numbered years 1919-35, is composed of 2 segments, each of which is an aggregative index with unit-value weights. The first segment, for the odd-numbered years 1919-27, includes the following 7 classes of products (which represent 90 percent of the total value of outerwear made in the group)¹⁴ weighted by averages of unit values for the same years:

Sweaters, sweater coats, jerseys, cardigan jackets, etc.	Headwear, except infants' Neckties Sueded cotton gloves
Bathing suits	Gloves and mittens except sueded
Scarfs and shawls	

The second segment, for the odd-numbered years 1927-35, includes 7 products (which account for about 86 percent of the value of

⁹The Census expanded the scope of its canvass in 1929 (see fn. 2). Infants' underwear, which is reported in terms of value only, is the only significant omission in all years.

¹⁰In addition to other fibers, includes silk for all years and silk and rayon mixtures for 1927-33.

¹¹In addition to other fibers, includes silk and silk or rayon mixed with other fibers for all years and silk and rayon mixtures for 1927-33.

¹²Includes wool, cotton and wool, and silk and rayon for 1927-33 and cotton and wool and other mixtures and fibers for 1935.

¹³An unweighted index constructed from sample statistics published in *Survey of Current Business*, ("1931 Annual Supplement," pp. 130-1, and Mar. 1932, p. 42) does not concur with the NRP series:

Year	Index (1929=100)	
	NRP	SCB
1921	118.2	71.7
1923	130.7	98.2
1925	128.5	97.8
1927	100.3	90.0
1929	100.0	100.0
1931	79.4	88.1

Footnote 14 appears on the following page.

outerwear produced in all industries)¹⁴ weighted by 1929 unit values; these 7 products consist of the first 5 listed above and "athletic and golf hose" and "dresses and suits."

No satisfactory data were available for completing the index for the even-numbered years.

Knit Cloth.— The production index for Knit Cloth, computed from Census data for the odd-numbered years 1919-31, is composed of 3 segments, each of which is an aggregative index with unit-value weights. The first segment, for the odd-numbered years 1919-27, includes 3 series weighted by averages of unit values for the same years: Jersey cloth (including milanese and tricot) and tricolette, sueded cotton cloth, and towels and toweling. The second segment, for the odd-numbered years 1927 and 1929, is based on 4 series weighted by averages of unit values for these 2 years: Wool jersey; other knit woolens; silk jersey, including milanese; and rayon tubing, including tricolette. The third segment, for 1929 and 1931,¹⁵ includes "other knit rayons", "cotton jersey", and "corset cloth" in addition to the products of the second segment; the weights are averages of unit values for the same years. The products in the first segment represent about 71 percent of the value of knit cloth made in establishments in the group, and those in the second and third account for about 82 percent of the value of knit cloth made in all industries.¹⁶

Employment and Man-hours

The index of employment for the group was computed from Census statistics for the odd-numbered years 1919-35 and completed for the even-numbered years 1920-36 by means of the BLS index. The index of man-hours for the group was derived from the group employment index and a series of actual weekly hours which includes adjusted Census prevailing hours for 1919 and NICB actual hours for subsequent years. Census prevailing hours for 1919 were reduced to actual by multiplication by the average of the ratios of NICB actual to Census prevailing hours for 1921, 1923, and 1929.

¹⁴The Census expanded the scope of its canvass in 1929 (see fn. 2).

¹⁵The change (by the Census) in the unit of measurement in 1933 from square yards to pounds made it impossible to extend the third segment to 1933 and 1935. It was possible, however, to construct an index for 1935 on the base 1933 and estimate the effect in 1935 of the exclusion of Knit Cloth from the group index (see fn. 1).

¹⁶The Census expanded the scope of its canvass in 1929 (see fn. 2).

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The employment index for each of the 4 component industries was computed for the odd-numbered years 1919-35, except 1921, from Census statistics; the 1921 relatives are based on estimates obtained by distributing the group total for this year in accordance with averages of the proportions in the 4 industries in 1919¹⁷ and 1923. The 4 indexes were completed for the period 1919-36, except 1920 and 1922, by means of corresponding unpublished BLS indexes. No satisfactory hours series was available for computing a man-hours index for any of these industries.¹⁸

Although the labor indexes for the group are practically comparable with the production index,¹⁹ the employment and production indexes for the component industries differ somewhat in scope. Some of the wage earners included in the employment index for each industry are engaged in making knit goods normally produced elsewhere in the group. This fact is indicated by the percentage which the value of such knit goods comprises of the value of all the output of each industry:²⁰

Year	Hosiery	Underwear	Outerwear	Knit Cloth
1919	3.6	10.3	15.9	18.0
1923	4.9	17.6	11.6	10.3
1925	5.1	16.3	7.8	13.0
1927	2.4	17.5	7.7	16.0
1929	3.9	19.1	6.9	16.0

On the other hand, some of the output included in the production index for each industry is contributed by wage earners in the others. This fact is indicated by the percentage of the total value of the primary output of each industry which is made in establishments in the other 3 industries of the group:

¹⁷For each industry, the number of wage earners in 1919 was assumed to be proportional to the number of spinners, knitters, stitchers, loopers, and finishers reported by the Census. The number of wage earners in these occupations comprised 63.8 percent of all wage earners in the group in 1919.

¹⁸Data in Bull. Nos. 328, 376, and 591 of the BLS Wages and Hours Series permit the computation of average weekly hours for the Hosiery and Underwear industries for the even-numbered years 1926-32. Figures for the same 2 industries for 1932-35 are available in a study by NRA Division of Review (see fn. 6). Census man-hours surveys provide statistics for all 4 industries in the group, but only for the years 1933 and 1935.

¹⁹The value of secondary products of the Knit Goods group (including cotton yarns for sale, cotton waste for sale, old bagging and ties, etc.) constitutes less than 1.5 percent of the total value of the group's output. On the other hand, less than 1 percent of the value of all knit goods has been contributed by establishments outside the group since 1929. (Prior to this year the production index refers only to output of establishments within the group. See fn. 2.)

²⁰The percentages are too high since the value of cotton yarns for sale, cotton waste for sale, old bagging and ties, etc. (see fn. 19) could not be eliminated from the value figures for all the secondary products of each industry.

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Year	Hosiery	Underwear	Outerwear	Knit Cloth
1919	3.2	5.2	8.3	17.6
1923	2.0	6.6	6.4	12.6
1925	1.1	3.3	10.1	11.0
1927	1.7	3.8	9.9	9.8
1929	0.7	9.6	8.4	9.4

The employment index for each industry could not be adjusted to correspond exactly to the production index.²¹

Table 32.- SUMMARY INDEXES FOR THE KNIT GOODS INDUSTRY GROUP: 1919-36
(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	60.8	82.8	81.0	73.4	75.1
1920	n. a.	86.1	81.6	-	-
1921	65.2	77.6	76.3	84.0	85.5
1922	n. a.	92.8	91.2	-	-
1923	79.2	93.2	90.6	85.0	87.4
1924	n. a.	83.3	76.5	-	-
1925	82.5	89.5	84.8	92.2	97.3
1926	n. a.	90.0	85.2	-	-
1927	85.2	91.3	90.1	93.3	94.6
1928	n. a.	91.3	89.8	-	-
1929	100.0	100.0	100.0	100.0	100.0
1930	n. a.	91.1	82.9	-	-
1931	92.6	85.4	75.7	108.4	122.3
1932	n. a.	83.4	67.5	-	-
1933	100.4	91.0	74.9	110.3	134.0
1934	n. a.	98.1	71.3	-	-
1935	111.0	105.4	76.4	105.3	145.3
1936	n. a.	107.5	80.9	-	-

²¹An adjustment for a few years could be attempted on the basis of the assumptions that:

- (1) The value output per wage earner of (a) hosiery, (b) underwear, (c) outerwear, and (d) knit cloth is the same in all 4 industries.
- (2) All the secondary output of each industry constitutes a part of the primary output of the group.
- (3) No knit goods are produced outside the group.

(The method used in making these employment estimates is an extension to 4 industries of the method applied to 2 industries of the Rubber Products, Tobacco Products, and Woolen and Worsted Goods groups.)

The comparative series are shown below with the NRP employment indexes:

Year	Index of employment							
	Hosiery		Underwear		Outerwear		Knit Cloth	
	NRP	Comparative	NRP	Comparative	NRP	Comparative	NRP	Comparative
1919	61.7	64.3	139.8	136.0	100.1	93.1	67.1	50.3
1923	74.8	76.5	117.0	114.3	143.3	135.2	85.2	86.5
1925	80.2	81.8	116.5	107.4	98.6	100.3	75.7	76.5
1927	87.1	89.4	111.4	101.7	85.1	88.0	77.2	76.9
1929	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

The validity of the first of the 3 assumptions stated above cannot be tested. With respect to the second assumption, it should be noted that the small percentage of secondary products in the group (see ftns. 19 and 20) may, if concentrated in one of the industries, distort the estimates for all. The third assumption is valid for every year prior to 1929.

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Table 33.- SUMMARY INDEXES FOR THE HOSIERY INDUSTRY: 1919-36

(1929 = 100)

Year	Production	Employment	Output per wage earner
1919	43.7	61.7	70.8
1920	n. a.	65.4	-
1921	48.9	60.1	81.4
1922	n. a.	73.2	-
1923	60.6	74.8	81.0
1924	n. a.	70.4	-
1925	70.3	80.2	87.7
1926	n. a.	82.2	-
1927	81.5	87.1	93.6
1928	n. a.	88.5	-
1929	100.0	100.0	100.0
1930	n. a.	91.9	-
1931	91.7	86.7	105.8
1932	n. a.	85.6	-
1933	96.8	91.0	106.4
1934	n. a.	99.4	-
1935	110.0	106.5	103.3
1936	n. a.	109.9	-

Table 34.- SUMMARY INDEXES FOR THE UNDERWEAR INDUSTRY: 1919-36

(1929 = 100)

Year	Production	Employment	Output per wage earner
1919	149.1	139.8	106.7
1920	n. a.	136.3	-
1921	118.2	114.3	103.4
1922	n. a.	128.8	-
1923	130.7	117.0	111.7
1924	n. a.	103.1	-
1925	129.3	116.5	111.0
1926	n. a.	119.0	-
1927	100.3	111.4	90.0
1928	n. a.	102.7	-
1929	100.0	100.0	100.0
1930	n. a.	86.6	-
1931	79.4	77.0	103.1
1932	n. a.	72.4	-
1933	92.2	86.6	106.5
1934	n. a.	84.6	-
1935	90.2	84.2	107.1
1936	n. a.	91.5	-

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Table 35.- SUMMARY INDEXES FOR THE OUTERWEAR INDUSTRY: 1919-38

(1929 = 100)

Year	Production	Employment	Output per wage earner
1919	59.6	100.1	59.5
1920	n. a.	110.9	-
1921	76.9	106.7	72.1
1922	n. a.	134.9	-
1923	112.1	143.3	76.2
1924	n. a.	117.4	-
1925	87.4	96.6	90.5
1926	n. a.	88.1	-
1927	82.0	85.1	96.4
1928	n. a.	91.9	-
1929	100.0	100.0	100.0
1930	n. a.	91.7	-
1931	106.5	90.2	118.1
1932	n. a.	90.7	-
1933	119.3	92.9	128.4
1934	n. a.	104.4	-
1935	131.4	122.4	107.4
1936	n. a.	111.3	-

Table 36.- SUMMARY INDEXES FOR THE KNIT CLOTH INDUSTRY: 1919-36

(1929 = 100)

Year	Production	Employment	Output per wage earner
1919	43.0	67.1	64.1
1920	n. a.	71.9	-
1921	63.9	66.7	95.8
1922	n. a.	82.0	-
1923	65.4	85.2	76.6
1924	n. a.	68.3	-
1925	71.1	75.7	93.9
1926	n. a.	72.8	-
1927	74.7	77.2	96.8
1928	n. a.	76.0	-
1929	100.0	100.0	100.0
1930	n. a.	100.3	-
1931	150.7	88.8	169.7
1932	n. a.	80.6	-
1933	n. a.	105.5	-
1934	n. a.	123.6	-
1935	n. a.	133.6	-
1936	n. a.	136.6	-

- 37. LEATHER GROUP
- 38. SOLE AND HARNESS LEATHER
- 39. SIDE AND UPHOLSTERY LEATHER
- 40. CALFSKIN
- 41. KID LEATHER
- 42. SHEEP AND MISCELLANEOUS LEATHER

The Leather group, which employed almost 50,000 wage earners in 1929, includes tanneries manufacturing leather (either from hides and skins owned by them or on a contract basis from hides and skins belonging to others) and establishments engaged only in currying and finishing. For the purpose of this study, the group has been divided into 5 industries:

- (1) Sole and Harness Leather. This industry, which has a lower ratio of wages to value of products than any other in the group, includes establishments engaged in the manufacture of heavy leathers, mainly from cattle hides, such as sole, machinery belting, harness, bag, and case. Offal, an important byproduct consisting of the inferior and thinner parts of the tanned hide and accounting for almost half of its weight, is usually made into rough leather, which may be used for heels or shoe welting. All of the leathers produced in this industry are principally vegetable tanned. In 1929 this industry employed 12,300 wage earners.
- (2) Side and Upholstery Leather. These 2 types of leather are manufactured in separate establishments, which had a combined employment of 12,100 wage earners in 1929.
- (3) Calfskin. This industry, which employed 7,600 wage earners in 1929, produces leather from calfskin and small kipskins, which are not too large to handle in 1 piece. (Calfskins are much smaller than cattle hides, averaging 10 square feet as compared with 35 for the latter.)
- (4) Kid Leather. The establishments in this industry make leather from goatskins and kidskins, almost all of which are imported. These skins are expensive and require a high degree of finishing. The Philadelphia area accounts for about 85 percent of the total output of kid leather, most of the remainder is produced in Massachusetts. About 10,300 wage earners were employed in this industry in 1929.
- (5) Sheep and Miscellaneous Leather. Sheepskins, which are comparatively cheap and more suitable for mechanical treatment than most hides and skins, are manufactured into a

number of special forms, such as shoe-lining stock; glove, fancy, garment, roller, and chamois leather; hat sweats; skivers; and shearlings. Some fancy leather is also manufactured from sealskins, pigskins, deerskins, etc. This industry employed 7,700 wage earners in 1929.

Production

The 2 NRP group indexes are, except for 1920, harmonic means of the production relatives for the 5 component industries, one with changing employment and the other with changing man-hour weights. The former was used in determining output per wage earner and the latter in determining output per man-hour. The figures for 1920 were interpolated by the use of an index constructed by BLS from Tanners' Council statistics.¹ The products included in the index represent about 90 percent of the value of the group's output.

Arithmetic means of the 5 series of production relatives with 1929 man-hour and employment weights agree very closely with the NRP group indexes. A composite index which employs 1929 value weights is also shown in the tabulation which follows:

Year	Index of production with -				
	Changing weights		Fixed weights (1929)		Fixed value weights (1929)
	Employ- ment	Man- hours	Employ- ment	Man- hours	
1919	104.1	104.3	103.9	104.5	109.0
1921	84.1	84.2	83.8	83.9	87.4
1922	104.9	104.7	105.2	105.1	107.7
1923	113.3	113.0	113.6	113.4	116.5
1924	97.4	96.5	97.2	96.6	99.1
1925	97.4	97.1	97.6	97.3	100.6
1926	99.3	98.9	99.6	99.4	100.8
1927	104.0	103.6	103.9	103.7	105.6
1928	101.6	101.7	101.5	101.7	102.2
1929	100.0	100.0	100.0	100.0	100.0
1930	91.4	91.7	91.7	91.8	92.4
1931	83.1	83.2	83.2	83.3	82.5
1932	73.6	73.6	74.1	73.8	73.3
1933	87.5	87.5	88.3	88.0	86.7
1934	95.7	95.9	96.1	96.0	96.7
1935	107.4	107.4	107.9	107.9	109.3
1936	109.4	109.1	108.2	108.2	110.4

¹This index was published in the *Monthly Labor Review*, October 1926, p. 14.

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The measure of production for each of the 5 component industries of the group for the years 1919, 1921-31, 1933, and 1935 is an aggregative index with 1929 unit-value weights derived from Census quantity statistics. Estimates for 1932, 1934, and 1936 were made through the use of 4 Census-Tanners' Council series published in the *Survey of Current Business*. No satisfactory data were available for computing relatives for 1920.

Annual production statistics published in the *Census of Manufactures* were used for 1919 and 1921-31.² These data include contract work and hence are comparable with the employment statistics. Similar figures for identical products were obtained for 1933 and 1935 by adjusting the regular biennial Census data to include all contract work.³ The products⁴ in the index for each industry for 1919, 1921-31, 1933, and 1935 are:

1. Sole and Harness Leather

- Oak and union sole
- Chrome sole
- Belting butts (rough and curried)
- Offal
- Harness leather: union black
- Harness leather: oak black and russet
- Bag, case, and strap leather
- Skirting and collar leather
- Lace

2. Side and Upholstery Leather

- Upper leather (other than patent): cattle (including kip side)
- Patent leather (other than upholstery): cattle (including kip side)
- Upper leather: horse, colt, ass, and mule
- Glove and garment leather: horse, colt, ass, and mule
- Fancy and bookbinders' leather: cowhide
- Fancy and bookbinders' leather: buffings (finished)
- Splits (other than upholstery; finished and rough)
- Upholstery leather: whole-hide grains and machine buffed
- Upholstery leather: buffings (russet)
- Upholstery leather: splits (main and second)

²The figures for 1919 were obtained by the Bureau of the Census in its regular biennial canvasses; those for 1921-31 were collected in its Monthly Census of Hides, Skins, and Leather authorized by the Kreider Act. The monthly census was discontinued after April 1932 as a consequence of the repeal of the Kreider Act.

³The adjustment factor for each product was the average of the ratios in 1929 and 1931 between the figures including and those excluding contract work (the latter are also reported by the Census).

⁴For certain years when statistics for some products were deficient, the index numbers were computed from comparable aggregates for as many products as possible. Minor adjustments were also made to assure the internal comparability of the individual series. For example, foreign tanned patent leather was excluded from the 1923 figure for patent; and the reported quantity of fancy and bookbinders' cabretta leather in 1922, which referred to only the last 7 months of the year, was raised to represent the entire year by multiplying the monthly average for this period by 12.

3. Calfskin

Upper leather: calf and kip (except kip side)

Fancy and bookbinders' leather: calf and kip

4. Kid Leather

Upper leather: goat and kid

Fancy and bookbinders' leather: goat and kid

5. Sheep and Miscellaneous Leather

Upper leather: sheep and lamb (shoe stock) and cabretta

Upper leather: kangaroo and wallaby

Glove and garment leather: sheep and lamb (except shearlings)

Glove and garment leather: shearlings

Glove and garment leather: deer and elk

Fancy and bookbinders' leather: sheep, lamb, and cabretta

Roller leather

Skivers (including hat-sweat)

Chamois

The Census-Tanners' Council leather-production series which were employed to interpolate the 5 industry indexes for 1932 and 1934 and to extend them to 1936 are:⁵

Industry	Census-Tanners' Council series
Sole and Harness Leather	Cattle hides
Side and Upholstery Leather	Cattle hides
Calfskin	Calf and kip
Kid Leather	Goat and kid
Sheep and Miscellaneous Leather	Sheep and lamb

Employment and Man-hours

The index of employment for the industry group was obtained by completing Census wage-earner statistics for the odd-numbered years through the use of the BLS employment index. The man-hours index was derived from the product of this employment series and an annual index of average weekly hours based on an estimate derived from a BLS study for 1919,⁶ on NICB statistics for 1920-31, and on BLS figures for the remaining years.

The employment and man-hours indexes for the 5 component industries were constructed principally from data collected in a survey

⁵The 4 Census-Tanners' Council series are based on monthly Census data for the period January 1931 to April 1932 (see fn. 2) and comparable Tanners' Council statistics thereafter (cf. *Survey of Current Business*, "1938 Supplement," p. 173).

⁶*Industrial Survey in Selected Industries in the United States: 1919* (Bull. No. 265). A weighted average of hours per day for male and female workers was multiplied by 6 to obtain the weekly-hours figure.

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of the Leather industry by the National Research Project in cooperation with the Bureau of Labor Statistics.⁷ The NRP-BLS labor series used for this purpose are available for 5 branches of the Leather group which manufacture the principal products of the corresponding industries as defined in this study: Sole, side, calf, kid, and sheepskin. These series are based on 3 different samples of the NRP-BLS survey and on a fourth of an earlier BLS survey:⁷

(1) A 1935 sample for all 5 branches which represents 67.4 percent of the total employment in the group.

(2) A sample for the sole and kid branches for 1923, the side branch for 1924, the calf branch for 1926 and 1933, and all 4 of these divisions for 1931 and 1934-36.⁸ The percentage of estimated total production in each branch accounted for by the plants surveyed is as follows:

Branch	Earliest year ⁹	1935
Sole	32	59
Side	46	59
Calf	26	37
Kid	48	51

(3) A sample which provides annual data for sole and kid leather (1923-36), for side leather (1924-36), and for calf leather (1926-36).⁸ The coverage percentages, estimated in the same manner as for the second sample, are as follows:

Branch	Earliest year ⁹	1935
Sole	23	39
Side	28	33
Calf	17	30
Kid	28	30

(4) A sample for the sheepskin branch for 1923 and 1931 considered in the earlier BLS survey. The plants canvassed accounted for about 50 percent of the output of the branch in 1931.

⁷The results of the survey are summarized by J. R. Arnold in *Labor Productivity in the Leather Industry* (WPA National Research Project in cooperation with U. S. Bur. Labor Statistics, Dept. Labor, Report No. B-1, Oct. 1937). More detailed unpublished statistics tabulated by NRP-BLS, as well as an earlier BLS study (*Monthly Labor Review*, September 1932), were also used in the derivation of these indexes.

⁸The 1936 figures were estimated on the basis of data for 6 months for sole, side, and calf and for 9 months for kid.

⁹1923 for sole and kid, 1924 for side, and 1926 for calf.

The first step in determining employment and man-hours for each of the 5 industries was to construct continuous sample indexes of output per man-hour for the 5 branches as defined by NRP-BLS: Sole, side, calf, kid, and sheepskin.¹⁰ This was accomplished by linking series from these several samples, adjusting the several segments to the levels of the series of highest coverage, and filling the gaps by straight-line interpolation. Annual indexes were thus obtained for the sole, kid, and sheepskin branches for 1923-36, for the side branch for 1924-36, and for the calf branch for 1926-36. The index number for the earliest year for each branch was assumed for each of the preceding years of the period 1919-25 (e. g., the 1923 index number for the kid branch was assumed for each of the years 1919-22); the 1935 figure for sheepskin was assumed for 1936.¹¹

Second, 5 branch indexes of production, comparable to the indexes of output per man-hour derived from the NRP-BLS data, were constructed from Census data for 1919, 1921-31, 1933, and 1935. The quantity series included in these indexes (reported in terms of number of pieces) were reduced to pounds for sole leather and to square feet for the other branches by application of conversion ratios computed from the 1935 *Census of Manufactures*. The products in the index for each branch are the principal ones included in the corresponding NRP industry index.¹²

Third, division of these production indexes by the corresponding output per man-hour series yielded indexes of man-hours for the

¹⁰The units for the first branch are pounds; and for the others, square feet.

¹¹The output-per-man-hour ratios for sheepskin for 1923 and 1931, which refer to direct labor in 4 large plants, were adjusted to include indirect labor by division by 0.86. (This factor was computed from data shown in *Monthly Labor Review*, September 1932, p. 474.) The 1935 ratio for this branch, like the ratios for all years for the other 4 branches, includes both direct and indirect labor.

¹²The products included in these branch indexes, which are not to be confused with those in the industry indexes (see text, section on "Production"), are:

Sole leather:	Oak and union sole Chrome sole Offal
Side leather:	Upper leather (other than patent): cattle (including kip side) Splits (other than upholstery; finished and rough)
Calfskin:	Upper leather: calf and kip (except kip side)
Kid leather:	Upper leather: goat and kid
Sheepskin:	Upper leather: sheep and lamb (shoe stock) and cabretta Glove and garment: sheep and lamb (except shearlings) Fancy and bookbinders': sheep and lamb and cabretta Roller leather

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5 branches. These were then converted into actual man-hours through the use of the productivity ratios for the 4 samples described above and the production aggregates (pounds or square feet) for 1935.

Fourth, the man-hours were adjusted to refer to the industries as defined in this study by multiplication by the ratio in each year of the production aggregates (1929 unit-value-weighted quantities) for the individual industries as here defined to the production aggregates for the corresponding branches as defined by NRP-BLS.

Fifth, NRP-BLS average weekly hours for the separate branches were pieced together in continuous series and multiplied by 52 to secure average hours per man per year.¹³ Division of the man-hours by these annual-hours series yielded estimates of the number of wage earners in each industry.

Finally, before reduction to relatives, the employment and man-hours estimates for each industry were adjusted by the same percentage in order to make the sum of the estimates for the 5 industries in each year equal to employment and man-hours in the group as a whole.

¹³The second NRP-BLS sample described above provided average weekly hours for all but the sheepskin branch for 1931 and 1934-36 and, in addition, for sole and kid leather for 1923, for side leather for 1924, and for calf leather for 1926 and 1933. Estimates for intervening years were made through the use of data for the third sample; weekly hours for the earliest year for each branch were assumed for each of the preceding years of the period 1919-25. Weekly hours for the sheepskin branch for 1923-36 are averages of those for the other 4 branches weighted by the number of wage earners included in the respective samples; the 1923 average was assumed for 1919-22.

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Table 37.- SUMMARY INDEXES FOR THE LEATHER INDUSTRY GROUP: 1919-36

(1929 = 100)

Year	Production (employment weights)	Employment	Output per wage earner	Production (man-hour weights)	Man-hours	Output per man-hour
1919	104.1	145.1	71.7	104.3	146.3	71.3
1920	86.0	131.0	65.6	86.1	127.2	67.7
1921	84.1	98.0	85.8	84.2	95.9	87.8
1922	104.9	117.2	89.5	104.7	117.4	89.2
1923	113.3	119.6	94.7	113.0	119.6	94.5
1924	97.4	104.7	93.0	96.5	101.7	94.9
1925	97.4	104.7	93.0	97.1	104.5	92.9
1926	99.3	106.1	93.6	98.9	103.7	95.4
1927	104.0	106.0	98.1	103.6	102.0	101.6
1928	101.6	103.5	98.2	101.7	98.3	103.5
1929	100.0	100.0	100.0	100.0	100.0	100.0
1930	91.4	92.9	98.4	91.7	97.6	104.7
1931	83.1	84.2	98.7	83.2	80.0	104.0
1932	73.6	75.5	97.5	73.6	66.6	110.5
1933	87.5	88.5	98.9	87.5	76.4	114.5
1934	95.7	98.2	97.5	95.9	75.9	126.4
1935	107.4	101.9	105.4	107.4	81.8	131.3
1936	109.4	103.0	106.2	109.1	84.9	128.5

Table 38.- SUMMARY INDEXES FOR THE SOLE AND HARNESS LEATHER INDUSTRY: 1919-36

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	127.0	187.5	186.2	67.7	68.2
1920	n. a.	n. a.	n. a.	-	-
1921	107.8	132.2	127.6	80.6	84.1
1922	113.3	137.1	135.8	82.6	83.4
1923	124.4	142.2	140.9	87.5	88.3
1924	99.9	116.2	111.2	86.0	89.8
1925	104.4	127.2	126.4	82.1	82.6
1926	98.7	120.4	116.5	82.0	84.7
1927	108.9	113.5	113.8	95.9	95.7
1928	105.2	108.4	105.7	97.0	99.5
1929	100.0	100.0	100.0	100.0	100.0
1930	99.0	103.6	98.4	95.6	102.7
1931	78.4	87.3	77.2	89.8	101.6
1932	68.3	81.7	62.6	83.6	109.1
1933	77.5	93.4	72.3	83.0	107.2
1934	93.2	101.2	76.1	92.1	119.3
1935	107.1	109.2	83.3	98.1	128.6
1936	110.5	107.4	90.1	102.9	122.6

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Table 39.- SUMMARY INDEXES FOR THE SIDE AND UPHOLSTERY LEATHER INDUSTRY:
1919-36

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	118.7	151.2	150.1	78.5	79.1
1920	n. a.	n. a.	n. a.	-	-
1921	77.1	82.6	79.7	93.3	96.7
1922	120.1	120.9	119.8	99.3	100.3
1923	126.7	122.0	120.9	103.9	104.8
1924	117.3	120.4	115.2	97.4	101.8
1925	122.4	116.2	115.5	105.3	106.0
1926	118.7	115.5	111.7	102.8	106.3
1927	114.9	119.8	107.7	95.9	106.7
1928	102.1	108.2	98.8	94.4	103.3
1929	100.0	100.0	100.0	100.0	100.0
1930	84.2	89.1	80.7	94.5	104.3
1931	84.1	74.7	73.6	112.6	114.3
1932	77.0	72.7	70.6	105.9	109.1
1933	92.1	85.9	78.1	107.2	117.9
1934	111.4	109.2	87.2	102.0	127.6
1935	129.8	114.9	95.3	112.1	135.2
1936	133.0	140.7	112.5	94.5	118.2

Table 40.- SUMMARY INDEXES FOR THE CALFSKIN INDUSTRY: 1919-36

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	77.9	106.2	110.4	73.4	70.6
1920	n. a.	n. a.	n. a.	-	-
1921	97.0	111.3	112.5	87.2	86.2
1922	100.7	110.8	114.9	90.9	87.6
1923	118.8	122.5	127.1	97.0	93.5
1924	106.8	116.7	116.9	91.5	91.4
1925	90.1	97.7	101.8	92.2	88.5
1926	102.1	107.4	108.8	95.1	93.8
1927	109.7	101.1	104.3	108.5	105.2
1928	101.2	95.7	93.7	105.7	108.0
1929	100.0	100.0	100.0	100.0	100.0
1930	92.3	86.8	86.2	106.3	107.1
1931	80.8	80.7	81.3	100.1	99.4
1932	77.7	65.9	65.2	117.9	119.2
1933	90.3	83.3	81.2	108.4	111.2
1934	86.3	88.5	69.6	97.5	124.0
1935	98.1	87.0	77.4	112.8	126.7
1936	91.1	57.3	54.7	159.0	166.5

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Table 41.- SUMMARY INDEXES FOR THE KID LEATHER INDUSTRY: 1919-36

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	93.2	135.9	134.9	68.6	69.1
1920	n. a.	n. a.	n. a.	-	-
1921	61.9	75.9	73.3	81.6	84.4
1922	86.4	101.6	100.7	85.0	85.8
1923	64.1	92.8	91.9	90.6	91.5
1924	63.0	64.4	65.5	97.8	96.2
1925	74.8	79.2	77.1	94.4	97.0
1926	88.7	93.6	90.5	94.8	98.0
1927	90.6	94.7	89.3	95.7	101.5
1928	98.0	99.7	93.4	98.3	104.9
1929	100.0	100.0	100.0	100.0	100.0
1930	98.6	93.4	88.7	105.6	111.2
1931	87.1	88.1	83.3	98.9	104.6
1932	68.4	74.1	64.2	92.3	106.5
1933	64.2	68.0	75.0	95.7	112.3
1934	66.3	93.8	68.3	92.0	126.4
1935	93.3	101.9	77.2	91.6	120.9
1936	91.8	96.7	74.6	94.9	123.1

Table 42.- SUMMARY INDEXES FOR THE SHEEP AND MISCELLANEOUS LEATHER INDUSTRY: 1919-36

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	63.8	118.3	120.1	70.8	69.8
1920	n. a.	n. a.	n. a.	-	-
1921	73.2	84.2	83.1	86.9	88.1
1922	98.3	106.5	107.7	92.3	91.3
1923	110.1	112.2	113.6	98.1	96.9
1924	97.0	103.8	101.5	93.4	95.6
1925	85.2	91.7	91.2	92.9	93.4
1926	82.8	84.1	83.0	98.5	99.8
1927	90.6	92.3	88.9	98.2	101.9
1928	99.8	100.8	96.3	99.0	103.6
1929	100.0	100.0	100.0	100.0	100.0
1930	81.9	87.3	82.9	93.8	98.8
1931	86.8	92.0	88.7	94.3	97.9
1932	82.6	81.5	72.0	101.3	114.7
1933	103.2	90.4	78.4	114.2	131.6
1934	99.3	91.4	71.3	108.6	139.3
1935	105.6	84.6	68.7	124.8	153.7
1936	104.2	90.6	74.9	115.0	139.1

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43. LUMBER AND TIMBER PRODUCTS GROUP

44. LOGGING CAMPS

45. SAWMILLS AND SAW-PLANE MILLS

In addition to Logging Camps, the Lumber and Timber Products group includes Sawmills and Saw-Plane Mills (i. e., merchant sawmills, cooperage-stock mills, and planing mills operated in conjunction with sawmills). The chief products of the logging camp are logs; shingle, stave, and heading bolts; hewn and round poles; mine timbers; fence posts; railway ties; and excelsior stock. Those of merchant sawmills are rough lumber, shingles, lath, sawed railway ties, and cooperage and veneer stock. Cooperage-stock mills make tight and slack staves, headings, hoops, etc. The principal planing-mill products are dressed lumber, sash, doors, blinds, and miscellaneous millwork.

The Lumber and Timber Products group does not include logging camps operated by establishments in the Paper and Pulp group, independent planing mills, box factories not conjointly operated with sawmills, and establishments making cooperage (which should be distinguished from cooperage stock). In every year of the decade 1919-29, except 1921, it employed more than a billion man-hours. In 1929 it paid 422 million dollars in wages to some 419 thousand wage earners and produced more than a billion dollars' worth of products. The high ratio of wages to value, about 35 percent, is largely a reflection of the fact that logging (which engages over $\frac{1}{3}$ of the employment in the group), as well as the further processing stages, is included.

Lumber production attained its peak in the early years of the present century and has been declining since then. The principal reason appears to be the shift to substitute materials, particularly steel and concrete, for building, highway, and engineering construction. The same tendency is observed in the increasing use of metal in automobiles and railroad cars and of paperboard boxes as containers.

The South and Northwest account for almost $\frac{2}{3}$ of the national production of lumber. The former region, which contributes yellow (southern) pine, cypress, and oak, declined from 37 to 32 percent of the total between 1919 and 1935, while the latter, cutting chiefly Douglas fir, ponderosa (western yellow) pine, hemlock, and white pine, advanced from 22 to 34 percent.

Production

The indexes of production are discussed in the following order: Logging Camps, Sawmills, Saw-Plane Mills, and the composite for the Lumber and Timber Products group. The second and third of these were combined to yield the index for Sawmills and Saw-Plane Mills.

Logging Camps.- Since the total output of logging camps is not reported in detail by the Census except in 1929,¹ a quantity series was obtained for 1919-36 by measuring what is tantamount to minimum log requirements or apparent consumption of logging-camp products by sawmills. The procedure was to reconvert to log volume, by means of a standard table of equivalents, the annual output of various sawmill products - lumber, lath, shingles, veneers, staves, headings, and hoops - as reported by the Census.²

This technique neglects at least 3 factors - waste, possible changes in actual conversion ratios, and changes in log stocks. It is impossible to appraise the consequent error in the computed total log and bolt requirement for each year.³

Sawmills.- The Sawmills index is based on the total output of 3 products for which the Census provides annual statistics: Lumber, lath, and shingles. These 3 products account for well over 90 percent of the total quantity produced by this division.

The index is a weighted average of relatives of the 3 series.⁴ The weighting factors were developed by multiplying the unit labor

¹Census value statistics for logs for sale, however, were available for 1919, 1929, 1933, and 1935. (Total output includes the amounts produced for sale and for consumption by reporting companies.)

²This method was suggested by R. C. Hall of the U. S. Forest Service. The equivalents are shown in *American Forests and Forest Products* (U. S. Dept. Agr. Statistical Bull. No. 21, Oct. 1927), p. 27. Since lumber production is reported by the Census in board measure, conversion was not necessary. The average overrun ratio for 1929 was applied to log-scale estimates for veneer. Overrun is the excess of actual production, board measure (the actual cubic content of the sawed timber), over the log-scale estimates (the potential board-measure yield of the unsawed logs). It is possible for the actual yield to be less than the log-scale estimate (underrun), but the reverse is more usual.

³A rough estimate could be made of the actual volume of production in 1929 by applying the overrun ratio computed from data representing 30 percent of 1929 output (U. S. Tariff Commission, *Report to the President on Lumber*, No. 32, 2d ser., 1932) to the Census log-scale figure, which represents 94 percent of the value of logging-camp production. The resulting quantity, 33 billion feet b. m., is lower than the NRP total of about 40 billion feet. Of the difference, about 3 billion feet appear to be ascribable to changes in log stocks, 2 billion to the incompleteness of the coverage of the Census log-scale figure, and the remainder to possible variations in the actual conversion ratios and to the limitations of the other statistics entering into these calculations.

⁴Production for 1919-21 is not precisely comparable with the figures for the remainder of the period. Although, in these years, mills cutting less than 50,000 board feet of lumber or its equivalent were covered by the Census, they were excluded thereafter. In 1919, however, the lumber cut of such mills could be determined - it amounted to less than 0.2 percent - and deducted from the

[Continued.]

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requirement for each product in 1935⁵ by its output in 1929, the base year. The series for lumber was constructed by combining regional production figures by means of regional labor weights.

The final Sawmills production index follows:

Year	Index	Year	Index
1919	98.2	1928	91.2
1920	93.7	1929	100.0
1921	78.5	1930	68.5
1922	89.7	1931	42.4
1923	103.7	1932	26.4
1924	100.7	1933	36.8
1925	106.5	1934	40.9
1926	100.6	1935	51.9
1927	94.0	1936	64.6

Saw-Plane Mills.- The index for this division - planing mills operated in conjunction with sawmills - was constructed from Census production statistics for 1925 and subsequent odd-numbered years. Four quantity series - for dressed lumber, doors, sash, and window and door frames - were reduced to relatives and combined in an arithmetic mean with labor weights corresponding to those used in the Sawmills index.⁵ The absence of any indication of the dimensions of these products (they vary in size) precluded the possibility of reducing the annual output of each to standard physical units. The quantities included in the index represent over 70 percent of the value of output of saw-plane mills.⁶

The production index for Saw-Plane Mills follows:

Year	Index
1925	108.4
1927	115.2
1929	100.0
1931	54.0
1933	43.8
1935	59.2

⁴ [Continued]
total. There is reason to believe that the proportions of lath and shingles produced by small mills were also negligible, but the amounts could not be eliminated. The series for each product, then, may be regarded as uniformly indicating only the production of the establishments with an output of over 50,000 board feet of lumber or its equivalent.

⁵Unit labor requirements for Sawmills, Saw-Plane Mills, and Logging Camps were derived from B. H. Topkis, "Labor Requirements in Lumber Production," *Monthly Labor Review*, May 1937, pp. 1136-52. The sample accounted for 12 percent of sawmill output in 1935.

⁶Absolute quantity production may be understated in each year by an indeterminate amount as a result of the failure of some respondents to the Census questionnaire to distribute their totals. In such cases, the Census was obliged either to attempt a detailed distribution or to tabulate the reported value as "miscellaneous millwork." Although the absolute quantities of each product are affected, their relatives are not necessarily distorted.

Lumber and Timber Products Group.—The indexes for Logging Camps and Sawmills, available annually for 1919-36, and for Saw-Plane Mills, available for alternate years of the period 1925-35, were combined by means of weights which represent the aggregate man-hours required by the production of each branch. These weights were obtained by inflating the man-hours for the several products included in each index⁵ by the ratio in 1929 of total value for the branch to the value of these products. These ratios were as follows: Logging Camps, 1.027; Sawmills, 1.140; and Saw-Plane Mills, 1.302.

The procedure consisted, first, in the combination of Sawmills and Saw-Plane Mills relatives of output for odd-numbered years; second, in the interpolation and extrapolation of the resulting indexes by means of the continuous Sawmills series; and, finally, in the combination of this annual Sawmills and Saw-Plane Mills index with the Logging Camps series.

Employment

The number of wage earners in the group was ascertained for the odd-numbered years from the *Census of Manufactures*.⁷ Intercensal employment in 1924 and thereafter was estimated by use of the BLS index for the group, which conforms to Census trend. Before 1924, interpolation was accomplished through the medium of an annual series obtained by subtracting employment in the Furniture industry from employment in the Census group, Forest Products, as determined in each case from continuous BLS indexes applied to Census totals.⁸

The next problem was to allocate the group totals between (1) Logging Camps and (2) Sawmills and Saw-Plane Mills. The number in each branch was computed from Census figures for 1919 and 1923 and from BLS data for 1927 and 1929.⁹ Estimates for

⁷Census employment statistics refer to establishments manufacturing not less than 200,000 feet of lumber annually or its equivalent in lath (1,000,000) or shingles (2,000,000), except in 1919 when the minimum was 50,000 feet. To maintain chronological comparability, an adjustment was made to exclude workers engaged in 1919 in mills which produced less than 200,000 feet of lumber or the equivalent thereof. The employment statistics, in any case, are not strictly comparable in scope with the production statistics (see fn. 4).

⁸The BLS indexes for "Lumber and Allied Products" and "Furniture" were applied to the census-year series for "Forest Products" and "Furniture", respectively.

⁹BLS figures, published in *Wages and Hours of Labor in the Lumber Industry in the United States: 1930* (Bull. No. 560), p. 25 and in *Wages and Hours of Labor in the Lumber Industry in the United States: 1932* (Bull. No. 586), p. 22, purport to show the number of wage earners engaged in sawmills located in States covered by special studies in 1927 and 1929. These States (22 in 1927 and 21 in 1929) account for about 95 percent of the number of wage earners in the Lumber and Timber Products group.

[Continued]

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the remaining years were obtained by straight-line interpolation and by extrapolation of the percentages of total wage earners in each of the 2 branches.

Man-hours

The determination of man-hours worked in Sawmills and Saw-Plane Mills and in Logging Camps involved two distinct techniques: (1) Multiplication of employment, average hours per man per day, and number of days per year in the period 1919-29; and (2) segregation of man-hours for the group, which were derived by deflation of wages by average hourly earnings in the years following. The discussion, therefore, may conveniently be divided into 2 parts.

1919-29.- The estimates for this period are based largely on information obtained from special BLS studies, which are available for the odd-numbered years 1919-25 and the even-numbered years 1928-32.⁹

Sawmills and Saw-Plane Mills.- Each of the above-mentioned studies, which covers only a few months of the year, supplied statistics on average weekly hours and the number of days worked per week.¹¹ The hours were adjusted by the ratio of NICB average weekly hours per man for the whole year to the NICB average for the specified months covered by the BLS survey.¹² They were then joined in a continuous series by means of the NICB data and divided by the average number of days worked per week (estimated

⁹[Continued]

For each of the 2 years, the total number of wage earners in all sawmills was assumed to bear the same relation to the number in the States canvassed by BLS as the Census group figure for the Nation bore to the Census group figure for the same States.

¹⁰*Industrial Survey in Selected Industries in the United States: 1919* (Bull. No. 265) and Bull. Nos. 317, 363, 413, 497, 560, and 586 in the series "Wages and Hours of Labor" (the titles vary somewhat) which refer to sawmills.

¹¹The data for 1921, 1923, and 1925 are shown for pay-roll periods of unequal length; those for later years are shown uniformly for 1 week. To reduce the earlier figures to the 1-week standard, a 2-week or 1-month pay-roll period was considered the equivalent of 2½ 1-week periods, while a month was considered the equivalent of 4½ 1-week periods. The data for 1919 are presented on a per-diem basis. Since, according to BLS Bull. No. 265, the weekly figures were standardized on the basis of a 6-day week, this factor was used to compute a comparable weekly average for 1919.

¹²The NICB hours series - for the "Lumber and Millwork" industry - refers to independent planing mills only. Half of the value of planing-mill products, however, is accounted for by saw-plane mills.

No adjustment was possible for 1928, since the months covered by the BLS study are not stated. Since no satisfactory NICB data were available for 1919, the adjustment factor for this year was the ratio of the average output per sawmill wage earner in the several months to the average for the year. (This assumes the constancy of man-hour productivity over the year, in which case wage-earner productivity would adequately reflect changes in hours worked.) The output per sawmill wage earner was computed from the Federal Reserve Board monthly production index for lumber and from Census wage-earner statistics.

for several years by straight-line interpolation) to ascertain the average number of hours worked per day.¹³

The number of days operated annually by Sawmills was read from a graph of BLS statistics plotted at the midpoints of the fiscal years to which they refer and joined by a smooth curve. The indicated days of operation clustered about 270 in all calendar years except 1921, when the number was 236. The number in each year of the period 1919-29 except 1921 and 1922 was, therefore, fixed at 270; in 1921, at 240; and in 1922, at 255 (the average of 240 and 270).

Finally, estimates of total man-hours worked annually in Sawmills and Saw-Plane Mills were obtained by multiplying wage-earner employment by average daily hours and the average number of days the mills operated during the calendar year.

Logging Camps.- Actual hours per week were estimated by applying to the actual weekly hours worked in Sawmills and Saw-Plane Mills the ratio of prevailing weekly hours for Logging Camps to those for Sawmills and Saw-Plane Mills in the years for which BLS studies were available. This procedure was necessitated by the fact that actual hours were shown only for the mills, although prevailing hours were presented for both branches. Furthermore, since no indication was given of the number of days worked per week and per year in logging camps, it was necessary to assume these to be the same as for sawmills in corresponding years. Total man-hours were obtained in the manner already described for Sawmills and Saw-Plane Mills.

Lumber and Timber Products Group.- The number of man-hours worked in the group in each year of the period 1919-29 was determined by addition of the estimates for the 2 branches. The aggregate thus derived for 1929 is only 0.7 percent below that computed from the man-hours statistics collected by the Census for the same year.¹⁴

1930-36.- Total man-hours for the Lumber and Timber Products group were estimated for the years 1930-36 by the deflation of pay rolls by average hourly earnings. These man-hour totals were

¹³The 1921 deflator is not strictly comparable with the rest of the series since it represents average number of days "starts" were made.

¹⁴The NRP total is 1,050 million man-hours; the Census' unpublished statistics for the same year indicate 1,057 million. The latter figure was computed by prorating to the whole industry the Census State data for 405 selected establishments which employed 82,875 wage earners, or some 20 percent of the total.

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apportioned between Logging Camps and Sawmills and Saw-Plane Mills in accordance with the modal relationship in the period 1919-29, during which the relative proportions were practically constant.

Census wage statistics for the group for the odd-numbered years of the period 1930-36 were completed by means of a BLS index. The average-hourly-earnings series for the group was obtained by linking the BLS regular survey series for 1932-36 to figures for 1930-32 which were computed as follows: (1) Earnings for each division of the Lumber and Timber Products group were first approximated for 1930 and 1932 from data for several months collected in special BLS surveys; (2) after adjustment to refer to the entire year, these figures were interpolated by means of an NICB earnings series;¹⁵ (3) the completed earnings series for the 2 divisions were finally combined in an average for the group with weights proportional to the modal percentage distribution of wages in the interval 1919-29. Wages for each division in the years 1919-29 were determined by multiplying man-hours by hourly earnings computed in a manner similar to average hours for the same period.¹⁶

Table 43.- SUMMARY INDEXES FOR THE LUMBER AND TIMBER PRODUCTS INDUSTRY GROUP: 1919-36

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	96.0	112.0	100.2	85.7	95.8
1920	92.8	102.9	101.2	90.2	91.7
1921	78.6	86.9	74.8	88.1	102.4
1922	88.4	113.9	107.9	77.6	81.9
1923	102.6	118.3	118.5	86.7	86.6
1924	99.4	112.7	112.7	88.2	88.2
1925	105.5	111.3	113.7	94.8	92.8
1926	101.4	108.9	109.4	93.1	92.7
1927	95.8	98.7	99.5	97.1	96.3
1928	92.7	96.2	97.7	96.4	94.9
1929	100.0	100.0	100.0	100.0	100.0
1930	70.3	77.1	71.3	91.2	98.6
1931	44.6	46.9	39.9	95.1	111.8
1932	27.6	36.1	28.3	78.5	97.5
1933	38.2	45.2	36.1	84.5	105.8
1934	42.1	55.3	38.6	76.1	109.1
1935	53.2	60.9	44.8	87.4	118.8
1936	66.2	65.9	52.4	100.5	126.3

¹⁵See fn. 12.

¹⁶A comparison of the NRP and Census (interpolated for even-numbered years in a manner similar to employment) estimates of group wages reveals a sizable discrepancy only in the intercensal year 1920.

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Table 44.- SUMMARY INDEXES FOR LOGGING CAMPS: 1919-38

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	91.5	119.9	105.8	76.3	86.5
1920	90.8	108.8	105.8	83.5	86.0
1921	73.0	90.7	76.9	80.5	94.9
1922	85.7	117.3	109.5	73.1	78.3
1923	100.0	120.2	119.1	83.2	84.0
1924	96.5	114.3	113.3	84.4	85.2
1925	103.1	112.8	114.3	91.4	90.2
1926	99.8	110.0	110.3	90.7	90.5
1927	93.9	99.6	100.5	94.3	93.4
1928	92.6	96.6	98.7	95.9	93.8
1929	100.0	100.0	100.0	100.0	100.0
1930	71.2	77.1	71.6	92.3	99.4
1931	45.6	46.9	40.1	97.2	113.7
1932	28.2	36.1	28.4	78.1	99.3
1933	38.9	45.2	36.1	86.1	107.8
1934	42.7	55.3	38.7	77.2	110.3
1935	53.6	60.9	44.8	86.0	119.6
1936	66.9	65.9	52.5	101.5	127.4

Table 45.- SUMMARY INDEXES FOR SAWMILLS AND SAW-PLANE MILLS: 1919-36

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	98.5	107.4	97.0	91.7	101.5
1920	94.0	99.5	98.8	94.5	95.1
1921	78.7	84.8	73.6	92.8	106.9
1922	90.0	112.0	107.0	80.4	84.1
1923	104.0	117.2	118.1	88.7	88.1
1924	101.0	111.8	112.3	90.3	89.9
1925	106.8	110.7	113.4	96.5	94.2
1926	102.3	108.3	108.9	94.5	93.9
1927	96.9	98.3	99.0	98.6	97.9
1928	92.7	96.0	97.2	96.6	95.4
1929	100.0	100.0	100.0	100.0	100.0
1930	69.8	77.1	71.2	90.5	88.0
1931	44.0	46.9	39.6	93.8	110.6
1932	27.3	36.1	28.2	75.6	96.8
1933	37.8	45.2	36.1	83.6	104.7
1934	41.8	55.3	38.5	75.6	108.6
1935	52.9	60.9	44.7	86.9	118.3
1936	65.8	65.9	52.3	99.8	125.8

46. MANUFACTURED GAS

This industry, which employed 43,000 wage earners in 1929, includes private and municipal utilities engaged primarily in the commercial manufacture and distribution, or in the manufacture only, of illuminating and heating gas for household and industrial purposes. It excludes establishments which merely distribute gas not of their own manufacture or which are engaged primarily in the production and marketing of natural gas. The industry thus defined is by no means the chief producer of gas; in fact, the Coke, Not Including Gas-House Coke industry usually produces much more gas and even sells some of it to the Manufactured Gas industry.

Gas has no uniform chemical composition or properties. Carbon monoxide, hydrogen, and methane comprise 80 to 90 percent of the combustible portion of gas used in the United States. The chief fuels used in its manufacture are bituminous coal, coke, oil, and anthracite. Of these, bituminous coal is the most important and anthracite the least.

The 4 major varieties of manufactured gas are water, coke-oven, coal, and oil. These are usually blended, enriched, or carbureted to yield mixtures which are appropriate to the particular needs of a community. Water gas, the principal variety, is essentially carbon monoxide and hydrogen; it is made by the chemical reaction of incandescent coal or coke with steam. Coke-oven gas, the manufacture of which also yields valuable byproducts, is made by the destructive distillation of bituminous coal. Coal gas, which is being replaced by coke-oven gas, is made by the carbonization of coal in vertical or horizontal retorts. Oil gas is produced by the cracking of petroleum or its derivatives into lower hydrocarbons and hydrogen.

Production

The NRP index is based on weighted aggregates of the amount of gas manufactured within the industry and the total distributed by it for sale to customers.¹ The output series for 1919-35 includes Census totals for the odd-numbered years and estimates for the other years derived from annual data available in the *Statistical Bulletin* of the American Gas Association. The 2 series relate to almost identical production universes and are in close accord in all common years.

¹Gas sales alone contributed about 85 percent of the revenue reported by the industry for 1929; the sale of byproducts and the sale and rental of lamps and appliances accounted for the remainder.

The distribution series was constructed from Census data for the odd-numbered years only. The amount of gas distributed is equal to the sum of the quantities produced and purchased from outside the industry by reporting establishments minus the sum of the quantities consumed on the premises and not accounted for.² The amount distributed is less than total "send-out", for it excludes losses.

The weights used in combining the 2 series are relative unit wage-earner requirements for 1933. In this year the Census segregated the wage earners engaged in the production and distribution activities of 21 establishments whose primary business was the distribution of purchased gas.³ A special tabulation furnished by the Census provided the supplementary statistics which were necessary for the calculation of the average number of wage earners required by these establishments to distribute a cubic foot of gas. This ratio was then applied to the total amount distributed by the industry to ascertain the total number of wage earners occupied in this phase of the work. The difference between all wage earners in the industry and this figure - i. e., the number of workers engaged in production - was then divided by total gas output to determine the requirement ratio for production. The preponderance of this weight - 2.3 times that for distribution - makes the composite index fairly similar to relatives for production alone; in no year does the difference exceed 5 units. The production series was therefore used to complete the composite for intercensal years.

Year	NRP production index	Gas- production index	Gas- distribution index	
1919	76.1	79.7	69.1	
1920	82.2	86.7	n.a.	
1921	78.3	83.2	68.4	
1922	79.9	83.2	n.a.	
1923	83.3	85.2	79.5	
1924	89.0	91.8	n.a.	
1925	91.4	95.2	83.8	
1926	99.5	102.0	n.a.	
1927	99.4	100.4	97.4	[Con.]

²The amount computed for 1935 is somewhat understated, for it does not include in purchases the quantity resold without further mixing, enriching, or carbureting.

³These 21 establishments accounted for about 25 percent of the total number of wage earners, 18 percent of production, over 99 percent of purchases, and almost 40 percent of sales.

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[con.]	Year	NRP production index	Gas- production index	Gas- distribution index
	1928	102.5	103.0	n.a.
	1929	100.0	100.0	100.0
	1930	94.0	93.2	n.a.
	1931	88.3	86.8	91.3
	1932	77.7	75.8	n.a.
	1933	71.6	69.4	76.2
	1934	73.0	70.5	n.a.
	1935	72.2	69.5	77.5

Several varieties of gas exhibit trends which differ significantly from that of the unweighted production index shown above. A weighted index,⁴ however, would have the same general contour since water gas, the chief variety, has consistently accounted for almost two-thirds of the total volume. The shifts in the composition of the total are confined to the 3 less-important types: Coke-oven, coal, and oil and other gas. Between 1919 and 1935 the first advanced from 3 percent of the total to 22, while the second declined from 23 to 11 and the third (which excludes the increasingly popular natural gas) declined from 11 to 2 percent.

Year	Relatives of production ⁵				
	All gas	Water gas	Coal gas	Coke-oven gas	Oil and other gas
1919	79.7	77.9	141.5	15.8	105.3
1920	86.7	90.2	138.5	17.3	94.3
1921	83.2	86.1	131.1	14.4	102.4
1922	83.2	91.6	110.0	12.2	96.6
1923	85.2	93.0	115.8	16.6	92.7

[con.]

⁴Labor requirements are most probably unequal since each important variety of gas is identified with a different process and requires mixing or enriching to a different extent before distribution to the consumer. Lack of uniformity within each type, due to variations in the fuel or process, makes it impossible to determine suitable weighting factors from available statistics. Fragmentary data are sufficient, however, to indicate that production-labor costs within and among the several varieties differ considerably.

⁵The production relatives for the 4 components, which are consistent with the unweighted aggregates, were constructed by interpolating and extrapolating Census statistics for the odd-numbered years 1925-35 by means of continuous AGA series. Coke-oven and coal gas, reported in combination by the Census, were distributed by means of the AGA data. Both sources agree substantially on the quantities in the first 3 categories in common years but not on the quantities in the miscellaneous and relatively unimportant fourth group, particularly after 1929. One reason for the difference may be the Census' transfer of Pintsch gas to the Compressed and Liquefied Gas industry (included by NRP in the Chemicals industry) in 1927; another may be AGA's inclusion of butane-air and reformed natural and oil-refinery gas since 1929.

The AGA-Census coke-oven gas quantities are lower in earlier years than the corresponding amounts reported by the Bureau of Mines for coke ovens owned by city gas companies. The 2 series converge, however, in later years. Although there are reasons to prefer the latter, the totals resulting from its use would not be so close to the totals reported by the Census.

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[con.]

Year	Relatives of production ⁵				
	All gas	Water gas	Coal gas	Coke-oven gas	Oil and other gas
1924	91.8	99.6	120.3	20.3	107.6
1925	95.2	101.0	127.2	26.7	116.5
1926	102.0	109.4	124.3	38.3	118.9
1927	100.4	104.0	118.7	56.4	118.0
1928	103.0	105.3	112.5	79.9	108.6
1929	100.0	100.0	100.0	100.0	100.0
1930	93.2	95.8	93.8	105.0	51.1
1931	86.8	87.1	86.4	117.2	31.7
1932	75.8	77.2	71.7	102.3	25.4
1933	69.6	68.6	65.4	106.0	18.0
1934	70.5	69.6	66.4	110.6	15.8
1935	69.5	69.7	59.6	109.2	14.8

It would have been desirable to include the byproducts of gas in the index of output, but no method of apportioning the labor required in their manufacture is altogether satisfactory. An index employing 1929 unit-value weights,⁶ however, differs from the NRP series of gas output by less than 3 units in any 1 year - a reflection of the fact that the aggregate value of byproducts in that year is only $\frac{1}{4}$ that of gas. A composite of this production index and the gas-distribution series, weighted by the estimated relative number of wage earners engaged in production and distribution, differs from the NRP index by a maximum of 2 units.

Year	Index of production		Index of production and distribution	
	Gas and byproducts	Gas only	Gas and byproducts	NRP
1919	78.6	79.7	75.2	76.1
1921	80.9	83.2	76.4	78.3
1923	83.0	85.2	81.8	83.3
1925	92.5	95.2	89.4	91.4
1927	98.8	100.4	98.3	99.4
1929	100.0	100.0	100.0	100.0
1931	88.3	86.8	89.4	88.3
1933	71.2	69.4	73.0	71.6
1935	71.2	69.5	73.5	72.2

⁶The byproducts are: Coke, breeze, and screenings; tar; crude light oil; and ammonia equivalent. The unit value used for gas production is really the value per unit of gas distributed.

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Employment and Man-hours

The index of wage earners is based on Census data for the odd-numbered years.⁷ Since no satisfactory interpolating medium could be found, the man-hours and productivity indexes are also deficient in intercensal years.⁸

A change in the Census schedule for 1935 resulted in the reporting of only those wage earners engaged in production. Therefore an adjustment had to be made for the excluded distribution workers. For this purpose it was assumed that the change in distribution-labor efficiency from 1933 to 1935 was the same as the change in manufacturing productivity between the same 2 years. It will be recalled that the 2 ratios for 1933 were provided by the Census in a special tabulation. The third known quantity, the manufacturing-productivity ratio for 1935, was easily derived from published Census statistics. The distribution ratio computed for 1935 was then divided into the corresponding quantity of gas distributed to determine the number of excluded wage earners. This estimate was added to the number reported by the Census to obtain a total comparable with those for earlier years.

The man-hours index was computed from relatives of wage earners and average actual hours per week. The weekly-hours series was derived from NICB data for only 1 or 2 months in each year,⁹ but since the industry is not seasonal the difference from the annual average is probably small. The 1919 figure, obtained by straight-line interpolation between NICB figures for July 1914 and June 1920, is probably the least reliable.

⁷An unknown number of employees is engaged neither in production nor distribution but in selling and renting lamps and appliances. Such secondary business accounts for about 8 percent of total revenue. Most of the workers so engaged are probably salaried and are therefore not included in the index but the number of such wage earners, if any, could not be excluded.

⁸An AGA total-employment series was rejected because it obviously refers to a larger universe than does the Census-AGA gas-production series. Furthermore it shows little resemblance in movement to the wage-earner or total-employment figures reported by the Census.

⁹A BLS hours series for the Electric Light and Power and the Manufactured Gas industries combined, which is available for several years, was not used since the total number of employees in the former industry is about 4 times the number in the latter.

MANUFACTURED GAS

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Table 46.- SUMMARY INDEXES FOR THE MANUFACTURED GAS INDUSTRY: 1919-35

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	76.1	99.6	99.0	76.4	76.9
1920	82.2	n. a.	n. a.	-	-
1921	78.3	81.2	83.4	96.4	93.9
1922	79.9	n. a.	n. a.	-	-
1923	83.3	93.2	95.4	84.8	87.3
1924	89.0	n. a.	n. a.	-	-
1925	91.4	109.1	99.9	83.8	91.5
1926	99.5	n. a.	n. a.	-	-
1927	99.4	112.6	105.6	88.3	94.1
1928	102.5	n. a.	n. a.	-	-
1929	100.0	100.0	100.0	100.0	100.0
1930	94.0	n. a.	n. a.	-	-
1931	88.3	80.2	78.2	110.1	112.9
1932	77.7	n. a.	n. a.	-	-
1933	71.6	71.0	61.1	100.8	117.2
1934	73.0	n. a.	n. a.	-	-
1935	72.2	71.9	57.8	100.4	124.9

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47. MANUFACTURED ICE

This industry, which employed over 30,000 wage earners in 1929, includes establishments engaged in the manufacture of ice for sale but excludes those engaged in the cutting and storage of natural ice. Delivery service is not classified by the Census as part of this industry.

Production

The index was derived from Census tonnage statistics for ice production within the industry and from estimates for intercensal years obtained by interpolation by an annual sales series.¹ Production and sales agree closely in trend although sales are consistently greater in tonnage.

The NRP production index does not include ice manufactured outside the industry. Although such production statistics are available, the corresponding employment could not be determined. The inclusion of such output would nevertheless result in a similar series:

Year	NRP production index	Index of production in all industries
1919	56.9	61.5
1921	66.7	69.0
1923	76.5	77.8
1925	87.3	88.3
1927	87.8	88.6
1929	100.0	100.0
1931	95.2	95.2
1933	73.9	74.7
1935	71.6	71.8

Employment and Man-hours

The trend of employment was established from Census wage-earner statistics. Satisfactory estimates for intercensal years could not be obtained.

The Census considers the employment figures for 1919-25 to be somewhat unreliable because of the inclusion, by the reporting

¹ Sales are reported in H. B. Drury, *Production and Capacity Control in the Ice Industry Under N. R. A.* (National Recovery Administration, Division of Review, Mar. 1936), pp. 4-5. Data for 1934 and 1935 were supplied by Ice Publicity Association of Philadelphia.

establishments, of some delivery employees.² An additional but negligible error is contributed by the inclusion of a small number of wage earners engaged in secondary productive activities.³

The index of man-hours was derived from the employment series and a series of average weekly hours. The latter includes Census prevailing weekly hours for 1919, 1921, 1923, and 1929; average actual weekly hours computed from Census surveys⁴ for 1933 and 1935; and estimates for intervening years obtained by straight-line interpolation.

Table 47.- SUMMARY INDEXES FOR THE MANUFACTURED ICE INDUSTRY: 1919-35
(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	56.9	94.0	93.2	60.5	61.1
1920	60.2	n. a.	n. a.	-	-
1921	66.7	74.8	74.3	69.2	69.8
1922	69.4	n. a.	n. a.	-	-
1923	76.5	83.4	82.6	91.7	92.6
1924	78.1	n. a.	n. a.	-	-
1925	87.3	77.4	77.0	112.8	113.4
1926	85.3	n. a.	n. a.	-	-
1927	87.8	66.7	66.5	127.8	128.2
1928	94.7	n. a.	n. a.	-	-
1929	100.0	100.0	100.0	100.0	100.0
1930	99.2	n. a.	n. a.	-	-
1931	95.2	78.4	73.1	121.4	130.2
1932	77.6	n. a.	n. a.	-	-
1933	73.9	66.3	57.3	111.5	129.0
1934	79.2	n. a.	n. a.	-	-
1935	71.6	59.1	50.6	121.2	141.5

²See *Census of Manufactures: 1925*, p. 146.

³The aggregate value of secondary products and receipts for cold storage never exceeds 5 percent of the total value of the industry's products in census years.

⁴*Census of Manufactures: 1933*, "Man-Hour Statistics for 32 Selected Industries"; and *Census of Manufactures: 1935*, "Man-Hour Statistics for 59 Selected Industries." The number of wage earners for whom man-hours were reported constituted 43 and 71 percent, respectively, of the totals for the industry in the 2 years.

48. MOTOR VEHICLES

The Motor Vehicles industry includes establishments classified by the Census in 2 industries: "Motor Vehicles" and "Motor-Vehicle Bodies and Motor-Vehicle Parts." These establishments are engaged primarily in the manufacture of automobiles, trucks, chassis, fire-department apparatus, trailers, etc.; motor-vehicle bodies; and a large variety of original and replacement parts (e. g., tops, gears, rims, frames, wheels, radiators, windshields, axles, bumpers, and shock absorbers). Motorcycles, engines (for sale), and accessories such as tires, ignition apparatus, batteries, and starting and lighting systems are the principal products of other Census industries.

In 1935 the 3 largest manufacturers - General Motors Corporation, Ford Motor Company, and Chrysler Motor Corporation - accounted for about 90 percent of all finished-motor-vehicle production and for a considerable volume of bodies and parts.

The Ford Motor Company shows a high degree of vertical integration. Its River Rouge plant, for example, includes blast furnaces, steel mills, a power station, a glass plant, a foundry, byproduct coke ovens, a cement plant, and a paper mill. Many of the parts (bodies are an exception) are produced on the premises, and a large proportion of the total number of vehicles is also assembled in this plant. The General Motors Corporation, on the other hand, is actually a holding company, the subsidiaries of which manufacture passenger cars, trucks, taxicabs, bodies, hardware, spark plugs, shock absorbers, springs, clutches, batteries, and various other parts and accessories. The Chrysler Motor Corporation is similar to General Motors in organization, but not so highly integrated.

The Motor Vehicles industry is not only the largest producer of machinery but also the largest employer among the manufacturing industries. In 1929 it had 447 thousand wage earners on its pay roll and disbursed 733 million dollars in wages; in 1935 it employed 388 thousand wage earners, to whom it paid 545 million dollars in wages. It also ranked first in the consumption of steel (not only all forms in general but also strip, bars, sheets, malleable iron, and alloys), rubber, plate glass, nickel, lead, and mohair.

Production

The measure of production for the years 1919-36 is a weighted index of the total output of finished vehicles (i. e., passenger cars and trucks) and chassis¹ adjusted to include replacement parts. The unadjusted series for vehicles and chassis comprises 2 segments, each of which is an aggregative index with averages of unit values for the odd-numbered years of the corresponding period as weights. The first segment, for 1919-29, includes the following 11 classes of products:

Open passenger cars	
(1) 2-door	(6) Public conveyances and other commercial vehicles
(2) 4-door	(7) Hearses and undertaker wagons
(3) Closed passenger cars	(8) Ambulances
(4) Light delivery trucks (under 1 ton)	(9) Fire-department apparatus
(5) Heavy trucks (1 ton and over) and truck tractors	(10) Other vehicles and apparatus
	(11) Chassis

The second segment, for 1929-36, includes 17 classes, which result from a more detailed classification of the 11 in the first segment. These 17 comprise, in addition to items (1), (2), (4), (5), and (7)-(10) of the above list, the following 9 products:

Closed passenger cars	
(1) 2-door	(6) Taxicabs and other commercial vehicles
(2) 4-door	
Motor buses	
(3) Under 21 passengers	(7) Passenger Chassis
(4) 21-32 passengers	(8) Commercial
(5) 33 passengers and over	(9) Bus

The quantity series were obtained for the odd-numbered years 1919-35 from *Census of Manufactures*; they were completed for the even-numbered years 1920-36 by distributing total sales (published in *Automobile Facts and Figures*),² which had first been adjusted to the level of total production, among the Census product classes. The adjusted sales were distributed in accordance with averages of the percentages of total output accounted for by each class of vehicles in adjacent odd-numbered years.³

¹Chassis are relatively unimportant. In all years except 1919 and 1929, they comprised about 5 percent of the total number of motor vehicles and chassis; in these 2 years, they accounted for about 10 percent.

²The sales series, which refers to the same group of establishments as the production series, was compiled by the Census in cooperation with the Automobile Manufacturers Association. The 2 series never differ by more than 4 percent.

³The percentage distribution for 1935 was assumed for 1936.

As has already been indicated, the establishments in the industry are engaged in the manufacture of replacement parts as well as of finished vehicles and original parts. Since replacement parts constitute an important though varying proportion (from one-eighth to one-fourth) of the unduplicated value of the industry's output (i. e., exclusive of original parts), it was desirable to include them in the NRP index.⁴ Although no quantity statistics were available, this purpose could be accomplished by the adjustment of the index for vehicles and chassis by means of value figures. The adjustment consisted in the division of this index by relatives of the ratios of (1) the value of finished vehicles and chassis to (2) the total value of finished vehicles, chassis, and replacement parts made in the whole industry (i. e., in the Census industries, "Motor Vehicles" and "Motor-Vehicle Bodies and Motor-Vehicle Parts"). The validity of the premise underlying this adjustment (viz, a constant relation between the price levels of the 2 types of products from year to year) could not be tested.

The above-mentioned adjustment factors were derived from 3 value series - one for finished vehicles and chassis and the others for replacement parts made in the 2 branches. The series for finished vehicles and chassis includes Census statistics for the odd-numbered years and intercensal-year estimates derived from Automobile Manufacturers Association sales data. The series for replacement parts produced in the Motor Vehicles branch was constructed (1) for census years by subtracting the value of assembled vehicles and chassis from the total value of products;⁵ (2) for the intercensal years 1920-24 by multiplying the value of vehicles and chassis by interpolated census-year ratios of

⁴Replacement parts, such as wheels, radiators, axles, gears, and shock absorbers, are made by both automobile manufacturers (sometimes in separate plants) and independent parts-makers. Spare parts for older models are often produced with equipment that might otherwise have been dismantled or modernized, while parts for current models are usually produced in the automobile factory itself. (Cf. W. L. Carver, "How the Factories Are Meeting the Complex Problem of Replacement Parts Production and Distribution," *Automotive Industries*, September 30, 1930, pp. 530-4; and "Supplying Service Parts," *American Machinist*, May 20, 1926, p. 485.)

In 1928, when Ford began the production of Model-A cars, the manufacture of Model-T parts (orders for which were filled at the rate of \$10,000,000 per month) still required as much as one-eighth of the factory equipment. By 1932, however, parts sales had been cut over 50 percent (to about \$3,830,000 per month), reflecting the increasing use of the improved Model-A car. (F. L. Faurote, "Ford Shop Changes Estimated at \$25,000,000," *Iron Age*, April 1928, p. 1080; and "Mr. Ford Doesn't Care," *Fortune*, December 1933, p. 67.)

⁵The remainder is here assumed to represent only replacement parts. According to the Census, it comprises the value of bodies and parts, particularly the latter, produced for sale to dealers or to ultimate consumers for replacement and as additional equipment. For 1919-23, the remainder had to be adjusted to exclude a small amount of contract and repair work.

the value of replacement parts to the value of vehicles and chassis; and (3) for the intercensal years 1926-36 by means of an index of replacement-parts shipments (value)⁶ compiled by the Motor and Equipment Manufacturers Association and published in *Survey of Current Business*. Shipments and production of replacement parts (value) moved as follows in common years:

Year	Census production (Motor Vehicles branch)	MEMA shipments
1925	82.5	77.9
1927	89.3	87.7
1929	100.0	100.0
1931	60.5	75.7
1933	58.1	68.9
1935	82.5	86.6

The third series, value of replacement parts made in the Bodies and Parts branch, which could not be determined from *Census of Manufacturers* data, was constructed for 1929 and 1935 from value of sales reported (by mode of disposition) in other Census publications;⁷ and for remaining years in the interval 1925-36 by means of the annual shipments series mentioned above. In treating the sales data for 1929 and 1935, it was assumed that all sales made to the manufacturers' own outlets, to independent wholesalers, jobbers, and retailers, and to ultimate consumers represent replacement sales only; the remainder (interplant transfers, receipts for contract and repair work, and sales to industrial and other large consumers) was assumed to refer only to original equipment for use in the assembly of motor vehicles.⁸ Since the relatives of replacement-parts shipments and of sales by this branch are almost identical in 1935 (87.7 and 86.6, respectively, base 1929), the former series was considered suitable for the completion of the latter from 1925 to 1936. The estimates could not be extended back to 1919, but the failure to do so has a negligible effect on chronological comparability.⁹

⁶The original series was adjusted by NRP to show the same percentage change from 1929 to 1935 as did the value of sales reported by the Census (see discussion of value of replacement parts made in the Bodies and Parts branch).

⁷The statistics for 1929 were obtained from *Fifteenth Census of the United States*, "Distribution of Sales of Manufacturing Plants", and those for 1935 from *Census of Business: 1935*, "Distribution of Manufacturers' Sales." The figures for total sales are in close accord with the total value of production shown in the *Census of Manufactures* for the Bodies and Parts branch.

⁸A small amount of replacement parts may be included in this residue. In 1935 sales not distributed through any of the above-mentioned channels or not allocated (only about 1.4 percent of the total) were assumed to be replacement parts.

⁹Footnote 9 appears on following page.

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The NRP index of production is higher in most years than the unadjusted series for finished vehicles and chassis; both, however, have the same general movement:

Year	NRP production index	Unadjusted production index for vehicles and chassis
1919	32.0	27.0
1920	36.2	31.9
1921	25.8	23.8
1922	40.7	38.2
1923	64.3	61.6
1924	57.6	57.9
1925	71.3	71.9
1926	75.4	76.0
1927	65.0	62.9
1928	83.0	81.0
1929	100.0	100.0
1930	65.1	62.2
1931	47.6	43.9
1932	30.0	25.1
1933	40.9	35.1
1934	56.3	51.1
1935	77.7	74.5
1936	85.3	84.0

The Census classification of vehicles is not entirely satisfactory for our purposes since it includes in the same category cars which may differ considerably in quality and unit labor requirements. A more detailed classification, like one which takes account of at least price differences within each specified type or model, was not available. It was possible, however, to construct a comparative index from series for cars of different makes grouped according to the estimated average price of all models of each make, but this could be done only with the sacrifice of other significant criteria of classification. The series included in this comparative index represent the output of trucks and of

⁹In 1923, however, and probably in earlier years also, 1 large establishment classified by the Census in the Motor Vehicles branch made a combined report for both vehicles and chassis and bodies and parts; hence its replacement-parts production is presumably incorporated in our estimates for this branch. The change in the reporting practice of this establishment in 1925 accounted, according to the Census, for the major part of the decline of over 43,000 in the number of wage earners in the branch between 1923 and 1925.

The percentage which the value of replacement parts comprised of the unduplicated value of products in both branches (i. e., exclusive of original parts) is higher in 1924 and earlier years despite the omission of the estimated value of replacement parts (except for the establishment noted above) produced in the Bodies and Parts branch.

passenger cars grouped in 4 price ranges: Low-priced, medium-low-priced, medium-high-priced, and high-priced.¹⁰ The form of the basic data made numerous estimates necessary; moreover, since the cars of a particular make are not necessarily included in the same price category from year to year, the continuity of the quantity series is only nominal. The following tabulation shows the NRP index, the index based on the price classification, and a third measure, which is a series of relatives of the unweighted total number of vehicles and chassis.¹¹ Although the 3 indexes sometimes differ considerably, they move in the same direction from year to year.

Year	NRP production index	Unweighted production index for vehicles and chassis	Index of production based on price classification
1919	32.0	39.8	35.4
1920	36.2	45.4	41.1
1921	25.8	30.7	30.1
1922	40.7	49.7	46.9
1923	64.3	73.0	73.5
1924	57.6	64.9	66.1
1925	71.3	81.2	78.7
1926	75.4	86.8	79.5
1927	65.0	73.7	63.0
1928	83.0	89.4	81.1
1929	100.0	100.0	100.0
1930	65.1	60.9	61.3
1931	47.6	43.7	43.4
1932	30.0	24.4	24.9
1933	40.9	31.9	34.9
1934	56.3	44.9	50.9
1935	77.7	66.7	74.1
1936	85.3	78.2	83.6

¹⁰The total number of passenger cars produced in the United States and Canada was distributed among the 4 price classes in accordance with percentages of total sales of cars of various makes (the sales statistics represent 93 to 100 percent of all output). These 4 series were first combined in an aggregative index with estimated average retail prices for 1929 as weights; this index, in turn, was combined with a series of relatives for trucks by means of 1929 value weights derived from *Census of Manufactures*.

The quantity statistics were obtained from *Annual Reports of General Motors Corporation*; *Moody's Manual of Investments: Industrials*; *Poor's Industrials*; *Standard Corporation Records* (Standard Statistics Co.); *Automobile Facts and Figures*; *Automotive Industries*; R. C. Epstein, *Automobile Industry* (Chicago: A. W. Shaw Co., 1928); and L. H. Seltzer, *Financial History of the American Automobile Industry* (Boston: Houghton Mifflin Co., 1928). The retail prices were estimated from statistics published in *Automobile Trade Journal* and *Automobile Facts and Figures*.

¹¹The series of unweighted relatives was derived in the course of constructing the unadjusted index for vehicles and chassis from statistics reported in *Census of Manufactures* and *Automobile Facts and Figures*.

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It was not possible to make any quantitative adjustment in the NRP index for the revolutionary improvement in the quality of the automobile since the war. Not only has this complex unit undergone change in materials, weight, power, engineering design, and body structure, but it has also been transformed by such innovations as the self-starter, knee-action wheels, synchromesh transmission, independent front-wheel suspension, 4-wheel and hydraulic brakes, aluminum piston heads, vibration dampeners, and, more recently, automatic and semiautomatic shifting devices. The net result of these improvements has been a progressive increase in durability, speed, economy of operation, comfort, and aesthetic appeal.

Employment and Man-hours

The index of employment, which conforms to the trend of the Census totals for both branches, was constructed by BLS. The man-hours index was derived from this employment series and an annual index of average actual weekly hours which includes adjusted Census prevailing hours for 1919, NICB actual hours for 1920-1931, and BLS actual hours thereafter. The average computed from the Census frequency distribution for 1919 was reduced to actual hours by multiplication by the average of the actual-prevailing-hours ratios for 1921 and 1923.

The production and labor indexes are not strictly comparable in scope since some of the workers are engaged in the manufacture of secondary products, which include springs, ignition apparatus, starting and lighting systems, and other original and replacement parts normally produced, according to the Census, in other industries. The lack of comparability, however, is restricted to the Bodies and Parts branch.¹² The value of secondary products not included in the index is consequently very small; it does not exceed 5 percent of the total value of finished vehicles, chassis, and replacement parts made in both branches. There is a counteracting tendency to understate employment in the omission of those wage earners in other industries who are engaged in the manufacture of items normally made in the Bodies and Parts branch. The value of such production constituted only about 2 percent

¹²All the secondary products of the Motor Vehicles branch (i. e., assembly plants) were assumed to represent *in toto* replacement parts (see discussion of Production).

of the total value of all bodies and parts in the odd-numbered years 1925-29.¹³

Another possible reason for differences in scope between the production and labor indexes is the changing integration of the industry. Although the Census excludes the employment of separate plants (owned by automobile companies) which are engaged wholly or primarily in activities preceding automobile manufacture (e. g., the production of pig iron, steel, wire, glass, etc. by the Ford Motor Company), it does include the employment for such products as engines made for consumption or interplant transfer and castings made for consumption in the same plant. When these products are made outside the industry (for sale, presumably, to assembly plants), their value is reported. The failure, however, to assign a value to, or report the quantity of, their production within the Motor Vehicles industry makes impossible an evaluation of the lack of comparability resulting from year-to-year changes in the proportion manufactured by establishments classified in the Motor Vehicles industry.¹⁴

Productivity

It is of interest to compare the NRP indexes of productivity with others derived from the unadjusted production index for finished vehicles and chassis. As in the case of the production

¹³Comparable percentages could not be computed for other years.

¹⁴Some fragmentary information on the changing proportion of engines and castings made in the industry suggests that the influence on employment may be significant. For example, the number of engines manufactured as primary products of the Census industry, Engines, Turbines, [Tractors,] Water Wheels, and Windmills, comprised the following percentages of the total number of motor vehicles produced in corresponding years:

1919	11.9	1933	1.4
1925	7.3	1935	1.8
1929	5.3		

Most of the remaining engines were produced (for consumption) in the Motor Vehicles industry.

The proportion of castings made within the Motor Vehicles industry appears to fluctuate considerably. Four illustrations follow: (1) Before 1933, outside foundries made the bulk of the castings for the cars of the Chrysler Corporation, but the modernization, in that year, of the foundry of the Corporation's Dodge plant permitted the manufacture of all castings except during rush periods. (2) In 1928 General Motors Corporation opened a foundry to make about 90 percent of the castings for Pontiac and Oakland cars. From 1932 to 1936 this foundry was closed, but it resumed operation in 1936 to make all the castings for Pontiac cars. (3) The production of castings in the Buick foundry, constructed in 1917, was supplemented by the production of outside firms and other General Motors foundries until 1927. In that year the foundry was remodeled and made self-sufficient. (4) The Ford Motor Company cast the V-8 crankshaft in its own foundry for the first time in 1935. On the other hand, it also ordered 700 to 800 cylinder blocks for V-8 engines from an outside company in the same year. In 1936 it began operation of a new alloy-steel casting department at the River Rouge foundry. (These and other illustrations may be found in various issues of *American Machinist, Blast Furnace and Steel Plant, The Foundry, and Iron Age.*)

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indexes, the NRP productivity measures are higher in most years than those based on the unadjusted measure of output. Both series for output per wage earner, however, like those for output per man-hour, usually move in the same direction from year to year:

Year	Output per wage earner		Output per man-hour	
	NRP	Comparative index	NRP	Comparative index
1919	41.8	35.3	42.7	36.0
1920	45.7	40.3	46.4	40.9
1921	54.3	50.1	56.8	52.4
1922	63.0	59.1	61.2	57.4
1923	71.1	68.1	69.8	66.9
1924	68.5	68.8	70.8	71.1
1925	75.0	75.6	74.2	74.8
1926	80.0	80.7	78.5	79.2
1927	78.7	76.2	79.4	76.8
1928	85.5	83.4	83.9	81.9
1929	100.0	100.0	100.0	100.0
1930	90.3	86.3	105.9	101.1
1931	74.6	68.8	94.6	87.3
1932	55.1	46.1	82.4	69.0
1933	75.2	64.5	100.0	85.8
1934	71.6	65.0	99.8	90.6
1935	89.6	85.9	112.4	107.8
1936	95.2	93.8	115.7	114.0

Table 48.- SUMMARY INDEXES FOR THE MOTOR VEHICLES INDUSTRY: 1918-36

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	32.0	76.5	75.0	41.8	42.7
1920	36.2	79.2	78.0	45.7	46.4
1921	25.8	47.5	45.4	54.3	56.8
1922	40.7	64.6	66.5	63.0	61.2
1923	64.3	90.4	92.1	71.1	69.8
1924	57.6	84.1	81.4	68.5	70.8
1925	71.3	95.1	96.1	75.0	74.2
1926	75.4	94.2	96.0	80.0	78.5
1927	65.0	82.6	81.9	78.7	79.4
1928	83.0	97.1	98.9	85.5	83.9
1929	100.0	100.0	100.0	100.0	100.0
1930	65.1	72.1	61.5	90.3	105.9
1931	47.6	63.8	50.3	74.6	94.6
1932	30.0	54.4	36.4	55.1	69.0
1933	40.9	54.4	40.9	75.2	100.0
1934	56.8	78.6	56.4	71.6	99.8
1935	77.7	86.7	69.1	89.6	112.4
1936	85.3	89.6	73.7	95.2	115.7

49. NEWSPAPER AND PERIODICAL PRINTING AND PUBLISHING

The establishments in this industry are engaged primarily in the printing and publishing or publishing only of newspapers and periodicals. Contrary to the usual Census practice, establishments which do any printing or publishing whatever, even though these activities account for but a small portion of their income, are considered a part of this industry. In 1929 the industry employed almost 130,000 wage earners and 143,000 salaried workers.

Production

Production is represented by total newsprint consumption, which was estimated by adding imports¹ to "shipments from mills" and subtracting from the sum exports, changes in "stocks at publishers", and changes in "stocks in transit to publishers." The import and export series were compiled by the Bureau of Foreign and Domestic Commerce and published in *Foreign Commerce and Navigation of the United States*.²

Although some newsprint is consumed outside the industry, the bulk of it is used in the manufacture of newspapers.³ Book paper, only 5 or 6 percent of which is accounted for by books in bound form,⁴ is also used in the production of certain newspaper sections and of many periodicals, but it was not feasible to include such paper in the NRP index since the quantities could not be determined in every year and no satisfactory weighting system could be devised. It should be noted, however, that relatives of the total tonnage of newsprint and book paper consumed⁵ in census years resemble closely the index for newsprint alone:

¹"General imports" were reported to 1933 and "imports for consumption" thereafter. This change in definition, however, probably has no significant effect on comparability since the 2 groups of imports differ only in that the former includes commodities entered into bonded customs warehouses for storage while the latter includes withdrawals for consumption from bonded warehouses.

²Prior to June 1923 "shipments from mills", "stocks at publishers", and "stocks in transit to publishers" were reported by the Federal Trade Commission to the *Survey of Current Business*. After that date the first series was continued by the Newsprint Service Bureau; the second and third, by the American Newspaper Publishers' Association. The 2 stocks series had to be adjusted for incomplete coverage.

³U. S. Congress, Senate, *Newsprint Paper Industry: Letter From the Chairman of the Federal Trade Commission*, S. Doc. No. 214, 71st Cong., spec. sess., 1930, p. 61.

⁴G. S. Witham, *Modern Pulp and Paper Making* (New York: Chemical Catalogue Co., 1920), p. 40. It is significant that the periodicals of the Curtis Publishing Company, which have an aggregate circulation of 16,000,000 copies per month, are made of smooth, surface-coated book paper.

⁵Book-paper consumption was estimated from Census production data and from Bureau of Foreign and Domestic Commerce statistics for imports and exports.

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Year	Newsprint- consumption index (NRP)	Newsprint and book-paper consumption index
1921	54.0	53.8
1923	71.7	74.4
1925	79.6	82.7
1927	90.2	90.0
1929	100.0	100.0
1931	85.8	84.4
1933	71.0	71.4
1935	87.8	87.3

An attempt to construct a production index from Census statistics for the number, publication period, and aggregate circulation per issue of the various classes of newspapers and periodicals was not successful because of the absence of an adequate series for average linage per copy, which would have permitted the reduction of aggregate annual circulation to additive (linage) units. Indexes of advertising linage per issue are available, but these are not suitable for our purpose since the ratio of advertising to editorial and news matter varies according to the phase of the business cycle. Thus an index of the aggregate annual circulation of newspapers and periodicals reduced to advertising-linage equivalents by use of the *Printer's Ink* series⁶ approximates the consumption index in the period 1921-29, during which no serious recessions occurred. After 1929, however, the aggregate-linage index falls considerably below the consumption series, reflecting the decline in the ratio of advertising to total linage concurrent with the retardation of business activity:

Year	Newsprint- consumption index (NRP)	Aggregate- linage index
1921	54.0	57.9
1923	71.7	73.7
1925	79.6	81.8
1927	90.2	94.3
1929	100.0	100.0
1931	85.8	72.6
1933	71.0	46.2
1935	87.8	63.7

⁶This series of advertising linage is based on a group of approximately 90 newspapers in 52 cities.

Employment and Man-hours

The index of wage-earner employment, which conforms to Census trend, is based on BLS relatives for 1923-36, the number of wage earners reported by the Census for 1919 and 1921, and the NICB index for 1920 and 1922.

The index of man-hours was obtained from the index of wage-earner employment and an annual series for average weekly hours computed from adjusted Census prevailing hours for 1919, NICB actual hours for 1920-31, and similar BLS statistics for remaining years. Census prevailing hours for 1919 were adjusted by the 1921 ratio of actual to prevailing hours.

The labor and production indexes are not strictly comparable in scope since some secondary activities - e. g., commercial or job printing - are carried on by establishments engaged primarily in the printing and publishing of newspapers and periodicals. Available data are not adequate for adjusting the employment index.⁷

Publishers who do no printing employ practically no wage earners, and even those who do their own printing doubtless have a large staff of salaried employees. In fact, according to the *Census of Manufactures*, the wage earners and salaried workers in the industry are about equal in number. If salaried employees were included with wage earners, the relatives of employment and productivity would compare as follows with the corresponding NRP indexes:

Year	Index of employment		Index of output per -	
	Wage earners (NRP)	All employees	Wage earner (NRP)	Employee
1921	82.9	75.2	65.1	71.8
1923	89.1	84.9	80.5	84.5
1925	90.2	88.2	88.2	90.2
1927	92.1	92.0	97.9	98.0
1929	100.0	100.0	100.0	100.0
1931	92.2	n. a.	93.1	-
1933	84.1	77.2	84.4	92.0
1935	91.5	83.7	96.0	104.9

⁷Only the value of secondary production is known. Such value constituted the following percentages of the total for the industry:

1919	12.8	1929	9.1
1921	10.6	1931	8.1
1923	9.0	1933	8.6
1925	8.7	1935	8.6
1927	7.9			

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Caution should be used in interpreting these indexes since the NRP production series is not an adequate measure of the output of salaried employees and hence of all workers in the industry.

Table 48.- SUMMARY INDEXES FOR THE NEWSPAPER AND PERIODICAL PRINTING AND PUBLISHING INDUSTRY: 1919-36

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	51.8	92.8	91.6	55.8	56.6
1920	56.0	85.4	83.4	65.6	67.1
1921	54.0	82.9	80.6	65.1	67.0
1922	64.7	85.7	84.2	75.5	76.8
1923	71.7	89.1	87.8	80.5	81.7
1924	75.1	91.0	89.4	82.5	84.0
1925	79.6	90.2	89.2	88.2	89.2
1926	91.0	91.6	90.8	99.3	100.2
1927	90.2	92.1	92.1	97.9	97.9
1928	94.4	94.1	92.9	100.3	101.6
1929	100.0	100.0	100.0	100.0	100.0
1930	94.4	99.3	98.2	95.1	96.1
1931	85.8	92.2	88.0	93.1	97.5
1932	75.3	84.0	78.3	89.6	96.2
1933	71.0	84.1	72.9	84.4	97.4
1934	80.7	89.9	73.4	89.8	109.9
1935	87.8	91.5	73.7	96.0	119.1
1936	96.1	94.9	76.9	101.3	125.0

- 50. NONFERROUS METALS GROUP
- 51. PRIMARY SMELTERS AND REFINERIES
- 52. SECONDARY SMELTERS AND REFINERIES
- 53. ALLOYERS, ROLLING MILLS, AND FOUNDRIES

The Nonferrous Metals group, which employed about 114,000 wage earners in 1929, comprises 3 industries: (1) Primary Smelters and Refineries (which corresponds to the Census industry "Smelting and Refining, Copper, Lead, and Zinc"), (2) Secondary Smelters and Refineries (which corresponds to the Census industry "Smelting and Refining, Nonferrous Metals Other Than Gold, Silver, or Platinum, Not From the Ore"), and (3) Alloyers, Rolling Mills, and Foundries (which corresponds to the Census industry "Nonferrous-Metal Alloys and Products, Not Including Aluminum Products").

Primary Smelters and Refineries, which in 1929 employed almost 31,000 wage earners, are engaged principally in smelting and refining primary copper, lead, and zinc. In addition, they produce some secondary copper, lead, and zinc (about 20 percent of the total); gold, silver, nickel, and other metals from complex nonferrous-metal ores; and some chemicals, such as sulphuric acid, copper sulphate, and lead and zinc pigments.

Secondary Smelters and Refineries, which employed 4,100 wage earners in 1929, are engaged primarily in recovering copper, lead, zinc, nickel, and alloys of these metals from scrap and dross. The recovery of secondary metals has become increasingly important since the World War. In 1919 secondary output accounted for 22 percent of the total tonnage of primary and secondary copper, lead, and zinc; by 1929 the percentage was 28, and by 1936, 34.

Alloyers, Rolling Mills, and Foundries, which employed over 79,000 wage earners in 1929, manufacture nonferrous-metal alloys, plates, sheets, rods, bars, tubing, pipe, bearings, forgings, and rough and finished castings.

Production

Nonferrous Metals Group.— The 2 NRP measures of production for the Nonferrous Metals group are harmonic means of the production indexes for the 3 component industries; one, with changing man-hour weights, was used in determining output per man-hour, and the other, with changing employment weights, in determining output per wage earner. Both are not only almost identical but are

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also in close accord with arithmetic means of the production indexes weighted by 1929 employment and man-hours:

Year	Index of production with -			
	Changing weights		Fixed weights (1929)	
	Employment	Man-hours	Employment	Man-hours
1919	43.4	43.8	44.8	45.2
1921	24.9	25.2	26.0	26.3
1923	60.0	60.1	59.7	60.0
1925	69.7	69.9	69.8	70.1
1927	68.8	69.0	69.8	70.2
1929	100.0	100.0	100.0	100.0
1931	53.3	53.4	53.4	53.4
1933	38.7	38.7	39.1	39.1
1935	54.1	54.0	54.4	54.4

Primary Smelters and Refineries.— The index of production for the period 1919-36 is based on Bureau of Mines statistics¹ for the following 14 products, which represent over 95 percent of the value of the industry's output:

- | | |
|----------------------------------|---------------------------------------|
| (1) Primary copper | Produced at primary refineries |
| (2) Secondary copper | |
| (3) Primary lead | Produced at primary smelters |
| (4) Antimonial lead | and refineries |
| (5) Secondary pig lead | |
| (6) Primary zinc | Produced at primary zinc- |
| (7) Redistilled secondary zinc | reduction plants |
| (8) Silver | Mine production from |
| (9) Gold | nonferrous-metal ores ² |
| (10) Nickel | Byproduct of copper refining |
| (11) Copper sulphate | Produced at primary-copper refineries |
| (12) Sulphuric acid from blende | Produced in zinc-blende |
| (13) Sulphuric acid from sulphur | roasting plants |
| (14) Sulphuric acid, byproduct " | Produced at copper smelters |

Annual statistics were available for the whole period for 9 of these products - i. e., for all but antimonial lead, redistilled secondary zinc, and the 3 types of sulphuric acid. The series

¹The basic production statistics are reported in annual issues of *Mineral Resources of the United States* and *Minerals Yearbook*.

²Copper, lead, zinc, copper-lead, copper-lead-zinc, and lead-zinc ores.

for antimonial lead (1929-36) and for secondary zinc (1919 and 1928-36) were completed by means of estimates derived from other Bureau of Mines statistics.³ The 3 series for sulphuric acid, however, could not be completed. The one for acid from blende, available for 1919, 1920, and 1924-36, was interpolated for 1921 and 1923 by means of Census statistics for the odd-numbered years 1919-25 for sulphuric-acid production from zinc ores. The series for acid from sulphur could not be extended to the years prior to 1924. The third series, for acid produced at copper smelters,⁴ available for 1919, 1920, and 1927-36, was interpolated for 1921, 1923, and 1925 by means of comparable Census statistics for the odd-numbered years 1919-27.

An aggregative index was constructed from these 14 series with estimated unit values added for 1929 as weights. In 7 years fewer than 14 products were represented (13 in 1919-21, 1923, 1924, and 1926 and 11 in 1922); the weighted aggregates for these years were therefore raised to the level of the 14-product aggregates for adjacent years before conversion to relatives. The weights are the differences between unit values before and after processing (the products are numbered as in the above list):

Product	Estimated unit value in 1929 ⁵	
	Before processing	After processing
(1) Primary copper	Average unit value of metal at mine (<i>Census of Mines and Quarries: 1929</i>)	Weighted average price of all grades of primary metal sold by producers (<i>Mineral Resources of the United States: 1930, Part I</i>)
(3) Primary lead		
(6) Primary zinc		
(2) Secondary copper	Average dealers' buying price at New York for principal grades of copper scrap, "heavy copper", and "No. 1 Composition." (<i>American Metal Market, Metal Statistics: 1934</i>)	Assumed to be the same as for primary metals

[Con.]

³The series for antimonial lead includes 2 varieties: (1) Byproduct antimonial lead (59 percent of the total in 1929) and (2) secondary antimonial lead produced at primary-lead refineries. Estimates were made for 1919-28 by the multiplication of annual figures for byproduct antimonial lead by ratios of the antimony content of all antimonial lead (i. e., both byproduct and secondary) made in primary refineries to the antimony content of byproduct antimonial lead only.

Estimates of the output of redistilled secondary zinc at primary zinc-reduction plants were made for the years 1920-27 by means of a series for the total output of redistilled secondary zinc. In 1919 and 1928 primary plants accounted for 55 and 28 percent, respectively, of the total output of redistilled secondary zinc.

Footnotes 4 and 5 appear on p. 153.

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[Con.] Product	Estimated unit value in 1929 ⁵	
	Before processing	After processing
(5) Secondary pig Lead	Average dealers' buying price at New York for "heavy lead" (<i>Mineral Resources of the United States: 1929, Part I</i>)	Assumed to be the same as for primary metals
(7) Redistilled secondary zinc	Average scrap-metal price at New York for "old zinc" (<i>Mineral Resources of the United States: 1929, Part I</i>)	
(4) Antimonial lead	Assumed to be the same as the average unit value of primary lead at mine	Average unit value of byproduct primary antimonial lead (<i>Mineral Resources of the United States: 1930, Part I</i>)
(11) Copper sulphate	Mine value of copper content per unit of copper sulphate (estimated from statistics for copper content and copper-sulphate production at copper refineries shown in <i>Mineral Resources of the United States: 1930, Part I</i>)	Average unit value of copper sulphate produced (<i>Census of Manufactures: 1929</i>)
(8) Silver	Average unit value at mine for copper-, lead-, and zinc-mining enterprises (as computed from total mine values reported in <i>Census of Mines and Quarries: 1929</i> and total quantities of metal production from copper, lead, zinc, copper-lead, copper-lead-zinc, and lead-zinc ores reported in <i>Mineral Resources of the United States: 1930, Part I</i>)	Average price at New York for all silver (<i>Mineral Resources of the United States: 1930, Part I</i>)
(9) Gold		Mint value of fine gold (<i>Mineral Resources of the United States: 1930, Part I</i>) [Con.]

[Cont.] Product	Estimated unit value in 1929 ⁵	
	Before processing	After processing
(10) Nickel	Assumed to be the same as the unit value of copper at mine (since unrecovered nickel reaches the market as an impurity in copper)	Average unit value of metallic nickel and the nickel content of nickel salts made as byproducts of copper refining (<i>Mineral Resources of the United States: 1929, Part I</i>)
(12) Sulphuric acid from blende	Assumed to be negligible since these are byproducts	Average unit value of sales of 60° Baumé sulphuric acid (<i>Minerals Yearbook: 1937</i>)
(14) Sulphuric acid, byproduct, produced at copper smelters		
(13) Sulphuric acid from sulphur		

Secondary Smelters and Refineries.— The production index for this industry was constructed for the odd-numbered years 1927-35 from Census quantity statistics; it was extended back to the odd-numbered years 1919-25, for which no satisfactory quantity data were available, by means of a series of deflated values based on Bureau of Mines and Census data.

The index for 1927-35 comprises 3 segments, each of which is an aggregative index for ingots and pigs of various metals with

⁴This series excludes the acid produced by the Anaconda Copper Company in 1933-36 and the acid produced from pyrites concentrate in Tennessee in 1934-36.

⁵The unit-value figures are subject to certain limitations. For example, price includes such extraneous costs as transportation from the smelter to the refinery, and unit value at the mine excludes transportation cost to both the smelter and refinery; price does not always refer to the grades of the metal included in the quantity statistics; unit value or price after processing is not always comparable to unit value before processing; and the unit values before processing assigned to byproducts (viz, nickel and 2 varieties of sulphuric acid) are somewhat arbitrary.

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1929 unit values as weights.⁶ The first segment, for 1927 and 1929, includes the first 7 of the following 10 metals; the second segment, for 1929 and 1931, includes the eighth and ninth in addition to the first 7; and the third segment, for 1931, 1933, and 1935, includes all 10:⁷

Copper	Solders ¹⁰
Lead ⁸	Type metal ¹⁰
Zinc ⁹	Tin ¹⁰
Brass and bronze ¹⁰	Aluminum ^{9, 10, 11}
Antifriction bearing metal ¹⁰	Miscellaneous metals ^{10, 12}

The series of deflated values for the odd-numbered years 1919-27 was computed from Census value statistics for the total output of the industry and unit values derived from *Mineral Resources of the United States* and *Minerals Yearbook*. The unit values - which refer to the secondary metals aluminum, antimony, brass, copper, lead, zinc, and tin - were combined into an aggregative

⁶Since value and quantity statistics for "miscellaneous metals" are not available for 1929, the unit value for this year was assumed to be the same as an estimate for 2 Census industries combined. (One of these industries corresponds to Secondary Smelters and Refineries, and the other to Alloyers, Rolling Mills, and Foundries.) The estimate for these industries was made on the assumption that the 1931 relationship between the unit value for "miscellaneous metals" and the weighted average unit value for the other 9 metals prevailed in 1929.

⁷The products included in the 3 segments represent the following percentages of the value of the industry's output:

7 products	9 products	10 products
1927 72.7	1929 85.9	1931 95.1
1929 77.7	1931 n.a.	1933 95.0
		1935 92.6

⁸The quantities for all years include both common and antimonial lead.

⁹The quantity for Secondary Smelters and Refineries for 1935 was segregated from the reported total for 2 Census industries (see fn. 6) on the basis of the 1933 relationship. (The output of zinc is reported in *Census of Manufactures: 1935*; the figure for aluminum was furnished by the Bureau of the Census.)

¹⁰A portion of the output in 1935 was reported by value only for 2 Census industries combined (see fn. 6). The quantity was estimated by dividing this figure by the unit value for the total quantity reported for both industries and then distributed in accordance with the proportions of the quantities reported separately. The percentages of the value for which quantities had to be estimated are:

Brass and bronze	1.4	Tin	1.6
Antifriction bearing metal	15.4	Aluminum	0.3
Solders	10.7	Miscellaneous metals	<u>39.9</u>
Type metal	4.8	All metals in index	10.8

¹¹The value for 1929 and the quantities and values for 1931 and 1933 were estimated by subtraction of revised figures which exclude aluminum ingots and pigs (shown in *Census of Manufactures: 1935*) from unrevised figures which include them (shown in *Census of Manufactures: 1933*). The quantity for 1929 was derived by deflation of the value for this year by an estimate of unit value; the latter was computed on the assumption that the 1931 ratio of the unit value of aluminum ingots and pigs made in Secondary Smelters and Refineries to the unit value of the quantity made in both this industry and Alloyers, Rolling Mills, and Foundries prevailed in 1929. (An unpublished figure for the total quantity of ingots and pigs made in the 2 industries in 1929 was supplied by the Bureau of the Census.)

¹²A portion of the output for 1933 (7.8 percent of the value) was estimated in the manner described in fn. 10.

index with 1929 quantity weights.¹³ The deflated-values series was extended to the years 1927-35 for comparison with the NRP index:

Year	NRP production index	Deflated-values index
1927	78.5	80.6
1929	100.0	100.0
1931	61.4	54.9
1933	74.0	68.9
1935	86.7	90.4

No satisfactory interpolating index could be constructed for this industry.¹⁴

Alloyers, Rolling Mills, and Foundries.— The index was constructed for the odd-numbered years 1919-35 from Census quantity statistics for secondary nonferrous metals and for nonferrous-metal alloys and products made chiefly in this industry.¹⁵ It consists of 5 segments:

Years	Number of series	Percentage of value of industry's output (excluding production for consumption in same works)
1919-25	10	55 (1925)
1925-27	20	68 (1925); 65 (1927)
1927-29	21	67 (1927); 76 (1929)
1929-31	29	65 (1929)
1931-35	31	68 (1931); 65 (1933-35)

¹³The weight for each product except brass represents the total amount produced in 1929, including the estimated quantity of pure metal contained in alloys. The weight for brass represents the output of brass and bronze.

¹⁴An aggregative index of the output of 8 secondary nonferrous metals made in all industries compares as follows with the NRP index:

Year	NRP production index	Comparative production index
1919	42.0	47.6
1921	18.5	35.3
1923	35.2	66.6
1925	72.2	72.6
1927	78.5	84.4
1929	100.0	100.0
1931	61.4	58.4
1933	74.0	58.6
1935	86.7	76.7

The weights (1929 unit values) and the quantities were derived from *Mineral Resources of the United States*, Part I, and *Minerals Yearbook*. The 8 metals, about 35 to 40 percent of the aggregate tonnage of which is produced in Secondary Smelters and Refineries, are copper, remelted brass scrap, lead, zinc, tin, antimony, aluminum, and nickel. The series for copper and zinc include the amounts of the respective metals in alloys other than brass; for aluminum, antimony, and lead, the amounts of the respective metals in alloys; and for nickel and tin, the amounts in alloys and salts.

Footnote 15 appears on following page.

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In all, 34 different series, weighted by 1929 unit values, enter into the index. Their names and the years for which they were available are as follows:

Product	Years	Product	Years
Copper		Alloys, other than brass and bronze	
(1) Ingots and pigs	1925-35	Ingots and pigs ¹⁰	
(2) Plates and sheets	1919-35	(21) Antifriction bearing metal	1925-35
(3) Seamless tubing and pipe	1919-35	(22) Solders	1925-35
(4) Rods	1919-35	(23) Type metal	1925-35
(5) Wire, bare	1919-29		
(6) Rough castings	1919-35	Heat-corrosion-resistant alloys, not including ferro-alloys	
Brass and bronze		(24) Rough castings	1929-35
(7) Ingots and pigs ¹⁰	1925-35	Nickel-alloy products	
(8) Plates and sheets	1919-35	(25) Plates and sheets	1927-35
(9) Seamless tubing and pipe	1919-35	(26) Seamless tubing and pipe	1929-35
(10) Rods	1919-35	(27) Rods, including some of miscellaneous metals	1929-35
(11) Wire, bare	1919-29	(28) Rough castings, other than heat-corrosion-resistant	1929-35
(12) Rough castings	1919-35		
Lead		Miscellaneous metals⁶	
(13) Ingots and pigs ⁸	1925-35	(29) Ingots and pigs ^{10,12}	1931-35
(14) Plates and sheets	1925-35	(30) Plates and sheets	1929-35
(15) Seamless tubing and pipe	1925-35	(31) Seamless tubing and pipe	1929-35
Zinc		(32) Wire, bare	1925-29
(16) Ingots and pigs ⁹	1925-35	(33) Rough castings	1929-35
(17) Plates and sheets	1929-35		
Aluminum		All metals	
(18) Ingots and pigs ^{9, 10, 11}	1929-35	(34) Tubing, other than seamless	1931-35
(19) Rough castings	1929-35		
Tin			
(20) Ingots and pigs ¹⁰	1929-35		

Twenty-seven of the 34 series include consumption in the same works and production for sale and interplant transfer; the remaining 7 refer to production for sale and interplant transfer only.¹⁶

¹⁵Unpublished figures for aluminum rough castings for 1919-35 were supplied by the Bureau of the Census. (See fn. 19 for adjustment made for 1935.)

A small portion of the output included in the index (about 1 or 2 percent by value) is accounted for by establishments other than Alloyers, Rolling Mills, and Foundries.

¹⁶The 7 products are:

Seamless tubing and pipe	Plates and sheets
Copper	Lead
Lead	Zinc
Nickel-alloy	Miscellaneous-metal
Miscellaneous-metal	

Various minor adjustments which are not likely to impair the validity of the NRP index were required in the Census statistics:

- (1) The quantities of ingots and pigs were estimated for some years in the same manner as the quantities made in Secondary Smelters and Refineries. (The methods are described in ftns. 9-12.)
- (2) For 6 products, the quantities in the years prior to 1929 and the values in 1929 were reported for production for sale and interplant transfer only; they were raised to include consumption in the same works by means of the quantity figures for the 2 types of output reported for 1929.¹⁷
- (3) The quantities of 5 brass, bronze, and copper products were reported for only a part of the industry for 1919-23; they were multiplied by the ratio between output in the entire industry and in this branch only in 1925.¹⁸
- (4) The quantities of brass, bronze, and copper rough castings for 1919 and 1921 were rendered comparable with those for later years by the exclusion of finished castings, the amounts of which were estimated on the basis of the 1923 relationship between rough and finished castings.
- (5) The quantities and values of heat-corrosion-resistant and nickel-alloy rough castings, reported in combination for 1929, were separated on the basis of the 1931 relationship.
- (6) For 9 products, a portion of the output was reported in terms of value only for some years; the corresponding quantity of each was estimated on the assumption that the unit value was the same as for the remainder reported in terms of both quantity and value. In 1935 the estimated quantities

¹⁷The quantities for the following 6 products were adjusted for the years indicated in parentheses:

Plates and sheets	Rods
Copper (1919-27)	Copper (1919-27)
Brass and bronze (1919-27)	Brass and bronze (1919-27)
Nickel-alloy (1927)	Seamless tubing and pipe
	Brass and bronze (1919-27)

For a seventh product, nickel-alloy and other rods, only the value in 1929 required adjustment.

¹⁸The 5 products are:

Brass and bronze	Copper
Seamless tubing and pipe (for sale and inter- plant transfer)	Seamless tubing and pipe
Rough castings	Rods (for sale and inter- plant transfer)
Wire	

The statistics for 1919-23 refer to the Census industry "Brass, Bronze, and Other Nonferrous Alloys, and Manufacture of These Alloys and of Copper Not Specifically Classified", which was consolidated with 2 other Census industries ("Babbitt Metal, White Metal, Type Metal, and Solder" and "Lead: Bar, Pipe, and Sheet") in 1929 to form the industry which corresponds to Alloyers, Rolling Mills, and Foundries.

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of the 9 products together represented only 7.1 percent of the value of all the items in the index.¹⁹

No satisfactory data were available for the completion of the index for the even-numbered years of the period 1919-36.²⁰

Employment and Man-hours²¹

Nonferrous Metals Group.- The NRP group indexes of employment and man-hours, which are available for only the odd-numbered years 1919-35, are based on the sums of the estimated number of wage earners and man-hours, respectively, for the 3 component industries.

¹⁹The 9 products, the years, and the percentages of total value for which the estimates were required are:

Product	Year	Percentage of total value
Copper rough castings	1935	45.5
Brass and bronze rough castings	1925	11.9
	1927	10.5
	1933	28.1
	1935	42.7
Aluminum rough castings	1935	25.6
Miscellaneous-metal		
Plates and sheets	1935	23.5
Seamless tubing and pipe	1935	5.6
Rough castings	1935	19.2
Heat-corrosion-resistant rough castings	1935	22.4
Nickel-alloy rough castings, other than heat-corrosion-resistant	1935	2.4
Tubing, other than seamless, all metals	1935	81.5

²⁰A continuous aggregative index with 1929 unit-value weights, which was constructed from domestic-output statistics for the 8 principal metals treated by Alloyers, Rolling Mills, and Foundries (primary and secondary antimony, nickel, lead, copper, and zinc - exclusive of the amounts of the last 2 metals contained in brass; secondary tin; secondary aluminum; and brass scrap re-melted), agrees with the NRP series only after 1929:

Year	NRP production index	Comparative production index
1919	37.7	59.6
1921	21.8	37.0
1923	55.7	71.9
1925	63.9	80.6
1927	62.1	87.4
1929	100.0	100.0
1931	52.8	55.5
1933	38.5	40.0
1935	53.9	56.0

The statistics for the comparative index were obtained from *Mineral Resources of the United States*, Part I, and *Minerals Yearbook*.

²¹The several labor indexes do not correspond precisely to the production indexes in scope. Some of the output included in the index for one industry may have been contributed by another, possibly outside the group; and some of the workers included in the labor indexes may be engaged in making products normally reported by the Census with the statistics for other industries within or outside the group. The possible lack of comparability between the production and labor indexes cannot be estimated, but, from some calculations based on value statistics which are not altogether satisfactory, it appears to be negligible.

Primary Smelters and Refineries.- The employment index for this industry was constructed for the odd-numbered years 1919-35 from Census wage-earner statistics. Interpolation for the even-numbered years 1920-30 was accomplished by means of a series for man-shifts of direct and indirect labor²² derived from Bureau of Mines data; estimates for 1932, 1934, and 1936 were made through the use of the BLS index for "Smelting and Refining, Copper, Lead, and Zinc" (which corresponds to the NRP industry).

The man-hours series was constructed in the following manner:

- (1) Bureau of Mines man-hours figures for 1931-36 were adjusted to include both direct and indirect labor at smelters and refineries.²³
- (2) Census prevailing weekly hours for each of the 3 branches of the industry (Copper, Lead, and Zinc) for 1919, 1921, 1923, and 1929 were multiplied by 52 times the corresponding Census employment figure; the results for these 3 branches were then totaled.
- (3) Estimates for 1925, 1927, and the even-numbered years 1920-30 were interpolated by means of the continuous employment series for the industry.

Secondary Smelters and Refineries.- The index of employment for this industry, which is based on Census wage-earner statistics, was constructed for only the odd-numbered years 1919-35. The man-hours index was derived from the employment series and another for average actual weekly hours. The weekly hours were estimated from the final hours series for Alloyers, Rolling Mills, and Foundries (described below) by means of ratios between the prevailing-hours figures for the 2 industries. These ratios were computed for 1919, 1921, 1923, and 1929 from Census figures and for 1925 and 1927 by straight-line interpolation; the 1929 ratio was assumed for 1931, 1933, and 1935.

²²The series for man-shifts includes, in addition to direct labor at smelters and refineries, the estimated man-shifts of indirect labor at "auxiliary works" assignable to this industry. The man-shifts for "auxiliary works" were distributed between smelters and refineries and ore-dressing plants in accordance with the proportions of the man-shifts of direct labor reported separately for both. (The necessary statistics are published in *Accidents at Metallurgical Works in the United States: 1932.*)

²³The method of estimating the man-hours of indirect labor at "auxiliary works" is analogous to the method of estimating man-shifts (see fn. 22). The man-hours statistics for 1932-36 for ore-dressing plants, smelters and refineries, and "auxiliary works" are published in Bureau of Mines reports on *Accidents at Metallurgical Works*; those for 1936 were supplied by the Bureau of Mines in advance of publication.

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Alloyers, Rolling Mills, and Foundries.—The index of employment for this industry was constructed for the odd-numbered years 1919-35 from Census statistics; relatives for 1924-36 were computed by means of the BLS index for "Brass, Bronze, and Copper Products", which is comparable to the NRP industry. The index of man-hours was derived from the employment series and another for average actual weekly hours. The latter was constructed from BLS actual hours for 1927 (obtained from a special study),²⁴ 1933, and 1935; from Census prevailing hours for 1919, 1921, 1923, and 1929 reduced to the level of actual hours by means of the 1927 ratio of BLS actual to BLS prevailing hours; and from estimates for 1925 and 1931 made by straight-line interpolation. The estimate for 1931 was interpolated between the adjusted figure for 1929 and a BLS actual-hours figure for 1932 (unpublished).

Table 50.—SUMMARY INDEXES FOR THE NONFERROUS METALS INDUSTRY GROUP:
CENSUS YEARS 1919-35

(1929 = 100)

Year	Production (employ- ment weights)	Employment	Output per wage earner	Produc- tion (man-hour weights)	Man-hours	Output per man- hour
1919	43.4	103.5	41.9	43.8	105.1	41.7
1921	24.9	54.3	45.9	25.2	54.6	46.2
1923	60.0	90.8	66.1	60.1	91.9	65.4
1925	69.7	88.4	78.8	69.9	89.9	77.8
1927	68.8	88.8	79.3	69.0	88.5	78.0
1929	100.0	100.0	100.0	100.0	100.0	100.0
1931	53.3	61.3	86.9	53.4	48.4	110.3
1933	38.7	57.1	67.8	38.7	41.9	92.4
1935	54.1	78.0	69.4	54.0	62.4	86.5

²⁴ BLS reports both actual and prevailing hours for 1927 in *Monthly Labor Review*, August 1938, p. 138, for a sample of 20 brass and copper sheet, rod, tube, wire, and shape mills, which employed 17 percent of the total number of wage earners in the industry.

NONFERROUS METALS GROUP

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Table 51.- SUMMARY INDEXES FOR PRIMARY SMELTERS AND REFINERIES: 1919-36

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	63.3	121.3	124.2	52.2	51.0
1920	61.8	126.1	129.6	49.0	47.7
1921	37.9	80.0	81.9	63.2	61.2
1922	52.1	90.5	91.4	57.6	57.0
1923	73.2	112.6	111.3	65.0	65.8
1924	80.3	111.1	110.0	72.3	73.0
1925	84.4	106.5	105.7	79.2	79.8
1926	89.3	105.3	104.7	84.8	85.3
1927	88.2	98.5	98.1	89.5	89.9
1928	92.3	98.7	98.5	93.5	93.7
1929	100.0	100.0	100.0	100.0	100.0
1930	80.2	91.4	84.1	87.7	95.4
1931	53.8	59.6	50.1	80.3	107.4
1932	30.6	45.3	34.0	67.5	90.0
1933	36.0	47.0	36.4	76.6	98.9
1934	41.8	62.5	43.9	66.9	95.2
1935	51.3	72.6	60.3	70.7	85.1
1936	64.3	80.6	71.4	79.8	90.1

Table 52.- SUMMARY INDEXES FOR SECONDARY SMELTERS AND REFINERIES:
CENSUS YEARS 1919-35

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	42.0	52.4	53.6	80.2	78.4
1921	18.5	29.0	30.4	63.8	60.9
1923	35.2	38.4	40.8	91.7	86.3
1925	72.2	71.2	75.0	101.4	98.3
1927	78.5	67.2	69.9	116.8	112.3
1929	100.0	100.0	100.0	100.0	100.0
1931	61.4	83.5	46.9	96.7	125.6
1933	74.0	70.7	51.3	104.7	144.2
1935	86.7	91.0	72.0	95.3	120.4

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Table 53.- SUMMARY INDEXES FOR ALLOYERS, ROLLING MILLS, AND FOUNDRIES:
1919-38

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	37.7	99.2	99.8	38.0	37.8
1920	n. a.	n. a.	n. a.	-	-
1921	21.8	53.4	52.9	40.8	41.2
1922	n. a.	n. a.	n. a.	-	-
1923	55.7	85.0	86.5	65.5	64.4
1924	n. a.	79.5	n. a.	-	-
1925	63.9	82.3	84.1	77.6	76.0
1926	n. a.	84.5	n. a.	-	-
1927	62.1	83.3	85.4	74.5	72.7
1928	n. a.	88.3	n. a.	-	-
1929	100.0	100.0	100.0	100.0	100.0
1930	n. a.	79.5	n. a.	-	-
1931	52.8	61.8	47.6	85.4	110.9
1932	n. a.	51.4	n. a.	-	-
1933	38.5	60.3	43.7	63.8	88.1
1934	n. a.	71.4	n. a.	-	-
1935	53.9	79.5	62.8	67.8	85.8
1936	n. a.	88.8	n. a.	-	-

54. PAINTS AND VARNISHES

This industry, which employed over 29,000 wage earners in 1929, includes establishments engaged primarily in the manufacture of pigments or colors (other than bone black, carbon black, and lampblack - which are classified elsewhere); paints in paste form; paints mixed ready for use; water paints and calcimines; varnishes, japans, and lacquers; and miscellaneous products, like fillers, putty, bleached shellac, driers, and stains.

Production

The index of output was constructed for the odd-numbered years of the period 1919-35 from Census quantity statistics for 19 classes of products; 1929 unit values were used as weights. These 19 products, which represent over 95 percent of the value of paint-and-varnish production, are:

White lead, dry	Paints mixed, ready for use
Lead oxides	Varnishes, oleoresinous
Zinc oxide	Varnishes, spirit not turpentine
Lithopone	Varnishes, other than oleoresinous and spirit
Iron oxides	Drying japans and driers
Chrome yellow, orange, and green	Baking japans
Pulp colors, sold moist	Enamels and pyroxylin lacquers and thinners
All other pigments	Putty
Water paints and calcimines	Shellac, bleached
Paints in paste form	

The production index was completed for the even-numbered years of the period 1919-36 by means of 2 additional series. The first, used for interpolation between 1919 and 1927, is an index based on annual Census output statistics for 3 groups of products - paints in oil in paste form, paints in oil in mixed form, and varnishes - weighted by 1929 unit values. This series is similar in contour to the 19-product index.¹ The gaps in the even-numbered years after 1927 were filled by means of an annual series of deflated sales of paints, varnishes, and lacquers.² The sales statistics were compiled by the Census from data furnished monthly

¹The data for the 3 groups, available for the years 1920-27, were derived from semiannual Census surveys covering from 53 to 59 percent of the establishments in the industry. The firms reporting in 1922 accounted in the previous year for 89 percent of the production of paste paints in oil, 95 percent of ready-mixed paints, and 80 percent of varnishes, lacquers, and japans.

²The sales series, available since 1928, was extended back to 1927 by applying to the Census production value for 1927 the ratio of sales to value of production in 1929.

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by establishments accounting for about 80 percent of the industry's output. The deflator is a weighted average of 19 BLS series of wholesale-price relatives.³

Employment and Man-hours

The NRP employment index, which conforms to Census trend, is based on the BLS series for 1923-25, 1927, 1929, and 1931-36; Census wage-earner figures for 1919 and 1921; and the NICB index for the remaining years of the period 1919-36.

The man-hours index was derived from the employment series and an annual index of average actual weekly hours. The latter is based on adjusted Census prevailing hours for 1919, NICB actual hours for 1920-31, and BLS actual hours thereafter. Prevailing weekly hours for 1919 were adjusted by the average of the 1921 and 1923 ratios of actual to prevailing hours.

It should be noted that the production and labor indexes are not precisely comparable in scope. Some of the labor consumed in the industry is devoted to the manufacture of secondary products, which accounted for 10.5 percent of total value in 1919 and only 4.0 to 7.0 percent thereafter. On the other hand, some of the production of paints and varnishes is contributed by establishments not classified in the industry. The value of such output comprised 12.0 percent of the total production of paints and varnishes in all industries in 1919 and 5.3 to 8.8 percent thereafter.

³The items in the price index, which are typical of products having about the same coverage as the sales series, were weighted by estimated sales values in 1926.

PAINTS AND VARNISHES

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Table 54.- SUMMARY INDEXES FOR THE PAINTS AND VARNISHES INDUSTRY: 1919-36

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	50.8	73.6	68.7	69.0	73.9
1920	54.9	89.1	84.3	81.6	65.1
1921	44.9	61.7	56.3	72.8	79.8
1922	59.8	66.5	63.9	89.9	93.6
1923	68.3	78.2	75.2	87.3	90.8
1924	71.4	79.8	81.5	89.5	87.6
1925	78.7	87.3	88.8	90.1	88.6
1926	82.2	101.8	99.9	80.7	82.3
1927	87.6	96.1	93.7	91.2	93.5
1928	96.4	97.0	95.2	99.4	101.3
1929	100.0	100.0	100.0	100.0	100.0
1930	81.6	86.5	80.0	94.3	102.0
1931	70.6	77.2	66.2	91.5	106.6
1932	55.4	71.4	56.3	77.6	98.4
1933	60.4	78.4	61.3	77.0	98.5
1934	70.7	90.1	66.3	78.5	106.6
1935	87.1	94.8	72.8	91.9	119.6
1936	97.2	98.9	80.0	98.3	121.5

55. PAPER AND PULP GROUP

56. PAPER

57. PULP

The Paper industry includes mills engaged principally in the manufacture of paper and the paper-making departments of mills which are also engaged in the manufacture of pulp. Similarly, the Pulp industry embraces mills which make pulp as their chief product and the pulp-making departments of mills which also produce paper. Together, all these mills constitute the Paper and Pulp group.

The Paper industry, which is by far the larger, employed about $\frac{3}{4}$ of the 128,049 wage earners in the group in 1929. In 1927, 545 of the 764 mills in the group produced paper only, while 54 produced pulp only and 165 made both.

The industries are both physically and financially interrelated. About $\frac{1}{2}$ of total pulp production is intended for consumption in the same mill or in others operated by the same company. In some instances integration extends beyond the processing stages to ownership of pulpwood reserves, light and power stations, and chemical plants.

The requirement of a large fixed investment in most of the branches of manufacture is conducive to the development of a few dominant companies. In 1931, for example, 6 companies controlled 54 percent of the newsprint capacity of North America; 7 controlled 52 percent of the book-paper capacity of the United States; and 10 accounted for 37 percent of national wrapping-paper capacity. A general tendency toward concentration is indicated by the fact that in 1920 the 10 largest American companies and their chief subsidiaries controlled 20 and 26 percent, respectively, of the national paper and pulp capacity; by 1933 the corresponding percentages were 26 and 34. Similarly, the 20 largest organizations controlled 29 and 38 percent, respectively, of the total paper and pulp capacity in 1920, and 36 and 42 percent by 1933.

Technologically, both industries are well advanced. In 1929 the group ranked second only to Iron and Steel in total primary horsepower and was also among the highest in the average per wage earner. Electric power was introduced at a very early date. The most important technological advances were made in the 19th century - viz, the invention of the Fourdrinier paper-making

machine, which laid the foundation for large-scale manufacture; the invention of the wood grinder, which opened a new unlimited source of raw material for the manufacture of pulp; and the development of chemical processes of pulping (particularly the sulphite process), which made possible the production of finer paper from a greater variety of wood species. Although the period since 1919 is characterized by a great increase in productivity, it is more distinguished, perhaps, for the rapid commercial development of the sulphate process for making a cheap variety of pulp (used for kraft paper and paperboard) than for any fundamental technological innovation. One of the chief factors accounting for the rise in productivity is the increase in the average capacity of such important items of equipment as wood grinders, chemical digesters, and paper machines. Between 1919 and 1929 the average grinder increased in capacity by $\frac{1}{3}$ and the average digester by over $\frac{1}{2}$. A generation ago the belt of the newsprint machine was only about 100 inches wide and traveled forward at a speed of less than 600 feet per minute; now the belt is about 230 inches wide and has a speed of 1,400 feet per minute. High-speed machines have also been adapted to the manufacture of better grades of paper. Sulphite bond, for example, which was made at the rate of 100 feet per minute at the beginning of the century, is now produced at the rate of 900. Other important factors are the introduction of various technical refinements (which resulted, for example, in the increased pulp yield per cord of wood) and the increased use of conveying and handling equipment and automatic control devices.

The traditional center of the Paper and Pulp industries is the Northern spruce region, which comprises New England, the Middle Atlantic States, and the Lake States. With the depletion of domestic spruce reserves (upon which mechanical pulp and newsprint are dependent) and the development of the sulphate process (which is adaptable to the pulping of the abundant yellow pine), the industries have spread to Canada and the South. Between 1920 and 1933 the percentage of the national pulp capacity located in the South increased from 9 to 20 and in the Pacific States from 7 to 16, while the percentage located in the New England and Middle Atlantic States declined from 61 to 42 and in the Lake States from 23 to 21.

The United States consumes more paper than any other country. It also has the highest per capita consumption - about 3 times

as large as Great Britain's and 10 times the average for the world. Much of the pulp and paper consumed, however, is of foreign origin, and the volume of exports is equal to only about $\frac{1}{4}$ of the volume imported. In 1919, 16 percent of the total tonnage of pulp consumed was imported (from Canada, the Scandinavian countries, etc.); in 1935, 29 percent. In the same 2 years imports of newsprint (from Canada), which practically constitute the total paper imports, accounted for 34 and 72 percent, respectively, of domestic newsprint consumption.

Production

Paper and Pulp Group.— The 2 NRP production indexes for the group are harmonic means of the relatives for the separate industries. One, which incorporates changing employment weights, was used to determine wage-earner productivity; the other, with changing man-hour weights, was used to compute output per man-hour. These indexes are not only very similar to each other but also to indexes with fixed (1929) labor weights:

Year	Indexes of production with -			
	Changing weights		Fixed weights (1929)	
	Employment	Man-hours	Employment	Man-hours
1919	59.8	59.7	60.1	59.9
1920	68.5	68.5	68.7	68.5
1921	51.9	52.0	52.0	51.9
1922	66.7	66.8	66.8	66.7
1923	74.8	74.8	74.7	74.7
1924	72.8	72.8	72.7	72.7
1925	82.7	82.7	82.7	82.8
1926	88.7	88.7	88.7	88.7
1927	89.7	89.7	89.8	89.8
1928	93.3	93.3	93.3	93.4
1929	100.0	100.0	100.0	100.0
1930	92.4	92.4	92.5	92.4
1931	85.8	85.8	85.9	85.8
1932	72.8	72.7	72.8	72.8
1933	83.0	83.0	83.2	83.1
1934	83.3	83.2	83.5	83.3
1935	94.2	94.1	94.4	94.3
1936	104.8	104.8	105.3	105.1

Paper.— The Paper industry production index was derived for the odd-numbered years 1919-35 from Census quantity data for 6 varieties of paper for which unit man-hour requirements could be

ascertained: Book paper, newsprint and similar paper, paperboard, tissue paper, wrapping paper, and writing (fine) paper. These products have consistently represented over 85 percent of the value of the whole output of the Paper industry and over 90 percent of the total value and tonnage of paper. The index was completed for the even-numbered years by the use of a continuous, unweighted production series constructed by the *Survey of Current Business* from data supplied by the Federal Trade Commission, the American Paper and Pulp Association, the Newsprint Service Bureau, and the National Paperboard Association.¹

The weighting factors, all of which refer to the NRA Code period (1934-35) represent the most satisfactory set which could be developed from available data. Those for book, writing, and tissue paper and newsprint are averages of unit man-hour requirements distributed by mill capacity and weighted by the midpoints of the respective capacity intervals. The weight for wrapping paper is an average of the requirement ratios for the North and the South, weighted by the relative production of the 2 regions. Finally, the weight for paperboard is a simple average of 12 monthly figures supplied by the National Paperboard Association.²

It is of interest to compare the NRP index with an unweighted index of the same 6 products. Although the man-hour weights show considerable dispersion (the maximum, for writing paper, is almost 5 times the minimum, for paperboard) and the pattern of production changes significantly (between 1919 and 1935 newsprint declined from 24 percent of the total tonnage to 12, while paperboard rose from 31 percent to 45), these 2 indexes never differ by as much as 3 units:

¹The *Survey of Current Business* tonnage figures for 1935 and 1936 were raised to the Census level by use of the 1935 ratio of the Census total to the reported tonnage. The figure for 1920 is an unpublished revision.

²The data for the first 4 weights and for wrapping paper (South), which represent about 300 mills, are shown by J. P. Hagenauer in "Labor Cost of Production in the Paper and Pulp Industry," *Paper Trade Journal*, April 25, 1935, p. 36. C. W. Boyce, "Labor Costs and Value of Paper Produced," *Paper Mill and Wood Pulp News*, February 23, 1935, provided the wrapping-paper figure for the North. Hagenauer's data really refer to "Kraft", which is made of sulphate pulp, a variety produced principally in the South. The weights used to combine the 2 wrapping-paper estimates represent 80 percent of the total of such output; they were obtained from Census State data for 1929, the last year for which a regional analysis of production is presented. The monthly man-hour-requirement ratios for paperboard were computed by the National Paperboard Association from a virtually complete sample. (In 1936 the paperboard branch employed 19,600 wage earners, or almost $\frac{1}{2}$ of the total in the Paper industry.)

Some of these sources presented additional statistics from which less satisfactory weights could be developed. Fragmentary material is also available in L. P. Alford and J. G. Hannum, "A Basis for Evaluating Manufacturing Operations," *Mechanical Engineering*, March 1929, pp. 184, 185; in *Labor Cost of Production and Wages and Hours of Labor in the Paper Box-Board Industry* (BLS Bull. No. 407); and in American Engineering Council, *Safety and Production* (New York: Harper and Bros., 1928), pp. 294-309.

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Year	NRP production index	Unweighted production index
1919	57.6	54.9
1921	50.7	49.5
1923	74.4	72.7
1925	83.4	81.7
1927	90.2	89.8
1929	100.0	100.0
1931	85.0	85.8
1933	81.9	84.2
1935	92.4	95.1

It is also noteworthy that, although wages constitute but 15 percent of the value of products, percentage distributions of unit man-hour requirements and unit values resemble each other:

Product	Percent of total		
	Man-hours per ton	Value per ton	
		1929	1935
Book paper	22.49	17.26	18.09
Newsprint	10.04	9.48	8.34
Paperboard	5.83	7.86	8.77
Tissue paper	18.17	21.12	20.11
Wrapping paper	16.45	15.64	16.03
Writing paper	27.03	28.64	28.66

An index embodying value weights therefore differs but little - in no year by as much as 2 units - from the NRP index:

Year	NRP production index	Production index with 1929 unit- value weights
1919	57.6	56.0
1921	50.7	49.4
1923	74.4	72.8
1925	83.4	82.1
1927	90.2	89.5
1929	100.0	100.0
1931	85.0	85.5
1933	81.9	83.4
1935	92.4	94.0

In view of the foregoing and of a comparison of unweighted and value-weighted indexes of the 6 NRP products and of all paper (including also building and absorbent paper and other relatively minor varieties), it may be concluded that the NRP index adequately represents the movement of all paper production:

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Year	Unweighted production indexes		Production indexes with unit-value weights	
	All paper	6 products	All paper	6 products
	1919	54.7	54.9	57.0	56.0
1921	48.8	49.5	49.0	49.4
1923	72.1	72.7	72.7	72.8
1925	82.4	81.7	82.9	82.1
1927	89.8	89.8	89.2	89.5
1929	100.0	100.0	100.0	100.0
1931	84.2	85.8	84.3	85.5
1933	82.5	84.2	82.6	83.4
1935	94.1	95.1	94.1	94.0

Pulp.— The measure of production for the Pulp industry is composed of 2 segments, both of which are aggregative indexes for 6 varieties of wood pulp (including screenings)³ weighted by unit man-hour requirements: Sulphite, bleached and unbleached; sulphate, bleached and unbleached; soda; and mechanical (ground wood).

The quantity data for the odd-numbered years were obtained from the *Census of Manufactures* and those for even-numbered years from the annual Census publication, *Forest Products: Pulpwood Consumption and Wood-Pulp Production* (the title varies). Before constructing the index, 2 adjustments were made in the reported quantities. First, mechanical screenings were added to mechanical pulp, and chemical screenings were distributed between the 2 chief chemical varieties, sulphate and sulphite. Second, the combined production of bleached and unbleached sulphite pulp in each even-numbered year from 1920 to 1926 was apportioned in accordance with the average distribution in adjacent (odd-numbered) years. Since the 2 constituents of sulphate pulp could not be segregated satisfactorily before 1930, 1 segment of the NRP index is based on 6 series (1930-36), and the other (1919-30) on 5 series representing the same products.

The products included in the index presumably account for all pulp production in the industry until 1927, in which year the Census extended its canvass from wood pulp only to pulp made from other fiber - like rags, waste paper, cotton linters, and manila. Apparent coverage has declined somewhat since then; by 1935 the

³Screenings, an inferior and unimportant grade of pulp (which is separated out by means of screens), accounted for a maximum of only 1.6 percent of total tonnage (1925).

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included products represented 96 percent of total pulp tonnage (or 90 percent of the value of the industry's products).⁴

The weights, relative man-hours per ton in 1935, refer to practically the same period as those for paper. Each weight except the one for soda pulp was computed by deflation of average unit labor cost by average hourly earnings for a sample of characteristic occupations. The basic labor-cost data (distributed by product and region) and the occupational wage rates were supplied by the Tariff Commission.⁵ The unit labor requirement for soda pulp was assumed to be the same as for sulphate upon the authority of McGraw-Hill's *Chemical and Metallurgical Flow Sheets of Process Industries* (2d ed.).

The distributions of man-hour and unit-value weights are not so close as in the Paper industry although the labor component of value - about 14 percent - is only slightly lower:

Product	Percent of total	
	Man-hours per ton	Value per ton (1935) ⁶
Sulphite		
Unbleached	16.7	16.4
Bleached	19.2	24.4

[Con.]

⁴Although in 1927 the Census revised its 1925 figure for total tonnage by including pulp other than wood fiber, it did not revise the number of establishments or wage earners. If this production - comparable with the amount reported for 1927 - was contributed only by establishments within the scope of the old definition, coverage was never complete, and the major consequence of the change in definition was the recording of pulp production from other fiber in the establishments normally canvassed. In 1929 only 3 of 208 mills were engaged exclusively in the manufacture of such pulp.

In 1927 the Census for the first time also presented data for semichemical pulp, which is a chemically treated ground wood. It is not indicated whether this variety was included with mechanical pulp before this year.

⁵Regional labor-cost data for January-September 1935 were supplied by the Tariff Commission in advance of publication of its *Report to the United States Senate on Wood Pulp and Pulpwood* (Rep. No. 126, 1938). They represent operating (conversion) labor (exclusive of power, repairs, and miscellaneous) employed in the production of pulp in slush form and, in the case of bleached pulp, include the additional cost of bleacher-men. In the absence of regional production figures, productive capacity was used in combining the regional costs for each product into a national average. Such capacity statistics, compiled from Lockwood's *Directory of the Paper and Allied Industries: 1936* and presented by States in O. C. Holleran, *Basic Industrial Markets in the United States: Pulp and Paper Industry* (U. S. Dept. Com., Bur. For. and Dom. Com., Market Res. Ser., No. 14.4, Aug. 1937), had to be regrouped to represent regions corresponding to those designated by the Tariff Commission.

The hourly earnings computed by the Tariff Commission from records of 34 mills are also distributed by regions. Since not every region is represented by each occupation, it was necessary in some instances to make estimates on the basis of relationships existing in others. Occupational earnings are also reported for May 1929 and 1933 by J. F. Hagenauer, *loc. cit.*, but these were not so satisfactory for our purposes as the Tariff Commission figures.

⁶Shown only for 1935 and not for 1929 because of the absence of segregated statistics for bleached and unbleached sulphate pulp before 1930. Furthermore, the 2 sets of weights presented here are strictly comparable insofar as both refer to 1935.

[Con.]

Product	Percent of total	
	Man-hours per ton	Value per ton (1935) ⁶
Sulphate		
Unbleached	16.6	11.2
Bleached	19.0	18.1
Mechanical	11.7	8.9
Soda	16.8	21.0

Furthermore, as in the case of paper, the production pattern has been modified greatly since the end of the war. For example, sulphate pulp (first reported in 1914) advanced from less than 4 percent of all wood-pulp output in 1919 to 30 percent in 1935, while mechanical pulp declined from 44 to 28 percent in the same interval. Despite the differences in the 2 weighting systems and the change in the composition of production, indexes incorporating labor weights or value weights or no weights at all (i. e., equal weights) are very similar. In general, however, the NRP series is slightly lower before 1929 and slightly higher thereafter. Most striking is the fact that an unweighted index which includes pulp made of fiber other than wood in 1927 and subsequent years differs from the NRP index by a maximum of 1.2 units.

Year	6-product production index with -			Index of production of all pulp (un- weighted)
	Man-hour require- ment weights (NRP)	1935 unit- value weights	No weights (equal weights)	
1919	70.3	72.0	73.0	71.3
1921	57.4	58.3	59.6	58.3
1923	76.3	77.2	78.6	76.7
1925	80.0	80.9	82.2	81.2
1927	87.9	88.3	89.2	88.5
1929	100.0	100.0	100.0	100.0
1931	89.7	87.5	89.6	90.7
1933	88.4	85.4	86.9	88.4
1935	102.7	100.3	100.2	101.9

Employment

The NRP index for the group is a series of relatives of total wage-earner employment in the component industries.

The Census reports only group employment for the odd-numbered years 1919-25 but provides separate figures for subsequent years.

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Because of the stability of the relationship between the industry employment figures from 1927 to 1935 (approximately, Paper, 4; Pulp, 1), the group totals for the preceding census years were distributed in accordance with the 1927 proportions.⁷

The number of wage earners in the group in the intercensal years 1920-36 was determined by interpolation of the Census figures by means of the continuous BLS index. These group totals were then distributed in accordance with the average percentage represented by each industry in adjacent odd-numbered years.

The NRP production and employment indexes are not precisely comparable in scope since the former exclude some secondary products, which are reported only by value, although the latter include the wage earners making them. The percentages such products (paper bags, boxes, etc.) comprise of the total value of output of the Paper industry range from about 3 to 8; the percentages such items (wood flour, fiber conduit, tannic acid, caustic soda, etc.) comprise of the total value of production in the Pulp industry are always less than 2.

Man-hours

The group index of man-hours is based on totals for the 2 component industries. The man-hours series for these components include 2 types of figures. One set, for 1919, 1923, 1929, 1933, and 1935, was obtained by methods determined by the nature of the most reliable statistics available for each industry. For 2 of these 5 years, 1919 and 1923, the pay rolls of each industry (the derivation of which will be discussed later) were divided by average hourly earnings, which were computed from statistics presented in 2 BLS bulletins.⁸ The number of man-hours worked

⁷ Other more complicated methods gave results which were considered less satisfactory. One such method involved the use of the Census distributions in the odd-numbered years 1919-25 of employment and wages by establishments producing paper only, pulp only, and paper and pulp. The average annual wages per man for establishments making only 1 kind of product (i. e., paper or pulp) were assumed for the whole corresponding industry and divided into estimated total wages (see fn. 12). The quotients for 1919-25, adjusted to equal the Census group totals, did not show the fixed relationship which might be expected in view of the stability in later years - 4:1 for 1919, 8:1 for 1921, 5:1 for 1923, and 7:1 for 1925.

⁸ *Wages and Hours of Labor in the Paper and Pulp Industry: 1923* (Bull. No. 365) supplies averages of hourly earnings for the Pulp industry and for 4 branches of the Paper industry: Book, newsprint, writing, and wrapping (excluding manila, bogus or wood manila, and heavy). The average for the Paper industry was computed by weighting these 4 figures by corresponding annual wages (estimated on the assumption that the ratio of wages to value for the whole industry in 1923 is applicable to each branch) and then dividing the sum of the products by the sum of the weights.

Industrial Survey in Selected Industries in the United States: 1919 (Bull. No. 265) supplied only detailed statistics for selected occupations in paper

[Continued]

in each industry in 1929 was determined by adding the products of average monthly hours per wage earner (computed principally from statistics for NRA "zones", which were compiled by the American Paper and Pulp Association) and the average number of wage earners for each zone in corresponding months (as estimated from Census data for States).⁹ The man-hours for 1933 and 1935 were also computed by summing the products of monthly employment, as reported by the Census, and average monthly hours per man, as shown in companion volumes to the usual biennial Census reports.¹⁰

The figures for the remaining years of the period 1919-36 (i. e., for the years 1920-22, 1924-28, 1930-32, 1934, and 1936) are simple averages of estimates of total man-hours made by 2 methods: (A) The multiplication of employment by 52 times the average weekly hours per man, and (B) the division of annual pay rolls by average hourly earnings. The estimated man-hours are based largely on statistics for the group as a whole which had to be distributed between the 2 component industries. Each series of estimates was so constructed as to be consistent with the totals obtained for the 5 years described in the preceding paragraph (i. e., for 1919, 1923, 1929, 1933, and 1935).

⁸[Continued]

and pulp mills. Average hourly earnings for each industry in 1919 were therefore computed as follows: (1) The averages for those occupations for which detailed statistics were also reported in the 1923 bulletin were weighted by corresponding sample employment and combined in an arithmetic mean; (2) this mean was then adjusted by the ratio in 1923 of the average for all occupations to the average for the several occupations (also weighted by corresponding sample employment).

The total number of workers included in the 1923 canvass, 39,087, represented 32.4 percent of the total for the Paper and Pulp group; those included in the 1919 survey, 8,326, accounted for 7.3 percent of the group total.

⁹The statistics, which refer to May 1929, were derived from reports by 209 paper mills employing 31,127 workers (or 30.1 percent of the industry total) and 73 pulp mills employing 7,195 workers (or 29.1 percent of the industry total); they are cited in *Brief and Reports Submitted by the Paper Industry Authority to the National Recovery Administration* (June 29, 1934).

The 9 NRA zones established for the Paper and Pulp group (NRA, *Codes of Fair Competition*, vol. III, November 11-December 7, 1933, p. 122), were Central (Del., D. C., Ky., Md., N. C., Tenn., Va., and W. Va.), Southern (Ala., Ark., Fla., Ga., La., Miss., S. C., and Tex.), and Northern (all other States).

After average monthly hours per wage earner were computed for May 1929 from APPA and Census figures, estimates were made for the remaining 11 months of the year on the assumption that average monthly and weekly hours (the latter, compiled by NICS for the group, will be discussed later in the text) had the same seasonal pattern. (The range of the NICS hours for 1929 is 51.1 to 52.9.)

¹⁰*Census of Manufactures: 1933*, "Man-hour Statistics for 32 Selected Industries" presents monthly man-hours for 84.1 percent of the wage earners in the Paper industry and 87.9 percent of the number in the Pulp industry. The corresponding coverage percentages for *Census of Manufactures: 1935*, "Man-hour Statistics for 59 Selected Industries" are 88.9 and 87.7.

A variation in procedure was necessary in computing 1933 man-hours for the Paper industry since the smaller establishments reported on abbreviated schedules which requested wage-earner figures for only 4 specified months. By use of employment weights for establishments reporting on the standard 12-month schedule, an annual average per man was obtained which was then multiplied by the number of wage earners for the whole industry, as computed by the Census from both sets of schedules.

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Method A required the development of a continuous series of average weekly hours for each industry. This was done by dividing man-hours for 1919, 1923, 1929, 1933, and 1935 by corresponding employment and interpolating the quotients by means of a weekly-hours series for the group, which includes NICB figures for 1919-32 and BLS figures thereafter.¹¹

Method B necessitated the construction of continuous series of pay rolls and average hourly earnings for each industry. As in the case of employment, separate pay-roll statistics are provided for the odd-numbered years 1927-35 by the *Census of Manufactures*; the figures for the earlier odd-numbered years were again obtained by distributing the Census group totals in accordance with the ratio of Paper to Pulp in 1927 (approximately 4:1);¹² and wages in the remaining (even-numbered) years were determined by distributing the totals derived from the BLS group index, which conforms to Census trend. Hourly earnings for each industry were derived by interpolating the figures for 1919, 1923, 1929, 1933, and 1935 (those for the latter 3 years are quotients of Census pay rolls and NRP man-hours) by means of a series for the group, which includes NICB earnings for 1919-32 and BLS earnings thereafter.¹³

Productivity

Tons of output per wage earner and per man-hour can be estimated for each industry if an adjustment is made in the NRP employment and man-hours series to exclude the labor attributable to secondary products. The basis for the adjustment - the assumption of equal

¹¹Extrapolation to 1936 was accomplished on the basis of the 1935 relationships between average annual and weekly hours per man.

The NICB figure for 1919 is a weighted mean of the averages presented in *Wartime Changes in Wages: September 1914-March 1919* (Boston: 1919), p. 78, for 988 females and 9,579 males employed in the Paper industry (about 10 percent of the total) in the month of March. The inclusion of this figure for the Paper industry in the series for the group is permissible inasmuch as weekly averages derived from 1919 man-hours and employment in the Paper and Pulp industries are 53.4 and 52.6, respectively. The hours for March, furthermore, should be representative of the whole year since the mean ratio to the annual average in later years is 1.001 and the dispersion is small. The NICB figures for the years 1920-32 were obtained from *Wages, Hours, and Employment in the United States: 1914-1936* (New York: 1936).

¹²Other methods of apportioning wages before 1927 gave results which were considered less satisfactory. One such method involved the assumption that the ratio of wages to value of products of mills producing paper only is typical of the Paper industry as a whole (wages for the Pulp industry were to be obtained by subtraction). The distribution of wages estimated on the basis of this assumption showed no stability - 4:1 in 1919, 8:1 in 1921, 6:1 in 1923, and 7:1 in 1925 (see ft. n. 7).

¹³The 1935 relationship was assumed in extrapolation of each series to 1936. The NICB figure for 1919 was computed from *Wartime Changes in Wages* (see ft. n. 11); although it refers to March, no adjustment was considered necessary since the ratio to the annual average in later years is 0.999.

value productivity and equal average annual hours for workers engaged in the manufacture of primary and secondary products - may not be tenable; nevertheless, since secondary products comprise but a small percentage of total value, particularly in the Pulp industry, the possible consequent error in the absolute man-hours series is small.

The output (short tons) per wage earner and per man-hour for pulp is about twice as high as for paper:

Year	Output (short tons) per -			
	Wage earner		Man-hour	
	Paper	Pulp	Paper	Pulp
1919	70.3	156.4	0.025	0.057
1920	69.8	149.1	.027	.057
1921	66.2	138.1	.027	.055
1922	83.1	162.5	.033	.060
1923	85.9	158.7	.036	.060
1924	87.9	160.3	.037	.065
1925	98.3	163.7	.041	.066
1926	101.5	176.2	.041	.071
1927	107.0	179.5	.043	.075
1928	113.1	194.3	.046	.083
1929	115.4	203.1	.046	.087
1930	109.4	202.7	.045	.089
1931	116.2	223.8	.052	.106
1932	107.7	210.0	.052	.105
1933	113.3	221.0	.054	.106
1934	98.6	198.5	.052	.106
1935	110.0	215.4	.055	.108
1936	119.5	245.0	.056	.115

The relatives of the foregoing ratios for paper compare as follows with the corresponding NRP indexes. The greatest differences - almost 6 units - occur in the period 1919-23:

Year	Paper			
	NRP index of output per -		Relatives of tonnage per -	
	Wage earner	Man-hour	Wage earner	Man-hour
1919	65.5	59.6	60.9	55.4
1920	65.4	63.2	60.5	58.5
1921	62.3	64.5	57.4	59.4
1922	77.6	77.0	72.0	71.4
1923	79.7	83.2	74.4	77.8 [Con.]

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[Con.]

Year	Paper			
	NRP index of output per -		Relatives of tonnage per -	
	Wage earner	Man- hour	Wage earner	Man- hour
1924	79.7	85.5	76.1	81.6
1925	87.1	91.0	85.2	89.0
1926	89.7	91.5	87.9	89.7
1927	94.5	97.0	92.7	95.1
1928	98.9	100.9	98.0	99.8
1929	100.0	100.0	100.0	100.0
1930	94.6	98.3	94.8	98.4
1931	100.1	113.6	100.6	114.3
1932	92.5	112.9	93.3	113.8
1933	97.0	116.5	98.1	117.9
1934	83.7	111.8	85.4	114.0
1935	92.4	116.1	95.3	119.7
1936	100.2	117.8	103.5	121.6

The relatives of the foregoing ratios for pulp differ from the corresponding NRP indexes by less than 1 unit in most years and always by less than 3:

Year	Pulp			
	NRP index of output per -		Relatives of tonnage per -	
	Wage earner	Man- hour	Wage earner	Man- hour
1919	76.0	64.6	77.0	65.4
1920	73.1	64.5	73.4	64.8
1921	67.1	61.9	68.0	62.8
1922	79.5	68.6	80.0	69.0
1923	77.8	68.9	78.2	69.3
1924	77.8	72.8	78.9	73.9
1925	79.4	74.6	80.6	75.6
1926	85.6	80.7	86.8	81.8
1927	87.6	85.5	88.4	86.2
1928	95.0	94.3	95.7	94.9
1929	100.0	100.0	100.0	100.0
1930	100.2	102.8	99.8	102.4
1931	109.7	121.2	110.2	121.7
1932	102.8	119.1	103.4	119.8
1933	108.9	121.3	108.8	121.1
1934	98.2	121.9	97.7	121.4
1935	107.5	125.9	106.0	124.1
1936	123.0	134.8	120.6	132.2

PAPER AND PULP GROUP

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Table 55.- SUMMARY INDEXES FOR THE PAPER AND PULP INDUSTRY GROUP: 1919-36

(1929 = 100)

Year	Production (employ- ment weights)	Employment	Output per wage earner	Produc- tion (man-hour weights)	Man-hours	Output per man- hour
1919	59.8	88.8	67.3	59.7	98.9	60.4
1920	68.5	102.6	66.8	68.5	107.9	63.5
1921	51.9	82.2	63.1	52.0	81.1	64.1
1922	66.7	85.6	77.9	66.8	88.7	75.3
1923	74.8	94.2	79.4	74.8	93.2	80.3
1924	72.8	91.7	79.4	72.8	87.8	82.9
1925	82.7	96.7	85.5	82.7	94.4	87.6
1926	88.7	99.7	89.0	88.7	99.2	89.4
1927	89.7	96.3	93.1	89.7	94.8	94.6
1928	93.3	95.0	98.2	93.3	93.7	99.6
1929	100.0	100.0	100.0	100.0	100.0	100.0
1930	92.4	96.6	95.7	92.4	93.3	99.0
1931	85.8	84.3	101.8	85.8	74.8	115.0
1932	72.8	77.1	94.4	72.7	63.8	113.9
1933	83.0	83.8	99.0	83.0	70.7	117.4
1934	83.3	96.6	86.2	83.2	73.4	113.4
1935	94.2	99.2	95.0	94.1	80.0	117.6
1936	104.8	100.9	103.9	104.8	87.0	120.5

Table 56.- SUMMARY INDEXES FOR THE PAPER INDUSTRY: 1919-36

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	57.6	88.0	96.7	65.5	59.6
1920	66.4	101.6	105.0	65.4	63.2
1921	50.7	81.4	78.6	62.3	64.5
1922	65.8	84.8	85.5	77.6	77.0
1923	74.4	93.3	89.4	79.7	83.2
1924	72.4	90.8	84.7	79.7	85.5
1925	83.4	95.8	91.6	87.1	91.0
1926	88.6	98.8	96.8	89.7	91.5
1927	90.2	95.4	93.0	94.5	97.0
1928	93.6	94.6	92.8	98.9	100.9
1929	100.0	100.0	100.0	100.0	100.0
1930	91.8	97.0	93.4	94.6	98.3
1931	85.0	84.9	74.8	100.1	113.6
1932	71.9	77.7	63.7	92.5	112.9
1933	81.9	84.4	70.3	97.0	116.5
1934	81.5	97.4	72.9	83.7	111.8
1935	92.4	100.0	79.6	92.4	116.1
1936	102.0	101.6	86.6	100.2	117.8

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Table 57.- SUMMARY INDEXES FOR THE PULP INDUSTRY: 1919-36

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	70.3	92.5	108.8	76.0	64.6
1920	78.1	106.8	121.0	73.1	64.5
1921	57.4	85.6	92.7	67.1	61.9
1922	70.8	89.1	103.2	79.5	68.6
1923	76.3	98.1	110.7	77.8	68.9
1924	74.3	95.5	102.0	77.8	72.8
1925	80.0	100.7	107.2	79.4	74.6
1926	88.9	103.8	110.2	85.6	80.7
1927	87.9	100.3	102.8	87.6	85.5
1928	92.1	96.9	97.7	95.0	94.3
1929	100.0	100.0	100.0	100.0	100.0
1930	95.3	95.1	92.7	100.2	102.8
1931	89.7	81.8	74.0	109.7	121.2
1932	76.8	74.7	64.5	102.8	119.1
1933	88.4	81.2	72.9	108.9	121.3
1934	91.9	93.6	75.4	98.2	121.9
1935	102.7	95.5	81.6	107.5	125.9
1936	119.4	97.1	88.6	123.0	134.8

58. PETROLEUM REFINING

The Petroleum Refining industry, which employed about 81,000 wage earners in 1929, includes establishments engaged primarily in the refining of crude petroleum by distillation and cracking processes. It does not embrace either the production of gasoline from natural gas (about 8 to 12 percent of all gasoline) or the compounding of refined or partly refined petroleum products outside petroleum refineries.

The principal products of the Petroleum Refining industry are gasoline, kerosene, fuel oil, and lubricants. The relative yields of the several products are dependent in part on the kind of crude petroleum run to stills but can be varied to a considerable degree by the use of different processes. Thus, with the displacement of the kerosene lamp by the gas and electric light and the increase in the demand for gasoline concomitant with the development of the automobile, the pattern of production has undergone considerable change since the beginning of the century. This is shown by the percent of crude petroleum run to stills accounted for by the principal products of the industry:

Year	Gasoline and naphtha	Kerosene	Gas oil and fuel oil	Lubri- cating oils
1899	12.9	57.6	14.0	9.1
1909	10.7	33.0	33.6	10.7
1919	25.2	15.4	50.2	5.8
1929	39.3	5.7	45.5	3.5
1935	44.2	5.8	37.3	2.9

The growing market for gasoline stimulated the development of newer processes capable of producing more gasoline than is naturally contained in the crude petroleum. The introduction of cracking, which involves distillation under high pressure, made possible the formation of the lighter gasoline molecules from the heavier hydrocarbons in petroleum. In 1919 there was only 1 commercial cracking process; in 1935 the Bureau of Mines recorded 33. Between 1919 and 1936 the percentage of gasoline produced by cracking rose from 16.4 to 47.5. A more recently developed technique, polymerization (i. e., the synthesis of lighter hydrocarbons into molecules of gasoline), has been making rapid strides. The other common methods of petroleum refining - like skimming or topping, which does not carry the distillation process to completion, and straight-run distillation, which con-

verts crude oil or the semicrude residues of the skimming plants into lubricants and byproducts - merely recover the amount of gasoline naturally contained in the petroleum.

The progress of automotive engineering has provided a stimulus for the improvement of the quality of gasoline. It is estimated that between 1925 and 1936 the average octane rating increased from 55 to 71.

Production

The index of production, which is continuous for the period 1919-36, is a series of relatives of the total volume of crude petroleum refined. This series was constructed from Bureau of Mines data by subtracting the estimated volume of shortage from the number of barrels of crude petroleum run to stills.¹ To maintain internal comparability of the shortage series, an adjustment was made to exclude some still gas burned at refineries in the years 1925-30. No adjustment was possible for the years 1919-24, but the error is probably negligible since still gas became important only with the extensive introduction of cracking units in 1925; no adjustment was required for 1931-36, for which years the total output of still gas was reported separately. The quantities of still gas to be deducted from shortage in the years 1925-30 were estimated on the basis of the percentage of all still gas burned which was included in shortage in 1930; and the quantity included in shortage in this year was assumed to be the difference between the total burned (considered equal to total production) and reported production.²

This series for crude petroleum refined is tantamount to an unweighted index of the total volume of finished products. The joint nature of many of the processes and the high proportion of maintenance labor (about 50 percent) precluded the construction of an index with satisfactory labor-requirement weights.³ That

¹The basic statistics are published in *Petroleum Refining Statistics: 1930*, *Minerals Yearbook: 1936*, and *Minerals Yearbook: 1938*.

²The statistics for still gas burned were obtained from *Survey of Fuel Consumption at Refineries in 1931* (R. I. 3198); and those necessary to estimate the volume of still gas included in shortage in 1930, from *Mineral Resources of the United States: 1931*, Part II. Still gas burned, reported in cubic feet, was converted to oil equivalents in barrels by use of a factor (1 bbl. = 3,989 cu. ft.) derived from statistics for 1931 in terms of both units published in *Minerals Yearbook: 1936*.

³Available labor statistics (e. g., those in the mimeographed BLS release dated Dec. 1935, *Changes in Average Wage Rates per Hour and Average Full-Time Hours per Week in 29 Important Occupations in the Refinery Branch of the Oil Industry, 1929-34*) were not adequate for even rough estimates of the labor imputable to the major products of the industry. Unit-value weights are most

[Continued]

an index with such weights might differ considerably from the NRP series is apparent from the differences in movement of the chief products of the industry:

Year	NRP production index	Relatives of production of -			
		Gasoline ⁴	Kerosene	Gas oil and fuel oil	Lubricants
1919	35.5	23.5	99.7	40.5	58.7
1920	42.7	29.1	98.7	47.0	72.6
1921	43.6	30.9	82.8	51.3	60.8
1922	49.6	37.1	98.2	56.8	67.8
1923	57.8	44.9	100.0	64.0	76.0
1924	64.1	51.6	107.3	71.4	80.0
1925	74.4	61.7	106.7	81.3	90.4
1926	78.4	70.7	110.4	81.3	94.0
1927	83.4	78.8	100.3	87.6	92.3
1928	92.5	87.9	106.1	95.2	100.9
1929	100.0	100.0	100.0	100.0	100.0
1930	94.1	100.1	88.0	83.0	99.5
1931	90.0	102.0	75.9	75.1	77.7
1932	82.2	94.3	78.4	65.7	65.3
1933	86.8	96.8	87.6	70.5	69.2
1934	90.4	100.0	96.3	74.7	76.8
1935	98.1	109.8	99.8	80.2	81.1
1936	108.9	121.2	100.3	92.2	90.0

Employment and Man-hours

The index of employment was derived from Census wage-earner statistics for the odd-numbered years 1919-35 and rendered continuous for the period 1923-36 by means of the BLS index. No satisfactory employment data were available for 1920 and 1922.

The man-hours index was constructed from the index of employment and another for average weekly hours. The latter series is based on actual weekly hours computed for the odd-numbered years 1929-35 from Census statistics for man-hours and employment⁵ and on figures

³[Continued]
probably not proportional to unit labor requirements since the ratio of wages to value of output for the industry as a whole is very small (4 to 7 percent) and the relative prices of the individual products are determined largely by market conditions. Another possible weighting system - derived by apportioning the total labor equally among the yields of the several products - is also unsatisfactory since, in addition to common treatment, the several products undergo separate processing.

⁴A relatively small amount of natural gasoline blended is excluded in all years.

⁵The hours for 1929 and 1931 were computed from unpublished data supplied by the Census; those for 1933, from *Census of Manufactures: 1933, "Man-hour Statistics for 32 Selected Industries"*; and those for 1935, from *Census of Manufactures: 1935, "Man-hour Statistics for 59 Selected Industries."* The 1931 sample included 85 percent of the total number of establishments in the industry; the sample for each of the other years accounted for 97 percent of the total number of wage earners employed.

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for other years obtained by interpolation and extrapolation of these actual hours. Thus Census prevailing hours for 1919, 1921, 1923, and 1929 were used to estimate actual hours for the first 3 of these years; BLS actual hours for 1932-36 were used to derive the hours for the even-numbered years of this period; Pennsylvania data for 1929-31⁶ provided the basis for the 1930 estimate; and in the absence of data for 1924-28, hours for these years were obtained by straight-line interpolation.

Table 58. - SUMMARY INDEXES FOR THE PETROLEUM REFINING INDUSTRY: 1919-36

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	35.5	73.1	71.9	48.6	49.4
1920	42.7	n. a.	n. a.	-	-
1921	43.6	78.4	77.5	55.6	56.3
1922	49.6	n. a.	n. a.	-	-
1923	57.6	82.8	80.9	69.8	71.4
1924	64.1	77.3	75.8	82.9	84.6
1925	74.4	81.1	79.8	91.7	93.2
1926	78.4	89.1	88.0	86.0	89.1
1927	83.4	88.4	87.7	94.3	95.1
1928	92.5	84.2	83.9	109.9	110.3
1929	100.0	100.0	100.0	100.0	100.0
1930	94.1	100.4	98.3	93.7	95.7
1931	90.0	85.4	77.1	105.4	116.7
1932	82.2	79.3	66.3	103.7	124.0
1933	86.8	85.7	65.0	101.3	133.5
1934	90.4	96.2	66.8	94.0	135.3
1935	98.1	96.0	66.4	102.2	147.7
1936	108.9	97.3	66.9	111.9	158.1

⁶Average weekly hours for Pennsylvania were computed from employment and man-hours series published in the *Monthly Bulletin* of the Pennsylvania Department of Labor and Industry. The coverage of the sample ranged from 6 to 9 percent of the total number of wage earners in the industry.

59. PLANING-MILL PRODUCTS

This industry, which employed over 90,000 wage earners in 1929, embraces "independent" planing mills, i. e., mills not operated in conjunction with sawmills. (Those which are attached to sawmills are classified in the Lumber and Timber Products industry.) The principal products of this industry are dressed lumber, sash, doors, window and door frames, interior woodwork, and molding.

Production

The index of production for the odd-numbered years 1925-35 was derived from Census quantity statistics for 4 products, which account for about 40 percent of the total value of planing-mill products made in the industry: Dressed lumber, doors, sash, and window and door frames. The 4 series were weighted by their respective unit values in 1929 and combined in an aggregative index.

For the years 1925-29 only the production within the industry is reported, but in the later years the output of establishments classified in other industries (except Lumber and Timber Products) is also included. Such production constitutes only about 1 percent of the total. More serious is the possible impairment of internal comparability of the quantity statistics as a result of the lack of uniformity in reporting throughout the period.¹

The production index constructed from Census quantity statistics was extrapolated for the years 1919, 1921, and 1923 by means of a value series deflated by a price index. The value series, which was obtained from Census data, includes planing-mill products made in the industry and receipts for custom planing.² The price index was constructed from BLS wholesale-price quotations for 12 kinds of lumber for 1919-25 and 16 kinds for the remaining years. In combining these prices in an aggregative index, use was made of BLS weights which represent the average production of each species in 1927 and 1929 as reported by the Census.³

¹According to the Census, "some of the manufacturers, including several of the more important ones, failed to supply data in regard to the principal classes of planing-mill products manufactured. This necessitated in some cases the making of estimates and in others the inclusion of the total output of the establishment in question in the item 'Miscellaneous millwork.'"

²For the odd-numbered years 1919-27 secondary products were excluded on the basis of the percentage (4.5) which their value comprised of the total value of the industry's output in 1929.

³Three sets of weighting factors are employed by BLS for these kinds of lumber during different periods, but these reveal little change in relative magnitude.

The price index is defective in at least 2 respects: (1) most of the series are for rough lumber; and (2) the weights refer, not to specific grades or to the amount of each produced in the industry, but to the total production of rough lumber of each kind.

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The deflated-value series and the index derived from Census quantity statistics compare as follows in common years:

Year	NRP production index (based on weighted quantities)	Index of deflated value
1925	123.8	121.8
1927	97.4	106.4
1929	100.0	100.0
1931	48.7	57.9
1933	29.6	29.7
1935	45.2	40.4

Employment and Man-hours

The employment index, which conforms to Census trend, is based on the BLS series for the years 1923-36. Census data were used for 1919 and 1921; the figures for 1920 and 1922 are based on the NICB employment index.

The index of man-hours was computed from the employment index and an annual series for average actual weekly hours, which includes an estimate for 1919 from Census data, NICB figures for the years 1920-32, and BLS hours for 1933-36. The estimate for 1919 was obtained by applying to the Census prevailing-hours figure for that year the average of the ratios of NICB actual to Census prevailing hours for 1921 and 1923.

Table 58.- SUMMARY INDEXES FOR THE PLANING-MILL PRODUCTS INDUSTRY: 1919-36

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	77.1	86.5	105.7	79.9	72.9
1920	n. a.	107.9	115.0	-	-
1921	92.4	86.6	90.8	106.7	101.8
1922	n. a.	106.1	115.4	-	-
1923	108.0	114.3	124.4	94.5	86.8
1924	n. a.	116.8	125.6	-	-
1925	123.8	123.5	133.3	100.2	92.9
1926	n. a.	121.4	128.1	-	-
1927	97.4	107.2	112.3	90.9	86.7
1928	n. a.	102.5	107.4	-	-
1929	100.0	100.0	100.0	100.0	100.0
1930	n. a.	76.1	73.7	-	-
1931	48.7	60.4	53.5	80.6	91.0
1932	n. a.	41.4	33.2	-	-
1933	29.6	39.2	31.1	75.5	95.2
1934	n. a.	44.0	33.6	-	-
1935	45.2	53.5	46.4	84.5	97.4
1936	n. a.	63.1	59.9	-	-

60. RAYON

The Rayon industry, which employed over 39,000 wage earners in 1929, manufactures rayon yarn and, in addition, staple fibre, transparent sheets, sausage casings, and cellulose caps and bands. It has been classified by the Census as a separate industry since 1925, before which year it had been included in the plastics subdivision of the Chemicals industry.

The 3 processes now used for making rayon in the United States - viscose, cellulose acetate, and cuprammonium - were all developed in Europe. A fourth, nitrocellulose, which was discontinued in 1934, had been patented half a century earlier in France, where it had been introduced commercially in 1891. The newest process, cellulose acetate, had made such rapid strides since its introduction at the end of the war that by 1935 it contributed 22 percent of the total domestic output of rayon yarn. In the same year the viscose and cuprammonium processes accounted for 75 and 3 percent, respectively.

The growth of rayon production has been phenomenal. Since the beginning of rayon manufacture in the United States in 1911, the output of yarn has increased from 363 thousand pounds to over 312 million, while world production has advanced from less than 19 million to over a billion.

Production

The index of production, which is continuous from 1919 to 1937, is based upon statistics supplied by the Census and by the Textile Economic Bureau in its publication, *Rayon Organon*. It was constructed for the odd-numbered years 1923-35 by extending relatives of the total poundage of rayon yarns for 1923-29 by means of an index of 4 groups of products with 1929 unit-value weights: Yarns finer than 125 denier, yarns of 125 to 150 denier, yarns heavier than 150 denier, and rayon staple fibre.¹ The total poundage of rayon yarns was provided by the *Census of Manufactures* for 1923-27 and by *Rayon Organon* for 1929. The statistics for the first 3 products of the weighted index were also obtained from the

¹The weighted and unweighted production indexes compare as follows in common years:

Year	Weighted	Unweighted
1929	100.0	100.0
1931	130.7	124.3
1933	190.5	175.9
1935	222.8	212.2

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former source; those for the fourth, from the latter.² Since the Census reports sales rather than production for 1929, the *Rayon Organon* figure for total production was used instead for that year; the Census figures for the 3 types of yarn were accordingly raised by the ratio of the 2 totals.³

The series for the odd-numbered years 1923-35 was then completed for the period 1919-37 by means of an index which was constructed from statistics available in *Rayon Organon*. The latter was derived by splicing relatives of the total poundage of yarn for 1919-27 to a weighted index of 4 products: Yarns finer than 113 denier, yarns of 113 to 162 denier, yarns heavier than 162 denier, and rayon staple fibre.⁴ Although the *Rayon Organon* classification of yarns is not identical with that of the Census, the degree of correspondence warranted the use of 1929 Census unit values as weights. The interpolating medium is similar to the basic series for the odd-numbered years 1923-35:

Year	NRP production index	Interpolating production index
1923	30.0	28.3
1925	42.8	41.4
1927	62.2	61.2
1929	100.0	100.0
1931	130.7	129.0
1933	190.5	188.4
1935	222.8	221.3

As the industry developed, products other than rayon yarn and staple fibre increased in relative importance. Thus the items included in the NRP production index accounted for practically all reported value in 1925 but for only 80 percent by 1935:

Year	Percent of total value of products
1925	99.9
1927	96.9
1929	94.4
1931	85.0
1933	82.9
1935	79.7

²The weight for staple fibre is the price for a specific type, "1½ in. 1½ denier no."

³The 2 quantity series for total yarns are in close accord; even in 1929 the difference was only 4 percent. In all other years since 1927 *Rayon Organon* has adjusted its figures to the Census level.

⁴Rayon-staple-fibre production was not reported for 1927. In 1928 it amounted to only 185,000 pounds in contrast with 20,100,000 pounds in 1937.

An adjustment for excluded products, although desirable, could have been made only for these few years on the assumption that their rayon-quantity equivalent is indicated by the ratio of their value to the total. Such a procedure, however, did not appear to be justifiable in view of the precipitous decline in the price of rayon yarn.⁵ Hence the NRP indexes of production and productivity should be regarded as conservative statements of the phenomenal increases which took place during this period.

It is interesting to note that a measure of production which agrees closely with the NRP index in all but 1 of the odd-numbered years 1919-35 may be obtained by deflating an index of the total value of rayon yarn by a series of price relatives for only 1 grade of an important type:⁶

Year	NRP production index	Deflated- value index
1919	7.1	6.9
1921	12.8	12.0
1923	30.0	18.7
1925	42.8	38.1
1927	62.2	63.4
1929	100.0	100.0
1931	130.7	132.8
1933	190.5	187.9
1935	222.8	227.4

Employment and Man-hours

The index of wage-earner employment, which extends from 1923 to 1937, is based on Census statistics for the odd-numbered years 1923-35 and on the BLS employment index, which is available for the entire period except 1926 and 1928. The relatives for these 2 years were interpolated by means of an index⁷ which closely resembles the BLS series.

⁵For example, the list price per pound of 150-denier yarn (first grade, minimum filament, viscose process, f. o. b., N. Y.), as quoted by the largest viscose producer, declined steadily between 1925 and 1935 from \$2.05 to \$0.57. (*Rayon Organon*, "Special Supplement," January 21, 1936, pp. 24-5.)

⁶The grade of yarn to which the price relatives refer is described in fn. 5. The Census value statistics had to be adjusted in 1919 and 1921 to exclude other plastics with which rayon was grouped.

⁷This index was constructed in the following manner: First, Census value figures for total production were completed by means of a continuous *Rayon Organon* series; second, the interpolated (straight-line) census-year ratios of wages to value (which are not only high - about 28 percent - but stable) were applied to the intercensal-year values to complete the series for wages; third, annual wages were divided by NICB hourly earnings for the Chemicals industry to obtain estimates of man-hours; and finally, relatives of these man-hours were divided by the index of average actual hours described subsequently.

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The man-hours index was derived from the employment series and an annual index of average actual weekly hours. The latter includes BLS statistics for 1932-37, Census (prevailing) hours for 1929,⁸ an estimate for 1930 based on a BLS study,⁹ and figures for 1931 and 1923-29 obtained by means of the continuous NICB index for the Chemicals industry.¹⁰

Table 60.- SUMMARY INDEXES FOR THE RAYON INDUSTRY: 1919-37

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	7.1	n. a.	n. a.	-	-
1920	8.7	n. a.	n. a.	-	-
1921	12.8	n. a.	n. a.	-	-
1922	20.7	n. a.	n. a.	-	-
1923	30.0	36.8	38.9	81.5	77.1
1924	30.8	38.7	40.1	79.6	76.8
1925	42.8	48.9	51.2	87.5	83.6
1926	52.1	48.6	48.4	107.2	107.6
1927	62.2	67.4	68.9	92.3	93.0
1928	80.0	79.8	79.3	100.3	100.9
1929	100.0	100.0	100.0	100.0	100.0
1930	108.9	99.2	84.8	107.8	126.1
1931	130.7	99.1	86.8	131.9	150.6
1932	120.3	87.8	77.8	137.0	154.6
1933	190.5	113.3	95.1	168.1	200.3
1934	185.1	119.4	90.0	155.0	205.7
1935	222.8	129.3	99.8	172.3	223.2
1936	247.4	133.8	105.2	184.9	235.2
1937	281.5	148.3	116.6	189.8	241.4

⁸ Average prevailing hours for 1929 were not reduced because they show almost the same relationship to actual hours in 1936 as existed between the actual hours in the Chemicals industry in the same 2 years.

⁹ This estimate was made on the assumption that the ratio between the actual hours for 1930 and 1932 was the same as that indicated by sample figures for these 2 years in *Wages and Hours of Labor in Rayon and Other Synthetic Yarn Manufacturing: 1932* (Bull. No. 567), p. 3.

¹⁰ The estimate for 1931 is based on the percentage change shown between 1931 and 1936 by NICB figures for the Chemicals industry; those for 1923-29 were obtained by extrapolation. In general, the Rayon and Chemicals series agree except in the depression years 1932 and 1933, when, as might be expected, hours in the growing Rayon industry were not curtailed so much as in the Chemicals industry.

- 61. RUBBER PRODUCTS GROUP
- 62. RUBBER TIRES AND INNER TUBES
- 63. OTHER RUBBER GOODS

The Rubber Products group, which employed 149,000 wage earners in 1929, comprises 2 industries: (1) Rubber Tires and Inner Tubes and (2) Other Rubber Goods. The former, which employed 65,000 wage earners in 1929, embraces the manufacture of all tires and tubes in establishments included in the group; the latter embraces the manufacture of other rubber products within the group - such as boots, shoes, belting, fabrics, and hose.

A few companies account for most of the production of tires and tubes. In 1935 tire sales of the 4 largest companies constituted about 90 percent of the total by value. Most other rubber goods, except boots and shoes, are manufactured principally in small establishments.

The automobile casing, the most important product of the group, has been improved considerably since the end of the war. Between 1921 and 1933 its average weight increased from 16.4 to 24.2 pounds; between 1921 and 1930 its estimated average life increased from 1.2 to 2.5 years.

Production

Rubber Products Group.- The NRP group indexes were constructed for the years 1921, 1923, 1925, and 1927-35 by combining relatives for the 2 component industries in harmonic means, one with changing employment weights and the other with changing man-hour weights. The former was used in determining output per wage earner and the latter in determining output per man-hour.

The NRP composite indexes are almost identical, except in 1921 and 1923, with arithmetic means of the relatives for the 2 industries weighted by 1929 employment and man-hours. The indexes with fixed weights for these 2 years are higher than those with changing weights because the relatives of production and productivity for the Other Rubber Goods industry are considerably higher than those for Rubber Tires and Tubes.

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Year	Index of production with -			
	Changing weights		Fixed weights (1929)	
	Employment	Man-hours	Employment	Man-hours
1921	45.8	47.6	52.3	54.4
1922	-	-	-	-
1923	70.1	72.2	74.2	76.4
1924	-	-	-	-
1925	79.7	80.4	80.2	80.8
1926	-	-	-	-
1927	93.8	94.9	94.6	95.7
1928	103.5	103.6	103.5	103.6
1929	100.0	100.0	100.0	100.0
1930	80.4	80.6	80.3	80.6
1931	68.1	67.8	68.4	68.1
1932	61.7	61.6	61.7	61.7
1933	70.7	70.7	70.7	70.7
1934	74.4	74.3	74.6	74.5
1935	78.4	78.3	78.8	78.6

Rubber Tires and Inner Tubes.- The index for this industry is an arithmetic mean of 4 series of relatives: (1) The poundage of automobile casings, (2) the poundage of automobile inner tubes, (3) the number of motorcycle and bicycle casings and inner tubes, and (4) the number of solid and cushion tires.¹ These 4 groups of products, which together represent 99 percent of the value of the industry's output, were weighted by estimated man-hours in 1929.

Weight was used as the measure of production for automobile tires and inner tubes in an endeavor to take account of the variation in labor requirements resulting from differences in tire sizes.² The 2 continuous poundage series were derived by multiplying the number of casings and inner tubes (obtained by completing Census figures for odd-numbered years of the period 1921-36 by means of annual statistics compiled by the Rubber

¹Since the quantities for only the first 2 groups of products could be determined in 1936, the index for this year is based on the 1935 relationship between these 2 and all 4.

²According to B. Stern (*Labor Productivity in the Automobile Tire Industry*, BLS Bull. No. 585, p. 5), the larger-size tires require more labor time.

The extent of variation in the same year and over the period in average weight of casings is apparent from the following tabulation for 6 plants which produce about half the total number (Bull. No. 585, pp. 13-4):

Year	Plant 1	Plant 2	Plant 3	Plant 4	Plant 5	Plant 6
1919	n.a.	n.a.	11.4	20.8	n.a.	n.a.
1921	n.a.	n.a.	11.9	21.7	16.9	n.a.
1923	17.1	12.3	11.6	21.8	15.6	18.8
1925	17.4	14.0	12.3	21.0	17.1	21.0
1927	19.9	14.4	13.3	24.5	18.4	26.0
1929	22.3	17.0	14.8	27.2	20.1	35.6
1931	21.9	18.4	16.1	30.6	22.9	32.6

Manufacturers Association³) by annual series of average poundage per casing and per tube, respectively (as estimated from a BLS report⁴ and from an article published in *Rubber Age*⁵). The average poundage of automobile casings was ascertained for 1922-31 from the combined weight of rubber, chemical ingredients, and fabrics required in the production of casings in 6 plants canvassed by BLS;⁴ for 1921, from an average for 3 plants raised to the 6-plant level;⁶ and for 1932-33, from *Rubber Age*. The average poundage of inner tubes was also determined for 1922-31 from the BLS study (5 plants); for 1920 and 1933, from *Rubber Age*; and for 1921 and 1932, by straight-line interpolation.

A different method was employed in determining total poundage of casings and of inner tubes for 1934-36. First, their combined weight in these years was estimated by means of a consumption index for crude and reclaimed rubber and tire fabrics,⁷ which corresponded in movement with the total weight of casing-and-tube production in earlier years; then the combined weight was apportioned between casings and inner tubes in accordance with the 1933 distribution.

The production of motorcycle and bicycle casings and tubes and of solid and cushion tires may be satisfactorily measured by their number since they vary little in size and weight.⁸ The number of motorcycle and bicycle casings and tubes was supplied by the Census for odd-numbered years and estimated for others by straight-

³The 2 RMA series, which are published in *Survey of Current Business*, cover about 80 percent of the total number of casings and tubes produced, except during the period January 1934-July 1935, when they represent 97 percent. These series, which had been raised to Census levels by Bureau of Foreign and Domestic Commerce through 1933, were adjusted by NRP for the remaining years.

⁴Bull. No. 585 (see fn. 2). The plants included in the survey produced 45-59 percent and 45-85 percent of the total number of casings and inner tubes, respectively.

⁵L. E. Carlsmith, "Changes in Tire Sizes," *Rubber Age*, May 1935, p. 83. The figures were supplied by a large tire manufacturer whose estimates for 1925, 1930, and 1931 agreed with those published by BLS.

⁶Since the averages for 3 and 6 plants move similarly in other years, the percentage change indicated by the former between 1921 and 1922 was applied to the latter.

⁷This index is a series of relatives of the total weight of the 3 materials, as estimated from Census and RMA statistics. Figures for crude-rubber consumption reported by the former were supplemented by comparable RMA data representing about 80 percent of the industry; the continuous series was then used to complete Census statistics for reclaimed-rubber consumption. The RMA rubber-tire-fabrics consumption series was adjusted to the Census level by application of the ratios employed in the completion of the Census crude-rubber series.

These 3 items comprised 82.7 percent of the total weight of the most important raw materials consumed in the manufacture of automobile casings and tubes in 1929, as reported by the Census. Chemicals represented the remaining 17.3 percent.

⁸In any event, these 2 classes of products are of minor importance. Together, they accounted for a maximum of 6.1 percent of the total value of products included in the production index in 1923; by 1935 they represented only 1.6 percent.

line interpolation. The Census also provided adequate statistics for solid and cushion tires for the odd-numbered years 1921-29;⁹ these were supplemented by an RMA series for the remaining years through 1935.

In determining the weighting factors for the 4 types of tires and tubes, the adjusted aggregate number of man-hours¹⁰ required in their production in 1929 was first divided into 3 parts in accordance with the proportions of total value accounted for in that year by (1) automobile casings and inner tubes, (2) motorcycle and bicycle casings and tubes, and (3) solid and cushion tires.

The next step was to apportion man-hours between automobile casings and inner tubes. "Direct" man-hours for each were first estimated by dividing the total weight of casings and tubes produced in 1929 by the pounds of each produced per man-hour of "direct" labor as indicated in the BLS report referred to above.¹¹ Finally, "indirect" man-hours of labor (the difference between "direct" man-hours and all man-hours for both casings and tubes) were allocated to casings and tubes on the basis of their respective total poundage,¹² and "direct" and "indirect" man-hours were summed to obtain the weights.

Other Rubber Goods.— The index for Other Rubber Goods, available for 1921, 1923, 1925, and 1927-35, is based on Census statistics for alternate years of the period 1921-35 and on RMA statistics for the intercensal years. A weighted arithmetic mean of relatives for 8 products in the odd-numbered years 1921-27 was spliced to a similar index of 25 products for census years 1927-35. The weights for the several products are their relative values in 1929.¹³

⁹Census statistics for solid and cushion tires after 1929 were not used since they are not comparable with those for earlier years.

¹⁰See discussion of Employment and Man-hours.

¹¹See ftns. 2 and 4.

¹²From a consideration of the nature of the manufacturing processes and incidental activities, it appears that poundage is the most suitable basis for the allocation of "indirect" labor.

¹³The 8 products for 1921-27, ranging from 45 to 54 percent of the total value of the industry's output are: Rubber boots, canvas footwear, reclaimed rubber, heels, soles, auto and carriage fabrics, shoes and overshoes, and rubberized fabrics.

Of the 25 products for which statistics are available during 1927-35 (these accounted for from 48 to 64 percent of total value), 6 are the same as the first 6 listed in the preceding paragraph; 3 (lumbermen's shoes and overshoes, arctics and gaiters, and other shoes and overshoes) result from a more detailed classification of the seventh listed above; and 3 more (raincoat fabrics, hospital sheeting, and other rubberized fabrics) result from a more detailed classification of the eighth and last-named product above. The 13 additional products are: Transmission belting; all other rubber belting; rubber packing; washers, gaskets, and valves; rubber and friction tape; water bottles and fountain syringes; rubber bands; rubber gloves; rubber cement; rubber flooring; rubber thread; jar rings; and bathing caps.

Interpolation for the even-numbered years 1928-34 was accomplished by means of an annual 8-product index based on Census and RMA data. Relatives of the 8 quantity series were combined in an arithmetic mean with 1929 value weights.¹⁴

Employment and Man-hours

Three sets of employment and man-hours indexes were constructed - 1 for the group as a whole and 2 others which correspond to the production of tires and tubes and of other rubber goods, respectively.

The first step was to determine the number of wage earners in the whole group and in the Rubber Tires and Inner Tubes industry as defined by the Census. This was done by completing Census statistics for 1921-35 by the use of BLS indexes for 1923-36, the NICB group employment index for 1921-23, and Ohio State tire-and-tube figures for the same 3 years.¹⁵

The second step was to derive man-hours series for the group and the Rubber Tires and Inner Tubes industry by averaging the quotients of pay rolls and average hourly earnings and the products of the employment series and average actual hours per man per year (i. e., weekly hours times 52). The necessary pay-roll series were obtained in the same manner as employment for 1921 and for 1923-36; the 1922 estimates are based on the NICB group index. The average-weekly-hours and hourly-earnings figures were derived by splicing NICB series¹⁶ for 1921-31 to corresponding BLS series for subsequent years.¹⁷

¹⁴RMA series were used to supplement the Census statistics for 1927-35 for rubber heels and rubber soles and for 1929-35 for tennis footwear and reclaimed rubber. Because of a change in Census classification, reclaimed-rubber production for 1935 was estimated by multiplication of the RMA figure for that year by the average of the ratios for 1929, 1931, and 1933 of Census to RMA data. An RMA production series for waterproof footwear was used for the period 1929-35 to complete the quantities reported by the Census for each of the 4 constituents - boots, lumbermen's shoes and overshoes, arctics and gaiters, and other shoes and overshoes. Estimates for 1928, except for rubber heels and soles, were made by straight-line interpolation.

Together, the 8 products account for from 28 to 44 percent of total value of the industry's output. The 5 RMA interpolating series ranged in coverage from 57-75 percent of the Census quantities for rubber soles to 88-100 percent for reclaimed rubber.

¹⁵The series for Ohio, which represents more than half the number of wage earners engaged in the manufacture of tires and tubes, is shown in *Fluctuation in Employment in Ohio, 1914 to 1929* (BLS Bull. No. 553), pp. 282, 294, 330.

¹⁶NICB hours and earnings (as well as employment and pay rolls) refer only to the Rubber Products group, but in view of their close agreement in 1932-38 with BLS statistics for the Rubber Tires and Inner Tubes industry, they were considered applicable to this industry in the earlier years.

¹⁷The BLS group series was derived by combination with proper weights of published statistics for 3 subgroups: Rubber Tires and Inner Tubes, Rubber Boots and Shoes, and Other Rubber Goods.

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The third step was to determine employment and man-hours for the Other Rubber Goods industry by subtraction. Finally, employment and man-hours in the group were redistributed so as to correspond exactly with the total production of tires and tubes and of other rubber goods. This was accomplished (see appended note) on the assumptions that the (Census) Rubber Tires and Tubes and the Other Rubber Goods industries:

- (1) Have the same value output per wage earner and per man-hour for (a) tires and tubes and for (b) other rubber goods.
- (2) Together produce all tires and tubes and all other rubber goods.
- (3) Produce only these 2 classes of products.

The validity of the first assumption cannot be tested; the last 2 appear to be justifiable since secondary products constitute less than 2 percent of the group's value of output and the value of rubber goods produced outside the group is also less than 2 percent of the total.

Note on the Method of Segregating Employment and Man-hours for Tires and Tubes and for Other Rubber Goods¹⁶

Let X = employment or man-hours required for total production of tires and tubes,

Y = employment or man-hours required for total production of other rubber goods,

T_t = value of tires and tubes produced in the Tires and Tubes industry,

T_r = value of tires and tubes produced in the Other Rubber Goods industry,

T = total value of tires and tubes,

R_t = value of other rubber goods made in the Tires and Tubes industry,

R_r = value of other rubber goods made in the industry of the same name,

M_t = total employment or man-hours worked in the Tires and Tubes industry,

M_r = total employment or man-hours worked in the Other Rubber Goods industry,

¹⁶This method was used for census years. For intercensal years M_t was used to interpolate X . Since f_r is known only in 1923 and 1925, it had to be estimated in other years on the assumption of the average relationship of f_r to f in these 2 years.

employment or man-hours consumed in production of tires and tubes in the Tires and Tubes industry, and employment or man-hours consumed in production of tires and tubes in the Other Rubber Goods industry.

The assumptions are:

$$1. (a) \frac{T_t}{m_t} = \frac{T_r}{m_r}$$

$$(b) \frac{R_r}{H_r - m_r} = \frac{R_t}{H_t - m_t}$$

$$2. (a) T = T_t + T_r$$

$$(b) X = m_t + m_r$$

$$3. Y = H_t + H_r - X$$

Solving equations 1(a) and 1(b) for m_t and m_r and using 2, we obtain:

$$X = \frac{T (H_t R_r - H_r R_t)}{(T_t R_r - T_r R_t)}$$

Table 81.- SUMMARY INDEXES FOR THE RUBBER PRODUCTS INDUSTRY GROUP: 1921-38

(1929 = 100)

Year	Production (employment weights)	Employment	Output per wage earner	Production (man-hour weights)	Man-hours	Output per man-hour
1921	45.8	69.2	66.2	47.6	68.0	70.0
1922	n. a.	89.5	-	n. a.	91.0	-
1923	70.1	92.4	75.9	72.2	92.5	78.1
1924	n. a.	92.7	-	n. a.	92.5	-
1925	79.7	95.1	83.8	80.4	93.9	85.6
1926	n. a.	94.7	-	n. a.	94.1	-
1927	93.9	95.2	98.5	94.9	96.1	98.8
1928	103.5	100.1	103.4	103.6	103.3	100.3
1929	100.0	100.0	100.0	100.0	100.0	100.0
1930	80.4	77.4	103.9	80.6	72.7	110.9
1931	68.1	66.6	102.3	67.6	55.8	121.5
1932	61.7	60.9	101.3	61.6	44.8	137.5
1933	70.7	71.3	99.2	70.7	52.3	135.2
1934	74.4	79.7	93.4	74.3	54.7	135.8
1935	78.4	77.0	101.8	78.3	55.8	140.3
1936	n. a.	81.7	-	n. a.	64.3	-

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**Table 62.- SUMMARY INDEXES FOR THE RUBBER TIRES AND INNER TUBES INDUSTRY:
1921-36**

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1921	32.1	66.5	69.0	46.9	46.5
1922	46.8	88.4	92.1	55.2	53.0
1923	53.6	89.1	89.7	60.2	59.8
1924	58.7	85.9	85.4	68.3	68.7
1925	74.3	97.2	94.9	76.4	76.3
1926	76.7	95.7	94.6	80.1	81.1
1927	84.4	94.3	94.8	89.5	89.0
1928	103.2	100.2	103.6	103.0	99.6
1929	100.0	100.0	100.0	100.0	100.0
1930	78.2	72.6	69.5	107.7	112.5
1931	71.7	60.3	52.1	118.9	137.6
1932	62.4	53.7	40.1	116.2	155.6
1933	70.8	60.6	43.5	116.8	162.6
1934	76.1	65.9	45.9	115.5	165.6
1935	80.8	59.4	43.6	136.0	185.3
1936	91.3	62.2	50.1	146.8	182.2

Table 63.- SUMMARY INDEXES FOR THE OTHER RUBBER GOODS INDUSTRY: 1921-36

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1921	67.9	69.8	67.5	97.3	100.6
1922	n. a.	90.4	90.4	-	-
1923	90.2	95.0	94.2	94.9	95.8
1924	n. a.	80.2	80.8	-	-
1925	84.7	93.5	93.3	90.6	90.6
1926	n. a.	93.9	93.8	-	-
1927	102.5	95.9	96.9	106.9	105.8
1928	103.6	100.0	103.1	103.8	100.7
1929	100.0	100.0	100.0	100.0	100.0
1930	82.0	81.1	74.7	101.1	109.8
1931	65.9	71.4	58.1	92.3	113.4
1932	61.2	66.4	47.7	92.2	128.3
1933	70.7	79.5	57.7	88.9	122.5
1934	73.5	90.3	60.0	81.4	122.5
1935	77.3	90.6	63.2	85.3	122.3
1936	n. a.	96.8	72.8	-	-

84. SILK AND RAYON GOODS

This industry, which employed 130,000 wage earners in 1929, includes 2 groups of establishments: (1) Those engaged primarily in the manufacture of silk and rayon fabrics and other finished silk and rayon products and (2) those engaged primarily in the manufacture of silk yarn (known as organzine, tram, and hard or crepe twist); in throwing, twisting, or otherwise changing rayon into different forms from those in which it was purchased; and in the dressing of warps. The first group of establishments is much larger than the second. Establishments which manufacture rayon yarn, knit fabrics, hosiery, and other knit goods made of silk and rayon are classified in other industries.

In 1935 the Bureau of the Census divided the Silk and Rayon Goods industry into 2 separate industries: Silk Manufactures and Rayon Manufactures. Together, however, these 2 embrace the same types of establishments as were included in the Silk and Rayon Goods industry in earlier years.

The increasing consumption of rayon in the industry since 1929 is illustrated by the production statistics (in millions of square yards) for all-silk and all-rayon broad goods:

Year	All-silk	All-rayon
1929	424	66
1931	386	109
1933	201	273
1935	239	732

Production

The production index for the odd-numbered years of the period 1919-35 is composed of 2 segments derived from Census quantity statistics¹ which were linked in 1929. The first, extending from 1919 to 1929, is an aggregative index with 1929 unit-value weights

¹The Census reports both the number of square yards and the number of pounds for each product. In this study the square yard was preferred as the unit of production since value per square yard is probably more closely related to labor requirements than is value per pound, which is largely dependent upon such factors as the type of yarn used and the amount of weighting material added. (Weighting is a process by which silk is made heavier through the addition of vegetable materials or an iron or tin salt.)

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of the output of the following 5 types of broad goods:² All-silk,³ mixed,³ velvets, plushes, and upholsteries and tapestries. The second segment, also an aggregative index, includes 9 series which represent a more detailed classification of the 5 types of broad goods in the first segment:⁴

- All-silk, including upholsteries⁵
- All-rayon and velvets, other than all-silk and silk-and-rayon mixed⁶
- Silk-and-rayon mixed³
- Silk-and-cotton mixed and other mixed silk or rayon³
- Rayon-and-cotton mixed³
- Silk-and-rayon mixed velvets
- Plushes and all-silk velvets
- Upholsteries other than all-silk
- Tapestries

Although no wage-earner data are available for the individual products included in the second segment, it was possible, through the use of 1935 Census wage-earner and production statistics for the 2 branches of the industry (Silk Manufactures and Rayon Manufactures), to compute weights which reflect, to some extent, the differences in labor requirements for silk and for rayon goods. In computing these weights, the wage earners employed in each of the industry branches were first allocated to the several products of the same branch in accordance with the percentages which their values constituted of the total value of the primary products of the branch.⁷ The total number of wage earners assigned to each product (some are made in both branches) was then divided by the corresponding production (number of square yards) in 1935.

²The quantities for 1919, reported in linear yards, were converted into square yards on the assumption that the average width for each fabric was the same as in 1921, when both the number of square yards and of linear yards were reported. The average width changed little between 1921 and 1923:

Fabric	Average width (inches)	
	1921	1923
All-silk broad goods	37.2	36.4
Mixed broad goods	34.0	36.9
Velvets	20.1	19.2
Plushes	35.5	39.7
Upholsteries and tapestries	47.2	48.9

³Other than velvets, plushes, upholsteries, and tapestries.

⁴The 1935 statistics for some products are not strictly comparable with those for earlier years, but the error introduced into the production index is probably negligible. For example, in 1935 all-silk tapestries and draperies (relatively unimportant items) are included with all-silk broad goods, and silk-and-rayon mixed velvets include a small quantity of silk-and-cotton mixed velvets with silk warp.

⁵Other than velvets, plushes, and tapestries.

⁶Other than plushes, tapestries, and upholsteries.

⁷All-silk broad goods (including upholsteries) comprised over 75 percent of the value of products of the Silk Manufactures industry; all-rayon broad goods and velvets accounted for over 80 percent of the value of the output of Rayon Manufactures.

This index of production, which includes from 80 to 90 percent of the value of all silk and rayon goods,⁸ was interpolated for the even-numbered years 1920-32 by the use of an index of raw-silk consumption in the industry. The inadequacy of available data did not permit the construction of index numbers for 1934 and 1936.⁹

The first step in constructing the raw-silk consumption index was the derivation of an annual series for raw-silk consumption in all the textile industries.¹⁰ Census statistics were used for 1919 and the odd-numbered years 1925-35,¹¹ except 1933; for remaining years, estimates were made by use of a series for silk deliveries to mills, which is published in the *Survey of Current Business*.¹² Second, the ratios of raw-silk consumption in the Silk and Rayon Goods industry to total consumption in the textile industries were computed from Census data for 1919 and the odd-numbered years 1925-35, except 1933, and estimated by straight-line interpolation for remaining years. Finally, multiplication of the total consumption in all textile industries by this series of ratios yielded the annual consumption of raw silk in the Silk and Rayon Goods industry. This annual consumption series was then converted into relatives.

⁸ Silk yarns and threads were not included in the production index (nor considered in the computation of coverage) since the quantities reported by the Census, which represent only the amounts produced for sale and on commission, probably do not comprise a constant proportion from year to year of either total production or sales to establishments outside the industry for the following reasons: (1) Many of the sales are made to establishments within the industry, (2) some of the yarns and threads made on commission may be sold, and (3) the yarns and threads made on own machinery from owned materials for use in further production may represent a varying proportion of the total output.

The detailed Census quantity statistics are not strictly comparable over the period 1919-36, but the errors introduced are believed to be negligible. The statistics for 1919-27 refer to silk and rayon goods made only in the Silk and Rayon Goods industry; those for 1929, 1931, and 1933 include the secondary production of establishments classified in other industries except certain products made in the Cotton Goods industry; and those for 1935 also include such products of the Cotton Goods industry.

⁹ The silk-consumption index does not reflect the large increase in rayon-goods production after 1933. A rayon-consumption index, derived from Census and *Rayon Organon* statistics, shows a trend significantly different from that of the NRP production index for census years. It was not possible to devise satisfactory weights for combining the silk- and rayon-consumption indexes into a composite resembling the NRP production index.

¹⁰ Cotton Goods, Cotton Small Wares, Felt Goods, Knit Goods, Lace Goods, Silk and Rayon Goods, and Woolen and Worsted Goods.

¹¹ Consumption in the Woolen and Worsted Goods industry for 1931 was estimated on the basis of the relationship between consumption in this industry and consumption in the Knit Goods and Silk and Rayon Goods industries combined in 1929 and 1935.

¹² Deliveries to mills, compiled monthly by the Commodity Exchange (in earlier years, by the National Federation of Textiles and the Silk Association of America), represent the difference between imports and the change in the United States stock position during the month.

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Employment and Man-hours

The employment index was constructed for the odd-numbered years from Census wage-earner statistics and completed for the period 1919-36 by the use of the BLS index.

The NRP index understates employment for 1935 (and hence for 1934 and 1936 also) as a consequence of the exclusion of the small number of wage earners in dyeing departments operated at the same location as the mill (except those engaged in dyeing yarn for use in the same establishment) from the number of wage earners reported by the Census for 1935. Wage-earner and man-hour productivity in 1935 are consequently somewhat overstated by the NRP indexes.

The production and employment indexes are not strictly comparable since some wage earners in the Silk and Rayon Goods industry are engaged in the manufacture of secondary products not included in the production index and, after 1929, the production index includes some products of wage earners in other industries. In both cases, however, the production involved constitutes less than 3 percent of the total value of the industry's output.

The man-hours index was derived from the employment index and another for average weekly hours, which is based on adjusted Census prevailing hours for 1919, NICB actual hours for 1920-31, and BLS actual hours for the remaining years. Prevailing hours for 1919, computed from a Census frequency distribution, were reduced to actual hours through the use of the average of the ratios of NICB actual to Census prevailing hours in 1921 and 1923.

SILK AND RAYON GOODS

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Table 84.- SUMMARY INDEXES FOR THE SILK AND RAYON GOODS INDUSTRY: 1919-36
(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	57.9	97.2	92.5	59.6	62.6
1920	36.9	99.6	87.3	37.0	42.3
1921	51.2	93.0	87.3	55.1	58.6
1922	63.0	91.1	87.1	69.2	72.3
1923	87.5	96.0	93.4	70.3	72.3
1924	64.7	91.3	86.7	70.9	74.6
1925	82.3	101.6	99.7	81.0	82.5
1926	80.2	99.2	93.8	80.8	85.5
1927	85.9	97.8	93.9	87.8	91.5
1928	91.3	97.4	96.4	93.7	94.7
1929	100.0	100.0	100.0	100.0	100.0
1930	90.5	91.6	86.0	98.8	105.2
1931	88.9	83.7	77.6	108.2	114.6
1932	84.1	71.3	57.8	118.0	145.5
1933	71.5	84.6	65.6	84.5	109.0
1934	n. a.	91.9	64.2	-	-
1935	107.8	96.5	70.3	111.7	153.3
1936	n. a.	86.9	65.7	-	-

65. SLAUGHTERING AND MEAT PACKING

The Slaughtering and Meat Packing industry as here defined embraces 2 Census industries: "Meat Packing, Wholesale" and "Sausage, Meat Puddings, Headcheese, Etc., and Sausage Casings." The former, which employed 122,500 wage earners in 1929, includes establishments engaged in wholesale slaughtering and meat packing and abattoirs engaged wholly or chiefly in custom slaughtering; it does not include establishments which slaughter for the retail trade unless they also wholesale considerable quantities of meat. The latter, which employed almost 5,900 wage earners in 1929, comprises establishments engaged primarily in the manufacture of the products from which it derives its name. The 2 Census industries were combined to minimize the effect of changes in the classification of establishments which may result from changes in the nature of their primary output. The Slaughtering and Meat Packing industry usually ranks first among manufacturing industries with respect to value of output.

Production

The index of production was computed from Census quantity statistics for the odd-numbered years of the period 1919-36 and completed for the even-numbered years by means of Department of Agriculture data. The index for the odd-numbered years comprises 3 segments, each of which, in turn, is an aggregative index with 1929 unit values as weights.¹ The first segment, for 1919 and 1921, includes the first 19 of the following 21 products; the second, for 1921-27, includes the first 20; and the third, for 1927-35, includes all 21:

¹An attempt was made to derive labor-requirement weights from man-hours statistics reported in BLS Bull. Nos. 262, 294, 373, 421, 472, 536, and 576 for establishments employing 30 to 60 percent of the wage earners in the industry. The results were not satisfactory, however, for various reasons: (1) There are many joint products, and some of these may be obtained at more than one stage; (2) the man-hours are reported by department with no basis for allocation to, or distribution among, the various products except the number and description of operations in Bull. No. 472, pp. 131-63; (3) the establishments surveyed in the several years (1917 and the odd-numbered years 1921-31) vary in number and represent plants at different levels of integration; (4) shrinkage, losses, and waste from stage to stage could not be estimated; and (5) the man-hours assignable to certain classes of products, such as canned meats, could not be segregated according to animal. Although the weights derived from these statistics (for 9 classes of products) are admittedly crude, their use in conjunction with Census quantities yields an index which resembles the NRP index in all years but 1919.

Fresh meat	Sausage (not canned), meat
Beef	puddings, headcheese, etc.
Veal	Sausage casings
Mutton and lamb	Lard
Pork	Stearin (oleo and other)
Edible organs, tripe, etc. ²	Hides
Other fresh meat ²	Cattle hides, cured and uncured
Cured meat	Calfskins, cured and uncured
Beef, pickled and other	Sheep and lamb pelts, cured
cured	and uncured
Pork, smoked; and hams,	Wool
cooked ³	Hair, hog and other
Pork, not smoked ³	Oleo oil and stock
Canned meat and sausage ⁴	Pickled sheep and lamb skins

Since Slaughtering and Meat Packing embraces 2 Census industries ("Meat Packing, Wholesale" and "Sausage, Meat Puddings, Headcheese, Etc., and Sausage Casings"), the quantities of "sausage (not canned), meat puddings, headcheese, etc." and "sausage casings" made in both were included in the NRP index.⁵ These 2 products account for almost all of the output of the "Sausage, Meat Puddings, Headcheese, Etc., and Sausage Casings" industry.⁶

The series included in the NRP index for the odd-numbered years account for well over 90 percent of the total value of the production of Slaughtering and Meat Packing despite the exclusion of some of the primary output, which is reported in terms of

²Edible organs, tripe, etc. and "other fresh meat", reported in combination from 1919 to 1923, were separated in accordance with their 1925 proportions.

³Includes "pickled and dry-cured" and "dry-salted" pork. The statistics for "pork, smoked; and hams, cooked" are not strictly comparable throughout the period since they do not include all cooked hams for the years prior to 1927.

⁴Does not include a small amount of "canned sausage" made in the Census industry "Sausage, Meat Puddings, Headcheese, Etc., and Sausage Casings." In 1931 and 1935, however, the output of "canned sausage" in this Census industry accounted for less than 1 percent of the amount of "canned meat and sausage" included in the index; no statistics were available for other years.

⁵The amounts of the 2 products made in the "Sausage, Meat Puddings, Headcheese, Etc., and Sausage Casings" industry were reported by the Census for 1929, 1931, and 1935. (The quantity figures for 1935 had to be adjusted to include small additional amounts reported in combination by value only. The combined value was distributed in the same proportion as the values reported separately; the value for each was then deflated by a unit value computed from the separate value and quantity figures.) The quantities for the remaining years were estimated (interpolated and extrapolated) by means of series of deflated values. The necessary value series include Census figures for 1919, 1921, 1927, 1929, 1931, and 1935 (those for 1935 were adjusted in the same manner as the reported quantities) and figures for 1923, 1925, and 1933 interpolated by means of a series for the value of products normally belonging to this Census industry (estimated for 1933 by means of statistics for the total value of this industry's output). The unit values used in deflating the 2 value series were computed from quantity and value data for the same products made in "Meat Packing, Wholesale."

⁶Because of the nature of the reported statistics, the estimated quantities of "sausage (not canned), meat puddings, headcheese, etc." made in this Census industry may include small amounts of "canned sausage", which is also a primary product of the industry. This fact is of no consequence, however, since "canned sausage" accounted for less than 0.2 percent of the output (by weight) of all sausage, meat puddings, headcheese, etc. made in the industry in both 1931 and 1935. (See ftns. 4 and 5.)

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undistributed value only.⁷ It should be noted, however, that coverage is somewhat overstated by percentages computed from Census value figures since some duplication results from intra-industry sales (presumably, for further processing only, not for resale).⁸

The index for the odd-numbered years was completed by means of another computed from the following 11 annual series, which were derived from Department of Agriculture data and adjusted to the levels of the quantities for corresponding Census products:

Department of Agriculture series ⁹	Corresponding Census product
Dressed weight of cattle slaughtered under Federal inspection	Beef, fresh
Dressed weight of calves slaughtered under Federal inspection	Veal, fresh
Dressed weight of sheep and lambs slaughtered under Federal inspection	Mutton and lamb, fresh
Dressed weight of hogs slaughtered under Federal inspection	Pork, fresh
Pork placed in cure under Federal inspection	Pork, smoked; and hams, cooked Pork, not smoked
Canned meat prepared under Federal inspection	Canned meat and sausage
Sausage prepared under Federal inspection	Sausage (not canned), meat puddings, headcheese, etc.
Number of calves slaughtered under Federal inspection	Calfskins, cured and uncured

⁷ Many of the secondary products of "Sausage, Meat Puddings, Headcheese, Etc., and Sausage Casings" are primary products of Slaughtering and Meat Packing (principally smoked, cured, and pickled meats, according to a communication from the Bureau of the Census).

⁸ A rough estimate made from Census value statistics for meat purchased (dressed weight) in 1929 indicates that the duplication may be as high as 11 percent of the total value. Another estimate based on Census quantity statistics for 1929 (viz, the ratio of dressed weight of purchased meat to the total weight of specified meat products) indicates about the same degree of duplication.

⁹ The basic statistics for these series were obtained from the following publications of the Department of Agriculture: *Market Review and Statistical Summaries of Livestock, Meats and Wool* (mimeo., June 15, 1936); *Livestock, Meats, and Wool Market Statistics and Related Data: 1936* and same for 1937; *Weather, Crops, and Markets* (Monthly Supplement, Feb. 4, 1922); *Yearbook of Agriculture: 1931*; and *Agricultural Statistics: 1937*.

The data for the fifth, sixth, and seventh series, which refer to years ending June 30, could not be satisfactorily adjusted to refer to calendar years, but the consequent effect upon the interpolating index is believed to be negligible.

Department of Agriculture series ⁹	Corresponding Census product
Lard rendered from hogs slaughtered under Federal inspection	Lard
Edible organs, tripe, etc. (estimated from the live weight of cattle, calves, sheep and lambs, and hogs and the yield of edible offal per pound live weight of each of these animals)	Edible organs, tripe, etc.
Cattle hides (estimated from the total live weight of cattle and the yield of hides per pound live weight)	Cattle hides, cured and uncured

The 11 adjusted series were combined in an aggregative index for the whole period 1919-36 except 1920; the 1929 unit values for the corresponding Census products were used as weights. Since figures for 1919 and 1920 were lacking for the last 3 of the 11 series, the index number for 1920 was obtained from a weighted aggregate for only 8 raised to the level of the aggregates for all 11 for 1919 and 1921.¹⁰

Employment and Man-hours

The employment index was constructed for the odd-numbered years 1919-35 from the combined wage-earners figures for the 2 Census industries; it was completed for the even-numbered years 1920-36 by means of the BLS index which corresponds to "Meat Packing, Wholesale", the larger of the 2. The man-hours index was derived from the employment index and another for average actual weekly hours. The weekly-hours series, which refers to "Meat Packing, Wholesale", was computed from: (1) Census prevailing hours for 1919 reduced to the level of actual hours (by means of the average of the ratios of NICB actual to Census prevailing hours for 1921 and 1923), (2) the NICB series for 1920-32, (3) Census statistics

¹⁰ For 1919, as for all other odd-numbered years, the Department of Agriculture series were rendered identical with the corresponding Census figures; hence, the weighted aggregate for 11 series could be constructed for 1919 even though Department of Agriculture figures were lacking for 3 of them. The third and fourth series could be considered complete for the same reason although no figures were available for 1919.

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for man-hours and employment for 1933 and 1935,¹¹ and (4) BLS hours for 1934 and 1936 adjusted to the level of the Census hours for 1933 and 1935.

Table 88. - SUMMARY INDEXES FOR THE SLAUGHTERING AND MEAT PACKING INDUSTRY: 1919-38

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	91.1	128.1	122.6	71.1	74.3
1920	84.3	112.1	107.4	75.2	78.5
1921	79.3	94.2	87.3	84.2	90.8
1922	86.8	92.6	90.0	93.7	96.4
1923	98.3	107.0	105.1	91.9	93.5
1924	100.8	102.8	100.5	98.1	100.3
1925	94.2	97.8	95.6	96.5	98.5
1926	96.7	95.8	94.3	100.9	102.5
1927	96.6	96.6	95.8	100.0	100.8
1928	98.5	97.7	97.7	100.8	100.8
1929	100.0	100.0	100.0	100.0	100.0
1930	97.2	95.8	94.7	101.5	102.6
1931	95.8	88.0	85.2	108.9	112.4
1932	90.9	84.7	80.7	107.3	112.6
1933	96.6	94.2	82.0	102.5	117.8
1934	98.4	116.2	94.4	84.7	104.2
1935	82.7	98.0	78.2	84.4	105.8
1936	92.6	103.2	86.1	89.7	107.5

¹¹Average weekly hours were computed for 1933 from *Census of Manufactures: 1933, "Man-hour Statistics for 32 Selected Industries"* and for 1935 from *Census of Manufactures: 1935, "Man-hour Statistics for 59 Selected Industries."* The sample for 1933 included 88 percent of all wage earners in the "Meat Packing, Wholesale" industry; the sample for 1935, 91 percent.

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- 67. CIGARS
- 68. CIGARETTES
- 69. CHEWING AND SMOKING TOBACCO AND SNUFF

The Tobacco Products group, which employed over 116,000 wage earners in 1929, consists of the following 3 industries whose principal raw material is leaf tobacco: (1) Cigars, (2) Cigarettes, and (3) Chewing and Smoking Tobacco and Snuff.

The Cigarettes industry has been growing rapidly, while the Cigars and the Chewing and Smoking Tobacco and Snuff industries have been declining. This shift in relative importance is reflected in the changing percentage distribution of the quantities of leaf tobacco consumed in the manufacture of the 3 types of products:

Year	Percent of leaf tobacco used for -		
	Cigars	Cigarettes	Chewing and smoking tobacco and snuff
1919	23.4	25.7	50.9
1929	19.1	43.5	37.4
1936	14.9	53.5	31.6

The decline of the Cigars industry since the war is attributable primarily to the increasing preference for the cigarette. Nevertheless, this industry still employed about three-fourths of the wage earners in the group in 1929 and almost two-thirds in 1936. The significance of the price factor in the competition between cigars and cigarettes is reflected in the fact that cigars manufactured to retail at 5 cents or less increased in both absolute and relative number (from 26 to 86 percent of the total between 1919 and 1936), while the production of cigars in all higher price classes declined.

The introduction in 1919 of a long-filler-cigar machine, capable of turning out in 1 continuous series of operations a finished cigar comparable in quality to the hand-made product, marked the beginning of a long period of mechanization. Although in 1919 only 3 percent of the total number of cigars were made by machine, by 1936 over 50 percent were machine-made. During this period the average size of the cigar plant increased. Between 1921 and 1934 the number of cigars produced by factories with an annual

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production of over 500,000 cigars rose from 86.3 to 94.1 percent of the total, while the percentage accounted for by those with an annual output of over 40,000,000 advanced from 15.7 to 54.3.¹

The Cigarettes industry, which employed about one-eighth of the wage earners in the group in 1929, has long been highly mechanized. In 1937 the cigarette was manufactured and packed, the package sealed and stamped, and the stamp canceled by automatic machinery. Machines now in use can turn out about 600 cigarettes per minute, and equipment capable of greater speeds is being developed.

Mechanization has favored the development of large cigarette factories. From 1919 to 1936 the estimated average annual output of cigarettes per factory increased from 202 million to 1,655 million. It is estimated that in 1934, 8 companies produced over 95 percent of the total number of cigarettes and that 4 of these accounted for about 85 percent.

North Carolina maintained its position as principal cigarette-producing State throughout the period of interest. Its output rose from 53.7 percent of the total in 1919 to 63.8 percent in 1930 but receded to 53.7 percent in 1936. Since 1919 New York has declined considerably while Virginia and Kentucky have grown in importance:

Year	Percent of total number of cigarettes produced in -		
	New York	Virginia	Kentucky
1919	27.9	11.3	Less than 0.1
1936	0.1	30.4	7.2

In 1929 the Chewing and Smoking Tobacco and Snuff industry employed slightly more wage earners than the Cigarettes industry. Chewing tobacco, made principally from burley, is produced in a variety of forms: "Scrap", or loosely packed scrap leaves; "plug", or compressed leaves; "twist", or an intact leaf in which others have been rolled; and "fine-cut", which is similar to smoking tobacco. All of these varieties are usually "cased", i. e., treated with sweetening and flavoring agents such as

¹For further discussion of this industry see "Technological Changes in the Cigar Industry and Their Effects on Labor," *Monthly Labor Review*, December 1931, pp. 11-7; D. Creamer and G. V. Swackhamer, *Cigar Makers - After the Lay-Off* (WPA National Research Project, Report No. L-1, Dec. 1937); and W. D. Evans, *Effects of Mechanization in Cigar Manufacture* (WPA National Research Project in cooperation with the Bureau of Labor Statistics, U. S. Department of Labor, Report No. B-4, May 1938).

licorice paste, cane or maple sugar, molasses, and rum. Snuff, a minor product of the industry, is manufactured chiefly in the highly mechanized establishments of 3 companies.

Production

Tobacco Products Group.— The 2 NRP group indexes of production are weighted harmonic means of the production relatives for the 3 component industries. The first, with changing employment weights, was used in determining output per wage earner, and the second, with changing man-hour weights, was used in determining output per man-hour. The harmonic mean with changing employment weights compares as follows with an arithmetic mean of relatives with fixed (1929) employment weights:

Year	Index of production with -	
	Changing employment weights	Fixed employment weights (1929)
1919	92.0	102.7
1920	97.2	111.5
1921	90.2	97.2
1922	92.7	98.4
1923	97.4	100.4
1924	95.7	97.7
1925	95.4	98.5
1926	97.0	97.4
1927	97.9	98.3
1928	96.9	97.1
1929	100.0	100.0
1930	92.7	92.8
1931	86.0	85.9
1932	73.0	73.3
1933	72.3	72.7
1934	77.5	77.0
1935	79.7	79.2
1936	87.0	86.6

Cigars.— The production index for the period 1919-36 was derived by reducing the total annual output of large and small cigars to relatives.² The Bureau of Internal Revenue reports the number of large and small cigars manufactured each year,³ as "compiled from

²Cigars are classified as large or small depending on whether they weigh more or less than 3 pounds per thousand.

³These figures are published in the *Annual Report of the Commissioner of Internal Revenue*.

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statements of accounts prepared from manufacturers' inventories and monthly returns filed under the United States internal-revenue laws." It was necessary to add to this series the production of large cigars which are made in bonded warehouses under customs supervision wholly from imported tobacco⁴ (principally Cuban). The output of these cigars (reported monthly to the Collector of Customs by the manufacturers operating the warehouses, and published by BIR) was available for every year of the period of interest except 1919 and 1920. Estimates for these years were made on the basis of the percentage that such cigars comprised of the total manufactured in the United States in 1921.⁵

No account is taken in the NRP production index of differences in labor requirements for long-filler and short-filler cigars and of shifts in production between these types. Although the paucity of existing data did not permit the construction of a satisfactory weighted index of the production of long- and short-filler cigars, it was possible, by making a number of rough estimates, to construct for comparative purposes 4 such indexes with unit-labor-requirement weights. Each of these is restricted to large cigars since no data are available for labor requirements of small cigars.⁶

In constructing the 4 indexes, the number of long-filler and short-filler cigars was first estimated from the total production of large cigars on the basis of the proportions which (1) leaf tobacco and (2) scraps, cuttings, and clippings (which are used principally for short-filler cigars) represented of the total unstemmed equivalent weight of tobacco used for large cigars. The same average weight was assumed for the 2 types of cigars. Failure to take account of the amount of leaf tobacco used for wrapper and binder leaves in short-filler cigars and in all cigars produced in bonded warehouses probably has a negligible effect upon the estimated quantities of the 2 types.

⁴This practice takes advantage of the lower import duties prevailing for cigar-leaf tobacco as compared with finished cigars and also of the guarantee of the tobacco's origin provided by the stamp placed upon each box or package of such cigars.

⁵The percentage in 1921 was 0.5; the maximum, 1.3, occurred in 1933.

⁶Small cigars constitute a declining percentage of the total:

1919	....	9.1	1925	....	6.4	1931	....	5.9
1920	....	7.2	1926	....	5.9	1932	....	5.9
1921	....	9.0	1927	....	6.3	1933	....	4.8
1922	....	8.6	1928	....	6.1	1934	....	4.6
1923	....	6.7	1929	....	6.0	1935	....	3.6
1924	....	7.4	1930	....	6.1	1936	....	3.3

The failure of the NRP index to take account of differences in labor requirements for large and small cigars is of little consequence since an unweighted index of large cigars alone never differs from the NRP index by more than 3.3 percent.

Four unit-labor-requirement weights referring to 1935-36 were derived from a study of plant records made by the National Research Project in cooperation with the Bureau of Labor Statistics:⁷

(1) Long-filler cigars. The unit labor requirement for this type is an average of unit labor requirements for machine-made and hand-made cigars weighted by the respective production in 1935.⁸ The unit labor requirement for hand-made long-filler cigars is, in turn, a weighted average of the figures reported in the NRP-BLS study for 3 retail price classes; the weights used were the percentages of total production in 1935 accounted for by the cigars in each of the 3 price classes.

(2) Short-filler cigars made on 2-operator cigar machines.

(3) Short-filler cigars made by hand (teamwork system).

(4) Short-filler cigars bunched by machine and rolled by hand.

Since the number of short-filler cigars made by each method could not be determined, 4 different assumptions were made with respect to the weight to be applied to them; each ultimately yielded a different index:

(1) Weighted index A is based on the assumption that all short-filler cigars are machine-made.

(2) Weighted index B is based on the assumption that all short-filler cigars are made by hand (teamwork system).

(3) Weighted index C is based on the assumption that all short-filler cigars are bunched by machine and rolled by hand.

(4) Weighted index D is based on the assumption that an equal quantity of short-filler cigars is made by each of the 3 methods.

In view of the nature of these assumptions, the resemblance of the 4 indexes to the NRP index indicates that the latter, although based merely on the unweighted total number of cigars produced, may be regarded as reliable:

⁷Productivity of Labor in the Cigar Manufacturing Industry, preliminary report by W. D. Evans (NRP in cooperation with BLS), June 1937. The survey, the results of which are summarized in *Effects of Mechanization in Cigar Manufacture* (WPA National Research Project in cooperation with U. S. Bur. Labor Statistics, Dept. Labor, Report No. B-4, May 1938), covered 15 cigar-manufacturing plants in Pennsylvania, New Jersey, and New York in the months of February, May, August, and November, 1935, and January, April, July, and October, 1936. The figures shown in the report are averages for these 9 months.

⁸The number of machine-made cigars was estimated by multiplying the number of 4-operator, automatic, long-filler-cigar machines leased to cigar manufacturers in 1935 (as reported to NRP-BLS by the International Cigar Machinery Company) by the estimated annual production per machine (*Monthly Labor Review*, December 1931).

As a result of the marked shift from hand-made to machine-made cigars since 1919, the unit labor requirement derived for long-filler cigars on the basis of the estimated 1935 proportions of hand-made and machine-made is lower than that for earlier years. The consequent effect upon the 4 comparative production indexes is, however, negligible.

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Year	NRP production index	Weighted production index			
		A	B	C	D
1919	112.3	109.4	108.3	108.0	108.5
1920	125.9	127.2	123.4	122.5	124.3
1921	106.7	105.0	102.7	102.2	103.2
1922	106.1	105.1	102.6	102.0	103.2
1923	107.6	108.6	106.1	105.5	106.7
1924	102.8	101.8	101.0	100.9	101.2
1925	99.7	99.3	99.1	99.1	99.2
1926	99.6	99.3	99.8	99.9	99.7
1927	100.3	100.1	100.0	100.0	100.0
1928	97.9	97.6	97.8	97.9	97.8
1929	100.0	100.0	100.0	100.0	100.0
1930	90.4	88.8	90.9	91.3	90.4
1931	81.9	79.9	82.6	83.3	82.0
1932	67.3	65.8	67.6	68.1	67.2
1933	65.5	64.6	66.3	66.8	65.9
1934	68.8	66.9	70.1	70.9	69.4
1935	70.5	68.8	72.7	73.6	71.8
1936	77.6	75.5	80.4	81.6	79.3

Cigarettes.- The index of production is based on the total number of large and small cigarettes reported annually by BIR. Since large cigarettes (those which weigh more than 3 pounds per thousand) constitute a very small proportion of the total, weighting the 2 types before combination was not considered necessary.

Chewing and Smoking Tobacco and Snuff.- The production index was constructed from the total poundage of chewing and smoking tobacco and snuff reported by BIR. The 3 classes of products show dissimilar trends:⁹

Year	Index of production of -			
	Chewing and smoking tobacco and snuff (NRP)	Chewing tobacco	Scrap chewing and smoking tobacco ¹⁰	Snuff
1919	111.2	145.3	99.6	85.1
1920	108.2	143.9	95.5	83.5 [Con.]

⁹It would have been desirable to construct a weighted index of these products, but no data for their respective labor requirements were available. Census value statistics, moreover, are not suitable for the construction of weights since they are not sufficiently detailed, include taxes, and reflect differences in leaf-tobacco prices for the several products.

Footnote 10 appears on following page.

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[Con.]

Year	Index of production of -			
	Chewing and smoking tobacco and snuff (NRP)	Chewing tobacco	Scrap chewing and smoking tobacco ¹⁰	Snuff
1921	101.5	117.2	97.0	84.3
1922	110.0	124.9	106.0	92.7
1923	108.3	125.4	102.3	95.4
1924	108.7	116.0	107.6	94.9
1925	108.6	116.1	107.9	92.0
1926	107.7	114.0	107.3	92.9
1927	104.0	107.0	103.6	97.7
1928	101.3	103.8	100.7	98.4
1929	100.0	100.0	100.0	100.0
1930	97.5	89.6	101.1	99.1
1931	97.4	78.9	106.4	96.9
1932	91.1	63.6	105.0	87.5
1933	89.7	62.9	103.0	87.8
1934	90.7	64.1	103.6	89.7
1935	89.9	64.1	102.7	87.8
1936	91.3	63.9	104.3	92.5

Employment: Unadjusted

Census data were available for the number of wage earners in the Tobacco Products group and the 3 component industries for the odd-numbered years 1919-35.¹¹ The close agreement between taxes paid by establishments in the industry group which reported to the Census and the value of internal-revenue stamps sold by BIR in 1931, 1933, and 1935 (the only years for which tax figures are published by the Census) attests the comparability of the Census employment statistics for the group as a whole with the total output of tobacco products. In the case of the Cigars

¹⁰The production of scrap chewing tobacco is not shown separately prior to 1931. Since that year it has constituted about 20 percent of the combined production of scrap chewing and smoking tobacco. From 1931 to 1936 the output of scrap chewing tobacco has decreased, and since it has probably been declining over the entire period, the increase in smoking tobacco alone has in reality been greater than that shown by the index for both combined.

¹¹As defined in this section and in the one which follows (Man-hours: Unadjusted), each industry, in accordance with the usual Census practice, includes establishments which are engaged primarily in the manufacture of the products which give the industry its name. After the employment and man-hours series have been adjusted for comparability with production, however, each industry refers to the total output, wherever manufactured, of the products which give it its name.

The Census did not publish separate employment figures for the Cigars and Cigarettes industries in 1925. The combined total for that year was distributed in accordance with the average proportions of the components in the 2 adjacent census years.

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industry alone,¹² however, the figures of the 2 agencies agreed for 1931 and 1935, but the 1933 ratio of the value of internal-revenue stamps reported by the Census for the Cigars industry to the total value of such stamps reported by BIR for large cigars was only 0.8153. Therefore, to render employment comparable with the total production of cigars in this year, the reported number of wage earners was divided by 0.8153.¹³

The Census employment series for the industry group was interpolated for intercensal years 1920 and 1922 through the use of a comparable BLS index of employment. BLS indexes¹⁴ were also utilized to render continuous over the period 1923-36 the employment series for the Chewing and Smoking Tobacco and Snuff industry, the Cigars industry, and the Cigars and Cigarettes industries combined.¹⁵ Employment in the Cigarettes industry in the intercensal years 1924-36 was determined by subtracting the estimates for the Cigars industry from the figures for the Cigars and Cigarettes industries combined. Thus wage-earner estimates were available for the 3 industries separately for the years 1919, 1921, and 1923-36. The series were completed by distributing group employment in 1920 and 1922 among the 3 component industries in accordance, respectively, with their proportions in 1921 and the average of their proportions in 1921 and 1923.¹⁶

¹²Separate comparisons could not be made for the Cigarettes and the Chewing and Smoking Tobacco and Snuff industries because each of these produces considerable quantities of the normal products of the other. In 1933 and 1935, however, Census and BIR quantity-production statistics for cigarettes differed by less than 1 percent.

¹³The exclusion by the Census of establishments with an annual production of less than \$5,000 appears to account for only a small portion of the discrepancy, since, according to BIR data, such establishments produced less than 6 percent of the total number of cigars in 1933. The Census statistics for "Cigar Manufacturers" in this year were compiled from replies to mailed questionnaires rather than, as in previous years, from data collected by a direct canvass. The consequent failure of a large number of firms to report accounts for the major portion of the difference in the 2 sets of figures for 1933.

¹⁴All of the BLS employment indexes used for interpolation were adjusted to the Census trend. The attempt made by both the Census and BLS to exclude employees engaged in stemming (the process of removing the hard midrib of the tobacco leaf) was not always successful. Strict internal comparability of the employment data may not therefore be preserved over the entire period 1919-36.

¹⁵No separate BLS index was available for the Cigarettes industry. An unpublished annual employment index for the Cigars industry for 1923-36 was obtained through the courtesy of Dr. Isador Lubin, Commissioner of Labor Statistics.

¹⁶An examination of the production series for the 3 industries indicated that, in making the estimates for 1920, the 1921 proportions were preferable to the average of the proportions for 1919 and 1921. The production of cigars rose in 1920 and declined in 1921; cigarettes declined in 1920 and rose in 1921; and chewing and smoking tobacco and snuff declined in both years. It appeared probable, therefore, that the ratio of Cigars to total group employment was higher in 1920 than in 1919 and 1921. Since it was not possible to determine exactly how much higher that ratio should be, the 1921 proportions, which give greater importance to Cigars, were used.

Man-hours: Unadjusted

Man-hours were computed for each of the 3 industries by multiplying the employment estimates by corresponding annual series of average weekly hours. The latter were pieced together from a variety of sources.

Cigars.— Census statistics for prevailing weekly hours were available for the Cigars and Cigarettes industries combined for 1919, 1921, 1923, and 1929 and for the Cigars industry alone for 1929. (The latter is an unpublished figure furnished by the Bureau of the Census.) The 1929 ratio of prevailing hours for the Cigars industry to prevailing hours for the Cigars and Cigarettes industries combined was utilized to obtain prevailing hours for Cigars in the earlier census years. Estimates for the intermediate years for both the Cigars and the Cigars and Cigarettes industries combined were obtained by straight-line interpolation.

Actual weekly hours for the Cigars industry were available for 1929 and later years from several sources. First, actual weekly hours for 1933 were computed from the *Census of Manufactures*.¹⁷ Second, a study of the industry by Rossmoore, Robbins, and Co. supplied actual-weekly-hours data for 1929, 1932, and May-July, 1933.¹⁸ The ratio of Census to Rossmoore-Robbins actual hours for May-July, 1933 was used to reduce the latter for 1929 and 1932 to the Census level. Third, the Pennsylvania State Department of Labor and Industry furnished actual-hours data for 1929, 1930, and 1931;¹⁹ these were linked to the adjusted Rossmoore-Robbins figure for 1929 to obtain the estimates for 1930 and 1931. Fourth, unpublished actual weekly hours for 1935 and 1936 were secured from BLS. Finally, interpolation by means of weekly-hours figures for the Cigars and Cigarettes industry combined (obtained from the *Census of Manufactures* for 1933 and from BLS for 1934 and

¹⁷*Census of Manufactures: 1933, "Man-hour Statistics for 32 Selected Industries."* The Census survey covered 65.8 percent of the estimated total number of wage earners in the Cigars industry in 1933.

¹⁸Rossmoore, Robbins and Co., *Investigation of the Cigar Manufacturing Industry in its Establishment of a Code of Fair Competition* (NRA files, Nov. 3, 1933, as transcribed by W. D. Evans). A weighted average was computed from the figures shown for cigar makers, other processors, and other factory workers in hand and machine factories. The sample (excluding strippers) included 25.3 and 30.3 percent of the total number of wage earners in 1929 and 1932, respectively.

¹⁹Weighted annual averages were computed from the figures published in the *Monthly Bulletin* of the Department. The industry is designated as "Cigars and Tobacco", but since tobacco products in Pennsylvania are predominantly cigars the statistics were assumed to refer to cigars alone. The sample covered between 2 and 5 percent of the total number of wage earners in the industry.

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1935) yielded the estimate for 1934. The prevailing- and actual-hours series were spliced in 1929.

Cigarettes.— Prevailing weekly hours in the Cigarettes industry for the years 1919-29 were estimated by subtracting prevailing weekly man-hours (the product of prevailing hours and employment) in the Cigars industry from the corresponding figures for the Cigars and Cigarettes industries combined and dividing the result by Cigarettes employment. Since both prevailing and actual hours for 1930 were available from a BLS study,²⁰ the prevailing weekly hours for 1919-29 were reduced to the level of actual hours by application of the 1930 actual-prevailing ratio. Actual hours for 1933 were derived from the *Census of Manufactures*.²¹ In order to obtain the figures for the 5 remaining years, it was first necessary to secure actual weekly hours for the Cigars and Cigarettes industries combined. This was accomplished for 1931 and 1932 by applying to actual hours for Cigars the ratio in 1931 of Census prevailing hours for Cigars and Cigarettes combined to those for Cigars alone. (The latter is an unpublished Census figure.) Hours for the 2 industries combined were furnished for 1934-36 by BLS. Average actual weekly hours in the Cigarettes industry for 1931, 1932, and 1934-36 were then computed in the same way as prevailing hours for the earlier period.

Chewing and Smoking Tobacco and Snuff.— Average weekly hours worked in the Chewing and Smoking Tobacco and Snuff industry agree closely with those for the combined Cigars and Cigarettes industries for the years 1933-36:²²

Year	Chewing and Smoking Tobacco and Snuff industry	Cigars and Cigarettes industries combined
1933	34.3	34.7
1934	34.5	35.4
1935	34.9	35.0
1936	35.7	35.7

²⁰*Wages and Hours of Labor in the Cigarette Manufacturing Industry: 1930* (Bull. No. 532). The survey covered establishments in North Carolina, Kentucky, and Virginia in representative pay-roll periods of March, April, and May, 1930. About 50 percent of the total number of wage earners in the industry were included in the sample. Wage earners engaged in stripping operations were excluded to make the figures comparable with the employment data of the Census.

²¹For source see fn. 17. The Census sample included 99.9 percent of the estimated total number of wage earners in the Cigarettes industry in 1933.

Footnote 22 appears on following page.

The series shown for the Chewing and Smoking Tobacco and Snuff industry was used for 1933-36 and extended back to 1919 by applying to the average weekly hours for the Cigars and Cigarettes industries combined for 1919-32 the ratio of the 2 hours figures shown for 1933.

**Adjustment of Employment and Man-hours for
Comparability With Production**

Since secondary products constituted a negligible percentage of the total value of products of the Cigars industry in 1931, 1933, and 1935 (the only years for which data were available), the unadjusted employment and man-hours series appeared to be sufficiently comparable with production to require no further correction. Hence these labor series were converted into relatives to secure the NRP indexes.

The labor series for the other 2 component industries of the Tobacco Products group had to be adjusted for comparability with production since a considerable quantity of chewing and smoking tobacco and snuff is manufactured in the Cigarettes industry,²² and some cigarettes are made in the Chewing and Smoking Tobacco and Snuff industry. To estimate the number of wage earners and man-hours required for the total production of cigarettes and of chewing and smoking tobacco and snuff, respectively, it was assumed (see appended note) that the (Census) Cigarettes and the Chewing and Smoking Tobacco and Snuff industries:

(1) Both have the same value output per wage earner and per man-hour for (a) cigarettes and for (b) chewing and smoking tobacco and snuff.

(2) Together produce all chewing and smoking tobacco and snuff and all cigarettes.

(3) Produce only these 2 types of products.

The second and third assumptions are not strictly correct since some cigars and insecticides are made in these 2 industries and some cigarettes and chewing and smoking tobacco and snuff are made in the Cigars industry. The amounts involved, however,

²²For source of both 1933 figures see ft. 17; those for the other years were compiled by BLS. Hours reported by BLS for the Chewing and Smoking Tobacco and Snuff industry in 1932 and 1933 were considered unreliable since in both years the BLS sample was probably small and the estimate for 1933 (38.8) differed considerably from that derived from the *Census of Manufactures*. The Census figure is based on a sample representing 82.8 percent of the estimated total number of wage earners in the Chewing and Smoking Tobacco and Snuff industry in 1933.

²³In 1935, 38.8 percent of the total value of chewing and smoking tobacco and snuff was produced in the Cigarettes industry.

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are so small that they may be neglected without introducing any significant error into the final results.

Note on the Method of Segregating Employment and Man-hours for Cigarettes and for Chewing and Smoking Tobacco and Snuff²⁴

Let X = employment or man-hours required for total production of cigarettes,

Y = employment or man-hours required for total production of chewing and smoking tobacco and snuff.

C_c = value of cigarettes produced in the Cigarettes industry,

C_s = value of cigarettes produced in the Chewing and Smoking Tobacco and Snuff industry,

C = total value of cigarettes,

S_c = value of chewing and smoking tobacco and snuff made in the Cigarettes industry,

S_s = value of chewing and smoking tobacco and snuff made in the industry of the same name,

M_c = total employment or man-hours worked in the Cigarettes industry,

M_s = total employment or man-hours worked in the Chewing and Smoking Tobacco and Snuff industry,

m_c = employment or man-hours consumed in production of cigarettes in the Cigarettes industry, and

m_s = employment or man-hours consumed in the production of cigarettes in the Chewing and Smoking Tobacco and Snuff industry.

The assumptions are:

$$1. (a) \frac{C_c}{m_c} = \frac{C_s}{m_s}$$

$$(b) \frac{S_s}{M_s - m_s} = \frac{S_c}{M_c - m_c}$$

$$2. (a) C = C_c + C_s$$

$$(b) X = m_c + m_s$$

$$3. Y = M_c + M_s - X$$

Solving equations 1(a) and 1(b) for m_c and m_s and using 2, we obtain:

$$X = \frac{C (M_c S_s - M_s S_c)}{(C_c S_s - C_s S_c)}$$

²⁴This method was utilized for census years. For intercensal years M_c and M_s were used to interpolate m_c and $(M_s - m_s)$, respectively.

TOBACCO PRODUCTS GROUP

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Table 86.- SUMMARY INDEXES FOR THE TOBACCO PRODUCTS INDUSTRY GROUP: 1919-36
(1929 = 100)

Year	Production (employ- ment weights)	Employment	Output per wage earner	Produc- tion (man-hour weights)	Man-hours	Output per man- hour,
1919	92.0	135.3	68.0	93.9	137.6	66.1
1920	97.2	132.7	73.2	97.6	137.5	71.1
1921	90.2	129.2	69.8	92.0	130.9	70.3
1922	92.7	126.1	73.5	94.4	126.0	73.8
1923	97.4	126.0	77.3	96.7	127.9	77.2
1924	95.7	117.7	81.3	96.6	119.1	81.1
1925	95.4	113.8	83.8	96.1	114.9	83.6
1926	97.0	108.1	89.7	97.5	109.0	89.4
1927	97.9	111.4	87.9	98.2	111.9	87.8
1928	96.9	108.3	89.5	97.1	108.4	89.6
1929	100.0	100.0	100.0	100.0	100.0	100.0
1930	92.7	93.3	99.4	92.6	93.9	98.6
1931	86.0	85.9	100.1	86.0	76.7	112.1
1932	73.0	84.3	86.6	72.9	69.1	105.5
1933	72.3	85.8	84.3	71.9	62.6	114.9
1934	77.5	87.0	89.1	77.5	64.6	120.0
1935	79.7	78.0	102.2	80.2	57.4	139.7
1936	67.0	77.7	112.0	66.7	58.3	148.7

Table 87.- SUMMARY INDEXES FOR THE CIGARS INDUSTRY: 1919-36
(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	112.3	135.6	138.0	82.7	81.4
1920	125.9	136.5	138.5	92.2	90.9
1921	106.7	132.9	134.3	80.3	79.4
1922	106.1	129.6	131.2	81.9	80.9
1923	107.6	129.3	130.9	83.2	82.2
1924	102.6	116.5	119.7	86.8	85.9
1925	99.7	114.8	115.8	86.8	86.1
1926	99.6	108.7	109.4	91.6	91.0
1927	100.3	112.3	112.6	89.3	88.9
1928	97.9	106.7	106.9	91.8	91.6
1929	100.0	100.0	100.0	100.0	100.0
1930	90.4	92.2	91.8	98.0	98.5
1931	81.9	81.0	71.0	101.1	115.4
1932	67.3	79.7	64.2	84.4	104.8
1933	65.5	79.5	67.8	82.4	113.3
1934	68.8	75.0	54.5	91.7	126.2
1935	70.5	66.6	46.9	105.9	150.3
1936	77.6	66.5	49.6	116.7	156.5

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Table 88.- SUMMARY INDEXES FOR THE CIGARETTES INDUSTRY: 1919-36

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	43.4	136.4	140.3	31.8	30.9
1920	38.8	118.3	135.1	32.8	28.7
1921	42.6	110.3	110.4	38.6	36.6
1922	45.6	103.9	103.7	43.9	44.0
1923	54.5	99.9	99.4	54.6	54.8
1924	59.4	97.7	97.7	60.8	60.6
1925	67.2	97.8	97.9	68.7	68.6
1926	75.3	93.0	93.2	81.0	80.8
1927	81.6	105.1	105.6	77.6	77.3
1928	88.8	114.1	115.2	77.8	77.1
1929	100.0	100.0	100.0	100.0	100.0
1930	101.1	89.6	96.0	112.8	105.3
1931	95.6	88.6	88.5	107.9	108.0
1932	87.1	86.5	78.3	100.7	111.2
1933	93.9	100.4	76.6	93.5	122.6
1934	106.3	123.7	104.5	85.9	101.7
1935	114.4	113.8	101.4	100.5	112.6
1936	129.8	114.1	95.2	113.8	136.3

Table 89.- SUMMARY INDEXES FOR THE CHEWING AND SMOKING TOBACCO AND SNUFF INDUSTRY: 1919-36

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	111.2	131.5	134.1	84.6	82.9
1920	108.2	126.7	134.7	85.4	80.3
1921	101.5	128.3	130.3	79.1	77.9
1922	110.0	130.0	132.2	84.6	83.2
1923	108.3	134.8	136.8	80.3	79.2
1924	108.7	133.0	134.8	81.7	80.6
1925	108.6	124.1	125.3	87.5	86.7
1926	107.7	120.1	120.8	89.7	89.2
1927	104.0	112.3	112.5	92.6	92.4
1928	101.3	110.6	110.6	91.6	91.6
1929	100.0	100.0	100.0	100.0	100.0
1930	97.5	102.9	103.3	94.8	94.4
1931	97.4	109.0	97.1	89.4	100.3
1932	91.1	106.3	87.5	85.7	104.1
1933	89.7	104.7	76.1	85.7	117.9
1934	90.7	113.3	84.0	80.1	106.0
1935	89.9	102.3	75.7	87.9	118.6
1936	91.3	100.3	73.4	91.0	124.4

70. WOOLEN AND WORSTED GOODS GROUP

71. WOOLEN GOODS

72. WORSTED GOODS

The Woolen and Worsted Goods group, which employed 147,000 wage earners in 1929, comprises 2 industries: Woolen Goods and Worsted Goods. The former, which employed almost 59,000 wage earners in 1929, embraces the manufacture of all woolen yarns and goods in establishments included in the group; the latter embraces the manufacture of all worsted yarns and goods in these establishments. Both industries are concentrated largely in New England; there was little shift in location, even within this region, in the period 1919-36.

The manufacturing activities of each industry include (1) spinning of yarns, (2) weaving of goods, and (3) wool scouring, dyeing, and finishing in woven-goods establishments. Woolen goods are made of carded yarns, in which the fibers are crossed; worsted goods are made of combed yarns, in which the short fibers have been removed and the long ones left more nearly parallel.

Production

Woolen and Worsted Goods Group.— The NRP group production indexes for the odd-numbered years 1919-31 are harmonic means of the production relatives for the component industries; one, with changing employment weights, was used in determining output per wage earner, and the other, with changing man-hour weights, in determining output per man-hour. The index numbers of group production for 1933 are based on weighted aggregates computed from Census statistics for 45 woolen and worsted products for 1931 and 1933; those for 1935 are based on the unweighted output (square yards) of 11 classes of goods for which quantity statistics were reported by the Census for both 1933 and 1935.¹ The group indexes were rendered continuous for the period 1919-36 by means of the Federal Reserve index of machinery activity.²

¹The 2 additional segments were required after 1931 because of changes in classification in 1933 and 1935. The 45 products in the first segment, which embrace practically all the output of woven goods and yarns, were weighted by 1931 unit values. The 11 classes in the second represent about 93 percent of the total number of square yards of woven goods (yarns are excluded) produced in 1935. For the years prior to 1935, relatives of the unweighted total yardage of woven goods are usually in close accord with the NRP index adjusted to exclude yarns.

²This index was obtained from *Federal Reserve Index of Industrial Production* (mimeo., April 1936) for the years 1919-35 and *Federal Reserve Bulletin* for 1936; it is based on the "percentage of loom and spindle hours active", as computed from data compiled by the Bureau of the Census.

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The NRP group indexes are almost identical with arithmetic means of the production relatives for the 2 industries weighted by employment and man-hours in 1929:

Year	Index of production with -			
	Changing weights		Fixed weights (1929)	
	Employment	Man-hours	Employment	Man-hours
1919	101.3	101.3	101.2	101.2
1921	99.2	99.1	99.3	99.2
1923	128.2	128.2	128.2	128.2
1925	110.9	111.1	111.1	111.2
1927	104.7	104.7	104.7	104.7
1929	100.0	100.0	100.0	100.0
1931	80.8	80.7	81.0	80.9

Woolen Goods.— The production measure for the Woolen Goods industry comprises 2 segments, each of which is an aggregative index constructed from Census output statistics. The first segment, for the odd-numbered years 1919-27, includes 12 series; the second, for 1927-31, includes 4. The series entering into each segment were weighted by averages of unit values for the corresponding years.^{3,4}

The change in the number of classes of products entering into the 2 segments results from a change in classification. The 12 classes in the first segment, which include practically all woolen goods and yarns,⁵ are:

³Quantity statistics for some products are reported by the Census for establishments engaged primarily in the manufacture of woolen goods and for those engaged primarily in the manufacture of worsted goods. The quantities produced in the 2 types of establishments were added before being weighted. The quantities (and values) of "all other woolen woven goods" and "all other worsted woven goods" (see discussion of production of the Worsteds Goods industry) were reported in combination for each of the 2 Census industries in all years of the first segment. They were segregated in accordance with the ratios for each Census industry of (a) the total quantity (and value) of all specified woolen woven goods and of (b) the total quantity (and value) of all specified worsted woven goods to (c) the sum of (a) and (b).

⁴Available data for labor requirements and labor costs were too fragmentary for use in developing more adequate weights than unit values. Federal Trade Commission statistics, published in reports on *Textile Industries* (e. g., January 1937), permit the computation of labor cost per dollar of sales in groups of spinning and weaving establishments; these refer to only a few products which do not correspond exactly to classes included in the NRP index. A BLS study of time and labor costs of production (*Monthly Labor Review*, September 1928) indicates, however, that in 1927 the relationship between time and labor cost per yard for 4 specific kinds of woolen woven goods and 23 specific kinds of worsted woven goods is fairly uniform. Ratios of man-hours (per unit) to value (per unit) in 1935 for broad classes of products (more strictly, for establishments engaged primarily in the manufacture of these products) are also fairly constant (see fn. 12 for source of statistics):

Woolen woven goods	Woolen yarns	.... 2.316
(including woven felts) 2.032	Worsteds yarns	.... 2.332
Worsteds woven goods		.... 2.492

Footnote 5 appears on following page.

Woven goods	Blankets
Suitings, dress goods, overcoatings, and cloakings ⁶	(6) All-wool
(1) All-wool woolen	(7) Cotton mixed
(2) Wool and cotton mixed	(8) Cotton warp
(3) Cotton-warp woolen	(9) Horse
(4) Domett flannels and shirtings	(10) All other woolen woven goods ^{3,7}
(5) Satinets and linseys	Yarns for sale
	(11) All-wool
	(12) Union or merino

The 4 classes in the second segment embrace the 10 types of woven goods in 1 category,⁸ the 2 varieties of yarn separately, and an additional item, "wool-card rolls, batts, and batting, for sale."

Although the group index was completed for the period 1919-36, it was not possible to extend the Woolen Goods index beyond 1931 or to interpolate relatives for the even-numbered years.⁹

Worsted Goods Industry.— The NRP production index for the Worsted Goods industry was constructed for the odd-numbered years 1919-31 by splicing 2 segments representing practically all worsted goods and yarns.⁵ The first segment, for 1919-27, contains 8 classes of products:

⁵The quantities and values of the items entering into the first segment refer to the total output of establishments in the group; those entering into the second segment represent the total output of all industries.

⁶The 1927 Census quantities for the subclasses of both woolen and worsted "suitings, dress goods, overcoatings, and cloakings" are not strictly comparable with those for earlier years because of a change in the method of reporting. The value of the items consequently excluded from the 2 industry indexes, however, represented only 6 percent of the total for woolen and worsted "suitings, dress goods, overcoatings, and cloakings" and less than 4 percent of the total for all woolen and worsted goods.

⁷To maintain internal comparability, the quantities of "all-wool and cotton-mixed flannels for underwear" were included in the years 1919-25.

⁸The quantities (and values) of "woolen woven goods" and "worsted woven goods", reported in combination for each of the 2 Census industries for 1929 and 1931, were separated in the same manner as the quantities (and values) of "all other woolen woven goods" and "all other worsted woven goods" for 1919-27 (see *fta.* 3).

⁹Three series available for all years did not concur sufficiently with the NRP index for the Woolen Goods industry to be used for completion of the latter. One of these series, for raw-wool consumption, was derived from the *Census of Manufactures*; the others, for machinery activity (spinning spindles and sets of cards), are based on figures computed from Census data and published in *Survey of Current Business*. The 3 series compare as follows with the NRP index:

Year	NRP production index	Index of -		
		Raw-wool consumption	Spinning spindles	Sets of cards
1919	102.3	82	106	102
1921	92.2	101	92	87
1923	127.7	122	118	120
1925	117.4	112	108	105
1927	108.4	100	100	98
1929	100.0	100	100	100
1931	72.2	75	73	70

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Woven goods		Yarns for sale	
	Suitings, dress goods, overcoatings, and cloakings ⁶	(4)	All-wool
(1)	All-wool worsted	(5)	Union or merino
(2)	Cotton warp worsted	(6)	All other
(3)	All other worsted woven goods ³	(7)	Noils and wool waste, for sale
		(8)	Tops and slubbing, for sale

The second segment, for 1927-31, is based on 6 classes; the reduction in number is a result of the Census' consolidation of the figures for all worsted woven goods.⁸ The series entering into each segment were weighted by averages of unit values for the corresponding years.^{3,4}

No satisfactory series was available for the completion of the Worsted Goods index for the period 1919-36.¹⁰

Employment and Man-hours

The group employment index was constructed for the odd-numbered years 1919-35 from Census wage-earners statistics;¹¹ it was interpolated for the years 1919-23 by means of the NICB index (for "Wool Manufacturing") and completed for the years 1923-36 by means of the BLS index.

The man-hours index for the group was constructed for the period 1919-36 from the employment series and another for average actual weekly hours. The latter is based on (1) figures for 1933 and 1935 computed from Census statistics for man-hours and employment

¹⁰As in the case of the Woolen Goods industry, 3 series available for all years were not considered satisfactory for interpolation or extrapolation. These series - 1 for raw-wool consumption, which was derived from the *Census of Manufactures*, and 2 for machinery activity (spinning spindles and sets of combs), which are based on figures computed from Census data and published in *Survey of Current Business* - compare as follows with the NRP index:

Year	NRP production index	Index of -		
		Raw-wool consumption	Spinning spindles	Sets of combs
1919	100.5	124	118	99
1921	104.2	135	122	106
1923	128.5	158	137	117
1925	106.8	111	100	92
1927	103.5	92	100	95
1929	100.0	100	100	100
1931	87.0	90	92	106

¹¹Because of a change in industry classification, it was necessary to estimate the number of wage earners in the group in 1935. First, a sum was obtained for the corresponding new Census industries (Woolen Woven Goods, Including Woven Felts; Woolen Yarns; Worsted Woven Goods; and Worsted Yarns); from this sum, the estimated number of workers engaged in the production of woven felts was deducted. The latter figure is an average of estimates computed on 2 alternative assumptions: (1) The value per wage earner for woven felts is the same as the value per wage earner for all products of the Felt Goods, Except Woven Felts industry; and (2) the value per wage earner for woven felts is the same as the value per wage earner for all products of the Woolen Woven Goods, Including Woven Felts industry.

and (2) figures for other years derived by means of a continuous series which includes NICB actual hours for 1920-36 and adjusted Census prevailing hours for 1919.¹²

The employment and man-hours indexes for the separate industries, which were constructed for only the odd-numbered years 1919-31, correspond to the respective production indexes.¹³ First, preliminary series were prepared for the Census industries, which embrace establishments engaged primarily in the manufacture of woolen goods or worsted goods. The *Census of Manufactures* provided the necessary employment statistics. The 2 man-hours series were constructed from these employment statistics and figures for average actual weekly hours. The latter were obtained by the multiplication of actual weekly hours for the group by (1) the ratios of Census prevailing weekly hours for each industry to Census prevailing weekly hours for the group in 1919, 1921, 1923, and 1929; (2) similar ratios for 1925 and 1927 obtained by straight-line interpolation; and (3) ratios for 1931 derived by straight-line interpolation between those for 1929 and others for 1933 based on Census actual hours. These preliminary employment and man-hours series were then adjusted so as to correspond to the total production of woolen goods and of worsted goods.¹³ The redistribution was accomplished (see appended note) on the assumptions that the (Census) Woolen Goods and Worsted Goods industries:

- (1) Have the same value output per wage earner and per man-hour for (a) woolen goods and for (b) worsted goods.
- (2) Together produce all woolen and worsted goods.
- (3) Produce only these 2 kinds of products.

¹²The average weekly hours for 1933 and 1935, respectively, were computed from *Census of Manufactures: 1933, "Man-hour Statistics for 32 Selected Industries"* and *Census of Manufactures: 1935, "Man-hour Statistics for 59 Selected Industries."* The sample for 1933 included 84 percent of all wage earners in the group; the sample for 1935, 91 percent.

The NICB series is not only continuous since 1920 but closer than the BLS regular-survey series to the computed Census figures for 1933 and 1935:

Year	Census	NICB	BLS
1933	39.4	39.5	41.3
1935	36.0	36.7	36.8

Census prevailing hours for 1919 were adjusted by the average of the ratios of NICB actual to Census prevailing hours for 1921, 1923, and 1929.

¹³The final labor series, however, are not exactly comparable with the production indexes in scope for (1) they include some wage earners engaged in the fabrication of secondary products (less than 2 percent of the total value of the output of the group) which do not normally belong to either component industry and (2) they exclude some wage earners producing woolen and worsted goods outside the group (also less than 2 percent of the total by value) in 1927, 1929, and 1931. (See ft. 5.)

No attempt was made to extend the labor indexes for the 2 industries beyond 1931 because the production indexes were not available after this year.

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The validity of the first assumption cannot be tested; available evidence indicates that the others are tenable.¹³

Note on the Method of Segregating Employment and Man-hours for Woolen Goods and for Worsted Goods¹⁴

- Let X = employment or man-hours required for total production of woolen goods,
 Y = employment or man-hours required for total production of worsted goods,
 L_l = value of woolen goods produced in the Woolen Goods industry,
 L_r = value of woolen goods produced in the Worsted Goods industry,
 L = total value of woolen goods,
 R_l = value of worsted goods produced in the Woolen Goods industry,
 R_r = value of worsted goods made in the Worsted Goods industry,
 N_l = total employment or man-hours worked in the Woolen Goods industry,
 N_r = total employment or man-hours worked in the Worsted Goods industry,
 m_l = employment or man-hours consumed in production of woolen goods in the Woolen Goods industry, and
 m_r = employment or man-hours consumed in the production of woolen goods in the Worsted Goods industry.

¹⁴In order to obtain L_l , L_r , R_l , and R_r for some years, it was necessary to distribute the values of certain products which were not reported in sufficient detail. In 2 instances similar woolen and worsted products were reported separately for the group but in combination for each industry: (1) "Union or merino woolen yarns" and "union or merino worsted yarns" for 1921-27 and (2) "wool-card rolls, batts, and batting, for sale" and "tops and slubbing, for sale" for 1927 and 1929. In the first instance the value of each type of yarn in the years 1921-27 was determined for each Census industry through the use of the 1919 ratio of the value of each type to the total for both for the Woolen Goods industry; in the other instance the ratio for the Woolen Goods industry in 1931 was used to effect the separation. In other cases, in which the total value of a woolen or worsted product was reported only for the group as a whole, the separation was accomplished on the assumption that the proportions of the total for the 2 industries were the same in each year as in the years for which the detailed statistics were available. This method was applied to the separation of "cotton-warp woolen suitings, dress goods, overcoatings, and cloakings" in 1927 (on the basis of the averages of the proportions in 1919-25); "cotton-warp worsted suitings, dress goods, overcoatings, and cloakings" in 1927 (on the basis of the averages of the proportions in 1919-25); "all-wool blankets" in 1921-27 (on the basis of the 1919 proportions); "domett flannels and shirtings" in 1921 (on the basis of the 1919 proportions); "all-wool woolen yarns" in 1931 (on the basis of the averages of the proportions in 1927-29); and "mohair and similar yarns" in 1927 and 1931 (on the basis of the 1929 proportions).

In several other instances no basis was provided for the reallocation of value; although in some years the value of output in one industry was included in the statistics for the other, in no year were the values for the 2 industries reported separately. For example, the value of "cotton-warp
 [Continued]

The assumptions are:

$$1. (a) \frac{L_l}{m_l} = \frac{L_r}{m_r}$$

$$(b) \frac{R_r}{M_r - m_r} = \frac{R_l}{M_l - m_l}$$

$$2. (a) L = L_l + L_r$$

$$(b) X = m_l + m_r$$

$$3. Y = M_l + M_r - X$$

Solving equations 1(a) and 1(b) for m_l and m_r and using 2, we obtain:

$$X = \frac{L (M_l R_r - M_r R_l)}{(L_l R_r - L_r R_l)}$$

Table 70.- SUMMARY INDEXES FOR THE WOOLEN AND WORSTED GOODS INDUSTRY GROUP: 1919-36

(1929 = 100)

Year	Production (employment weights)	Employment	Output per wage earner	Production (man-hour weights)	Man-hours	Output per man-hour
1919	101.3	113.5	89.3	101.3	114.0	88.9
1920	89.8	102.3	87.8	89.8	92.4	97.2
1921	99.2	110.5	89.8	99.1	109.3	90.7
1922	106.0	113.5	93.4	106.0	118.4	91.1
1923	128.2	132.4	96.8	128.2	135.5	94.6
1924	106.9	118.6	90.1	107.0	110.9	96.5
1925	110.9	112.4	98.7	111.1	108.8	104.0
1926	103.6	101.9	101.7	103.7	99.3	104.4
1927	104.7	105.0	99.7	104.7	102.1	102.5
1928	99.3	100.6	98.7	99.3	96.3	103.1
1929	100.0	100.0	100.0	100.0	100.0	100.0
1930	73.6	81.5	90.3	73.6	73.1	100.7
1931	80.8	81.3	99.4	80.7	73.3	110.1
1932	67.0	67.9	98.7	66.9	57.5	116.3
1933	86.5	86.6	99.9	86.4	73.7	117.2
1934	72.4	81.3	89.1	72.3	57.2	126.4
1935	114.2	107.9	105.8	114.0	83.9	135.9
1936	111.4	103.1	108.1	111.1	78.8	141.0

¹⁴[Continued]

blankets¹⁴ reported for the Woollen Goods Industry for 1923, 1925, and 1927 includes the value of such blankets made in the Worsted Goods Industry; the figures for 1919 and 1921, however, refer only to the output of the Woollen Goods Industry.

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Table 71.- SUMMARY INDEXES FOR THE WOOLEN GOODS INDUSTRY:
CENSUS YEARS 1919-31

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	102.3	121.5	123.6	84.2	82.8
1921	92.2	105.5	105.2	87.4	87.6
1923	127.7	130.4	138.5	97.9	92.2
1925	117.4	112.6	109.6	104.3	107.1
1927	106.4	106.1	104.5	100.3	101.8
1929	100.0	100.0	100.0	100.0	100.0
1931	72.2	74.1	66.7	97.4	108.2

Table 72.- SUMMARY INDEXES FOR THE WORSTED GOODS INDUSTRY:
CENSUS YEARS 1919-31

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Wage earner	Man-hour
1919	100.5	107.9	107.2	93.1	93.8
1921	104.2	113.9	112.2	91.5	92.9
1923	128.5	133.7	133.4	96.1	96.3
1925	106.8	112.3	104.9	95.1	101.8
1927	103.5	104.3	100.4	99.2	103.1
1929	100.0	100.0	100.0	100.0	100.0
1931	87.0	86.3	77.9	100.8	111.7

PRODUCTION EMPLOYMENT AND PRODUCTIVITY IN 59 MANUFACTURING INDUSTRIES

PART THREE: APPENDIXES



WORKS PROGRESS ADMINISTRATION
NATIONAL RESEARCH PROJECT

WORKS PROGRESS ADMINISTRATION

F. C. HARRINGTON
Administrator

CORRINGTON GILL
Assistant Administrator

NATIONAL RESEARCH PROJECT

on

**Reemployment Opportunities and Recent Changes
in Industrial Techniques**

DAVID WEINTRAUB
Director

Studies of the Labor Supply, Productivity, and Production
Harry Magdoff, Statistician in Charge

**PRODUCTION, EMPLOYMENT, AND PRODUCTIVITY
IN 59 MANUFACTURING INDUSTRIES,
1919-36**

**With an Appendix on the Electric Light and Power
and Telephones Industries**

by

Harry Magdoff

and

Irving H. Siegel Milton B. Davis

PART THREE: APPENDIXES

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PART THREE: APPENDICES

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APPENDIX A

BASIC TABLES FOR 59 MANUFACTURING INDUSTRIES

EXPLANATORY NOTES

This appendix comprises the more or less final series used in the derivation of the NRP indexes of production, employment, man-hours, and productivity for 59 manufacturing industries. These series incorporate most of the adjustments and estimates required for the achievement of continuity and comparability. The description of methods in Part Two of the report will be found helpful in using this appendix.

Many of the terms employed here have already been defined in Part One, chapters I and II. The order of the industries and groups is the same as in Part One, chapter II, table IV, and in Part Two. The tables are numbered consecutively. Those for each industry or group appear together, usually in the following order: Production - basic series, production - auxiliary series,¹ employment, average weekly hours,² and man-hours.³

In many tables the figures were rounded off so that fewer places are shown than were used in the computation of the NRP indexes. This was done not only to conserve space but also to avoid the implication that certain estimates are correct to the very last digit used in computations (e. g., employment estimates interpolated for the even-numbered years, or man-hours for all years). If a group employment figure for any year is shown as reported, it is not necessarily the sum of those for the component industries, which may have been estimated and, hence, rounded off. If a group employment or man-hours figure was derived by the summation of those for the component industries, it was rounded off if any of the latter had been rounded off.

The procedure as described in the footnotes to the tables may sometimes vary in minor details from the description in Part Two.

¹Also called "interpolating" series or, if they refer to individual products, series for "selected products."

²When the series represents only actual hours, the word "worked" appears in the column heading. This word is omitted, however, if the series includes any unadjusted prevailing hours.

³Man-hours are generally omitted when both employment and average weekly hours are presented. Series for wages and hourly earnings are also shown if used in the derivation of man-hours.

The difference results from an endeavor (1) to reduce the number of tables in this appendix necessary for reproducing the NRP indexes and (2) to present absolute figures where relatives were actually used if the former were considered to be of additional interest *per se*. In any case, the alternative procedures are equivalent to those described in Part Two.

The presentation was simplified through the use of abbreviated footnote references or their omission altogether when common to many industries. Thus when different volumes of a series extending over several years are referred to in the same footnote, every one but the first is designated "*ibid.*: (year)", or simply by year. The entry "n. a." signifies that satisfactory data were not available, while a dash (-) indicates either that no figure was required or that none could be computed because of a deficiency in one or more underlying series also shown in this appendix. Reports on field surveys made by the National Research Project in cooperation with the National Bureau of Economic Research or the Bureau of Labor Statistics are sometimes referred to simply as "NRP-NBER" or "NRP-BLS" studies.

Since the *Census of Manufactures* (U. S. Dept. Com., Bur. Census) provides most of the production (quantity) statistics, it is to be understood as the source when none is cited. Furthermore, the specific volume from which the statistics were obtained is seldom indicated by date since they are usually available in others also. The most recent Census figures were used where revisions had been made. Volumes published as part of decennial censuses and those embodying the results of the regular biennial canvasses are not distinguished from each other in the footnotes.⁴ The adjective "Census" is used to designate statistics derived from the *Census of Manufactures*. A "census year" is an odd-numbered year for which a canvass was made by the Bureau of the Census, and an "intercensal year" is an even-numbered year. The *Census of Manufactures* is also the source of value statistics for which no source is cited; these were employed principally in the computation of unit values for use as fixed weights (in absolute or relative form) or in the derivation of unit-value-added weights.

One of the procedures not indicated in the footnotes is the adjustment of incomplete Census production statistics for the

⁴Thus, *Census of Manufactures: 1919* refers to volume X of the Fourteenth Decennial Census.

following 18 industries in 1933 (described in Part One, chapter II, "Census Production Series"):⁵

1. Agricultural Implements
5. Biscuit and Crackers
6. Bakery Products Other Than Biscuit and Crackers
12. Chemicals
20. Fertilizers
21. Flour and Other Grain-Mill Products
25. Plate Glass
26. Glass Containers
27. Pressed and Blown Ware
38. Sole and Harness Leather
39. Side and Upholstery Leather
40. Calfskin
41. Kid Leather
42. Sheep and Miscellaneous Leather
46. Manufactured Gas
54. Paints and Varnishes
63. Other Rubber Goods
65. Slaughtering and Meat Packing

Similar adjustments of incomplete quantity statistics for years other than 1933 are always indicated.

The fact that the 1929 Census "production" statistics for at least the following 19 industries refer to sales (more strictly shipments or deliveries) is also not noted:⁶

5. Biscuit and Crackers
6. Bakery Products Other Than Biscuit and Crackers
7. Cane-Sugar Refining
9. Canned and Preserved Fruits and Vegetables
10. Canned and Cured Fish
17. Confectionery
21. Flour and Other Grain-Mill Products
22. Furniture
24. Window Glass
25. Plate Glass
26. Glass Containers
27. Pressed and Blown Ware
28. Ice Cream
47. Manufactured Ice
48. Motor Vehicles
54. Paints and Varnishes
60. Rayon
62. Rubber Tires and Inner Tubes
63. Other Rubber Goods

⁵The adjustment could not be made for a nineteenth industry, Confectionery (No. 17), since sufficient data were not available.

When unit values for 1933 were required, they were computed from the unadjusted quantity and value statistics.

⁶Only the 1929 value figure was used for Furniture (No. 22).

4 PRODUCTION, EMPLOYMENT, AND PRODUCTIVITY

In addition to production statistics, the *Census of Manufactures* provided most of the employment and pay-rolls data (wages) for the odd-numbered years. In the absence of a specific citation, it is to be understood as the source of the wage-earner figures for these years. When the year and page of a particular volume are cited, the data are available in no other. The Census employment and pay-rolls series were usually completed, if necessary, by means of the Bureau of Labor Statistics indexes published in *Revised Indexes of Factory Employment and Pay Rolls: 1919 to 1933* (Bull. No. 610), *Revised Indexes of Factory Employment and Pay Rolls* (mimeographed release, November 1936), and various issues of the *Monthly Labor Review*. No mention is made of this fact in the footnotes. Furthermore, since BLS indexes conform to Census trend,⁷ they were often used as the NRP series for all years; this, too, is not indicated in the footnotes.⁸ When employment figures were obtained from special BLS studies (usually in the Wages and Hours Series), the specific bulletins are always named.

In addition to BLS series, National Industrial Conference Board statistics were sometimes used in conjunction with Census employment and pay-rolls data. These statistics, which are identified merely as "NICB", were almost invariably obtained from *Wages, Hours, and Employment in the United States: 1914-1936* (New York: 1936).

The figures for average weekly hours and average hourly earnings used in the derivation of most of the NRP man-hours indexes are based principally on BLS and NICB series. These are identified simply as "BLS" and "NICB" hours or earnings. Most of the BLS hours and earnings were supplied to NRP in an unpublished report.⁹ The BLS hours for 1932 and subsequent years are sometimes referred to as "regular BLS" hours to distinguish them from those

⁷All the BLS series, which conform to the Census levels for 1919-33, were adjusted by NRP for 1934-36 to the Census level of 1935. This adjustment is also not noted in the tables. Recently, after most of the NRP indexes had been constructed, BLS made its adjustment to the 1935 level. Since the differences were usually very small, the adjusted BLS figures for these years were not substituted for those computed by NRP. (See Part One, chapter II, "Census Employment Series and Their Completion," for a description of the BLS series.)

⁸In order to convert the BLS relatives to absolute figures, they were first shifted from the base 1923-25 to the base 1929 and then multiplied by the 1929 Census figures.

⁹The BLS average weekly hours for January-October 1932 for Bread and Other Bakery Products (No. 4), Canning and Preserving (No. 8), and Furniture (No. 22) were derived from transcriptions made by NRA; the hours for 1937 for Rayon (No. 60) were obtained from the *Monthly Labor Review*.

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obtained from BLS bulletins. These BLS bulletins are always identified by name or number or both.

Unless otherwise indicated, the NICB hours and earnings were derived from *Wages, Hours, and Employment in the United States: 1914-1936* and various issues of the *Conference Board Service Letter*. Whether or not noted in the tables, the NICB annual employment, pay-rolls, hours, and earnings figures for 1920 refer to but 7 months (June-December), and those for 1922 to but 6 months (January-June).

The prevailing weekly hours for 1919, 1921, 1923, and 1929, which are usually referred to as "Census prevailing hours" or simply "prevailing hours", were derived from frequency distributions shown in the *Census of Manufactures* for these years.

Table A-1.- PRODUCTION OF PRINCIPAL AGRICULTURAL IMPLEMENTS: 1920 TO 1951

Product	Weight ^a	1920 ^b	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1951
Plows and listers													
Moldboard plows													
Horse													
Walking													
1-horse	5.87	370,979	132,548	96,298	217,384	201,422	227,218	227,155	202,349	208,809	242,186	188,212	75,561
2-horse and larger	12.95	346,351	179,876	190,708	285,083	219,579	182,306	211,940	165,638	185,436	204,545	172,790	54,784
Sulky													
1-bottom	62.36	51,911	28,741	8,814	26,528	20,901	17,331	25,461	24,246	16,379	22,617	14,274	5,805
2-bottom and larger	94.28	51,038	19,155	7,615	33,419	22,172	29,462	55,765	34,009	29,833	33,649	17,191 ^c	1,529 ^d
Tractor													
2-bottom	64.10	87,059	9,846	41,580	55,479	32,124	48,966	72,304	53,365	55,558	61,698	58,408	17,613
3-bottom	105.70	44,509	9,321	2,503	4,704	1,950	3,749	11,956	14,419	26,776	38,106	22,268	4,885
Listers (middle busters), horse, 1-bottom	24.49	35,551	20,607	7,032	34,576	31,413	30,536	39,878	23,779	25,689	37,255	36,082	6,859
Harrows, rollers, pulverisers, and stalk cutters													
Harrow sections													
Spike-tooth	6.80	169,529	175,777	98,640	194,570	180,573	176,951	315,844	242,459	283,612	339,192	275,677	102,838
Spring-tooth	11.44	92,601	82,527	67,246	120,462	87,850	109,464	117,757	117,434	133,029	126,306	104,159	44,018
Disk harrows													
Horse	42.77	164,586	80,403	45,457	91,224	57,618	66,828	96,525	76,864	80,490	81,402	61,795	20,094
Tractor	91.04	67,095	36,118	24,492	35,415	28,081	29,086	45,439	45,816	53,637	57,447	51,969	26,769
Soil pulverisers and packers	46.72	31,085 ^d	7,283	2,940	11,873	9,046	6,757	19,339	22,813	18,499	16,831	19,205	5,892
Planting and fertilizing machinery													
Corn planters, horse, 2-row													
Combination corn and cotton planters	55.78	59,627	35,765	12,917	41,324	37,907	41,173	53,272	42,533	45,033	55,393	53,247	27,713
1-row	20.39	90,732	33,142	9,595	34,791	50,919	52,140	65,235	39,636	41,702	80,995	79,196	10,962
2-row	70.48	2,854	1,869	3,901	8,953	5,830	10,787	9,013	4,893	4,013	12,966	16,243	4,431
Combined listers and drills	86.24	8,939	12,408	5,920	4,463	17,308	20,203	22,908	9,231	5,289	7,004	15,323	2,031
Grain drills													
Horse	150.60	100,637	41,106	16,741	29,425	15,288	31,777	45,041	52,506	63,087	51,113	34,133	8,893
Tractor	174.10	3,406	1,465	865	1,147	291	805	2,072	6,123	10,347	19,295	12,663	2,487
Fertilizer distributors, horse or tractor	7.76	48,540 ^e	19,553	14,845	38,398	50,780	68,058	84,407	53,427	63,154	92,741	77,917	21,096
Mature spreaders	117.86	103,036	44,145	24,023	36,548	35,842	53,839	67,322	67,722	62,559	61,000	47,722	19,707
Potato planters, horse	67.14	8,471	6,456	6,618	5,760	4,058	3,539	6,340	6,357	12,543	6,540	4,294	4,130
Cultivators and weeders													
Cultivators, horse-drawn, except disk													
1-horse	4.83	316,312	86,349	58,619	154,786	129,372	155,539	136,154	132,244	159,173	202,755	156,134	57,999
1-row													
Walking	32.25	57,379	32,987	20,651	54,142	71,904	51,975	68,121	34,546	37,401	51,694	41,365	8,822
Riding	36.78	121,637	104,932	57,699	137,368	118,036	122,292	147,224	86,691	91,978	115,254	98,443	40,502
2-row	82.32	74,827	23,502	11,283	27,844	46,921	50,471	64,723	41,037	37,567	54,505	44,659	10,405

Harvesting machinery													
Potato-digging machines (elevator type)	80.08	11,718	7,707	15,585	10,099	7,458	4,594	7,058	12,139	16,428	9,400	7,892	5,908
Grain binders	163.84	139,372	72,314	38,332	62,764	55,751	42,405	79,155	71,091	67,099	55,069	46,166 ^f	18,566 ^f
Combines (harvester-threshers)	1,371.42	3,627	5,027	2,846	4,012	5,828	5,131	11,780	16,307	25,392	35,987	24,409	8,907
Haying machinery													
Mowers	55.79	259,165	105,826	80,484	130,374	126,448	112,299	112,259	110,644	121,955	128,560	117,601	45,312
Rakes, sulky (dump)	30.69	84,495	54,228	30,019	44,392	52,479	61,050	42,209	51,058	46,298	58,154	45,919	17,788
Loaders	79.21	55,337	21,497	15,891	23,340	13,454	15,748	19,793	25,102	24,695	24,920	28,222	10,943
Rakes (sweep)	39.87	22,954	14,444	9,091	15,011	13,846	11,092	13,270	12,265	17,125	18,273	17,151	7,118
Stackers	54.14	10,129	6,818	1,651	3,651	4,841	3,716	4,004	3,342	5,409	8,276	5,092	2,369
Machines for preparing crops for market or for use													
Grain threshers (steel)													
Width of rear-													
46 inches or under	863.33	7,280	5,286	2,832	6,353	6,487	10,486	13,327	12,688	15,909	12,180	7,572	3,231
47 inches or over	1,211.45	1,312	1,357	667	1,677	1,558	1,898	2,705	1,605	1,931	1,378	922	557
Ensilage cutters (silo fillers)	210.15	27,004	12,251 ^g	15,465 ^h	12,846 ^h	10,582	8,771	8,857	9,247	9,817	6,065	6,749	3,156
Corn shellers, power, cylinder	356.99	850	1,100	727	1,746	1,949	1,343	1,607	1,498	1,996	2,162	1,453	1,052
Hay presses, engine	416.20	5,247	2,914	1,953	3,010	1,814	1,744	1,849	2,047	1,955	2,172	2,069	1,311
Feed grinders and crushers, power	68.08	61,977	15,336	42,572	53,007	39,492	53,283	41,221	40,743	47,301	53,106	25,692	17,124
Grain cleaners and graders (for small grains only)	56.49	19,765	3,962	4,842	7,148	8,899	17,329	16,890	15,237	10,120	11,635	9,125	3,642

^aUnit value (dollars) in 1929.

^bH. R. Folley and L. M. Church, Manufacture and Sale of Farm Equipment in 1920 (U. S. Dept. Agr., Dept. Circular No. 212, Apr. 1922).

^cTwo-bottom only.

^dSoil pulverizers only.

^eHorse-drawn only.

^fIncludes an unspecified but small number of rice binders. In 1921 the value of rice binders comprised about 2 percent of the value of grain and rice binders combined.

^gIncludes data for fodder cutters.

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Table A-2.- PRODUCTION OF PRINCIPAL AGRICULTURAL IMPLEMENTS: 1929 AND 1933

Product	Weight ^a	1929	1933
Plows and listers			
Moldboard plows			
Horse			
Walking			
1-horse	5.87	242,186	65,019
2-horse and larger	12.93	204,545	54,501
Sulky			
1-bottom	52.36	22,817	2,371
2-bottom	94.28	33,649	2,171
Tractor			
1- and 2-bottom	61.90	66,813	4,827
3-bottom and larger	123.66	56,084	1,201
Disk plows, tractor	129.69	16,397	1,048
1-way disk tillers	196.47	22,992	434
Listers (middle busters), tractor	140.72	2,966	784
Harrows, rollers, pulverizers, and stalk cutters			
Harrows			
1-horse (spike- and spring-tooth)	5.24	30,885	10,967
Harrow sections			
Spike tooth	6.80	339,192	40,043
Spring tooth	11.44	126,306	31,371
Disk harrows			
Horse	42.77	81,402	8,952
Tractor	91.04	57,447	3,477
Stalk cutters	37.57	11,696	447
Planting and fertilizing machinery			
Corn planters, horse			
1-row	17.29	19,385	5,082
2-row	56.78	55,393	4,632
Combination corn and cotton planters			
1-row	20.39	80,993	6,052
2-row	70.48	12,966	497
Combined listers and drills	86.24	7,004	1,525
Grain drills			
Horse	130.60	51,115	3,748
Tractor	174.11	19,295	432
Fertilizer distributors, horse or tractor	7.76	92,741	8,844
Lime spreaders	28.20	12,265	524
Manure spreaders	117.87	61,000	6,415
Cultivators and weeders			
Cultivators			
Horse-drawn, except disk			
1-horse	4.83	202,755	56,744
1-row			
Walking	32.26	51,694	6,055
Riding	38.78	115,254	15,325
2-row	82.32	54,505	2,209
Tractor-drawn	83.81	34,634	3,906
Weeders	17.79	25,221	4,109
Harvesting machinery			
Combines (harvester-threshers)	1,371.42	36,957	554
Potato-digging machines (elevator type)	80.08	9,400	1,643
Haying machinery			
Mowers	56.79	126,360	37,491
Rakes, sulky (dump)	30.69	58,134	5,164
Loaders	79.91	24,920	953
Machines for preparing crops for market or for use			
Grain threshers	894.38	15,813	384
Ensilage cutters (silo fillers)	210.15	8,065	1,536 ^b
Corn shellers			
Hand	10.28	54,928	9,970
Power	222.68	5,450	490

^a Unit value (dollars) in 1929.

^b For a part of the production, only value was indicated. The "number reported" was, therefore, adjusted by the ratio of value of total production to value of "number reported."

BASIC TABLES: AGRICULTURAL IMPLEMENTS

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Table A-3.- PRODUCTION OF PRINCIPAL AGRICULTURAL IMPLEMENTS:
1929, 1935, AND 1936

Product	Weight ^a	1929	1935 ^b	1936 ^b
Plows and listers				
Moldboard plows				
Walking				
1-horse	5.87	242,186	159,184	166,878
2-horse and larger	12.93	204,545	160,368	124,569
Tractor				
2-bottom	64.10	61,698	38,927	85,217
3-bottom	105.70	38,106	9,032	15,204
Disk plows, tractor, 1-way disk tillers	196.47	22,992	6,980 ^c	9,651 ^c
Harrow, rollers, pulverizers, and stalk cutters				
Harrow:				
Spike- and spring-tooth, horse or tractor	7.88	496,383	276,272	337,483
Disk harrows, horse or tractor (single or double action)	62.74	138,849	82,756	109,680
Planting and fertilizing machinery				
Corn planters, 2-row, horse or tractor	55.78	55,393	19,779	41,351
Combination corn and cotton planters				
1-row	20.39	80,993	38,375	49,567
2-row, horse or tractor	70.48	12,966	11,104	8,161
Grain drills, horse or tractor	142.52	70,408	32,410	47,218
Manure spreaders	117.86	61,000	31,462	53,361
Cultivators and weeders				
Cultivators				
Horse-drawn, except disk				
1-horse	4.83	202,755	128,853	122,326
1-row				
Walking	32.25	51,694	16,706	15,742
Riding	36.78	115,254	34,287	46,328
Tractor-drawn	83.81	34,634	54,519	116,957
Harvesting machinery				
Grain binders	163.84	65,069	47,140	66,970
Combines (harvester-threshers)	1,371.42	36,957	3,872	16,983
Corn binders (row binders)	140.48	15,246	19,290	19,364
Haying machinery				
Mowers	55.79	126,360	118,898	124,651
Rakes, sulky (dump)	30.69	58,134	40,730	46,549
Loaders	79.91	24,920	8,813	22,742
Machines for preparing crops for market or for use				
Grain threshers	894.38	13,813	4,619 ^d	8,622 ^d
Ensilage cutters (silo fillers)	210.15	8,065	7,294	12,850
Corn huskers and shredders	473.49	972	1,304	1,428
Hay presses, engine or belt power	416.20	2,172	3,211	3,577

^aValue per unit (dollars) in 1929.

^bData for 1935 and 1936 from Manufacture and Sale of Farm Equipment and Related Products, 1935 (U. S. Dept. Com., Bur. Com.), pp. 3-12 and ibid., 1936, pp. 6-12.

^cClassified as "1-way disk plows or tillers."

^dIncludes rice and alfalfa threshers.

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Table A-4.- NUMBER OF WAGE EARNERS AND AVERAGE WEEKLY HOURS
IN THE AGRICULTURAL IMPLEMENTS INDUSTRY:
1920 TO 1936

Year	Average number of wage earners ^a	Average hours worked per week ^b
1920	73,900	48.4
1921	30,500	41.1
1922	29,400	48.2
1923	30,962	49.2
1924	24,800	47.9
1925	28,696	49.6
1926	32,500	49.3
1927	33,346	48.9
1928	38,800	49.6
1929	41,663	49.3
1930	31,200	43.2
1931	17,529	35.3
1932	10,400	32.7
1933	11,140	33.7
1934	19,400	36.5
1935	28,200	39.5
1936	31,900	39.7

^aThe number of wage earners for 1920-22 was estimated through the use of the N.I.C.B. index and for 1935, by means of the B.L.S. index.

^bHours for 1920-32 are the N.I.C.B. series spliced to B.L.S. hours for 1932-36.

Table A-5.- BEET SLICING AND SUGAR PRODUCTION IN
THE BEET SUGAR INDUSTRY:
1918 TO 1936

(Thousands of short tons)

Calendar year in which campaign began	Washed beets sliced ^a	Sugar production ^b
1918	5,649	719
1919	5,882	684
1920	7,873	1,023
1921	7,977	1,046
1922	5,786	749
1923	7,296	924
1924	7,423	1,076
1925	7,133	906
1926	6,711	893
1927	7,443	1,095
1928	6,951	1,068
1929	7,153	1,023
1930	8,789	1,210
1931	7,620	1,156
1932	8,821	1,350
1933	10,746	1,626
1934	7,343	1,151
1935	7,745	1,178
1936	8,930	1,299

^aFor even-numbered years 1918-28 and for 1931 and 1935, Census of Manufactures; for other years of period 1918-1933, estimates made by means of statistics obtained from Yearbook of Agriculture: 1934 (U. S. Dept. Agr.), p. 471, and Agricultural Statistics: 1936 (U. S. Dept. Agr.), p. 91; and for 1934-36, Lamborn's Vest Pocket Sugar Data (Lamborn and Co., Inc.). The years to which the Census data refer prior to 1923 were established by correspondence with the Bureau of the Census.

^bFor even-numbered years 1918-28 and odd-numbered years 1931-35, Census quantities; for remaining years, estimates obtained by interpolation of the Census series by another based on Agricultural Statistics: 1936, p. 91 (for 1918-34) and Lamborn's Vest Pocket Sugar Data (for 1935-36).

Table A-6.- CAMPAIGN, INTERCAMPAIGN, AND FISCAL-YEAR MAN-HOURS IN THE BEET SUGAR INDUSTRY: 1919 TO 1935

Year	Campaign man-hours per ton of sugar produced ^a	Intercampaign man-hours per ton of -		Thousands of man-hours		
		Beets sliced ^b	Sugar produced ^c	Campaign ^d	Inter-campaign ^e	Fiscal year ^f
	(1)	(2)	(3)	(4)	(5)	(6)
1919	22.64	1.98	-	15,486	11,664	27,150
1920	18.53	1.54	-	18,955	12,101	31,056
1921	14.69	1.52	-	15,362	12,141	27,503
1922	15.25	1.60	-	11,419	9,275	20,694
1923	15.20	0.82	-	14,047	5,975	20,022
1924	12.71	1.02	-	13,680	7,557	21,237
1925	14.87	1.14	-	13,476	8,132	21,608
1926	12.54	0.92	-	11,197	6,141	17,338
1927	11.29	0.84	-	12,366	6,267	18,633
1928	10.16	-	5.66	10,852	6,044	16,896
1929	10.92	0.86	6.02	11,175	6,164	17,339
1930	10.23	-	3.78	12,383	4,574	16,957
1931	8.95	-	4.63	10,344	5,358	15,702
1932	9.42	-	4.07	12,716	5,489	18,205
1933	8.52	-	4.47	13,854	7,268	21,122
1934	9.06	-	5.78	10,426	6,659	17,085
1935	8.70	-	4.65	10,254	5,473	15,727

^aComputed from sugar-production and man-hours statistics collected by N.R.P.-N.B.E.R. in a field study, the results of which are summarized in *Productivity and Employment in Selected Industries: Beet Sugar* (N.R.P. Rep. No. N-1), by R. K. Adamson and M. E. West. The two series are for 31 identical plants which accounted for 37-55 percent of the total production of the industry.

^bA first approximation to total intercampaign man-hours was derived as follows: For the odd-numbered years 1919-29, the average number of wage earners per intercampaign day (average Census employment for Mar.-Sept. except in 1927, when the average of the intercampaign-to-annual ratios for 1925 and 1929 was applied to the Census average for the year) was multiplied by intercampaign hours per man. The latter is the product of (1) the difference between 357 working days per year (365 less 5 holidays and 3 for factory delays) and the number of campaign days and (2) 44 hours per week divided by 7 days per week (all based on information collected in N.R.P.-N.B.E.R. field study). This series, a first approximation, was then raised to the level of the final estimate of intercampaign man-hours in 1929 (see fn. c) and divided by the beets-sliced series (Table A-5). The man-hour-requirement ratios thus obtained were then interpolated by means of a continuous series for 1919-27 based on an observed inverse relationship in 1928-35 between intercampaign labor-requirement ratios and the length of the campaign for 27 identical plants (see fn. c).

^cIntercampaign man-hours per ton of sugar (27-plant sample) raised to level of 31-plant sample (see fn. a) by use of ratio of campaign beet-slicing man-hour requirements for 31 plants to those for 27. The latter group includes 21 of the 31 plants and accounts for 34-55 percent of total beet-sugar production.

^dProduct of sugar output (Table A-5) and campaign man-hour requirements (col. 1).

^eFor 1919-27, tonnage of washed beets sliced (Table A-5) multiplied by beet-slicing-requirement ratios (col. 2); and for 1928-35, product of sugar output (Table A-5) and intercampaign man-hours per ton of sugar (col. 3).

^fSum of 2 preceding columns.

Table A-7.- PRODUCTION OF BOOTS AND SHOES: 1919 TO 1936^a

(Thousands of pairs)

Year	Men's shoes ^b	Boys' and youths' shoes	Women's shoes	Misses' and children's shoes	Slippers and all other footwear ^c
1919	95,017	26,503	104,813	48,538	56,353
1920	(d)	(d)	(d)	(d)	(d)
1921	69,458	18,462	101,474	35,066	62,312
1922	89,984	21,632	105,568	39,444	67,449
1923	100,283	22,239	109,676	40,136	78,781
1924	84,663	20,274	104,135	35,694	68,465
1925	86,546	21,021	104,782	38,691	72,513
1926	85,600	22,290	113,872	44,290	69,760
1927	93,013	26,916	123,517	51,386	72,235
1928	92,791	24,133	129,820	44,642	69,248
1929	100,747	22,616	136,010	44,206	67,629 ^e
1930	80,465	18,139	116,011	37,519	56,360
1931	79,152	19,524	115,261	42,352	59,769 ^e
1932	75,241	16,648	116,675	45,730	58,887
1933	88,656	17,277	133,691	49,339	60,383 ^e
1934	90,021	16,519	135,040	45,848	71,698
1935	96,650	18,500	146,286	43,521	83,535
1936	100,773	17,183	162,985	43,036	95,792
Weight ^f	3.102	2.171	3.178	1.758	1.191

^aQuantities for even-numbered years 1926-34 were obtained by interpolation and for 1936 by extrapolation of Census of Manufactures data by means of statistics published in Survey of Current Business, "1936 Supplement," p. 110, and Mar. 1937, p. 46.

The supplementary series were "compiled by the U. S. Department of Commerce, Bureau of the Census. The figures for . . . 1922 to date are compiled from monthly reports to the Bureau of the Census from manufacturers representing approximately 95 percent of the total United States production for 1922 to 1929; 98 percent from 1930 to 1933; and 99 percent for 1934 and 1935." ("1936 Supp.," p. 174, fn. 3 to p. 110.) The monthly averages were multiplied by 12 to obtain the annual totals.

^bSurvey of Current Business statistics for years prior to 1927 are not strictly comparable with those for subsequent years because large quantities of heavy footwear were included with "athletic" in the earlier period. ("1936 Supp.," p. 174, fn. 4 to p. 110.)

^cIncludes the following kinds of shoes: Infants', athletic and sporting, canvas and other textile-fabric, slippers for housewear, and "other footwear."

^dData not available. The index number for 1920 was extrapolated by means of the F.R.B. index of boot-and-shoe production (Federal Reserve Index of Industrial Production, mimeo., Apr. 1936, p. 19). The F.R.B. index numbers (1923-25 = 100) are 96 for 1920 and 87 for 1921.

^e"Other footwear" not called for on schedule.

^fValue per pair (dollars) in 1929.

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Table A-8.- NUMBER OF WAGE EARNERS AND AVERAGE WEEKLY HOURS IN THE BOOTS AND SHOES INDUSTRY: 1919 TO 1936

Year	Average number of wage earners	Average hours worked per week ^a
1919	211,049	45.8
1920	198,900	44.1
1921	183,502	45.7
1922	203,000	44.1 ^b
1923	225,216	45.6
1924	205,600	44.1
1925	206,992	45.8
1926	203,400	44.6
1927	203,110	45.2
1928	197,200	44.3
1929	205,640	44.2
1930	191,900	40.4
1931	181,374	44.5
1932	179,700	41.1
1933	190,914	39.6
1934	202,100	37.3
1935	202,113	37.1
1936	199,900	36.4

^aThe figure for 1919 was obtained by adjusting Census prevailing hours by the average of the ratios for 1921 and 1923 of N.I.C.B. actual to Census prevailing hours; those for 1920-36 are from N.I.C.B.

^bAverage of the N.I.C.B. figure (46.3) for the last 6 months of the year and a B.L.S. figure (41.8) for the earlier part of the year, principally April and May. The latter was computed from data for 47,361 wage earners, or 23 percent of the total, which were published in *Wages and Hours of Labor in the Boot and Shoe Industry: 1922* (Bull. No. 324), pp. 40-91.

BASIC TABLES: BREAD GROUP

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Table A-9.- PRODUCTION OF PRINCIPAL BAKERY PRODUCTS:
CENSUS YEARS 1923 TO 1935

(Thousands of specified units)

Industry and year	Pounds			Doughnuts, crullers, and other fried cakes (dozens)	Census coverage ^a (percent)
	Bread, rolls, and coffee cake	Biscuit, crackers, and cookies	Pretzels		
Biscuit and Crackers					
1923 ^b	9,131	1,120,378	n.a.	n.a.	100.0
1925	30,282	1,166,658	688	n.a.	100.0
1927	25,249	1,243,364	8,535	n.a.	100.0
1929	22,077	1,322,682	43,865	699	100.0
1931	48,002	1,115,229	44,235	289	99.8
1933	35,238	1,010,952	48,879	396	100.0
1935	39,052	1,259,600	56,754	153	100.0
Weight ^c	0.070	0.196	0.160	0.200	-
Bakery Products Other Than Biscuit and Crackers					
1923 ^b	8,437,778	12,879	n.a.	n.a.	100.0
1925	7,293,421	30,749	26,839	n.a.	81.1
1927	8,754,848	12,693	31,293	n.a.	86.2
1929	9,842,145	26,114	1,439	200,392	89.5
1931	9,044,295	21,776	946	163,097	88.6
1933	8,168,105	33,613	815	117,457	91.4
1935	9,268,526	63,445	3,101	203,035	93.7
Weight ^c	0.077	0.165	0.186	0.200	-

^aPercentage that value of production reported in detail is of value of total production. The N.R.P. production indexes for the 2 industries are quotients of the indexes derived from the quantities and weights shown in the preceding columns and indexes of the coverage percentages.

^bThe quantities for this year were raised by the Census to represent the total output of these products from detailed statistics for establishments accounting for 96.9 percent of the total value of products of Biscuit and Crackers and 79.3 percent of the total value of output of Bakery Products Other Than Biscuit and Crackers.

^cUnit value (dollars) in 1929.

Table A-10.- INDEX OF WHEAT-FLOUR CONSUMPTION IN THE BREAD AND OTHER BAKERY PRODUCTS GROUP: 1923 TO 1936

Year	Total production of wheat flour		Wheat-flour consumption in industry group	
	Thousands of barrels	Index ^a (1929=100)	Thousands of barrels ^b	Index ^c (1929=100)
	(1)	(2)	(3)	(4)
1923	114,439	95.3	34,964	79.5
1924	n.a.	101.4	n.a.	87.5
1925	114,690	95.8	37,538	85.1
1926	n.a.	99.5	n.a.	92.2
1927	118,132	98.4	41,728	94.7
1928	n.a.	99.3	n.a.	97.4
1929	120,040	100.0	44,047	100.0
1930	n.a.	101.9	n.a.	101.8
1931	115,364	96.1	42,205	95.8
1932	n.a.	87.2	n.a.	88.8
1933	101,638	84.7	n.a.	87.9
1934	n.a.	86.4	n.a.	91.5
1935	102,327	85.2	40,507	91.9
1936	n.a.	89.2	n.a.	96.2

^aFigures for census years computed from preceding column. The series was completed for intercensal years by means of the Federal Reserve Board index of wheat flour milled (Federal Reserve Index of Industrial Production, mimeo., Apr. 1936, pp. 19-20; and Federal Reserve Bulletin, Apr. 1937, p. 352). The F.R.B. index is based on figures in Russell's Commercial News and Northwestern Miller.

^bQuotient of the quantity consumed by reporting establishments and the percentage which the value of products of these establishments comprises of the total value. The 1923 figure was adjusted by the Census in a similar manner. The percentages are:

1923	....	80.6	1929	....	90.8
1925	....	86.4	1931	....	85.3
1927	....	87.9	1935	....	86.2

^cCol. (2) multiplied by relatives of the percentage of wheat-flour production consumed in the Bread and Other Bakery Products group. For census years except 1933, these percentages were computed from cols. (1) and (3). For all other years except 1936, percentages were obtained by straight-line interpolation. The 1935 percentage was assumed for 1936.

BASIC TABLES: BREAD GROUP

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**Table A-11.- NUMBER OF WAGE EARNERS AND AVERAGE WEEKLY HOURS
IN THE BREAD AND OTHER BAKERY PRODUCTS GROUP:
1923 TO 1936**

Year	Average number of wage earners			Average hours per week in the Bread and Other Bakery Products group ^b
	Bread and Other Bakery Products group	Biscuit and Crackers ^a	Bakery Products Other Than Biscuit and Crackers ^a	
1923	162,613	35,117	127,496	50.6
1924	164,300	34,300	130,000	50.7
1925	160,411	32,377	128,034	50.7
1926	164,700	32,400	132,300	50.8
1927	171,995	32,982	139,013	50.9
1928	182,400	33,000	149,400	50.9
1929	200,841	33,871	166,970	51.0
1930	197,400	32,000	165,400	49.6
1931	183,161	28,397	154,764	48.1
1932	173,500	26,400	147,100	46.7
1933	182,382	27,153	155,229	44.4
1934	212,300	30,200	182,100	40.5
1935	218,423	29,241	189,182	40.5
1936	225,700	30,200	195,500	42.3

^aFigures for wage earners for intercensal years were estimated by distributing the group totals on the basis of the average of the proportions in adjacent (odd-numbered) years. The 1935 proportions were assumed for 1936.

^bFor 1923 and 1929, Census prevailing weekly hours; for 1932-36, B.L.S. actual hours; for all other years, estimates made by straight-line interpolation. B.L.S. hours for the first 10 months of 1932 were supplied by N.R.A. Research and Planning Division; those for Nov. 1932 to Dec. 1933, were reported in Monthly Labor Review, Jan. 1933 to Feb. 1934.

Table A-12.- PRODUCTION IN THE CANE-SUGAR REFINING INDUSTRY:
1919 TO 1936

(Short tons)

Year	Refined-sugar production ^a	Raw-sugar meltings ^b
1919	4,205,400	4,502,548
1920	4,357,100	4,665,024
1921	3,770,163	4,036,032
1922	5,416,300	5,811,456
1923	4,429,128	4,763,136
1924	4,805,800	5,173,056
1925	5,411,717	5,838,336
1926	5,460,000	5,877,312
1927	5,128,082	5,511,744
1928	4,997,100	5,304,768
1929	5,115,308	5,365,248
1930	5,027,400	5,269,824
1931	4,429,799	4,639,488
1932	4,017,800	4,185,216
1933	3,938,468	4,080,384
1934	3,931,800	4,057,536
1935	4,209,966	4,328,688
1936	4,279,800	4,398,563

^aThe Census series for the odd-numbered years 1921-35, which represents hard and soft (or brown) sugar production in continental United States, was completed by means of the raw-sugar-meltings series shown in the next column. The Census figure for 1919 (3,521,453 short tons) was not used since it appeared to be an understatement.

^bFigures for 1919-35 from Survey of Current Business, "1936 Supplement," p. 100; and for 1936, from Mar. 1937, p. 44. Data were compiled by Willett and Grey's Statistical Sugar Trade Journal. "Meltings of raw sugar represent operations of refineries located at 8 ports - Boston, New York, Philadelphia, Baltimore, Savannah, New Orleans, Galveston, and San Francisco, the Baltimore figure being added in 1921 upon the completion of a refinery in that city. The figures are reported weekly, and these figures have been used to compute monthly totals by prorating the data for the overlapping weeks. The New Orleans figures are partly estimated." ("1936 Supp.," p. 171, fn. 1 to p. 100.) The published monthly averages - in long tons - were converted to yearly totals in short tons by multiplication by 13.44.

Table A-13.- NUMBER OF WAGE EARNERS, AVERAGE WEEKLY HOURS, WAGES, AND AVERAGE HOURLY EARNINGS IN THE CANE-SUGAR REFINING INDUSTRY: 1919 TO 1936

Year	Average number of wage earners	Average hours per week ^a	Wages (dollars)	Average hourly earnings ^b (dollars)
1919	18,202	58.9	-	-
1920	17,300	59.6	-	-
1921	15,457	60.2	-	-
1922	18,100	58.5	-	-
1923	15,254	56.7	-	-
1924	14,500	57.2	-	-
1925	14,502	57.7	-	-
1926	14,000	58.3	-	-
1927	13,996	58.8	-	-
1928	13,200	59.3	-	-
1929	13,912	59.8	-	-
1930	13,600	58.7	17,538,000	0.461
1931	11,855	-	15,547,243	.454
1932	10,900	-	13,002,000	.447
1933	11,495	-	12,237,321	.482
1934	13,600	-	13,256,000	.549
1935	13,832	-	13,913,501	.568
1936	13,200	-	13,765,000	.579

^aAll figures are prevailing hours. Those for 1919, 1921, 1923, and 1929 were computed from Census frequency distributions; those for intermediate years were obtained by straight-line interpolation; and the 1930 estimate was derived from Wages and Hours of Labor in the Cane-Sugar Refining Industry: 1930 (B.L.S. Bull. No. 547), p. 18.

The B.L.S. sample for representative pay periods in 1930 included 11,890 wage earners (in 21 refineries), or about 87 percent of the total number for that year.

^bThe figure for 1930 was obtained from B.L.S. Bull. No. 547, p. 18 (for description of sample, see fn. a); those for 1932-36, from the regular B.L.S. series; and that for 1931, by straight-line interpolation.

Table A-14.- PRODUCTION OF PRINCIPAL CANNED AND PRESERVED FRUITS AND VEGETABLES: CENSUS YEARS 1919 TO 1935^a

Product	Weight ^b	1919	1921	1925	1925	1927	1929	1931	1935	1935
Canned vegetables										
Asparagus (#2½)	6.663	1,007	740	1,462	1,476	1,853	2,321	1,598	1,756	2,493
Beans (#2)	2.205	14,824	11,316	20,468	24,441	25,994	31,587	24,755	26,215	30,926
Beets (#3)	2.632	584	391	545	1,214	742	1,739	1,333	1,123	2,216
Corn (#2)	2.178	14,403	9,011	14,704	22,837	10,358	16,891	19,571	10,308	22,274
Hominy	1.435	-	n.a.	n.a.	-	1,895	1,765	1,075	1,170	1,248
Kraut	1.894	-	n.a.	-	-	4,224	3,101	3,645	3,345	4,406
Peas (#2)	2.507	9,326	8,222	14,454	16,796	13,242	17,757	13,412	13,452	25,446
Pimentos	3.980	n.a.	n.a.	n.a.	-	487	506	274	270	712
Pumpkin and squash	1.739	-	n.a.	n.a.	-	1,094	2,424	1,008	1,753	1,019
Spaghetti	1.953	n.a.	n.a.	n.a.	-	2,751	4,239	2,797	3,168	3,414
Spinach (#3)	2.736	676	581	1,875	1,531	2,288	4,435	1,634	2,345	3,294
Tomato sauce	2.678	n.a.	n.a.	n.a.	-	410	952	466	1,667	1,509
Tomatoes (#5)	2.491	11,836	4,134	14,781	15,303	14,419	16,926	10,930	12,577	20,708
Canned fruits										
Apples (#5)	1.868	2,448	2,239	2,726	2,604	3,303	4,039	2,323	2,871	2,308
Apricots (#2½)	4.183	3,940	1,057	1,552	1,941	2,975	4,086	2,031	2,389	3,143
Berries (#2)	3.784	2,347	1,257	2,447	2,502	2,581	2,841	2,975	1,823 ^c	2,991
Cherries (#2)	4.510	1,553	780	2,124	1,878	1,489	2,612	2,323	3,116	3,809
Fruit salad	8.551	n.a.	n.a.	-	-	1,101	1,680	1,573	2,242	3,091
Grapefruit	3.521	n.a.	n.a.	-	-	455	1,175	1,599	2,280	2,956
Olives, ripe	5.005	n.a.	n.a.	n.a.	-	458	934	816	433	608
Peaches (#2½)	4.242	7,707	5,417	7,039	9,899	10,898	8,410	8,307	10,109	11,087
Pears (#2½)	5.246	2,022	1,165	1,818	3,593	2,792	4,661	3,705	4,566	4,473
Plums	3.275	-	n.a.	-	-	224	171	194	187	285
Prunes	3.017	-	n.a.	-	-	519	1,069	800	610	1,709
Dried fruits										
Apples	0.117	46,623	22,975	19,398	21,121	22,253	44,820	44,332	53,288	70,388
Apricots	0.170	24,193 ^c	21,812 ^c	54,029	33,039	35,755	43,090	74,136	83,007	49,176
Peaches	0.120	73,379	35,407	61,616	35,857	38,038	35,850	50,304	48,668	50,696
Prunes	0.087	138,377 ^c	124,442 ^c	245,786	397,583	438,886	347,349	447,196	405,227	475,601
Raisins	0.056	293,301	275,282	380,068	533,722	455,292	421,204	391,921	375,909	414,129
Other dried fruits	0.111	41,536 ^c	24,987 ^c	30,303	31,805	41,573	46,587	76,494	47,970	61,700

^aThe quantities for the 13 canned products for which can sizes are specified in parentheses are quoted in thousands of standard cases of 24 such cans (for 1927-35, the reported actual-case quantities were converted by division by the average ratio in 1919-25 of the actual-case total of each product to its standard-case equivalent); the quantities for the remaining 11 canned products, which have been reported only since 1927, are shown in thousands of actual cases; and those for the 6 dried fruits are quoted in thousands of pounds.

^bUnit value (dollars) in 1929.

^cNot strictly comparable with figures for other years.

Table A-15- PRODUCTION OF SELECTED CANNED FRUITS AND VEGETABLES: 1919 TO 1936^a

Year	Asparagus (\$c)	Green peas (\$c)	Corn (\$c)	Apricots (\$c)	Black- berries (\$c)	Sweet cherries (\$c)	Peaches (\$c)	Pears (\$c)	Logan- berries	Olives	Green beans (\$c)	Wax beans (\$c)	Beets (\$c)	Apples (\$c)	Rasp- berries (\$c)	Spinach (\$c)	Prunes (\$c)	Fruits for salad
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
1919	814	8,885	15,550	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1920	810	12,317	16,040	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1921	701	8,207	9,943	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1922	980	13,042	11,419	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1923	1,201	15,944	14,104	1,520	424	915	7,322	1,492	317	676	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1924	1,416	19,315	12,131	1,995	670	550	6,210	2,029	374	425	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1925	1,498	17,816	24,320	2,138	581	510	10,551	3,475	410	400	4,240 ^b	718 ^b	2,075	n.a.	n.a.	n.a.	n.a.	n.a.
1926	1,766	17,709	19,069	3,302	781	1,140	14,197	3,158	995	470	3,407	650	1,234	n.a.	n.a.	n.a.	n.a.	n.a.
1927	1,720	12,955	10,347	3,033	631	489	11,121	2,825	461	728	4,037	659	1,130	n.a.	n.a.	n.a.	n.a.	n.a.
1928	1,847	17,943	14,497	2,040	632	845	14,690	3,987	544	865	5,227	988	1,294	n.a.	n.a.	n.a.	n.a.	n.a.
1929	2,155	18,530	17,467	4,152	717	891	8,558	4,602	355	635	7,245	1,280	2,004	n.a.	n.a.	n.a.	n.a.	n.a.
1930	2,104	22,035	16,692	1,901	493	999	13,041	4,167	234	635	6,739	1,511	2,923	n.a.	n.a.	n.a.	n.a.	n.a.
1931	1,484	13,286	19,415	2,059	636	390	6,566	3,653	475	417	4,871	1,196	1,614	n.a.	n.a.	n.a.	n.a.	n.a.
1932	1,054	10,367	9,358	1,759	280	480	7,203 ^c	3,393	160	385	3,435	689	1,044	n.a.	n.a.	n.a.	n.a.	n.a.
1933	1,900	12,393	10,193	2,487	356	809	10,363	4,614	166	488	4,844	688	1,216	1,969	423	3,179	788	2,281
1934	1,697	15,742	11,268	2,012	636	494	8,796	5,699	353	642	5,157	1,143	2,198	2,389	415	3,802 ^d	1,087	2,550
1935	1,989	24,699	21,471	3,230	407	491	11,484	4,463	228	640	9,031	1,130	2,462	2,176	405	4,318	1,722	2,990
1936	2,121	16,553	14,621	2,932	510	530	11,281	5,578	165	690	5,475	954	2,490	2,408	309	4,143	1,647	3,622
Weight ^e	6.668	2.507	2.178	4.183	3.370	6.558	4.242	5.246	3.677	5.005	2.238	2.867	1.639	1.689	6.818	1.599	3.116	6.551

^aAll quantities were derived from Canned Food Pack Statistics, 1936 (National Cannery Association), Pts. I and II, *passim*. The figures in cols. (9), (10), and (18) are in thousands of actual cases; those in remaining columns represent thousands of standard cases of 24 cans of the specified size. The quantities shown in cols. (1), (4)-(8), (14), (15), and (17) were determined for 1933-36 from distributions of actual cases of cans of various sizes by the use of conversion factors, which are given in Pt. II, p. 13; for earlier years, the reported actual-case totals were multiplied by the average of the ratios of standard to actual cases in 1933-36.

The percentage these products represent of the total (Census) value of the industry's output follows: 1919-23 (3 products), 12-17; 1925-26 (10 products), 26-31; 1925-33 (18 products), 30-35; and 1933-36 (18 products), 35.

^bGreen and wax beans, reported in combination, were separated by use of 1927 ratios of the quantity of each to "all other beans."

^cEstimated by multiplying production of peaches in 1931 by the 1932-1931 ratio of the totals of the other 5 fruits for which statistics are reported in both years.

^dReported in actual cases, but converted to standard by means of factors derived from Canned Food Pack Statistics, 1936, Pt. I, p. 16.

^eUnit value (dollars) in 1929 computed from Census statistics for corresponding items. Some adjustments were necessary (e.g., the conversion of Census quantities in actual cases to standard-case equivalents by use of averages of standard-actual ratios for 1933-36).

Table A-16.-- PRODUCTION OF PRINCIPAL CANNED AND CURED FISH: CENSUS YEARS 1919 TO 1935^a

Year	Canned fish, oysters, etc.							Cured fish
	Clams ^b	Oysters	Salmon	Sardines	Shrimp ^c	Tuna	All other canned fish	
1919	158	718	2,186	5,778	322	874	309	143,899
1921	195	464	1,250	1,702	633	360	296	83,012
1923	303	525	1,367	3,395	700	818	335	80,703
1925	348	568	1,559	5,163	736	1,102	366	88,349
1927	494	447	1,504	6,183	1,079	1,266	293	91,213
1929	464	455	1,561	9,273	1,240	1,541	861	99,789
1931	400	351	1,187	4,118	1,035	1,190	424	66,364
1933	415	348	1,137	3,936 ^d	1,088	1,443	1,137	n.a.
1935	596	533	918	6,737 ^d	1,396	2,824	2,104	77,329
Weight ^e	4.685	4.778	9.163	1.962	4.464	7.007	6.146	0.176

^aQuantities for canned fish are in thousands of standard cases; for cured fish, in thousands of pounds.

^bIncludes clam chowder, juice, bouillon, and broth. Figures for 1919 to 1923 are not strictly comparable with those for 1925 and subsequent years since clam chowder, etc. manufactured by canners of fruits and vegetables were included in the Canned Fruits and Vegetables industry under "soups" prior to 1925.

^cThe quantities reported for 1927-35 were multiplied by 1.265 to take account of the increase in the size of the can in 1927 from 4-1/4 oz. to 5 - 5-3/4 (average 5-3/8).

^dAdjusted to include "pilchard" and "herring" sardines by multiplying the former by 1.92 and the latter by 1; these factors are proportional to the weights of the standard cases of the two types of sardines (see Census of Manufactures: 1933, p. 75, fn. 10).

^eUnit value (dollars) in 1929.

BASIC TABLES: CANNING AND PRESERVING GROUP 23

Table A-17.- PRODUCTION OF SELECTED CANNED FISH: 1921 TO 1935^a

(Thousands of standard cases)

Year	Salmon	Oysters	Sardines		Shrimp	Tuna and tuna-like fishes
			Pilchard	Herring		
1921	1,003	442	399	1,400	655	549
1922	733	506	715	1,670	580	672
1923	1,367	525	1,100	1,272	700	818
1924	959	447	1,367	1,900	719	652
1925	1,559	655	1,715	1,871	736	1,102
1926	836	414	2,093	1,718	732	851
1927	1,504	447	2,563	1,262	853	1,256
1928	843	504	2,772	2,056	852	1,216
1929	1,621	519	3,831	2,026	910	1,504
1930	1,054	396	2,979	1,399	818	2,011
1931	1,336	306	1,713	885	821	1,217
1932	654	393	954	546	758	1,206
1933	1,137	348	1,539	981	860	1,443
1934	901	439	1,970	1,143	1,022 ^b	1,967
1935	895	501	2,420	1,656	1,086	2,511
Weight ^c	9.63	5.26	3.13	3.40	6.08	6.56

^aData from annual issues of Fishery Industries of the United States (U. S. Dept. Com., Bur. of Fisheries). The 6 products represent 65-76 percent of the total Census value of canned- and cured-fish production.

^bExcludes production of 1 Alaskan plant.

^cUnit value (dollars) in 1929 computed from data in Fishery Industries of the United States. Value is defined as the gross amount received by the packer at the cannery, with no deductions for commissions or expenses (ibid: 1933, p. 233).

Table A-18.- NUMBER OF WAGE EARNERS AND AVERAGE WEEKLY HOURS IN THE CANNING AND PRESERVING GROUP: 1919 TO 1936

Year	Average number of wage earners			Average hours per week		
	Canning and Preserving group ^a	Canned Fruits and Vegetables industry ^b	Canned and Cured Fish industry ^c	Canning and Preserving group ^d	Canned Fruits and Vegetables industry ^e	Canned and Cured Fish industry ^f
1919	89,925	77,486	12,457	54.2	54.5	52.1
1920	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1921	59,675	51,729	7,946	53.5	53.8	51.6
1922	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1923	81,678	72,534	9,144	55.7	54.0	51.3
1924	72,600	64,600	8,000	53.6	53.9	51.1
1925	95,396	85,866	10,530	53.4	53.8	50.9
1926	100,900	89,400	11,500	53.3	53.7	50.7
1927	93,574	80,924	12,650	53.2	53.6	50.4
1928	104,800	92,400	12,400	53.1	53.4	50.2
1929	112,478	98,866	13,612	52.9	53.3	50.0
1930	116,000	105,600	10,400	48.9	49.3	46.4
1931	98,775	80,184	8,591	45.0	45.2	42.8
1932	72,000	64,500	7,500	41.0 ^g	41.2	39.2
1933	94,267	84,274	9,993	38.1	38.3	36.4
1934	120,300	108,000	12,300	32.9	33.1	31.6
1935	129,633	116,298	13,335	35.9	36.1	34.3
1936	123,100	107,400	15,700	36.5	36.7	34.9

^aFigures for intercensal years were obtained by adding wage-earner estimates for the two component industries.

^bThe estimate for 1924 was made by distributing the interpolated group total in accordance with the average relationship of each industry to the group in 1923 and 1925. Figures for intercensal years 1926-36 were derived from an index of wage earners constructed from data for 3 states: New York, New Jersey, and California. Continuous sample series for the period 1925-36 were first raised to Census state levels and then combined in an index with fixed weights (N.Y., 5; N.J., 1; and Calif., 8) which conforms to the trend of the national Census figures; this index, like that for Canned and Cured Fish (see fn. c), was then adjusted in the even-numbered years 1930-36 (multiplied by 0.970, 0.945, 1.056, and 1.036) so that the combined employment for the Canned Fruits and Vegetables and the Canned and Cured Fish industries agreed with the totals indicated by the group index.

Data for N.Y. from Course of Factory Employment in New York State from 1921 to 1930 (N.Y. State Dept. Lab., Div. Stat. and Inf., Spec. Bull. 171) and January issues of Industrial Bulletin (N.Y. State Dept. Lab.).

Data for N.J. for Jan. 1927-Apr. 1932 from monthly issues of Industrial Bulletin (N.J. Dept. Lab.) and for Nov. 1933-Dec. 1936 from Employment and Wages in New Jersey (N.J. Dept. Lab.). Estimates for N.J. were made for May 1932-Oct. 1933 by applying the seasonal pattern in the neighboring years to data for adjacent months; for 1925, by multiplying 1927 sample employment by the 1925-27 ratio of annual Census wage-earner figures; and for 1926, by straight-line interpolation.

Data for Calif., from monthly issues of California Labor Market Bulletin (Calif. Div. Lab. Stat. and Law Enforcement).

Sample coverage, computed in terms of Census state employment, was 22-29 percent for N.Y., 80-89 percent for N.J., and 58-73 percent for Calif. The 3 state samples combined accounted for 53-66 percent of the Census totals for the same states, and for 37-43 percent of the number of wage earners in the whole Canned Fruits and Vegetables Industry.

^cThe estimate for 1924 was made by distributing the group total in the manner described in fn. b. Figures for intercensal years 1926-36 were computed from an index of employment constructed by interpolating the national Census statistics by a continuous index for California; the California series was constructed in turn by interpolating Census state figures by a sample series for the Canning and Packing Fish industry. The estimates for the even-numbered years were adjusted for consistency with the interpolated group totals (see fn. b). The sample data, which were obtained from monthly issues of California Labor Market Bulletin (Calif. Div. Lab. Stat. and Law Enforcement) for Jan. 1925-Jan. 1937, represent 58-67 percent of the Census total for California and 17-23 percent of the national figure.

^dFor 1919, 1921, 1923, and 1929, Census prevailing hours; for 1932-33, actual hours computed from monthly data compiled by B.L.S. and published in The Canning Industry (N.R.A., Div. of Review, Evidence Study No. 47), p. 7; for 1934-36, B.L.S. actual hours; and for remaining years, estimates made by straight-line interpolation.

^eFor 1919, 1921, 1923, and 1929, Census prevailing hours; for 1932-36, weekly hours for the group multiplied by average of the ratios in 1919, 1921, 1923, and 1929 of prevailing hours in each industry to the group; and for remaining years, estimates made by straight-line interpolation.

^fAverage for last 10 months.

Table A-19.- PRODUCTION AND SHIPMENTS OF HYDRAULIC CEMENTS:
1919 TO 1936^a

(Thousands of barrels)

Year	Portland cement			Masonry, natural, and puzzolan cement ^b
	Clinker	Finished	Shipments	
1919	n.a.	80,778	85,613	529
1920	n.a.	100,023	96,312	767
1921	n.a.	98,842	95,507	539
1922	n.a.	114,790	117,701	889
1923	n.a.	137,460	135,912	1,272
1924	n.a.	149,358	146,048	1,418
1925	160,098	161,659	157,295	1,729
1926	163,464	164,530	162,187	2,105
1927	169,788	173,207	171,865	2,124
1928	173,742	176,299	175,838	2,210
1929	168,988	170,646	169,868	2,209
1930	160,992	161,197	159,059	1,792
1931	121,814	125,429	127,151	1,242
1932	75,004	76,741	80,843	457
1933	62,965	63,473	64,283	467
1934	77,757	77,748	75,901	672
1935	75,327	76,742	75,233	1,006
1936	112,097	112,396	112,566	1,726
Weight ^c	0.66	0.15	0.19	-

^aData from Mineral Resources of the United States, 1926 to 1931 (U. S. Dept. Com., Bur. Mines), Pt. II, "Nonmetals;" Statistical Appendix to Minerals Yearbook, 1934 and 1935 (U. S. Dept. Int., Bur. Mines); and Minerals Yearbook: 1937.

^bFor 1919-24, shipments; for all other years, production.

^cEmployed to reduce clinker and cement production and cement shipments to "equivalent" portland-cement production. In 1919-24, cement production was assigned the combined weight for clinker and cement (0.81). The weights are averages of 1919 and 1934 ratios of man-hours consumed in clinker production, clinker grinding, and cement shipping, respectively, to total man-hours of direct labor. To clinker production was assigned the labor involved in quarrying, raw grinding, clinker burning, operating the coal-mill department, and, in addition, 60 percent of the labor in the power department; the remaining 40 percent of power-department labor was assigned to clinker grinding. The ratios for 1919 were derived from a study by H. E. Hiltz (see Table A-20, fn. b); and for 1934, from a study by B. E. Topkis (see Table A-20, fn. a).

Table A-20.- NUMBER OF WAGE EARNERS AND OUTPUT PER MAN-HOUR IN THE CEMENT INDUSTRY: 1919 TO 1936

Year	Average number of wage earners	Output of portland cement per man-hour ^a (barrels)	Portland cement production for sample ^b (thousands of barrels)	Number of man-hours for sample ^b (thousands)	Ratio of "equivalent" to finished portland-cement production ^c
	(1)	(2)	(3)	(4)	(5)
1919	25,524	1.015	32,803	32,311	1.011
1920	30,500	1.066	63,500	59,586	0.993
1921	26,231	1.225	76,250	62,247	0.994
1922	32,900	1.338	85,000	63,527	1.005
1923	35,091	1.324	101,500	76,641	0.998
1924	37,300	1.359	119,250	87,767	0.996
1925	38,437	1.483	144,500	97,415	0.989
1926	37,700	1.486	n.a.	n.a.	0.993
1927	36,322	1.562	n.a.	n.a.	0.985
1928	34,200	1.628	157,122	96,541	0.990
1929	33,368	1.718	152,116	88,528	0.993
1930	31,300	1.787	140,772	78,771	0.997
1931	24,317	2.071	111,502	53,833	0.984
1932	16,900	1.996	67,449	33,799	0.995
1933	15,829	2.013	56,464	28,048	0.997
1934	19,900	2.056	77,748	37,819	0.996
1935	20,698	1.957	76,332	39,008	0.984
1936	22,800	2.195	111,238	50,689	0.999

^aFigures for 1919-25 and 1928-36, col. (3) divided by col. (4); for 1926 and 1927, interpolated by means of a productivity series (barrels of portland cement per man-hour) for other-than-shipping employees supplied by B. H. Topkis ("Labor Requirements in Cement Production," Monthly Labor Review, Mar. 1936, p. 577). These productivity ratios appear to be based on the records of member plants of the Portland Cement Association. In 1934, the plants in the sample produced 75 percent of all portland cement. The actual productivity ratios for 1925-28 are 1.64, 1.70, 1.85, and 2.00 barrels per man-hour.

^bFigures for 1919 computed from H. E. Hiltz, "Shall the State Own and Operate Its Own Portland Cement Plant?," Public Roads (U. S. Dept. Agr., Bur. Public Roads), Jan. 1921, p. 14. Basic data refer to 51 plants which accounted for 41 percent of total production in 1919.

Output and man-hours for 1920-25 computed by American Engineering Council (from data compiled by the Portland Cement Association) and published in Safety and Production (New York: Harper and Bros., 1928), p. 118.

Data for 1928-33 from Minerals Yearbook: 1935 (U. S. Dept. Int., Bur. Mines), p. 893; for 1934-36, unpublished figures furnished by Bureau of Mines. Prior to 1932, the employment schedules called for average number of men employed in an active pay-roll period, average number of days worked, average length of work-day, and (since 1928) total man-shifts; since 1932 they have called for total man-hours. The percentage of total finished portland-cement production accounted for by the Bureau of Mines sample is as follows: 1928-29, 1931 and 1933, 89; 1930, 87; 1932, 88; 1934, 100; 1935-36, 99.

^cComputed for the entire industry from data in Table A-19 (see also Table A-19, fn. c). Relatives of this ratio were used to adjust the index of productivity derived from col. (2).

Table A-21.- PRODUCTION OF PRINCIPAL CHEMICALS: CENSUS YEARS 1919 TO 1935^a

(Quantities in thousands of specified units)

Product	Unit ^b	Weight ^c	1919	1921	1923	1925	1927	1929	1931	1933	1935
Acids											
Acetic, dilute	pound	0,060	35,058	22,449	28,032	28,722	30,481	52,915	48,847	28,791	80,100
Citric	pound	0,499	3,164	3,850	5,689	7,598	7,058	10,766	8,381	5,896	10,493
Hydrochloric	ton ^d	65,600	48	31	50	50	52	63	41	45	55
Nitric	ton ^d	130,000	18	8	21	25	27	33	31	30	25
Oleic	pound	0,087	44,351	47,898	48,788	55,278	55,688	56,948	29,948	32,492	43,763
Phosphoric	pound	0,079	13,380	6,197	12,829	21,330	22,397	34,874	19,096 ^e	24,653 ^e	45,386 ^e
Stearic	pound	0,123	16,970	14,332	22,478	26,877	37,277	39,154	24,868	25,330	27,438
Sulphuric	ton ^f	9,290	2,209	2,003	3,301	3,283	3,266	4,141	2,845	2,854 ^g	3,164 ^g
Nitrogen and fixed-nitrogen compounds											
Ammonia, anhydrous	pound	0,162	25,684	21,127	23,529	31,725	45,115	173,349	127,099	150,185	138,779
Sodium compounds											
Sodium bicarbonate	ton	27,960	142	101	145	123	121	140	128	130	137
Sodium bichromate and chromate	ton	151,454	23	18	27	28	31	39	25	29	42
Sodium borate	ton	82,791	30	18	53	50	65	92	80	94	106
Caustic soda (sodium hydroxide)	ton	53,907	302	231	431	487	547	725	634	645	720
Sodium silicate	ton ^h	14,901	287	222	331	395	505	590	664	656	608
Soda ash (sodium carbonate)	ton	23,297	1,033	776	1,259	1,369	1,466	1,814	1,509	1,654	1,872
Sodium sulphate (salt cake)	ton	16,334	123	96	141	141	175	170	99	115	131 ^j
Sodium sulphate (niter cake)	ton	9,280	81	49	129	102	121	83	31	17	19
Potassium compounds											
Potassium bitartrate	pound	0,273	4,855	5,779	5,971	7,073	7,595	7,853	6,881	5,789	3,855
Alums and aluminum compounds											
Aluminum abrasives	ton	132,673	11	9	20	16	20	33	7	8	n.a.
Aluminum sulphate	ton	29,002	313	155	234	284	314	345	309	322	348
Coal-tar products											
Dyes ^k	pound	0,580	63,402	39,009	93,668	86,345	95,168	111,422	85,200 ^l	100,953	101,933
Plastics											
Fyroxilin	pound	0,869	n.a.	n.a.	23,980	13,703	16,298	16,991	12,008	10,096	13,341
Compressed and liquefied gases											
Acetylene	M cu. ft.	21,542	311	291	522	526	682	970	743	754	1,143
Carbon dioxide ^m	pound	0,078	59,771	54,616	51,098	59,721	74,344	136,930	153,575	117,382	87,657
Chlorine	pound	0,034	34,392	57,223	76,118	104,960	180,163	289,855	255,511	249,128	414,780
Oxygen	M cu. ft.	10,289	1,173	1,060	2,058	2,074	2,360	3,140	2,050	1,822	2,684

Footnotes appear at end of table.

BASIC TABLES: CHEMICALS

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TABLE A-51.- PRODUCTION OF PRINCIPAL CHEMICALS: CENSUS YEARS 1919 TO 1935^a - Continued

(Quantities in thousands of specified units)

Product	Unit ^b	Weight ^c	1919	1921	1923	1925	1927	1929	1931	1933	1935
Miscellaneous											
Butyl acetate	gallon	1,503	n.a.	n.a.	65	870	2,342	4,524	4,664	3,778	5,651
Carbon bisulphide	pound	0,047	11,606	14,942	25,201	39,875	44,972	71,010	85,045	90,179	117,758
Calcium chloride	ton	20,750	75	79	91	171	191	277	232	158	227
Calcium phosphate	ton	148,068	22	23	39	36	34	38	41 ^d	42 ^d	41
Carbon tetrachloride	pound	0,062	9,812	n.a.	11,746	16,060	17,026	32,713	34,095	30,344	51,970
Copper sulphate	pound	0,053	35,288	27,222	32,304	32,297	56,687	78,669	60,981	56,238	54,759
Ether	pound	0,259	4,134	3,417	4,935	5,390	6,135	6,464	6,982	7,421	7,915
Ethyl acetate	gallon	0,524	354	520	2,530	2,907	4,607	10,932	5,457	6,164	5,563
Glycerin, refined	pound	0,164	67,343	59,861	74,105	94,303	89,585	113,140	102,510	108,824	118,727
Ferro-alloys	ton	108,584	n.a.	49	215	150	197	247	146	155	243
Sulphur, refined	ton	43,038	52	29	61	47	44	78	67	49	48
Vanillin	pound	6,222	135	191	228	215	300	317	172	263	257

^aQuantities represent production for sale and interplant transfer.

^bThe unit "ton" refers to the short ton of 2,000 pounds.

^cAverage unit value of production for sale for all census years for which available; for dyes, average unit value of sales.

^dTon of 100-percent equivalents. Reported quantities for 1919-27 were converted to 100-percent equivalents on the basis of the relationship between actual tons and 100-percent equivalents in 1929.

^ePounds of 50-percent phosphoric-acid equivalents.

^fTon of 50° Baumé equivalents.

^gEstimated on the basis of the average relationship in earlier years of production for sale by the Chemicals industry to production for sale by all industries.

^h40° basis, except in 1919.

^jCensus production figure minus natural-brine output as reported in Sodium Sulphate (U. S. Tariff Commission, Report No. 124, 1937), p. 8.

^kTotal production, as reported in the publication usually entitled Census of Dyes and Other Synthetic Organic Chemicals (U. S. Tariff Commission, Tariff Information Series) for 1927 and later years.

^lSales (rounded off), not total production, as reported in Textile World (Feb. 28, 1936), p. 136.

^mDoes not include dry ice, but does include carbon dioxide gas piped to companies producing dry ice.

ⁿSum of monobasic, dibasic, and tribasic calcium phosphates.

Table A-22.- PRODUCTION OF SELECTED CHEMICALS: 1919 TO 1936^a

(Quantities in thousands)

Year	Acetic acid ^b	Aniline oil ^b	Butyl acetate ^b	Carbon tetrachloride ^b	Saustic soda ^d (tons)	Chlorine	Dyes ^e	Ethyl acetate ^e (85 per cent pure)	Ethyl ether ^e (U.S.P.)	Formaldehyde solution ^e	Hexamethyl-ene-tetramine ^e	Naphthalene ^e	Soda ash ^d (tons)	Sulphuric acid ^d (tons)	Vanillin ^e	Interpolating index ^f (1929=100)
1919	N.S.	-	N.S.	N.S.	502	-	-	N.S.	N.S.	N.S.	N.S.	-	1,055	2,209	N.S.	50.6
1920	N.S.	-	N.S.	N.S.	571	N.S.	-	N.S.	N.S.	N.S.	N.S.	-	1,304	2,800	N.S.	55.6
1921	N.S.	8,659	-	N.S.	251	-	-	-	3,025	N.S.	922	15,564	776	2,005	206	41.0
1922	N.S.	21,402	-	11,166	N.S.	N.S.	-	16,114	4,017	25,958	2,015	17,420	N.S.	N.S.	221	53.4
1923	N.S.	26,672	-	15,514	451	-	-	25,998	5,104	24,061	1,561	28,184	1,269	5,301	170	64.4
1924	N.S.	-	7,096	14,275	404	N.S.	66,679	27,225	5,315 ^g	26,155	1,266	-	1,188	5,027	220	61.0
1925	N.S.	-	16,473	16,163	487	-	86,345	26,679	5,355	31,456	1,656	-	1,369	5,255	315	72.4
1926	N.S.	-	27,240	18,999	542	N.S.	87,979	45,661	5,896	31,953	1,495	-	1,520	5,408	357	78.7
1927	98,454	-	26,304	14,550	547	-	95,168	49,203	5,855	29,920	1,515	-	1,466	5,266	301	79.3
1928	107,365	-	30,050	19,765	585	N.S.	95,625	55,578	5,933	30,716	1,662	-	1,574	5,495	362	84.2
1929	115,716	55,745	38,791	34,720	725	289,855	111,422	75,896	6,147	51,786	2,568	31,144	1,814	4,141	537	100.0
1930	81,496	26,588	35,456	34,298	613	N.S.	-	69,570	5,699 ^g	40,763	1,872	31,956	1,623	5,752	-	88.0
1931	65,185	N.S.	N.S.	N.S.	654	-	-	N.S.	N.S.	N.S.	N.S.	N.S.	1,509	2,845	N.S.	50.3
1932	71,456	N.S.	N.S.	N.S.	565	N.S.	-	N.S.	N.S.	N.S.	N.S.	N.S.	1,246	2,598	-	69.9
1933	105,815	29,495	32,608	35,707	645	-	-	41,121	7,495 ^h	-	N.S.	42,708	1,654	2,854	-	84.4
1934	N.S.	29,578	42,112 ⁱ	44,920	694	N.S.	-	47,671	5,134 ^h	N.S.	N.S.	38,750	1,705	2,875	-	89.9
1935	N.S.	32,573	47,552 ⁱ	55,795	720	414,760	101,955	57,865	7,972 ^h	N.S.	N.S.	46,564	1,672	3,164	-	97.4
1936	N.S.	-	-	-	783	469,264 ^j	117,427	-	-	N.S.	N.S.	-	2,119	5,561	-	110.0
Weight ^k	0.080	0.160	0.210	0.062	55,807	0.034	0.590	0.098	0.250	0.091	0.740	0.050	25.297	9.290	6.750	-

^aUnless otherwise specified, quantities are shown in pounds. "Tons" are short tons.^bChemical and Metallurgical Engineering (Jan. 1935), p. 24.^cProduction as reported in annual issues of the publication usually entitled Census of Dyes and Other Synthetic Organic Chemicals (U. S. Tariff Commission, Tariff Information Series).^dFor intercensal years, Chemical and Metallurgical Engineering estimates adjusted to Census level. The original figures were selected from various issues in an effort to achieve chronological comparability. The intercensal-year quantities for sulphuric acid represent consumption in all industries; those for caustic soda are estimates of sales for all industries for 1924-28 and of total production for 1930-36. All figures for soda ash represent sales for all industries.^eComputed from preceding columns. See fn. k for weights.^fIncludes technical ether.^gContains some isobutyl acetate in addition to normal and secondary.^hIncludes technical and absolute ether.ⁱDerived from production index (adjusted to Census trend) in Chem. and Met. Eng., Feb., 1937, p. 60.^kAverage unit value for various years in the period 1919-35.

BASIC TABLES : CHEMICALS

29

30 PRODUCTION, EMPLOYMENT, AND PRODUCTIVITY

Table A-23.- NUMBER OF WAGE EARNERS AND AVERAGE WEEKLY HOURS
IN THE CHEMICALS INDUSTRY: 1919 TO 1936

Year	Average number of wage earners ^a	Average hours worked per week ^b
1919	72,918	53.6
1920	59,000	49.2
1921	42,138	50.0
1922	53,800	53.2
1923	62,853	53.2
1924	58,600	52.2
1925	57,890	52.8
1926	56,600	50.2
1927	55,559	50.0
1928	59,000	50.1
1929	65,589	50.4
1930	59,900	47.5
1931	51,366	44.5
1932	45,700	40.7
1933	55,953	39.1
1934	69,700	38.5
1935	69,626	39.3
1936	74,300	39.9

^aCensus data for odd-numbered years 1919-23 were adjusted to exclude wage earners engaged in rayon production; the figures for odd-numbered years 1927-35 are sums of those for Chemicals, N.E.C. and Compressed and Liquefied Gases; those for 1920, 1922, 1926, and 1928 are estimates based on N.I.C.B. index; and those for 1924 and intercensal years 1930-36 were derived by means of B.L.S. index.

The number of wage earners for rayon for 1923 is reported in Commerce Yearbook: 1932 (U. S. Dept. Com., Bur. For. and Dom. Com.), I, 423, which cites the Bureau of the Census as its source; the numbers for 1919 and 1921 were estimated by the division of rayon-yarn production by output-per-wage-earner ratios extrapolated on the assumption of the average biennial rate of change between 1923 and 1929.

^bFor 1920-36, N.I.C.B.; for 1919, the quotient of Census pay rolls and average hourly earnings (Wartime Changes in Wages, N.I.C.B., 1919, p. 96) divided by the product of average number of wage earners and 52 (weeks per year).

Table A-24.- PRODUCTION OF PRINCIPAL CLAY PRODUCTS (OTHER THAN POTTERY) AND NONCLAY REFRACTORIES: 1919 TO 1936^a

Year	Common brick (thousands)	Fire brick and clay brick, block, or tile (thousands)	Face brick (thousands)	Sewer pipe (tons)	Hollow building tile (tons)	Silica brick (thou- sands)	Architec- tural terra cotta (tons)	Wall tile (1,000 sq. ft.)	Enameled brick (thou- sands)
1919	4,751,887	963,439 ^b	791,068	1,155,131	2,329,217	211,420	28,610 ^c	7,496	14,166
1920	4,851,626	1,114,809 ^b	786,614	1,187,378	2,579,068	250,582	77,826	10,217	11,178
1921	4,447,987	621,009 ^b	873,346	1,366,265	2,017,543	104,990	68,360	10,946	12,712
1922	5,898,898	836,724 ^b	1,416,878	1,422,162	2,870,308	186,547	107,224	16,606	15,380
1923	7,282,181	1,105,573	1,931,175	1,777,584	3,764,744	268,388	138,462	26,301	19,502
1924	7,158,714	940,948	2,030,403	1,951,612	3,534,784	204,338	140,624	30,658	21,074
1925	7,561,501	990,113	2,474,690	2,138,672	4,224,902	235,877	152,441	30,366	16,931
1926	7,517,211	1,007,784	2,439,820	1,994,333	4,096,417	266,409	155,564	39,010	15,441
1927	7,060,984	866,397	2,412,903	2,115,688	4,114,309	245,881	155,932	39,537	18,097
1928	6,412,810	854,895	2,411,575	1,895,487	3,976,311	241,523	142,720	33,805	15,407
1929	5,505,359	938,218	2,139,408	1,675,453	4,163,521	294,402	133,958	30,443	17,137
1930	3,631,436	738,934	1,481,825	1,270,527	3,148,005	212,640	96,396	17,675	13,402
1931	2,314,664	416,041	903,226	823,303	1,927,658	103,557	54,706	17,716	8,605
1932	1,013,000	217,000	384,000	439,000	829,000	40,000	25,000	7,703	6,000
1933	1,019,810	372,523	270,323	451,272	607,885	110,889	25,604	9,930	4,000
1934	1,098,689	390,214	305,208	661,222	685,710	103,534	13,281	7,306	n.a.
1935	1,811,341	481,679	472,587	670,181	913,090	149,621	17,552	10,705	n.a.
1936	2,966,521	615,498	848,760	990,984	1,534,866	229,325	22,944	13,095	n.a.
Weight ^d	10.7	38.6	16.9	12.7	7.2	51.5	103.9	369.7	73.5

Footnotes appear at end of table.

BASIC TABLES: CLAY PRODUCTS

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Table A-24.- PRODUCTION OF PRINCIPAL CLAY PRODUCTS (OTHER THAN POTTERY) AND NONCLAY REFRACTORIES; 1919 TO 1956^a - Continued

Year	Drain- tile (tons)	Vitrified brick, block, for paving (thousands)	Roofing tile (100 sq. ft.)	Floor tile (1,000 sq. ft.)	Ceramic mosaic (1,000 sq. ft.)	Vitrified brick or block, other than for paving (thousands)	Enameled and faience tile (1,000 sq. ft.)	Clay sold (raw or prepared) (tons)	Aluminum brick (thousands)	Stove lining (tons)	Magnesite and chroms brick (thousands)	Refractory cement (tons)
1919	1,241,188	392,528	94,148	7,791	7,472	96,716	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1920	1,191,290	366,205	98,361	8,007	10,949	102,289	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1921	976,515	466,946	131,886	7,794	10,572	95,001	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1922	594,845	440,388	211,588	5,788	16,608	76,899	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1923	615,640	539,658	231,462	15,320	20,976	160,611	1,865	647,768	28,650	54,694	13,045	95,812
1924	592,641	448,439	304,613	13,153	20,979	106,001	2,555	385,208	14,451	41,986	12,762	27,448
1925	660,673	448,492	289,956	19,244	20,356	90,609	4,916	656,918	4,966	25,852	12,732	78,477
1926	519,463	331,684	408,724	24,920	22,573	85,896	7,703	476,020	9,095	11,573	16,130	77,604
1927	734,392	405,612	368,451	20,454	20,508	97,588	10,157	487,301	11,351	13,646	13,941	105,937
1928	694,205	290,632	351,360	17,765	20,053	87,827	15,333	507,302	13,860	9,708	14,116	121,434
1929	858,521	274,155	370,771	15,887	18,052	95,495	19,357	464,215	23,911	16,305	17,399	138,334
1930	675,276	229,523	297,429	12,041	10,573	70,342	18,436	542,155	11,853	9,368	13,432	98,662
1931	253,308	178,693	285,253	12,131	8,744	28,693	21,431	214,168	7,020	8,977	8,365	74,219
1932	149,000	115,000	126,000	6,467	4,973	18,000	9,453	135,000	5,000	5,000	3,000	39,000
1933	167,960	53,814	105,257	5,793	4,229	9,297	8,401	192,207	9,553	5,827	9,027	68,474
1934	168,126	99,718	113,327	5,234	3,936	14,079	6,825	253,311	15,719	4,626	10,640	66,518
1935	264,123	71,800	134,822	7,556	6,416	11,452	12,625	252,670	18,220	7,614	12,112	76,192
1936	338,428	79,043	211,264	12,317	8,585	18,169	21,555	377,344	11,151	12,970	20,403	96,404
Weight ^d	7.6	21.8	10.6	237.5	207.1	16.4	523.6	4.7	68.5	27.9	323.6	22.5

^aData for 1936 from Clay Products (Including Pottery), Nonclay Refractories, and Sand-Lime Bricks: Production and Stocks, 1936 (U. S. Dept. Com., Bur. Cen.).

Data for interensual years apparently do not include clay products made in other industries. Such output, however, amounted to only 0.18-0.93 percent of the aggregate value of clay products in census years 1921-55.

^bIncludes data for high-alumina brick.

^cEstimated by dividing value in 1919 by value per unit in 1920.

^dUnit value (dollars) in 1929.

Table A-25.- NUMBER OF WAGE EARNERS, WAGES, AND AVERAGE HOURLY EARNINGS IN THE CLAY PRODUCTS (OTHER THAN POTTERY) AND NONCLAY REFRACTORIES INDUSTRY: 1919 TO 1936

Year	Average number of wage earners ^a	Wages ^b (thousands of dollars)	Average hourly earnings ^c (dollars)
1919	76,915	78,256	0.456
1920	82,700	106,100	.576
1921	68,759	73,726	.471
1922	84,500	91,100	.465
1923	102,723	123,773	.531
1924	100,700	127,700	.543
1925	102,777	127,127	.531
1926	105,000	128,400	.534
1927	100,972	121,968	.539
1928	94,200	110,400	.543
1929	93,336	106,918	.524
1930	73,600	78,500	.532
1931	51,128	44,368	.475
1932	32,500	19,600	.388
1933	31,944	18,967	.367
1934	39,300	27,300	.437
1935	44,583	34,603	.450
1936	56,000	51,000	.453

^a Figures for 1920 and 1922 computed from interpolated relatives (based on the B.L.S. employment index for the Stone, Clay, and Glass Products group) and the number of wage earners in the base year.

Figures for 1931-36 include a small number (less than 1 percent of the total) of wage earners employed in the Crucibles industry.

^b Figures for 1920 and 1922 are estimates interpolated by means of a series for the total value of the industry's output. (The ratio of wages to value, 37-38 percent, is quite stable.) The value figures, in thousands of dollars, are: 1919, 208,404; 1920, 282,030; 1921, 195,503; 1922, 243,954; 1923, 333,508.

^c For 1932-36, B.L.S.; for earlier years, figures from an N.R.P.-N.B.E.R. field study - the results of which are summarized in M. E. West, Productivity and Employment in Selected Industries: Brick and Tile (N.R.P. Rep. No. N-2) - adjusted to the B.L.S. level.

The field study presents average hourly earnings for the following 5 regions: Calif., Iowa, Kans., Mo., Okla.; Ind., Ill. (excluding Chicago area); N. J., N. Y., Ohio, Pa.; Fla., Ga., Md., N. C., Va.; Chicago area. A simple average of the earnings for these regions was used to interpolate a harmonic mean with Census pay-roll weights for the odd-numbered years. The resulting series, as noted above, was adjusted to the level shown by the B.L.S. data for 1932-36 (the ratio of the 2 series varied from 1.06 to 1.09).

Table A-26.- PRODUCTION AT BEEHIVE COKE OVENS:
1919 TO 1936^a

(Short tons)

Year	Coke	Coke breeze recovered
1919	19,042,936	45,200 ^b
1920	20,511,092	173,900 ^b
1921	5,538,042	41,200 ^b
1922	8,573,467	64,681
1923	19,379,870	140,827
1924	10,286,037	225,814
1925	11,354,784	160,057
1926	12,488,951	183,361
1927	7,207,417	128,475
1928	4,492,803	111,277
1929	6,472,019	203,708
1930	2,776,316	83,311
1931	1,128,337	15,230
1932	651,888	34,931
1933	911,058	32,236
1934	1,028,765	28,194
1935	917,208	19,068
1936	1,706,063	32,565
Conversion factor ^c	1.000	0.877

^aData for 1919-31 from Mineral Resources of the United States (U. S. Dept. Com., Bur. Mines), Pt. II, "Nonmetals;" and for 1932-37, from Minerals Yearbook (U. S. Dept. Int., Bur. Mines). Breeze recovered represents the difference between breeze production and waste.

^bEstimated by multiplying breeze production by the 1922 ratio of breeze recovered to breeze production.

^cRelative heat value (B.t.u.) per short ton. The absolute values are: 22.8 million for coke and 20.0 million for breeze.

Table A-27.- PRODUCTION AT BYPRODUCT COKE OVENS:
1919 TO 1936^a

Year	Thousands of short tons		Millions of cu. ft. of gas recovered ^b	Thousands of gallons	
	Coke	Coke breeze recovered		Tar produced	Light oil produced
1919	25,138	1,828 ^c	405,046	288,902	92,473
1920	30,834	2,434 ^c	466,118	360,664	109,710
1921	19,750	1,811	301,338	253,052	76,917
1922	28,551	2,362	434,622	327,780	101,438
1923	37,598	3,283	588,610	440,907	135,647
1924	33,984	2,879	530,502	422,074	128,957
1925	39,912	3,494	628,366	480,849	146,443
1926	44,377	4,136	694,345	529,486	164,060
1927	43,885	4,081	689,160	546,859	164,488
1928	48,313	4,354	757,221	631,845	188,598
1929	53,412	4,830	824,391	680,864	200,594
1930	45,196	4,312	707,769	602,486	178,326
1931	32,356	3,111	517,990	450,856	122,529
1932	21,137	2,105	344,544	303,812	73,763
1933	26,678	2,521	423,930	363,299	96,632
1934	30,793	2,726	485,440	408,710	115,695
1935	34,224	2,859	536,459	450,308	133,697
1936	44,569	3,568	687,765	560,386	170,234
Conversion factor ^d	1.000	0.877	0.0241	0.00658	0.00570

^aSee Table A-26, fn. a.

^bDifference between production and waste.

^cEstimated by multiplying breeze production by the 1921 ratio of breeze recovered to breeze production.

^dRelative heat value (B.t.u.) per specified unit. The absolute values are: 22.8 million per ton of coke, 20.0 million per ton of breeze, 550 per cu. ft. of coke-oven gas, 150 thousand per gallon of tar, and 130 thousand per gallon of light oil.

Table A-28.- NUMBER OF WAGE EARNERS AND MAN-HOURS WORKED AT BEEHIVE AND BYPRODUCT COKE OVENS: 1919 TO 1936^a

Year	Beehive ovens		Byproduct ovens	
	Wage earners ^b	Man-hours	Wage earners ^c	Man-hours
1919	13,766	28,110,000	16,828	50,863,000
1920	12,924	26,202,000	21,488	59,868,000
1921	3,656	7,360,153	12,871	33,312,778
1922	6,348	12,427,654	14,928	40,168,014
1923	9,598	18,511,452	19,546	48,125,693
1924	4,903	10,238,636	16,772	41,709,401
1925	5,617	13,125,934	18,085	47,827,266
1926	5,244	12,450,988	18,293	49,183,524
1927	3,284	7,900,745	18,652	50,333,202
1928	2,422	5,906,048	16,981	48,251,099
1929	2,706	6,585,657	19,016	57,071,083
1930	1,737	3,711,647	18,141	52,257,408
1931	841	1,609,295	15,237	42,964,986
1932	663	1,251,843	11,999	31,964,730
1933	893	1,633,556	13,858	35,580,210
1934	920	1,478,012	17,248	41,414,825
1935	866	1,370,478	17,538	39,570,695
1936	1,231	1,942,072	20,899	47,377,028

^aData for 1919-34 from annual issues, 1930-34, of Coke-Oven Accidents in the United States (U. S. Depts. Com. and Int., Bur. Mines); and for 1935-36, from Accidents at Coke Ovens During 1936 (U. S. Dept. Int., Bur. Mines), p. 2.

^bCensus wage-earner series was completed for even-numbered years and 1933-35 by means of relatives of man-shifts as reported by Bureau of Mines in Coke-Oven Accidents in the United States (annual series, 1930-34) and Accidents at Coke Ovens During 1936.

^cThe figures for the odd-numbered years 1919-35 were derived from Census statistics for 1919-31 and estimates for 1933 and 1935 obtained by subtracting employment for Beehive Coke from the Census totals for the 2 industries; they were adjusted to include employment at city gas companies. (The adjustment factor is the ratio of the output - in terms of aggregate coke equivalents - of wage earners at all byproduct coke ovens to the output of those at byproduct coke ovens not owned by city gas companies.) The employment series was completed for the period 1919-36 by means of a comparable Bureau of Mines series for man-shifts published in Accidents at Coke Ovens during 1936.

Table A-29.- PRODUCTION OF CONFECTIONERY: CENSUS YEARS 1925 TO 1935^a

(Thousands of pounds)

Product	Weight ^b	1925	1927	1929	1931	1933	1935
Chocolates							
Fancy	0.493	124,613	131,999	149,240	103,869	94,070	138,688
Bulk	.256	171,091	189,780	171,121	132,897	138,991	188,534
Count	.170	n.a.	53,976	63,966	53,923	47,355	65,496
Bars							
Chocolate-covered	.185	190,489	271,677	367,772	324,319	337,972	336,669
Others	.203	58,488	75,003	86,529	62,292	58,419	59,267
Hard candy	.149	190,350	223,481	227,798	237,038	205,170	226,303
Caramels and chewing candy	.163	n.a.	102,258	92,855	70,654	79,584	121,045
Gum work	.112	n.a.	83,181	96,522	72,203	75,527	96,617
Fan work	.138	59,499	72,990	68,022	64,390	64,145	90,718
Marshmallows	.157	n.a.	54,498	53,754	59,225	45,930	59,340
Lozenges	.211	n.a.	23,725	29,265	22,174	21,542	24,978

^aIn 1925 and 1927, a number of establishments did not report production in detail. In the same years, the Census did not report detailed production statistics for confectionery produced as secondary products of other industries. Index numbers for 1925 and 1927 were, therefore, adjusted for comparability with subsequent years. This was done by multiplying the two relatives by the ratio of the total value of confectionery produced in all industries to the value of confectionery reported in detail by establishments within the industry. The ratios are 1.148 in 1925 and 1.095 in 1927.

^bValue per pound (dollars) in 1929.

PRODUCTION, EMPLOYMENT, AND PRODUCTIVITY

Table A-30.- SALES OF CANDY: 1925 TO 1936^a

(Thousands of pounds)

Year	Package goods		Bulk candy		Candy bars			Five- and ten-cent packages	Penny goods
	Plain	Fancy	Chocolate	Other	Molded chocolate	Chocolate covered	Other types		
1925	83,805	47,170	160,885	321,101	54,840	218,967	36,627	48,606	164,643
1926	94,210	52,993	165,471	325,143	61,944	259,027	40,198	49,375	166,548
1927	70,062	41,887	138,323	326,636	52,842	278,661	56,400	60,510	182,217
1928	72,091	40,564	134,554	333,306	54,995	282,807	45,773	55,260	174,618
1927	72,535	46,217	144,044	334,176	102,191	255,350	63,035	64,961	201,302
1928	64,245	44,088	142,559	337,423	112,568	262,357	51,449	58,943	191,790
1929	66,396	42,742	137,442	348,145	112,056	351,842	59,069	55,425	203,125
1929	75,936	43,252	133,921	342,865	99,379	347,866	59,357	48,612	209,376
1930	75,402	35,707	109,351	338,806	100,604	374,216	51,866	52,804	196,862
1933	97,228	11,236	108,334	265,281	97,830	299,107	22,657	58,874	206,228
1934	117,322	14,279	131,043	296,227	129,399	285,014	25,824	52,859	247,135
1934	119,299	14,316	136,746	291,861	132,125	290,252	26,304	56,838	254,113
1935	141,119	14,364	152,956	313,264	153,952	296,879	31,433	57,858	250,817
1935	135,619	13,247	149,415	301,919	153,283	282,313	29,323	47,491	224,855
1936	146,980	15,171	166,024	320,225	154,360	311,295	35,563	54,397	236,128
Weight ^b	0.364	0.767	0.242	0.151	0.323	0.195	0.203	0.220	0.148

^aData from Confectionery Distribution in the United States (U. S. Dept. Com., Bur. For. and Dom. Com.). For each group of years, the figures are from the most recent issue in which they were available. Data were compiled "in cooperation with the National Confectioners' Association, the National Wholesale Confectioners' Association, the Associated Retail Confectioners of the United States, local confectionery associations, and the trade press."

A certain amount of duplication results from sales of manufacturers to each other. The percentages of resales to total sales are:

1925	7.0	1927	5.5	1929	4.7
1926	6.0	1928	6.1	1930	5.5
1927	5.0	1929	5.2		
1928	6.9				

In the 1933-34, 1934-35, and 1935-36 surveys, resales were not included in the data collected.

The coverage of the various surveys, in terms of value and the number of identical establishments, are, approximately as follows:

Survey	Percent of value of commercial production	Number of identical establishments
1925-28	80	482
1927-29	87	499
1929-30	86	517
1933-34	75-80	343
1934-35	75	402
1935-36	70	348

^bValue per pound (dollars) in 1929.

Table A-31.- INTERPOLATING SERIES FOR CONFECTIONERY PRODUCTION INDEX:
1925 TO 1936

Year	Index of candy sales ^a	Millions of pounds of candy produced ^b
1925	92.7	n.a.
1926	100.4	n.a.
1927	95.0	n.a.
1928	93.5	n.a.
1929	100.0	1,680
1930	96.8	1,543
1931	n.a.	1,457
1932	n.a.	1,355
1933	88.4 ^c	1,443
1934	100.0 ^c	1,571
1935	108.5 ^c	1,614
1936	116.9 ^c	1,830

^aComputed from Table A-30. Relatives of the aggregates computed for each of the surveys were linked to yield the index numbers, which are on a 1929 base for 1925-30 and on a 1934 base for 1933-36.

^bInternational Confectioner, Mar. 1937, p. 22. Figures for 1929, 1932, and 1936 were reported; those for other years were read from a bar graph prepared by the Corn Industries Research Foundation. Quantity coverage, apparently quite high, could not be determined exactly because some confectionery is reported by the Census only in terms of value.

^cNot on same base as figures for 1925-30. See fn. a.

Table A-32.- NUMBER OF WAGE EARNERS AND AVERAGE WEEKLY HOURS
IN THE CONFECTIONERY INDUSTRY: 1925 TO 1936

Year	Average number of wage earners	Average hours per week ^a
1925	63,600	50.6
1926	66,000	50.6
1927	63,163	50.6
1928	61,700	50.6
1929	63,501	50.6
1930	67,600	47.5
1931	61,262	44.4
1932	46,700	41.3
1933	50,609	37.2
1934	51,600	36.3
1935	52,109	36.7
1936	50,400	39.5

^aFigures for 1925-28 were estimated by straight-line interpolation between those for 1923 and 1929, which represent prevailing weekly hours. Data for 1932-36, B.L.S. Estimates for 1930-31 were made by straight-line interpolation.

Table A-35.- PRODUCTION OF PRINCIPAL COTTON GOODS: CENSUS YEARS 1919 TO 1958^a

Product	Weight ^b	1919	1921	1923	1925	1927	1929	1931	1935	1938
Sheetings	0.086	1,368,946	1,600,999	1,695,520	1,636,169	1,857,478	1,692,167	1,859,698	1,680,325	1,390,466
Pillow tubing	0.188	12,113	28,116	17,286	30,529	26,652	21,264	12,452	9,646	11,642
Print cloth	0.071	997,485	1,157,880	1,579,196	1,166,374	1,583,861	1,708,025	1,686,359	1,709,960	1,628,460
Looms, mainsocks, osambries, and similar muslins	0.112	417,898	392,208	367,209	326,087	272,454	226,554	161,697	296,441	215,899
Tobacco, cheese, butter, bunting, and bandage cloths	0.029	239,866	274,256	402,312	451,635	660,424	617,411	597,147	634,499	641,660
Ginghams	0.120	368,308	536,809	571,665	356,476	290,619	147,120	56,313	69,569	40,550
Mosquito netting and tarlatan	0.071	54,425	38,058	37,384	21,095	14,727	33,298	38,782	6,002	n.a.
Shirtings	0.144	352,150	300,720	341,225 ^c	455,597	378,550	317,046	272,178	276,349	275,589
Drills	0.125	314,822	191,715	303,421	286,115	347,778	323,041	184,646	161,987	178,698
Twills and satens	0.132	424,476	384,638	489,580	632,851	415,997	284,117	201,434	274,155	278,153
Fickings	0.219	53,685	46,525	55,499	48,522	59,285	42,411	32,416	47,265	56,574
Denims	0.197	166,898	169,127	225,640	180,492	264,118	249,891	202,111	268,788	206,387
Happed fabrics	0.150	268,068	294,718	381,397	340,416	400,097	323,140	286,073	377,791	297,706
Cottonades and cotton worsteds	0.240	21,132	22,980	20,952	29,131	32,697	34,333	44,968	67,892	46,967
Fire fabrics	0.369	160,271	97,657	226,555	242,126	225,952	302,864	156,337	146,206	146,969 ^d
Ounce duck (except tire)	0.259	178,640	97,033	159,221	161,884	178,207	188,058	111,575	132,780	126,903
Numbered duck (except tire)	0.389	54,438	36,167	27,662	31,450	39,698	42,068	25,004	19,519	22,628
Tapestries	1.325	21,708	10,414	20,684	16,737	18,619	9,610	9,188	9,978	9,072
Flushes, velvets, and velveteens	0.774	20,521	11,510	27,711	35,478	42,689	52,668 ^e	23,794	18,196	20,595
Corduroys	0.850	19,863	16,358	27,389	21,593	23,171	27,134	16,702	24,625	31,773
Towels, toweling, and wash cloths	0.195	74,725	119,925 ^f	122,646 ^f	126,566	169,997	169,694	159,378	149,933	170,637
Cotton table damask	0.254	27,499	43,120	40,905	53,468	33,523	35,868	20,524	15,618	15,341
Blankets	0.270	86,621	81,620	88,060	92,077	107,263	94,061	71,989	103,165	n.a.
Bedspreads and quilts	0.310	24,072	31,328	35,691	52,637	71,285	52,902	55,927	50,472	n.a.
Cotton yarns produced for sale	0.591	618,034	484,219	620,725	626,367	664,355	647,725	414,463	496,496	399,111
Thread	1.469	26,442	25,278	31,646	34,157	29,992	25,250	19,876	27,755	34,954 ^e
Twines	0.350	11,850	13,440	16,596	16,596	21,292	40,643	47,063	59,076	50,733
Battings, wadding, and mattress felts	0.130	66,517	49,856	100,870 ^h	90,691	129,656	149,491	114,324	96,368	n.a.
Cotton card laps, sliver, and rovings produced for sale	0.174	4,260	4,343	4,595	4,957	3,418	10,134	5,462	7,878	9,819
Cotton waste produced for sale	0.073	314,954	271,775	378,640	417,094	484,416	443,916	315,808	361,051	339,675

^a Figures for yarns for sale and subsequent products represent thousands of pounds; for all other products, thousands of square yards.

^b Unit value (dollars) in 1929.

^c Census of Manufactures, 1927, p. 226.

^d Not strictly comparable with prior years because of exclusion of data for "tire cords on cones" (the only figure reported for this item is in pounds).

^e Ibid., 1931, p. 230.

^f Ibid., 1927, p. 227.

^g For 1935, finished thread manufactured in all industries.

^h Ibid., 1927, p. 248.

Table A-54.- INDEX OF RAW-COTTON CONSUMPTION: 1919 TO 1936^a

Year	Index (1929=100)
1919	84
1920	83
1921	77
1922	87
1923	93
1924	79
1925	91
1926	96
1927	105
1928	94
1929	100
1930	76
1931	77
1932	71
1933	89
1934	77
1935	81
1936	101

^aFigures for 1919-34 from Federal Reserve Index of Industrial Production (Federal Reserve Board, mimeo., Apr. 1936), pp. 19, 20; and for 1935-36, Federal Reserve Bulletin, Mar. 1937, p. 256. The base was shifted from 1923-25 to 1929. The original data were "compiled by the U. S. Department of Commerce, Bureau of the Census, from reports of all cotton consuming plants, textile mills, for the most part. The consumption figures are taken as the bales of cotton are opened at the mills." (Record Book of Business Statistics, U. S. Dept. Com., Bur. For. and Dom. Com., Pt. I, "Textiles," 1927, p. 20, fn. 1.)

Table A-55.- PRODUCTION OF PRINCIPAL COTTON GOODS, NEW ENGLAND STATES: CENSUS YEARS 1919 TO 1933^a

Product	Weight ^b	1919	1921	1923	1925	1927	1929	1931	1933
Woven goods (over 12 inches in width)									
Sheetings	0.130	271,010	352,571	329,036	270,166	236,977	176,482	146,166	142,933
Print cloth	.080	407,633	435,171	544,161 ^c	257,097	281,097	181,683 ^d	129,203	102,597
Tire fabrics	.370	117,162	60,160	97,743	90,937	87,572	102,425	63,300	48,151
Shirtings	.191	166,768	167,789	123,853	156,852	93,464	70,411 ^e	36,655	47,027
Napped fabrics	.182	138,233 ^e	149,466	189,208	156,002	131,190	80,048 ^d	68,617	97,092
Twills and sateens	.129	289,461 ^d	234,428	288,704	274,708	203,689 ^c	120,412	58,082	70,649
Denims	.212	43,218	30,559	34,802 ^d	22,950	31,491	21,977	15,272	14,885
Lawns, nainsooks, cambrics, and similar muslins	.113	361,875 ^d	313,824	268,066	215,967	235,188	178,777 ^d	138,692	219,434
Bedspreads and quilts	.328	14,743	19,893	23,518	24,983	22,288	19,790	13,701	10,234
Other woven goods ^e	.160	966,626	977,295	1,073,979	955,390	972,388	875,061	633,028	548,279
Cotton yarns produced for sale	.511	208,965	104,393	113,310	109,123	92,730 ^f	90,682 ^k	33,196	42,423
Cotton waste produced for sale	.088	180,971	144,113	172,783	172,548	161,907	134,714	89,849	97,791

^aThe New England States are: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut. Figures for last 2 products represent thousands of pounds; for others, thousands of square yards.

^bUnit value (dollars) in 1929.

^cOutput of 1 establishment included by Census with "other woven goods."

^dOutput of 2 establishments included by Census with "other woven goods."

^eCensus statistics were adjusted insofar as possible for variation in the composition of this class from year to year. In addition to items not enumerated, it includes: Tobacco, cheese, butter, bunting and bandage cloths; gingham; mosquito netting and tarlatan; drills; ounce duck (except tire); numbered duck (except tire); plushes, velvets and velveteens; corduroys; cotton table damask; draperies (except velvets and plushes); tapestries; voiles; pajama checks, dimities, and similar fabrics; crepes; rugs (except bath mats); pillow tubing; bath mats; and terry-woven fabrics (except towels, towelings, wash cloths, and bath mats).

^fCensus of Manufactures, 1927, p. 231.

^kEstimated by multiplying national output in 1929 by the ratio of New England to national output in 1927.

Table A-36.- PRODUCTION OF PRINCIPAL COTTON GOODS, COTTON-GROWING STATES: CENSUS YEARS 1919 TO 1935^a

Product	Weight ^b	1919	1921	1923	1925	1927	1929	1931	1935
Woven goods (over 12 inches in width)									
Sheetings	0.081	1,047,308	1,195,390	1,305,829	1,318,671	1,557,196	1,465,802	1,192,274	1,466,877
Print cloth	.070	544,752 ^c	702,997	1,012,068 ^c	906,455	1,300,293	1,520,453	1,426,035	1,604,217
Tire fabrics	.368	19,779	25,498	86,218	112,976	121,147	196,262	95,298	95,383
Shirtings	.130	180,507	130,523	214,252	295,393	282,696	244,575	236,194	231,322
Napped fabrics	.139	124,445	145,252	192,187	184,414	268,233	242,528	219,412	280,700
Twills and satens	.137	98,538	109,560	160,480	227,711	170,574	125,078 ^d	140,832	201,256
Denims	.196	123,480	137,546	186,778	156,357 ^d	222,618	227,914	186,838	253,903
Lawns, mainsooks, cambrics, and similar muslins	.104	43,966	78,279	87,502	105,499 ^d	35,326 ^c	39,342	38,923	76,007
Bedspreads and quilts	.297	8,119	10,878	11,287	26,130	46,627	31,014 ^d	42,068	58,645
Other woven goods ^e	.130	964,775	870,848	1,260,753	1,213,689	1,475,904	1,513,555	1,173,146	1,322,417
Cotton yarns produced for sale	.374	359,004	347,875	451,635	490,781	552,445 ^f	538,907 ^e	374,668	448,371
Cotton waste produced for sale	.067	118,762	117,531	190,759	228,118	307,941	299,274	219,539	254,763

^aThe Cotton-growing States are: Alabama, Arkansas, California, Georgia, Kentucky, Louisiana, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia. Figures for last 2 products represent thousands of pounds; for others, thousands of square yards.

^{b-f}See corresponding footnotes, Table A-35.

^eEstimated by multiplying national output in 1929 by the ratio of the production of Cotton-growing States to the national total in 1927.

BASIC TABLES: COTTON GOODS

Table A-37.- PRODUCTION OF PRINCIPAL COTTON GOODS, BY REGIONS: 1933 AND 1935^a

Product	New England States			Cotton-growing States		
	Weight ^b	1933	1935	Weight ^b	1933	1935
Cotton woven goods (over 12 inches in width)	0.102	1,438,528	1,349,534	0.083	6,263,102	5,609,135
Cotton yarns produced for sale	.444	42,423	32,177	.288	446,371	353,411
Cotton twine	.325	1,118	1,458	.234	53,205	44,846
Cotton cordage and rope	.368	4,651	4,389	.212	21,526	16,910
Cotton waste produced for sale	.057	97,791	83,108	.045	254,763	249,616

^aQuantities for first product represent thousands of square yards; for remaining products, thousands of pounds.

^bAverage unit value (dollars) in 1933-35.

Table A-38.-- NUMBER OF WAGE EARNERS AND MAN-HOURS IN
THE COTTON GOODS INDUSTRY:
1919 TO 1936

Year	Average number of wage earners	Wages (thousands of dollars)	Average hourly earnings ^a (dollars)	Man-hours ^b (thousands)
1919	430,966	355,475	n.a.	1,003,100
1920	432,600	452,500	0.480	942,300
1921	412,058	328,227	.347	945,900
1922	415,100	315,700	.330	956,600
1923	471,503	396,603	.378	1,049,200
1924	409,200	330,100	.372	887,500
1925	445,184	353,883	.350	1,011,100
1926	450,000	354,800	.328	1,081,700
1927	467,596	380,910	.323	1,179,300
1928	422,400	318,400	.324	982,900
1929	424,916	324,289	.324	1,000,900
1930	357,300	250,000	.325	769,100
1931	329,962	219,680	.281	781,800
1932	296,900	157,900	.239	660,800
1933	379,445	216,384	.277	781,200
1934	393,100	244,300	.378	646,200
1935	369,062	236,339	.376	628,600
1936	391,000	265,600	.368	721,200

^aEarnings for even-numbered years 1920-30, from Wages and Hours of Labor in Cotton-Goods Manufacturing; 1910 to 1930 (B.L.S. Bull. 539), p. 2. The B.L.S. samples represented the following percentages of total employment: in 1920, 13.8; 1922, 15.2; 1924, 19.1; 1926, 18.4; 1928, 20.9; and 1930, 25.3. Figures for odd-numbered years 1921-31 are unpublished B.L.S. estimates; data for 1932-36, regular B.L.S. survey.

^bFor all years except 1919, quotients of wages and average hourly earnings. For 1919, the product of weekly man-hours (i. e., wage earners times average weekly hours) and the estimated average number of weeks in the year (i. e., 50.6, the average for 1920-36). Average weekly hours for 1919 are Census prevailing reduced to actual by means of the average of the 1921 and 1923 ratios (0.865) of actual (B.L.S.-N.I.C.B.) to prevailing. The average number of weeks was obtained from the quotients of annual man-hours and weekly man-hours (derived from employment and B.L.S.-N.I.C.B. actual weekly hours). The N.I.C.B. actual hours for the United States are averages (with employment weights) for the North and South.

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Table A-39.- NUMBER OF WAGE EARNERS AND MAN-HOURS IN THE COTTON GOODS INDUSTRY, BY REGIONS: CENSUS YEARS 1919 TO 1935

Year	New England States				Cotton-growing States			
	Average number of wage earners ^a	Wages ^a (thousands of dollars)	Average hourly earnings ^b (dollars)	Man-hours ^c (thousands)	Average number of wage earners ^d	Wages ^d (thousands of dollars)	Average hourly earnings ^e (dollars)	Man-hours ^f (thousands)
1919	205,589	184,130	n.a.	399,903	193,451	139,706	n.a.	421,813
1921	187,051	173,938	0.415	419,128	193,847	121,910	0.320	380,969
1923	195,947	199,373	.445	448,029	239,562	156,688	.352	445,136
1925	164,954	158,774	.428	370,967	247,384	157,010	.309	508,123
1927	155,642	154,795	.433	357,494	281,769	190,032	.324	566,519
1929	127,041	119,053	.420	283,460	274,851	179,143	.322	566,345
1931	90,906	77,097	.392	196,676	222,488	126,768	n.a.	457,673
1933	91,566	63,184	.358	176,492	273,470	142,418	n.a.	477,347
1935	76,581 ^g	58,500 ^g	.448	130,580	278,674 ^g	166,992 ^g	n.a.	395,526

^aDerived from Census statistics for individual New England States (see Table A-35, fn. a). Figures for Vermont for 1931 were estimated on the assumption that they bore the same proportion to the national totals as the average for all the other odd-numbered years except 1929 and 1935.

^bN.I.C.B. series for North (viz., Connecticut, Illinois, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, and Rhode Island).

^cFor all years except 1919, wages divided by average hourly earnings; for 1919, the product of weekly man-hours and the average number of weeks per year in census years 1921-35. Weekly man-hours were obtained by multiplying total man-hours for the 2 regions in 1919 (i. e., the product of total employment in New England and Cotton-growing States and the hours figure described in Table A-38, fn. b) by the 1921 ratio of man-hours for New England to the sum for New England and the Cotton-growing States. The average number of weeks per year is the quotient of annual and weekly man-hours; the series for the latter was derived by multiplication of employment by N.I.C.B. average weekly hours.

^dCompiled from Census statistics for individual Cotton-growing States (see Table A-36, fn. a). Since separate figures were not always reported, estimates were made by applying to the national total the average ratio of employment (or wages) in the state (or group of states) for which separate statistics are not presented to employment (or wages) in the whole United States.

^eN.I.C.B. series for South (viz., Alabama, Georgia, Kentucky, Maryland, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia).

^fFor all years except 1919 and 1931-35, wages divided by average hourly earnings. For 1919, the method parallels that described in fn. c. For 1931-35, estimates for both regions combined (i. e., New England and Cotton-growing States) were first made on the assumption that the average ratio in 1919-29 of their total man-hours to man-hours in the United States (Table A-38) was typical of the later years; then, man-hours for New England were deducted from these estimates.

^gThe Census figures, which include data for the Cotton Narrow Fabrics and the Fish Nets and Seines industries, were adjusted by multiplication by the average of the ratios for 1931 and 1935 of Cotton Goods to the Cotton Goods and Cotton Narrow Fabrics industries combined. No adjustment was possible for the Fish Nets and Seines industry.

BASIC TABLES: ELECTRIC LAMPS

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Table A-40.- PRODUCTION IN THE ELECTRIC LAMPS INDUSTRY:
1920 TO 1931^a

(Thousands of units)

Year	Manufacture of -			Assembly of lamps	
	Bulbs		Bases	Large	Miniature
	Large	Miniature			
1920	255,815	117,170	432,068	234,770	127,370
1921	199,989	71,850	187,648	161,665	80,850
1922	257,892	95,646	348,932	206,019	105,246
1923	308,707	145,979	442,751	248,347	155,879
1924	244,218	173,400	435,901	251,752	183,420
1925	299,517	175,030	463,571	274,087	185,188
1926	327,649	188,891	488,024	281,588	200,867
1927	377,910	194,135	565,616	340,545	203,967
1928	334,915	232,459	573,129	313,475	243,478
1929	388,159	269,711	713,849	362,826	281,131
1930	360,726	205,740	559,017	335,001	218,198
1931	348,203	168,143	513,001	326,613	176,737

^aData from Witt Bowden, Technological Changes and Employment in the Electric-Lamp Industry (B.L.S. Bull. No. 593), pp. 46, 48, 52, 33. According to this report, "the figures of the volume of output and of labor are estimates derived from the best available sources. For relatively small portions of the industry, only the production figures are available, but manufacturing methods are known and the approximate amounts of labor can be apportioned. For other small portions of the industry, records of labor are not available for some of the years 1920 to 1931, but for these years reasonably close approximations can be made. In some of the minor details, the figures are not comparable for the entire period. For example, in the volume of labor employed in lamp-assembly plants there is included a small amount of labor used in making miniature bulbs before this work was completely transferred to separate plants. On the other hand, a counterbalancing illustration is the extension of dining-room facilities in lamp-assembly plants, which tended to increase the volume of labor in these plants during the later years of the period from 1920 to 1931.

"While the basic figures given in the tables are not to be regarded as exact transcriptions of records, and while there is undoubtedly a margin of error, at the same time it is believed that the actual trends in lamp-assembly plants of the industry as a whole are shown with an unimportant margin of error." (P. 33.)

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Table A-41.- NUMBER OF WAGE EARNERS IN THE ELECTRIC LAMPS INDUSTRY: 1920 TO 1931^a

Year	Number engaged in manufacture of -			Number engaged in assembly of lamps	
	Bulbs		Bases	Large	Miniature
	Large	Miniature			
1920	2,892	259	455	12,196	5,087
1921	2,878	330	275	7,826	3,103
1922	1,485	226	314	8,387	3,737
1923	1,288	214	375	8,844	3,989
1924	1,093	193	389	6,574	3,639
1925	863	161	352	5,915	3,147
1926	1,092	142	330	5,383	2,907
1927	1,042	155	350	5,442	2,657
1928	905	202	361	4,564	2,689
1929	836	204	405	4,425	2,833
1930	919	196	348	3,987	2,473
1931	988	140	317	3,753	2,064

^aSee Table A-40, fn. a.

Table A-42.- MAN-HOURS IN THE ELECTRIC LAMPS INDUSTRY: 1920 TO 1931^a

(Thousands)

Year	Number consumed in manufacture of -			Number consumed in assembly of lamps	
	Bulbs		Bases	Large	Miniature
	Large	Miniature			
1920	6,587	623	1,024	25,194	10,951
1921	6,227	342	619	15,764	5,946
1922	3,352	310	706	16,484	8,065
1923	2,886	371	843	18,459	8,362
1924	2,538	460	875	14,240	7,839
1925	1,943	405	789	13,055	6,698
1926	2,467	350	786	11,498	6,078
1927	2,346	331	803	12,064	5,858
1928	2,032	347	806	9,902	6,074
1929	2,005	335	1,006	10,097	5,906
1930	2,077	296	798	8,521	4,903
1931	1,840	210	642	7,520	3,928

^aSee Table A-40, fn. a.

Table A-43.- PRODUCTION OF PRINCIPAL FERTILIZERS: CENSUS YEARS 1919 TO 1935

(Thousands of short tons)

Year	Complete fertilizers	Super-phosphates produced for sale	Fish scrap	Other fertilizers			
				Total	Potash super-phosphates	Bone meal	"Other" fertilizers
1919	4,271 ^a	2,515	48	1,450 ^a	n.a.	n.a.	n.a.
1921	2,985	1,977	45	1,032 ^b	n.a.	n.a.	n.a.
1923	4,033	2,458	76	1,059 ^b	n.a.	n.a.	n.a.
1925	4,926	2,639	72	592	248	48	296
1927	5,088	2,435	96	504	233	42	229
1929	5,992	2,531	85	713	211	40	462
1931	4,545	1,968	46	409	149	52	208
1933	3,336	1,549	57	396	89	61	246
1935	4,202	1,755	114	389	142	56	191
Weight ^c	28.18	11.21	38.30	31.26	22.97	39.04	34.38

^aTo make the 1919 figure for "complete fertilizers" comparable with those for later years, the amount of "ammoniated fertilizers" included by the Census (estimated on the basis of the 1921 ratio) was deducted and transferred to "other fertilizers, total."

^b"Ammoniated fertilizers" added to maintain comparability with later years.

^cValue per ton (dollars) in 1929.

BASIC TABLES: FERTILIZERS

Table A-44.- CONSUMPTION OF FERTILIZERS: 1919 TO 1936

Year	Short tons ^a	Index ^b (1929=100)
1919	6,858,322	84.9
1920	7,176,754	88.0
1921	4,862,931	60.2
1922	5,669,915	70.2
1923	6,442,314	79.7
1924	6,824,911	84.5
1925	7,333,166	90.8
1926	7,328,268	90.7
1927	6,843,199	84.7
1928	7,985,019	98.8
1929	8,078,548	100.0
1930	8,163,870	101.1
1931	6,306,083	78.1
1932	4,335,607	53.7
1933	4,870,471	60.3
1934	5,546,220	68.7
1935	6,218,131	77.0
1936	6,815,814	84.4

^aData for 1919 from American Fertilizer Handbook: 1931 (Philadelphia: Ware Bros., 1931), p. 23; 1920-28, Fertilizer Review (National Fertilizer Association), May-June 1931, p. 15; 1929, Apr.-May-June 1932, p. 14; 1930-31, Jan.-Feb.-Mar. 1933, p. 6; 1932, Apr.-May-June 1936, p. 13; 1933-36, Mar.-Apr. 1937, p. 13.

The figures represent total consumption of fertilizers in the U. S. The estimates made by the National Fertilizer Association are based primarily on records of fertilizer tag sales, and where these are not available, on estimates of state authorities and of the Association itself. All but 5 states have laws regulating the manufacture and sale of fertilizers, and in none of these 5 is the consumption of fertilizers important. Many require that sellers attach tags to "commercial fertilizers" and, with few exceptions, to any other materials which may be used for fertilizing purposes. These tags are purchased from state authorities and give such information as weight of package, brand name, and guaranteed analysis. (American Fertilizer Handbook: 1932, pp. 65-97)

^bComputed from preceding column.

Table A-45.- NUMBER OF WAGE EARNERS AND AVERAGE WEEKLY HOURS IN THE FERTILIZERS INDUSTRY: 1919 TO 1936

Year	Average number of wage earners	Average hours worked per week ^a
1919	26,296	49.6
1920	31,200 ^b	52.8
1921	16,898	48.9
1922	22,600 ^b	49.0
1923	18,572	50.0
1924	17,200	49.4 ^c
1925	19,644	49.4
1926	20,800	49.3
1927	18,612	49.3
1928	19,900	49.2
1929	20,926	49.2
1930	20,500	46.9
1931	14,551	44.6
1932	10,400	42.3
1933	13,063	41.1
1934	17,600	33.5
1935	17,473	34.1
1936	16,200	39.5

^aFigures for 1919 and 1929 represent Census prevailing weekly hours adjusted by the average of the 1921 and 1923 ratios of N.I.C.B. actual to Census prevailing hours. The actual hours for 1920-24 were derived from N.I.C.B. figures /for 1920, from Wages, Hours, and Employment in American Manufacturing Industries, July 1914-January 1923 (New York: N.I.C.B., 1923), p. 116; for 1921-22, ibid., July 1914-July 1923 (1923), p. 116; for 1923, ibid., July 1914-January 1924 (1924), p. 83; and for 1924, from Wages and Hours in American Industry (1925), p. 160/. The hours for 1932-36 were supplied by B.L.S.; and those for 1925-28 and 1930-31 are estimates derived by straight-line interpolation.

^bWage earners for 1920 and 1922 were determined from the number in the base year and interpolated relatives. Interpolation was accomplished by means of N.I.C.B. figures for 1920-23 (for sources, see fn. a). Since the data for 1920 and 1922 were available for only 7 and 6 months, respectively, they had to be adjusted by the mean ratio (computed from Census statistics) of the annual average to the average for the same months in the adjacent years.

^cAverage for first 9 months.

Table A-46.- PRODUCTION OF WHEAT FLOUR AND OTHER PRINCIPAL GRAIN-MILL PRODUCTS: CENSUS YEARS 1919 TO 1935

(Thousands of specified units)

Year	Wheat flour (barrels ^a)	Bran and middlings (short tons)	Feed, screenings, etc. ^b (short tons)	Corn meal and corn flour (barrels ^c)	Rye flour (barrels ^a)	Buckwheat flour (pounds)
1919	132,466	4,760	3,270	10,683	2,528	90,137
1921	110,846	4,041	3,506	10,932	1,335	65,438
1923	114,439	4,188	3,922	12,155	1,635	49,181
1925	114,690	4,527	3,430	9,707	1,598	47,873
1927	118,132	4,638	2,749	9,867	1,724	44,659
1929	120,094	4,682	2,472	11,077	1,679	38,453
1931	115,419	4,826	1,549	8,889	1,568	31,092
1933	101,638	3,959	1,232	8,922 ^d	1,909	22,013
1935	102,327	4,103	1,368	7,519	1,509	25,198
Weight ^e	6.14	30.33	37.96	5.01	5.47	0.041

^aBarrels of 196 pounds.^bExcludes production of prepared feed for livestock and poultry in all years. The quantities for 1919 and 1921 were estimated on the basis of the 1923 proportion (determined from Census of Manufactures: 1925, p. 116) and then deducted.^cBarrels of 200 pounds.^dDoes not include data for corn flour, which, however, comprised less than 0.3 percent of the total for corn meal and flour in 1927, 1929, and 1931.^eValue per unit (dollars) in 1929.

BASIC TABLES: FLOUR

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Table A-47.- WHEAT GROUND: 1919 TO 1936

Year	Flour production (thousands of barrels)			Bushels of wheat required per barrel of flour ^c		Wheat ground ^d (thousands of bushels)
	Total ^a	First half year ^b	Second half year ^b	First half year	Second half year	
	(1)	(2)	(3)	(4)	(5)	(6)
1919	134,321	n.a.	n.a.	4.450	4.645	612,235
1920	107,600	n.a.	n.a.	4.645	4.712	502,778
1921	112,493	n.a.	n.a.	4.712	4.727	531,079
1922	n.a.	n.a.	n.a.	4.727	4.632	543,167 ^e
1923	116,267	n.a.	n.a.	4.632	4.632	538,548
1924	120,300	n.a.	n.a.	4.632	4.582	553,981
1925	-	52,600	63,335	4.562	4.635	533,519
1926	-	52,452	66,311	4.635	4.568	546,024
1927	-	55,715	63,464	4.568	4.620	547,710
1928	-	56,891	64,406	4.620	4.578	557,687
1929	-	58,373	63,722	4.578	4.603	560,544
1930	-	57,610	63,020	4.603	4.613	555,890
1931	-	53,375	61,295	4.613	4.575	526,644
1932	-	51,281	56,312	4.575	4.585	492,802
1933	-	54,183	49,108	4.585	4.582	473,442
1934	-	51,286	53,189	4.582	4.561	477,587
1935	-	50,038	52,884	4.561	4.628	472,970
1936	-	51,621	56,134	4.628	4.608	497,567

^aWheat Studies (Palo Alto, Calif.; Leland Stanford University Food Research Institute), Vol. XII, No. 8, p. 276 for odd-numbered years; IV, 2, pp. 90, 102 for even-numbered years. Data for even-numbered years were adjusted slightly.

^bFor 1925-31, *ibid.*, XII, 9, p. 335; for 1932-36, XIV, 1, p. 33.

^cFor 1919-35, *ibid.*, IV, 2, p. 101, and XIII, 4, p. 225; for 1936, XIV, 4, p. 175.

^dFor 1919-21 and 1923-24, col. (1) multiplied by weighted average of cols. (4) and (5); for 1925-35, the sum of the products of cols. (2) and (4) and cols. (3) and (5). The weights for earlier years are ratios (and their complements) of first-half-year to full-year flour production as given in Wheat Studies, IV, 2, pp. 90, 102; 1919, 0.446; 1920, 0.525; 1921, 0.414; 1924, 0.458. (No average is necessary for 1923, since the two yield ratios are identical.)

^eThe product of wheat ground in 1929 and the relative for 1922 interpolated by means of the Federal Reserve Board index of flour production (Federal Reserve Index of Industrial Production, mimeo., Apr, 1936, p. 9). The F.R.B. index numbers (shifted from base 1923-25 to 1929) are: 1921, 94.1; 1922, 97.0; 1923, 97.0.

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Table A-48.- NUMBER OF WAGE EARNERS AND AVERAGE WEEKLY HOURS
IN THE FLOUR AND OTHER GRAIN-MILL PRODUCTS
INDUSTRY: 1919 TO 1936

Year	Average number of wage earners	Average weekly hours		Average yearly man-hours ^b	Average hours worked per week ^c
		Actual ^a	Prevailing		
	(1)	(2)	(3)	(4)	(5)
1919	45,481	n.a.	54.5	-	50.6
1920	40,800	n.a.	n.a.	-	50.5
1921	35,378	n.a.	54.0	-	50.2
1922	35,800	n.a.	n.a.	-	50.2
1923	35,194	n.a.	54.0	-	50.2
1924	33,400	n.a.	n.a.	-	50.0
1925	31,988	n.a.	n.a.	-	49.8
1926	30,800	n.a.	n.a.	2,458.0	49.6
1927	29,982	n.a.	n.a.	2,456.8	49.5
1928	28,700	n.a.	n.a.	2,462.9	49.7
1929	27,028	n.a.	52.9	2,438.5	49.2
1930	24,800	n.a.	n.a.	2,488.2	50.2
1931	22,840	n.a.	n.a.	2,416.0	48.7
1932	22,000	47.9	n.a.	2,396.1	47.9
1933	23,207	43.4	n.a.	2,167.8	43.4
1934	26,600	38.6	n.a.	1,918.4	38.6
1935	26,495	39.4	n.a.	1,917.3	39.4
1936	25,900	43.8	n.a.	n.a.	43.8

^aB.L.S.

^bFrom data collected by N.R.P.-N.B.E.R. in field study of establishments producing 14-33 percent of value of the industry's output. The results of this survey are summarized in *Productivity and Employment in Selected Industries: Wheat Flour*, by R. T. Bowman (in preparation).

^cFor 1932-36, col. (2); for 1926-31, col. (4) multiplied by the average ratio of col. (2) to (4) in 1932-35; for 1919-26, col. (3) spliced to the 1929 figure in col. (5) after completion for this period by straight-line interpolation.

BASIC TABLES: FURNITURE

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Table A-49.- VALUE OF FURNITURE AND WHOLESALE-PRICE INDEX: 1919 TO 1936

Year	Value of furniture produced in Furniture Industry ^a (thousands of dollars)	Wholesale-price index for furniture ^b (1929=100)
1919	557,522 ^c	110.8
1920	715,700	165.4
1921	529,187 ^c	128.6
1922	652,700	115.7
1923	746,847	119.0
1924	744,000	110.4
1925	823,737	106.3
1926	868,200	103.2
1927	849,194	100.9
1928	838,100	101.1
1929	912,942	100.0
1930	659,100	99.6
1931	462,094	94.1
1932	273,900	82.0
1933	286,223	80.9
1934	333,200	83.9
1935	415,025	80.6
1936	508,600	83.7

^aEstimates for intercensal years were obtained by interpolation by means of the B.L.S. pay-rolls index.

^bComputed from B.L.S. wholesale-price relatives as published in its wholesale-price bulletins. The index is composed of three segments - one for 1919-25, one for 1925-28, and the third for 1928-33 - which were linked in their common years. The three segments include, respectively, the first 10, 12, and all 17 of the following products:

Bedroom furniture	Kitchen furniture,
Beds, wood	cabinets
Chairs	Living-room furniture,
Dressers and vanities	chairs
Dining-room furniture	Bedroom furniture,
Buffets	beds, metal
Chairs (set of 6)	Office furniture
Tables	Armchairs
Kitchen furniture	Side
Chairs	Swivel
Tables	Desks
Living-room furniture	Flat-top
Davenports	Typewriter
Tables	

The weight for each relative is the Census value in 1929 for the corresponding product. In the case of bedroom chairs, the weighting factor is the combined value of "chairs" and "benches." In 2 other cases (armchairs and desks) the Census weights were applied to the simple averages of price relatives for 2 varieties (side and swivel armchairs and flat-top and typewriter desks).

^cIn 1919 and 1921, the Census did not segregate the value of products not normally belonging to the industry and of contract, custom, and repair work. The value of such production, estimated on the basis of the 1923 proportion, was therefore deducted from the value of all products of the industry. The 1919 figure was further adjusted to include the value of hammocks (for other years, this had been done by the Census).

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Table A-50.- NUMBER OF WAGE EARNERS AND AVERAGE WEEKLY HOURS IN THE FURNITURE INDUSTRY: 1919 TO 1936

Year	Average number of wage earners	Average hours worked per week ^a
1919	140,252	49.0
1920	154,700	46.8
1921	124,362	44.4
1922	147,800	48.4
1923	168,157	48.2
1924	164,800	47.1
1925	181,016	47.5
1926	189,900	48.0
1927	188,143	47.7
1928	184,500	46.8
1929	193,399	46.9
1930	153,800	42.4
1931	127,605	39.8
1932	99,200	34.5
1933	105,488	36.2
1934	112,600	34.6
1935	130,781	38.9
1936	145,400	42.4

^aFor 1919, prevailing hours adjusted by the 1923 ratio of actual to prevailing; for 1920-31, N.I.C.B. actual; and for 1932-36, B.L.S. actual hours.

Table A-51.- PRODUCTION OF WINDOW AND OBSCURED GLASS;
1919 TO 1936

(Thousands of square feet)

Year	Census series		Auxiliary series	
	Window glass	Obscured glass	Cylinder, crown, and sheet glass ^a	Window glass ^b
1919	368,912	33,822	n.a.	368,900
1920	n.a.	n.a.	n.a.	400,000
1921	260,065	20,902	n.a.	260,050
1922	n.a.	n.a.	n.a.	507,900
1923	510,215	46,376	n.a.	510,200
1924	n.a.	n.a.	n.a.	538,675
1925	567,151	53,951	n.a.	567,150
1926	n.a.	n.a.	529,998	n.a.
1927	481,021	41,545	481,021	n.a.
1928	n.a.	n.a.	425,088	n.a.
1929	402,559	34,294	402,559	n.a.
1930	n.a.	n.a.	266,792	n.a.
1931	266,772	17,796	219,252	n.a.
1932	n.a.	n.a.	162,885	n.a.
1933	249,443 ^c	11,600 ^d	246,756	n.a.
1934	n.a.	n.a.	315,264	n.a.
1935	428,938	14,372	406,755	n.a.
1936	n.a.	n.a.	352,854	n.a.
Weight ^e	0.0663	0.1278	-	-

^aThe statistics were obtained from Flat Glass and Related Products (U. S. Tariff Commission, Report No. 123, 2nd Series), p. 44. The figures for 1926-30 are based on data obtained directly from manufacturers; those for later years were furnished by the Window Glass Manufacturers Association and exclude some of the smaller establishments included in the earlier period. (In interpolating Census statistics by means of the Tariff Commission series, the 1929 Census-Tariff Commission ratio was applied to the Tariff Commission figure for 1930.)

^bThe figures, supplied by H. Jerome, were collected in the course of preparation of *Mechanization in Industry* (National Bureau of Economic Research, 1934). Production for 1924 was estimated by straight-line interpolation.

^cThis figure did not require the usual adjustment for incomplete coverage since, according to the Census, the data "were so nearly complete as to be fairly comparable with those for 1935."

^dThe combined output of obscured and wire glass for 1933 was distributed between the 2 products in accordance with their 1931 proportions.

^eAverage unit value (dollars) for odd-numbered years 1919-35.

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Table A-52.- PRODUCTION OF PLATE AND WIRE GLASS:
1919 TO 1936

(Thousands of square feet)

Year	Polished plate glass	Wire glass	Auxiliary series for polished plate glass ^a
1919	56,824	15,691	48,640
1920	n.a.	n.a.	67,776
1921	56,239	16,159	53,580
1922	n.a.	n.a.	76,680
1923	94,470	31,606	89,064
1924	n.a.	n.a.	91,560
1925	117,369	32,909	118,536
1926	n.a.	n.a.	134,244
1927	118,124	29,115	118,452
1928	n.a.	n.a.	130,644
1929	148,743	42,817	150,504
1930	n.a.	n.a.	105,828
1931	87,017	15,664	86,976
1932	n.a.	n.a.	52,224
1933	85,438 ^b	10,204 ^c	86,040
1934	n.a.	n.a.	94,572
1935	177,263	11,961	179,820
1936	n.a.	n.a.	198,070
Weight ^d	0.434	0.153	-

^aStatistics for 1919-20 were obtained from Cast Polished Plate Glass (U. S. Tariff Commission, 1929), p. 3; they were compiled by the Plate Glass Manufacturers of America and are directly comparable with those for subsequent years. Data for 1921-35, from Survey of Current Business, "1936 Supplement," p. 139; and for 1936, from later monthly issues. "The data were compiled by the Plate Glass Manufacturers of America, and starting in 1925, represent practically the entire industry. In earlier years the coverage was slightly less." (Ibid., p. 181, fn. 4 to p. 139.)

^bEstimated through use of production series shown in last column.

^cSee Table A-51, fn. d.

^dAverage unit value (dollars) for odd-numbered years 1919-35.

Table A-53.- PRODUCTION OF GLASS CONTAINERS: CENSUS YEARS 1919 TO 1956

(Thousands of gross)

Year	All glass containers ^a	Pressure ware	Non-pressure ware	General purpose containers	Milk bottles	Fruit jars	Medicinal, toilet, etc.	Narrow-neck bottles	Wide-mouth bottles	Pressed ware (packers')
1919	22,296	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
1921	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
1923	26,393	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
1925	26,044	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
1927	34,532	3,740	413	4,223 ^b	2,181	1,515	12,097	3,301	6,299	753
1929	35,686	4,130	437	1,356	2,610	1,153	15,792	2,856	6,469	761
1931	31,924	3,538	577	1,029	2,138	2,082	12,765	2,637	6,338	522
1933	34,897	6,073	467	1,353	1,860	1,104 ^c	14,120	2,756 ^d	6,616 ^d	436 ^e
1935	40,956	7,838 ^e	1,278 ^e	1,925	2,124	1,386	14,579	3,351	7,826	652
Weight ^f	-	3.77	4.01	3.51	4.86	7.39	2.41	3.26	2.99	2.77

^aSum of figures for individual products. The Census does not report separate statistics for each product prior to 1927. Statistics for 1919, 1923, and 1925 were derived from Productivity of Labor in the Glass Industry (B.L.S. Bull. No. 441), p. 16.

^bCommunication with the Bureau of the Census established the fact that this figure, though reported as representing thousands of dozens, actually represents thousands of gross.

^cData for fruit jars and pressed ware (packers'), reported in combination by the Census, were segregated on the basis of their 1931 proportions.

^dData for narrow-neck and wide-mouth bottles, reported in combination by the Census, were segregated on the basis of their 1931 proportions.

^eThe total for "beer bottles", "liquor ware", and "other pressure and non-pressure ware" was allocated to pressure ware and to non-pressure ware on the basis of their 1931 proportions.

^fAverage unit value (dollars) for odd-numbered years 1927-35.

BASIC TABLES: GLASS GROUP

Table A-54.- PRODUCTION OF GLASS CONTAINERS: 1926 TO 1936^a

(Thousands of gross)

Year	31 companies	42 companies
1926	24,552	-
1927	25,404	-
1928	28,392	-
1929	29,316	-
1930	27,276	-
1931	24,684	-
1932	20,558	26,568
1933	23,522	33,352
1934	-	35,796
1935	-	38,760
1936	-	45,216

^aThe 2 series, which were used for completion of the index derived from Table A-53, were compiled by the Glass Container Association and published in *Survey of Current Business*, "1932 Annual Supplement," pp. 258-9; "1936 Supplement," p. 139; March 1933, p. 52; and March 1934, p. 52. The 31 companies account for over 80 percent of the industry's output, and the 42 companies, for approximately 95 percent.

Table A-55.- PRODUCTION OF PRINCIPAL KINDS OF PRESSED AND BLOWN GLASS:
CENSUS YEARS 1919 AND 1925 TO 1935

(Units in thousands)

Year	Pressed tumblers and goblets (dozens)	Chimneys (dozens)	Lantern globes (dozens)	Tubing (pounds)	Bulbs for electric lamps ^a
1919	25,182	6,615	1,986	18,147	220,363
1925	29,678	3,439	1,080	16,860	474,547
1927	27,281	2,987	869	21,519	572,045
1929	17,542	3,019	942	23,067	657,870
1931	8,534	1,597	404	17,292	516,346
1933	11,522	2,591	377	14,370	475,150
1935	10,120 ^b	2,433	616	27,302	696,552
Weight ^c	0.355	0.656	0.803	0.187	0.028

^aThe figure for 1919 was obtained from *Census of Manufactures*; those for odd-numbered years 1925-31, from Witt Bowden, *Technological Changes and Employment in the Electric-Lamp Industry* (B.L.S. Bull. No. 593), pp. 46, 48. The estimates for 1933 and 1935 were made through the use of a series for incandescent-filament lamps (included by the Census as a normal product of the Electrical Machinery, Apparatus, and Supplies industry). The figures for incandescent-filament lamps for these two years were multiplied by the average of the ratios (1.099) in the odd-numbered years 1921-31 of the output of bulbs reported by B.L.S. to the output of lamps reported by the Census.

^b Estimated from total which includes blown tumblers, goblets, and barware on basis of 1931 value ratio.

^c Average unit value (dollars) for odd-numbered years 1925-35, except for bulbs. Weight for bulbs is unit value (dollars) for 1925.

Table A-56.- WEIGHTS USED IN CONSTRUCTION OF N.R.P. PRODUCTION INDEX FOR THE GLASS GROUP^a

Year	Window Glass	Plate Glass	Glass Containers	Pressed and Blown Ware
1919	13.8	14.2	33.2	38.8
1920	13.8	14.2	33.2	38.8
1921	13.8	14.2	33.2	38.8
1922	13.8	14.2	33.2	38.8
1923	13.8	14.2	33.2	38.8
1924	15.4	16.5	32.0	36.1
1925	16.8	18.4	32.1	32.7
1926	15.3	17.8	32.8	34.1
1927	13.8	17.1	33.7	35.4
1928	11.6	17.5	35.3	35.6
1929	10.0	18.4	34.5	37.1
1930	8.8	15.5	36.1	39.6
1931	7.2	12.0	40.5	40.3
1932	7.3	10.3	44.0	38.4
1933	8.1	9.6	41.5	40.8
1934	8.4	10.3	40.6	40.7
1935	8.5	10.7	41.3	39.5
1936	8.3	10.4	42.9	38.4

^aThe weights, which represent the percents of group employment in the 4 industries, were computed for the odd-numbered years 1923-35 from the wage-earner statistics shown in Table A-57; the 1923 distribution was assumed for 1919-22; the weights for the remaining even-numbered years were computed from the series for Glass Containers (Table A-57) and estimates for the other 3 industries derived by distributing the differences between the group totals and employment in Glass Containers in accordance with the average proportions in adjacent census years.

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Table A-57.- AVERAGE NUMBER OF WAGE EARNERS IN THE GLASS GROUP AND COMPONENT INDUSTRIES: 1919 TO 1936^a

Year	Glass group ^b	Window Glass	Plate Glass	Glass Containers ^c	Pressed and Blown Ware
1919	72,700	n.a.	n.a.	n.a.	n.a.
1920	75,700	n.a.	n.a.	n.a.	n.a.
1921	51,300	n.a.	n.a.	n.a.	n.a.
1922	62,100	n.a.	n.a.	n.a.	n.a.
1923	68,800	9,500	9,800	22,900	26,600
1924	62,200	n.a.	n.a.	19,900	n.a.
1925	64,600	10,900	11,900	20,600	21,100
1926	67,500	n.a.	n.a.	22,200	n.a.
1927	61,500	8,500	10,500	20,800	21,700
1928	61,700	n.a.	n.a.	21,800	n.a.
1929	65,700	6,600	12,100	22,600	24,400
1930	56,100	n.a.	n.a.	20,300	n.a.
1931	47,100	3,400	5,700	19,000	19,000
1932	39,000	n.a.	n.a.	17,200	n.a.
1933	46,400	3,700	4,500	19,300	18,900
1934	59,200	n.a.	n.a.	24,000	n.a.
1935	62,000	5,300	6,600	25,600	24,500
1936	63,600	n.a.	n.a.	27,300	n.a.

^aThe number of wage earners in each industry was adjusted for comparability with the production series. The unadjusted series for each industry was obtained for odd-numbered years 1929-35 from a special Census tabulation of wage earners, wages, and value of products; for 1923 and 1925 from Boris Stern, *Productivity of Labor in the Glass Industry* (B.L.S. Bull. No. 441), p. 15; and for 1927, by distributing the total for the Glass group among the component industries in accordance with the average of the 1925 and 1929 proportions. The B.L.S. figures did not include data for obscured glass in the Window Glass industry and for wire glass in the Plate Glass industry. The number of wage earners engaged in the manufacture of these products in 1923 and 1925 was estimated by subtracting the sum of the B.L.S. industry figures from the total for the Glass group and apportioning the difference between the 2 products on the basis of their value proportions in these years.

The series thus obtained were adjusted for comparability with the corresponding production indexes. The adjustment factors for each series for odd-numbered years 1929-35 were the ratios of (a) the total value reported by the Census for those products normally belonging to the industry of the same name (regardless of the industry in which produced) to (b) the total value indicated by the special Census tabulation for all products made in that industry; the average of these ratios was used for 1923, 1925, and 1927.

^bEmployment for odd-numbered years 1923-35 is the sum of the wage earners in the component industries; for 1919-22 and intercensal years 1924-36, estimates were made through the use of the B.L.S. index.

^cEstimated for even-numbered years 1924-36 were made through the use of statistics supplied in an unpublished B.L.S. tabulation.

BASIC TABLES: GLASS GROUP

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Table A-58.- AVERAGE WEEKLY HOURS IN THE GLASS GROUP:
1919 TO 1936

Year	Average hours per week ^a
1919	49.4
1920	49.3
1921	49.2
1922	49.1
1923	48.9
1924	49.1
1925	49.2
1926	49.4
1927	49.5
1928	49.7
1929	49.8
1930	45.6
1931	41.5
1932	37.3
1933	35.9
1934	33.8
1935	35.4
1936	36.8

^aFigures for 1919, 1921, 1923, and 1929 are Census prevailing hours; those for 1932-36 are B.L.S. actual hours; and those for remaining years are estimates obtained by straight-line interpolation.

Table A-59.- PRODUCTION OF ICE CREAM AND RELATED PRODUCTS:
1919 TO 1936

(Quantities in thousands of gallons)

Year	Ice cream, ices, and specialties	Ice cream	
		Quantity ^a	Index ^b (1929=100)
1919	n.a.	133,056	52.3
1920	n.a.	148,298	58.2
1921	n.a.	147,949	58.1
1922	n.a.	161,609	63.5
1923	224,992 ^c	173,412	68.1
1924	n.a.	181,564	71.3
1925	243,907	214,382	84.2
1926	n.a.	215,248	84.5
1927	252,339	226,756	89.1
1928	n.a.	232,185	91.2
1929	279,776	254,618	100.0
1930	n.a.	240,750	94.6
1931	230,930	208,239	81.8
1932	n.a.	154,604	60.7
1933	166,391	148,913	58.5
1934	n.a.	179,594	70.5
1935	227,349	199,385	78.3
1936	n.a.	243,000	95.4

^aQuantities for 1919-20 from Yearbook of Agriculture: 1923 (U. S. Dept. Agr.), p. 911; for 1921-28 from ibid.: 1930, p. 904; for 1929-35 from Agricultural Statistics: 1937 (U. S. Dept. Agr.), p. 301; and for 1936 from Moody's Manual of Investments, "Industrials: 1937," p. a13.

^bComputed from preceding column.

^cAdjusted to include the output of specialties, which was assumed to bear the same proportion to the total as in 1925.

**Table A-60.— NUMBER OF WAGE EARNERS AND AVERAGE WEEKLY HOURS
IN THE ICE CREAM INDUSTRY: 1919 TO 1936**

Year	Average number of wage earners	Average hours per week ^a
1919	19,155	54.9
1920	19,700 ^b	55.1
1921	20,209	55.3
1922	21,700 ^b	55.6
1923	23,132	55.8
1924	23,800	55.7
1925	23,043	55.6
1926	22,500	55.5
1927	21,927	55.4
1928	22,300	55.3
1929	22,399	55.2
1930	20,800	54.1
1931	17,819	52.9
1932	15,100	51.8
1933	14,367	47.6
1934	16,800	44.1
1935	17,321	45.4
1936	17,600	47.4

^aFor 1919, 1921, 1923, and 1929, Census prevailing hours, which were computed for the first 2 years by multiplying the average for the Confectionery and Ice Cream industries combined (classified together by the Census prior to 1923) by the mean ratio for 1923 and 1929 of hours for Ice Cream to the average for both; for 1932-36, B.L.S.; and for remaining years, estimates obtained by straight-line interpolation.

^bEstimated by straight-line interpolation.

Table A-61.- PRODUCTION OF PRINCIPAL IRON AND STEEL PRODUCTS: 1919 TO 1956^a

(Thousands of long tons)

Product	Weight ^b	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936
Pig iron and ferro-alloys	-	30,867	36,778	16,618	27,111	40,163	31,249	36,496	39,097	36,230	37,927	42,487	31,693	18,289	8,720	13,267	16,010	21,164	30,719
Ingots, steel	10.77	33,290	40,341	18,865	34,193	43,401	36,900	44,111	46,896	43,774	50,167	54,794	39,725	26,438	13,449	22,864	26,793	33,891	47,475
Castings, steel	140.80	737	865	415	805	1,120	866	1,008	1,067	983	1,181	1,367	852	469	205	279	340	514	723
Nails																			
New	8.84	2,089	2,490	2,100	2,075	2,748	2,334	2,704	3,122	2,716	2,591	2,692	1,849	1,141	392	398	976	685	1,167
Rerolled ^c	22.54	96	88	54	89	113	77	70	90	88	69	57	21 ^d	12	18	56	20	34	
Rail joints and fastenings	21.22	465	579	385	588	772	644	818	984	893	821	877	694	394	162	202	356	272	475
Structural shapes																			
Heavy	8.84	2,207 ^e	2,903	1,159	2,434	2,991	2,910	3,216	3,370	3,104	3,392	3,946	2,928	1,736 ^f	741	820 ^g	1,054	1,293 ^f	2,140
Light	13.86	320 ^h	374	133	345	610	460	449	562	608	622	680	617	313 ^f	173	240 ^g	357	449 ^f	744
Concrete-reinforcing bars	11.67	301	460	202	517	817	581	709	746	783	937	972	836	617	371	557	464	523	966
Merchant bars																			
Iron	20.33	469	734	213	415	410	260	271	255	218	239	198	109	54	28	47	48	53	71
Open-hearth and Bessemer ⁱ	17.15	3,883 ^h	5,752	1,551	3,963	5,548 ^h	4,061	5,077	5,008	4,539	6,085	6,508	4,131	2,444	1,342	2,379	2,795	3,521	4,823
Crucible and electric ^k	282.62	143 ^h	214	66	110	108 ^h	84	116	107	90	142	173	116	72	37	61	91	142	194
Wire rods	10.49	2,500	3,128	1,578	2,674	3,091	2,599	3,000	2,839	2,959	3,140	3,152	2,356	1,645	1,188	2,033	1,705	2,377	2,920
Plates	12.26	4,427	5,031	1,722	3,441	4,308	3,284	3,953	4,394	3,984	4,090	5,286	3,835	2,046	955	1,462	1,806	1,820 ^j	3,161
Sheets	39.23	3,377	4,258	2,221	4,171	5,038	4,628	5,608	6,018	5,760	6,943	7,285	5,427	4,171	2,637	5,026	5,118	7,802 ^j	10,377
Skelp	7.29	2,589	3,658	2,312	3,122	3,647	3,241	3,445	3,938	3,503	3,433	3,656	2,674	1,472	609	1,017	1,144	1,376	2,198
Cotton ties, hoops, bands, and strips	22.69	832	1,217	480	1,084	1,405	1,259	1,733	1,687	1,724	2,512	2,764	1,789	1,450	1,034	1,538	1,812	2,206	2,687
Wrought-welded -																			
Oil-country casing, tubing, and pipe	36.87	922	1,151	752	1,017	1,224 ^k	953	939	1,136	1,114	953	888	491	162	55	69	71	68	105
Other black pipe	34.59	772	935	592	849	1,081 ^k	909	998	1,061	946	903	948 ^l	821	466	200	294	355	399	613
Galvanized pipe	54.07	211	268	177	258	334 ^k	323	398	532	362	362	402 ^l	346	193	100	174	182	177	273
Tin plate ^m	75.32	1,059	1,849	731	1,193	1,410	1,331	1,554	1,882	1,589	1,712	1,800	1,650	1,398	995	1,651	1,500	1,692	2,099
Seamless pipe and tube	66.50	166	265	116	223	303 ^k	220	333	765	878	1,096	1,329 ^l	1,211	722		858	478	659	1,365
Blooms and billets, and slabs, except for forging	2.86	25,368 ⁿ	n.a.	14,010	n.a.	34,681 ⁿ	n.a.	32,395	n.a.	30,491	n.a.	36,619	n.a.	18,724	n.a.	16,550	n.a.	25,182	n.a.
Rolled blooms and billets for forging	12.95	811	n.a.	95	n.a.	255 ⁿ	n.a.	257	n.a.	274	n.a.	658	n.a.	173	n.a.	121	n.a.	267	n.a.
Sheet and tin-plate bars	1.64	4,164	n.a.	2,908	n.a.	6,333	n.a.	7,136	n.a.	7,121	n.a.	6,711	n.a.	4,565	n.a.	4,787	n.a.	6,463	n.a.
Bolt and nut rods and spike and chain rods	15.70	233	n.a.	251	n.a.	490	n.a.	380	n.a.	348	n.a.	433	n.a.	180	n.a.	151	n.a.	237	n.a.
Muck and scrap bars	30.64	906	n.a.	437	n.a.	653	n.a.	461	n.a.	372	n.a.	341	n.a.	123	n.a.	65	n.a.	90	n.a.
Axles, rolled and forged	46.98	95	n.a.	56	n.a.	197	n.a.	135	n.a.	119	n.a.	150	n.a.	27	n.a.	55	n.a.	62	n.a.
Car and locomotive wheels	87.48	118	n.a.	85	n.a.	237	n.a.	147	n.a.	155	n.a.	209	n.a.	84	n.a.	69	n.a.	85	n.a.
Armor plate and ordnance ^o	331.70	101	n.a.	71	n.a.	9	n.a.	1	n.a.	8	n.a.	10	n.a.	17	n.a.	8	n.a.	21	n.a.
Scrap iron and steel	13.83	11,468	n.a.	5,440	n.a.	11,300	n.a.	13,317	n.a.	13,283	n.a.	16,818	n.a.	8,305	n.a.	7,207	n.a.	10,172	n.a.
Ternsplate ^p	73.43	74	n.a.	39	n.a.	61	n.a.	81	n.a.	86	n.a.	154	n.a.	71	n.a.	69	n.a.	191	n.a.

^aUnless otherwise specified, the quantities refer to total production (i.e., sum of production for sale, interplant transfer, and consumption in the same establishment) in the Iron and Steel group.

The Census series for the first 21 products were completed for intercensal years by the use of comparable American Iron and Steel Institute data (Annual Statistical Report of the American Iron and Steel Institute for 1928, 1930, 1934, and 1938). Since A.I.S.I. does not report production of the components of a few classes of products (viz., ingots and castings; and iron, open-hearth and Bessemer, and crucible and electric merchant bars), the series for these classes were first interpolated, and the interpolated totals then distributed in accordance with averages of the ratios of the components to the totals in adjacent census years. In 8 other instances (rails and structural shapes) it was considered preferable to interpolate the production of the entire class by the corresponding A.I.S.I. series even though more detailed statistics were available.

^bAverage of values added per long ton in census years 1921-35. The values added are differences between values at successive stages of fabrication.

Value per ton of steel ingots was computed from value and tonnage data for interplant transfer only. In computing the value added for rerolled rails it was assumed that they are derived from scrap iron and steel. Unit value added of scrap iron and steel, which is a by-product obtained at many stages, is represented by unit value.

^cProduction for sale and interplant transfer.

^dA.I.S.I., Annual Statistical Report of the American Iron and Steel Institute for 1938, p. 80.

^eCensus of Manufactures, 1912, pp. 848-9.

^fTotal production of each of the two kinds of structural shapes was estimated by multiplying production for sale and interplant transfer by the ratio of their combined total production to combined production for sale and interplant transfer.

^gFor 1925-35, total production was estimated by the method indicated in fn. f.

^hCensus quantities were adjusted to the level of the revised total for steel bars (Census of Manufactures, 1929, II, 264) by multiplication by ratio of revised to unrevised total. The figures shown are not strictly comparable with those for other years since some establishments reported the quantity produced and consumed in the same works in 2 or more forms, e.g., both as bars and as rail joints and fastenings.

ⁱQuantities of stainless steel plates and sheets, which were not reported separately for 1935, were estimated from their combined tonnage on the basis of the 1938 proportions.

^kCensus of Manufactures, 1925, p. 449.

^lCensus of Manufactures, 1933, p. 466.

^mProduction in all industries.

ⁿNot strictly comparable with quantities for other years because of the duplication in the figures for some establishments.

^oProduction for sale only.

Table A-62.- NUMBER OF WAGE EARNERS AND AVERAGE WEEKLY HOURS
IN THE IRON AND STEEL GROUP: 1919 TO 1936

Year	Average number of wage earners			Average hours worked per week in the Iron and Steel group ^c
	Iron and Steel group ^a	Blast Furnaces ^b	Steel Works and Rolling Mills ^b	
1919	419,092	44,004	375,088	63.7
1920	429,200	38,200	391,000	60.7
1921	254,213	18,698	235,515	51.9
1922	324,700	26,000	298,700	55.8
1923	424,913	36,712	388,201	55.4
1924	394,800	31,200	363,600	49.2
1925	399,914	29,188	370,726	51.5
1926	410,700	29,600	381,100	52.2
1927	389,270	27,958	361,312	51.0
1928	391,000	25,400	365,600	51.8
1929	419,534	24,960	394,574	52.7
1930	367,100	19,800	347,300	46.9
1931	278,206	13,572	264,634	41.7
1932	234,900	10,600	224,300	26.1
1933	288,945	12,098	276,847	32.5
1934	347,400	14,300	333,100	30.5
1935	374,808	15,178	359,630	34.9
1936	427,100	17,100	410,000	40.9

^aFigures for intercensal years 1924-36 were computed from B.L.S. index; for 1920 and 1922, from an index constructed from a monthly series of link relatives of the number of wage earners in identical establishments (Monthly Labor Review, Mar. 1919-Mar. 1923). This index was adjusted to Census trend.

^bEstimates for intercensal years were obtained by multiplying group totals by the average of the ratios in adjacent census years of the number of wage earners in each industry to employment in the group. The 1935 ratios were assumed for 1936.

^cFor 1932-36, B.L.S.; for 1920-31, N.I.C.B. series multiplied by 1932 ratio of B.L.S. to N.I.C.B. hours; and for 1919, an estimate obtained by applying the percentage change in prevailing hours for selected occupations between 1919 and 1920 (Wages and Hours of Labor in the Iron and Steel Industry: 1907 to 1920, B.L.S. Bull. No. 305) to actual hours for 1920.

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Table A-63.- PRODUCTION OF HOSIERY: BY MATERIAL AND STYLE,
CENSUS YEARS 1919 TO 1925, AND BY MATERIAL,
1925 AND 1927

(Thousand dozen pairs).

Product	Weight ^a	1919	1921	1923	1925	1927
By material and style:						
Hose						
All-cotton						
Full-fashioned	3.200	2,941	1,715	1,796	728	-
Seamless	2.162	33,895	28,521	32,895	27,906	-
All-wool						
Full-fashioned	10.671	27	26	37	7	-
Seamless	6.449	368	1,098	573	272	-
Cotton and wool mixed						
Full-fashioned	7.381	31	32	220	88	-
Seamless	3.979	998	2,600	3,155	937	-
Silk						
Full-fashioned	15.603	935	973	1,720	1,484	-
Seamless	9.944	913	1,617	1,399	260	-
Rayon, seamless	3.991	691	1,550	2,161	305	-
Silk or rayon mixed with other fibers						
Full-fashioned	13.354	2,340	4,797	6,039	9,985	-
Seamless	5.496	8,236	9,105	9,614	17,626	-
Half-hose						
All-cotton, full- fashioned and seamless	1.658	23,778	20,658	22,929	21,769	-
All-wool, full- fashioned and seamless	4.895	652	390	567	361	-
Cotton and wool mixed, seamless	3.100	3,115	1,835	4,358	3,199	-
Silk						
Full-fashioned	9.312	84	46	19	209	-
Seamless	5.385	996	1,495	1,502	183	-
Rayon, seamless	3.197	846	451	591	252	-
Silk or rayon mixed with other fibers						
Full-fashioned	7.449	871	616	819	540	-
Seamless	3.988	2,829	2,670	6,875	13,656	-
By material:						
All-cotton	1.640	-	-	-	50,403	43,238
All-wool	5.185	-	-	-	639	565
Cotton and wool	3.022	-	-	-	4,235	4,204
Silk	12.882	-	-	-	2,137	3,566
Rayon	2.850	-	-	-	556	906
Silk or rayon mixed with other fibers	6.300	-	-	-	41,807	50,577

^aAverage unit value (dollars) in years for which quantity statistics are shown.

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Table A-64.- PRODUCTION OF HOSIERY: CENSUS YEARS 1927 TO 1935

(Thousand dozen pairs)

Product	Weight ^a	1927	1929	1931	1935	1935
Men's hosiery						
All-cotton						
Full-fashioned	5.115	159	26	16	22	40
Seamless	1.217	21,385	16,406	11,520	12,456	12,357
All-wool, full-fashioned and seamless	5.858	442	337	245	360	881
All-pure-thread-silk, and pure-thread-silk with lisle or cotton tops, heels, and toes, full-fashioned and seamless						
All-wool, principally seamless	4.956	1,817	2,206	1,614	2,091	1,674
Rayon with cotton tops, heels, and toes, full-fashioned and seamless	2.383	472	402	1,796	1,010	874
Cotton and wool, principally seamless	2.235	5,351	7,826	10,675	9,492	12,983
Silk and rayon, principally seamless	2.686	3,648	5,221	1,172	2,712	3,614
Rayon and wool, principally seamless	4.545	2,479	1,719	1,141	1,146	1,473
Rayon and cotton, principally seamless	4.720	404	543	190	304	31
Other mixtures, principally seamless ^b	1.915	5,959	9,615	8,485	7,370	7,927
	5.730	2,145	2,687	3,569	1,169	663
Women's hosiery						
All-cotton						
Full-fashioned	5.120	371	541	198	179	38
Seamless	1.676	10,456	6,928	4,161	5,748	4,220
All-pure-thread-silk						
Full-fashioned	11.589	3,079	5,816	9,075	13,370	18,841
Seamless	6.367	297	663	466	489	1,115
Pure-thread-silk with lisle or cotton tops, heels, and toes						
Full-fashioned	10.006	14,758	19,224	17,410	15,636	16,231
Seamless	6.713	2,853	2,624	835	1,384	2,966
All-rayon and rayon with cotton tops, heels, and toes						
Full-fashioned	6.133	95	1,665	1,106	538	65 ^c
Seamless	2.847	5,027	5,475	6,020	4,250	3,918
All-wool and cotton and wool, full-fashioned and seamless						
Other mixtures, full-fashioned and seamless ^d	4.540	280	250	85	104	42 ^d
	6.190	6,946	7,875	3,150	3,914	1,650
Boys', misses', and children's hosiery, principally seamless						
All-cotton						
All-rayon and rayon with cotton tops, heels, and toes	1.732	10,865	9,694	7,060	8,429	8,788
Cotton and wool	2.417	597	1,032	811	658	343
Rayon and cotton	3.189	327	359	62	137	141
Other mixtures ^e	2.326	1,745	3,480	4,343	3,271	1,652
	4.161	583	579	858	290	199
Infants' hosiery, principally seamless						
All-cotton						
Rayon and wool	1.449	3,052	1,778	1,677	2,369	2,144
Rayon and cotton	2.505	170	182	84	115	61
Other mixtures ^f	1.712	961	1,468	1,394	2,180	1,264
	2.075	2,656	2,746	2,374	1,480	2,021

^aUnit value (dollars) in 1929.

^bSilk and cotton, silk and wool, and triple mixtures, except in 1935, when no mention is made of silk and wool.

^cNot strictly comparable with prior Census years since "all-rayon" hose is not reported in 1935.

^dNot strictly comparable with prior Census years since "all-wool" hose is not reported in 1935.

^eSilk and cotton, silk and wool, silk and rayon, rayon and cotton, and triple mixtures.

^fSilk and cotton; silk and wool; silk and rayon; rayon and wool; pure-thread-silk with lisle or cotton tops, heels, and toes; all-pure-thread silk; and triple mixtures.

^gAll-wool; all-pure-thread silk; pure-thread-silk with lisle or cotton tops, heels, and toes; all-rayon; rayon with cotton tops, heels, and toes; cotton and wool; silk and rayon; silk and cotton; silk and wool; and triple mixtures.

Table A-66.- PRODUCTION OF UNDERWEAR: CENSUS YEARS 1919 TO 1936
(Thousand dozen pieces)

Product	Weight ^a	1919	1921	1923	1925	1927	1929	1931	1933	1935
Shirts and drawers^b										
All-cotton	8.216	14,656	10,268	11,558	9,367	7,176	7,180	6,447	9,084	9,108
All-wool	16.320	818	74	112	47	61	50	40	54	10 ^c
Cotton and wool mixed	11.818	1,849	1,077	723	698	873	360	159	458	765 ^c
Rayon	6.946	n.a.	n.a.	n.a.	n.a.	784	1,002	733	557	552
Other ^d	13.179	360	278	354	650	255	180	580	260	217
Union suits										
All-cotton	6.831	7,519	8,154	9,412	10,249	8,340	7,378	5,993	7,488	5,298
All-wool	22.625	77	29	25	70	104	136	26	78	81 ^e
Cotton and wool mixed	14.457	1,134	755	1,156	808	702	811	369	417	708 ^e
Rayon	8.944	n.a.	n.a.	n.a.	n.a.	442	481	399	102	116
Other ^f	16.623	482	348	174	236	197	85	201	89	128
Bloomers and step-ins^g										
All-cotton	3.539	n.a.	n.a.	n.a.	n.a.	458	482	784	1,077	990
Silk	20.924	n.a.	n.a.	n.a.	n.a.	150	92	89	57	96
Rayon	8.054	n.a.	n.a.	n.a.	n.a.	1,085	1,715	911	978	1,430
Other ^h	9.330	n.a.	n.a.	n.a.	n.a.	57	94	78	219	335
Slips and petticoats										
	8.185	n.a.	n.a.	n.a.	n.a.	218	259	109	82	143

^aUnit value (dollars) in 1929.

^bIn 1936, sum of following categories: Shirts and vests, athletic; shirts and vests, other than athletic; drawers and shorts, athletic; and drawers and shorts, other than athletic.

^cThe reported number of women's all-wool and cotton-and-wool drawers and shorts, other than athletic (see fn. b) was distributed by material in the same proportions as the corresponding items for men.

^dIncludes silk and, for 1927-35, silk and rayon mixtures (not called for on schedule prior to 1927).

^eThe reported number of women's all-wool and cotton-and-wool union suits was distributed by material in the same proportions as the corresponding items for men.

^fIncludes silk, silk and rayon (for 1927-35), and silk or rayon mixed with other fibers.

^gIn 1935, classified as "panties, step-ins, and bloomers."

^hIncludes wool, cotton and wool, and silk and rayon for 1927-35; and for 1935, wool and cotton, and "other fibers and other mixtures."

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Table A-66.- PRODUCTION OF OUTERWEAR: CENSUS YEARS 1919 TO 1935

(Thousands of dozens)

Product	Weight ^a	1919	1921	1923	1925	1927
Sweaters, sweater coats, jerseys, cardigans, jackets, etc.	24.292	2,133	2,748	4,455	3,714	3,781
Bathing suits	19.474	301	909	972	695	740
Scarfs and shawls	13.375	298	363	980	492	188
Headwear, except infants'	6.145	558	508	843	805	700
Neckties	4.952	548	1,757	3,324	2,705	1,810
Sueded cotton gloves (pairs)	9.445	163	469	95	70	28
Gloves and mittens, except sueded (pairs)	7.319	3,408	2,216	1,999	1,231	1,022
	Weight ^b	1927	1929	1931	1933	1935
Sweaters, sweater coats, jerseys, cardigans, jackets, etc.	18.604	3,781	4,807	4,032	4,999	4,386
Bathing suits	21.630	740	1,021	963	833	990
Scarfs and shawls	9.157	188	127	58	178	334 ^c
Headwear, except infants'	4.831	700	783	1,078	1,147	969
Neckties	2.734	1,810	628	131	56	425
Athletic and golf hose (pairs)	4.317	950	1,105	2,132	2,295	3,079
Dresses and suits	10.909	868	1,023	2,906	2,908	4,675

^aAverage unit value (dollars) in 1919-27.^bUnit value (dollars) in 1929.^cReported as "scarfs, shawls, and mufflers."

Table A-57.- PRODUCTION OF KNIT CLOTH: CENSUS YEARS 1919 TO 1935^a

Year	Jersey cloth (including milanese and tricot) and tricolette	Sueded cotton cloth	Towels and towelings	Wool jersey	Other knit woolens	Silk jersey, including milanese	Rayon tubing, including tricolette	Other knit rayons	Cotton jersey	Corset cloth
1919	25,343	166	697	-	-	-	-	-	-	-
1921	38,112	42	754	-	-	-	-	-	-	-
1923	38,703	102	1,055	-	-	-	-	-	-	-
1925	42,172	111	976	-	-	-	-	-	-	-
1927	44,439	24 ^b	1,035 ^b	-	-	-	-	-	-	-
Weight ^c	1.085	1.535	0.843	-	-	-	-	-	-	-
1927	-	-	-	10,236	1,875	3,509	28,819	-	-	-
1929	-	-	-	7,212	2,509	4,127	49,948	-	-	-
Weight ^d	-	-	-	1.089	1.606	0.777	0.660	-	-	-
1929	-	-	-	7,212	2,509	4,127	49,948	1,614	14,234	4,858
1931	-	-	-	12,959	4,563	6,025	74,106	3,302	15,250	5,621
Weight ^e	-	-	-	0.631	1.435	0.590	0.428	0.489	0.238	0.714
1933	-	-	-	3,425	4,911	687	19,705	5,051	7,388	-
1935	-	-	-	3,048	5,321	277	24,010	4,567	10,796	-
Weight ^f	-	-	-	1.204	1.272	2.113	0.751	0.889	0.328	-

^aFigures for 1933 and 1935 represent thousands of pounds; for other years, thousands of square yards.

^bCensus of Manufactures: 1927, p. 314.

^cAverage unit value (dollars) in 1919-27.

^dAverage unit value (dollars) in 1927-29.

^eAverage unit value (dollars) in 1929-31.

^fAverage unit value (dollars) in 1933-35.

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Table A-68.- AVERAGE NUMBER OF WAGE EARNERS IN KNIT GOODS GROUP AND COMPONENT INDUSTRIES AND AVERAGE HOURS WORKED PER WEEK IN THE GROUP: 1919 TO 1936

Year	Number of wage earners ^a					Average hours worked ^b per week
	Knit Goods group	Hosiery	Underwear	Outerwear	Knit Cloth	
1919	172,572	79,901	57,984	29,992	5,695	46.6
1920	179,500	84,700	56,600	32,100	6,100	45.1
1921	161,880	77,864	47,431	30,919	5,666	46.8
1922	193,500	94,800	52,600	39,100	7,000	46.8
1923	194,244	96,957	48,552	41,503	7,232	46.3
1924	173,600	91,100	42,700	34,000	5,800	43.7
1925	186,668	103,930	48,328	27,986	6,424	45.1
1926	187,400	106,300	49,400	25,500	6,200	45.1
1927	190,283	112,842	46,227	24,662	6,552	47.0
1928	190,300	114,600	42,600	26,600	6,500	46.8
1929	208,488	129,542	41,487	28,968	8,491	47.6
1930	189,900	119,000	35,900	26,500	8,500	43.3
1931	178,011	112,374	31,951	26,142	7,544	42.2
1932	173,900	110,800	30,000	26,300	6,800	38.5
1933	189,698	117,919	35,915	26,908	8,956	39.2
1934	204,600	128,900	35,000	30,200	10,500	34.6
1935	219,776	138,021	34,930	35,455	11,370	34.5
1936	224,200	142,400	38,000	32,200	11,600	35.8

^aThe number of wage earners in each of the component industries in 1919 was estimated from a percentage distribution of over 60 percent of the workers in the group (Census of Manufactures; 1919, p. 214); similar distributions required for 1920-22 were determined by straight-line interpolation between 1919 and 1923. The numbers for all other odd-numbered years were reported by the Census; and those for all other even-numbered years were derived by means of unpublished B.L.S. indexes for the 4 industries.

^bFigures for 1920-36 from N.I.C.B.; for 1919, Census prevailing hours multiplied by the average ratio in 1921, 1923, and 1929 of N.I.C.B. actual to Census prevailing hours.

Table A-69.- PRODUCTION IN THE SOLE AND HARNESS LEATHER INDUSTRY: 1919 TO 1936*

(Quantities in thousands)

Year	Sole and belting leather				Harness leather		Bag, case, and strap leather (sides)	Skirting and collar leather (sides)	Lace (sides)
	Oak and union sole ^b (backs, bends, and sides)	Chrome sole (backs, bends, and sides)	Belting butts, rough and curried (butts, and butt bends)	Offal (pounds)	Union black (sides)	Oak black and russet (sides)			
1919	19,135	583	1,505	(c)	378 ^d	1,339 ^e	1,226	582	496
1920	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1921	17,576	468	1,195	100,104	305	506	621	410	151
1922	17,145	592	1,014	121,637	654	823	1,249	663	207
1923	18,104	629	1,471	136,167	659	896	1,200	928	211
1924	14,080	580	n.a.	104,938	545	724	1,056	685	187
1925	14,327	552	n.a.	109,873	543	745	1,176	659	170
1926	13,153	462	1,852	104,312	511	668	1,183	590	145
1927	15,194	635	1,891	118,392	458	558	1,105	545	146
1928	15,654	465	1,625	116,360	377	435	612	426	135
1929	13,939	577	2,068	106,858	256	366	947	357	119
1930	14,972	541	1,432	117,249	189	317	751	318	106
1931	12,342	413	931	92,505	86	272	624	185	96
1932	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1933	11,836	571	1,025	88,426	177	286	493	271	126
1934	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1935	16,535	1,123	1,427	100,879	166	550	936	319	105
Weight ^f	6.850	6.704	13.033	0.250	6.711	7.850	6.929	5.054	6.584

*Figures for 1921-31 were collected by the Bureau of the Census in its Monthly Census of Hides, Skins, and Leather (authorized by the Kreider Act) and published in the Census of Manufactures; those for 1919, 1933, and 1935 were collected in the regular biennial canvass. The 1933 and 1935 figures for each product were adjusted to include contract tanning by multiplication by the average of the ratios in 1929 and 1931 of the monthly-census to the (biennial) Census of Manufactures quantities.

^bQuantities for 1919-23 include hemlock sole.

^cReported figure (40,041,353 pounds) was not used since it is probably a serious understatement.

^dIncludes chrome.

^eIncludes hemlock, which is probably reported with oak in later years.

^fUnit value (dollars) in 1929 computed from (biennial) Census of Manufactures data (see fn. a).

Table A-70.- PRODUCTION IN THE SHOE AND UPHOLSTERY LEATHER INDUSTRY: 1919 TO 1935^a

(Quantities in thousands)

Year	Cattle (including kip side) leather		Horse, colt, ass, and mule leather		Fancy and bookbinders' leather		Splits (other than upholstery), finished and rough (equivalent side splits)	Upholstery leather		
	Upper, other than patent ^b (sides)	Patent, other than upholstery ^c (sides)	Upper (equivalent half fronts)	Glove and garment (equivalent half fronts)	Cowhide (sides)	Buffings, finished (hides)		Whole-hide grains and machine buffed (hides)	Buffings, russet (hides)	Splits, main and second (pieces)
1919	16,695	2,564	1,721	969	655	n.s.	n.s.	935 ^d	n.s.	1,611
1920	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
1921	12,549	2,279	398 ^{e,f}	544 ^{e,f}	80	74	n.s.	414	n.s.	676
1922	16,321	6,472	181 ^f	688 ^f	187	210	n.s.	715	n.s.	1,182
1923	18,427	5,542	198	930	232	197	24,751 ^g	745	179 ^h	1,230
1924	14,300	8,854	111	1,000	285	100	20,362 ^g	649	142	917
1925	15,328	8,628	108	1,146	502	89	24,023	628	115	852
1926	15,473	7,459	116	1,009	299	88	24,617	601	201	807
1927	13,459	8,388	91	1,459	202	59	24,645	502	163	938
1928	11,485	7,831	80	1,500	156	78	21,945	470	149	709
1929	12,610	5,954	106	1,857	240	64	22,465	414	119	672
1930	11,112	4,626	130	2,170	182	50	19,315	239	85	389
1931	12,084	4,501	92	1,646	185	33	17,666	248	59	393
1932	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
1933	16,947	3,358	36	1,333	n.s.	30	20,454	108	n.s.	298
1934	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
1935	20,985	n.s.	106	1,554	316	29	25,274	506	12	354
Weight ⁱ	4.223	4.373	3.703	3.436	5.940	6.020	0.920	14.287	5.635	6.989

^aSee Table A-69, fn. a.^bExcludes foreign-tanned cattle sides.^cCensus quantities for 1919-25 include foreign-tanned patent leather; the 1925 figure was adjusted by subtracting imports of patent leather (about 2 percent of the total) as reported in Foreign Commerce and Navigation of the United States: 1925 (U. S. Dept. Com., Bur. For. and Dom. Com.).^dWhole-hide grains only.^eFigure shown is average for 10 months multiplied by 12.^fThe quantities, reported in whole fronts and half fronts, were combined on the assumption that 2 half fronts are equivalent to 1 whole front.^gWhole splits and butt splits were reduced to equivalent side splits by multiplication by 2.^hFigure shown is average for 5 months multiplied by 12.ⁱUnit value (dollars) in 1929 computed from (biennial) Census of Manufactures data (see Table A-69, fn. a).

Table A-71.- PRODUCTION IN THE CALFSKIN AND
KID LEATHER INDUSTRIES: 1919 TO 1935^a

(Quantities in thousands)

Year	Calfskin industry		Kid Leather industry	
	Upper leather, calf and kip, except kip side (skins and whole skins)	Fancy and bookbinders' leather, calf and kip (skins)	Upper leather, goat and kid (skins)	Fancy and bookbinders' leather, goat and kid (skins)
1919	11,697	277	51,509	336
1920	n.a.	n.a.	n.a.	n.a.
1921	14,827	119	34,356	165
1922	15,435	97	47,880	254
1923	18,004	281	46,537	291
1924	15,981	430	34,641	338
1925	13,621	249	40,887	541
1926	14,943	704	48,415	664
1927	16,150	674	49,417	717
1928	14,975	558	52,862	1,116
1929	14,541	766	54,355	889
1930	13,589	564	54,451	398
1931	12,030	381	47,980	422
1932	n.a.	n.a.	n.a.	n.a.
1933	13,379	473	46,804	162
1934	n.a.	n.a.	n.a.	n.a.
1935	13,837	1,125	51,769	220
Weight ^b	3.447	4.019	1.289	2.283

^aSee Table A-69, fn. a.^bUnit value (dollars) in 1929 computed from (biennial) Census of Manufactures data (see Table A-69, fn. a).

Table A-72.- PRODUCTION IN THE SHEEP AND MISCELLANEOUS LEATHER INDUSTRY, 1919 TO 1935^a

(Quantities in thousands)

Year	Upper leather		Glove and garment leather			Fancy and bookbinders' leather - sheep, lamb, and cabretts (skins)	Miscellaneous leather		
	Sheep, lamb, and cabretta (skins)	Kangaroo and wallaby (skins)	Sheep and lamb, except shearlings (skins)	Shearlings (skins)	Deer and elk (skins)		Roller leather (skins)	Skivers - including hat-sweat (dozens)	Chamois (dozens)
1919	15,256	n.a.	4,976	544	324	1,755 ^b	n.a.	692	n.a.
1920	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1921	16,259	963	5,813	1,245	370	1,995	511	502	244
1922	20,127	1,072	6,776	2,001	410	2,886 ^c	969	580	278
1923	21,966	1,283	7,789	2,559	540	3,038	1,009	462	265
1924	20,528	1,105	5,561	1,978	574	3,022	738	404	267
1925	16,536	820	5,326	1,986	665	2,078	849	392	256
1926	16,317	680	5,297	2,519	634	2,432	827	266	244
1927	16,399	705	7,575	2,727	595	2,861	930	272	237
1928	19,016	883	9,026	3,297	522	3,394	943	220	179
1929	19,424	854	8,633	3,990	614	2,761	1,083	212	154
1930	12,926	926	9,298	3,551	558	1,998	842	132	156
1931	14,078	967	10,934	3,172	546	2,066	769	79	203
1932	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1933	12,215	n.a.	18,424	3,309	n.a.	1,519	n.a.	n.a.	n.a.
1934	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1935	14,979	845	18,478	3,450	257	1,128	n.a.	94	n.a.
Weight ^d	1.084	1.614	1.326	1.785	2.629	1.557	1.743	15.856	15.327

^aSee Table A-69, fn. a.^bSheep and lamb only.^cProduction of cabretta, reported separately only for 7 months, was raised to yearly total by multiplying 7-month average by 12.^dUnit value (dollars) in 1929 computed from (biennial) Census of Manufactures data (see Table A-69, fn. a).

Table A-73.- INTERPOLATING SERIES FOR PRODUCTION
IN LEATHER GROUP AND COMPONENT INDUSTRIES:
1919 TO 1921 AND 1931 TO 1936

Year	Index of leather production ^a (1921=100)	Leather production ^b (thousands)			
		Cattle hides	Calf and kip skins	Goat and kid skins	Sheep and lamb skins
1919	126.9	-	-	-	-
1920	103.5	-	-	-	-
1921	100.0	-	-	-	-
1931	-	16,236	12,444	48,636	32,448
1932	-	14,580	11,580	37,020	28,836
1933	-	17,112	13,044	44,516	33,876
1934	-	19,776	12,444	44,988	34,260
1935	-	21,936	14,136	48,252	38,460
1936	-	22,628	13,127	47,450	37,942

^a"Productivity of Labor in the Cement, Leather, Flour, and Sugar-Refining Industries, 1914 to 1925," *Monthly Labor Review*, Oct. 1926, p. 14. The index is an arithmetic mean of relatives of the production of all sole and belting leather and of all upper leather, weighted 1 and 2, respectively. Sole and belting leather was reduced to pounds, and upper leather, to square feet by means of conversion factors used by the Bureau of the Census.

^b*Survey of Current Business*, "1936 Supplement," p. 109, and later issues. "Data were compiled by the U. S. Department of Commerce, Bureau of the Census for the period through April 1932, and subsequently by the Tanners' Council of America. The census returns collected under the Kreider Act represented a complete coverage of the industry, and the Tanners' Council states that their figures are directly comparable with the census figures." (*Ibid.*, p. 173, fn. 2 to p. 109.)

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Table A-74.- NUMBER OF WAGE EARNERS AND AVERAGE WEEKLY HOURS
IN THE LEATHER GROUP: 1919 TO 1936

Year	Average number of wage earners	Average hours worked per week ^a
1919	72,476	48.0
1920	65,400	46.2
1921	48,955	46.6
1922	58,500	47.7
1923	59,703	47.6
1924	52,300	46.2
1925	52,263	47.5
1926	53,000	46.5
1927	52,924	45.8
1928	51,700	45.2
1929	49,932	47.6
1930	46,400	44.9
1931	42,047	45.2
1932	37,700	42.0
1933	44,191	41.1
1934	49,000	36.8
1935	50,877	38.2
1936	51,400	39.2

^a For 1920-31, N.I.C.B.; for 1932-36, B.L.S. The figure for 1919, computed from Industrial Survey in Selected Industries in the United States: 1919 (B.L.S. Bull. No. 265), pp. 37-8, represents average actual hours per man per day multiplied by 6.

Table A-75.- NUMBER OF WAGE EARNERS^a AND MAN-HOURS^b IN THE COMPONENT INDUSTRIES OF THE LEATHER GROUP: 1919 TO 1936

(Man-hours in thousands)

Year	Sole and Harness Leather		Side and Upholstery Leather		Calfskin		Kid Leather		Sheep and Miscellaneous Leather	
	Wage earners	Man-hours	Wage earners	Man-hours	Wage earners	Man-hours	Wage earners	Man-hours	Wage earners	Man-hours
1919	23,100	60,024	18,300	43,801	8,000	18,783	14,000	35,577	9,100	22,715
1920	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1921	16,300	41,160	10,000	23,269	8,400	19,136	7,800	19,334	6,500	15,729
1922	16,900	43,787	14,700	34,933	8,400	19,530	10,400	26,522	8,200	20,381
1923	17,500	45,334	14,800	35,217	9,300	21,578	9,500	24,193	8,600	21,455
1924	14,300	35,785	14,600	33,541	8,800	19,854	6,600	17,245	8,000	19,170
1925	15,600	40,680	14,100	33,653	7,400	17,274	8,100	20,267	7,000	17,216
1926	14,800	37,503	14,000	32,578	8,100	18,478	9,600	23,840	6,500	15,702
1927	14,000	36,656	14,500	31,378	7,600	17,708	9,700	23,505	7,100	16,797
1928	13,300	34,020	13,100	28,791	7,200	15,904	10,200	24,564	7,700	18,190
1929	12,300	32,215	12,100	29,153	7,600	16,988	10,300	26,333	7,700	18,903
1930	12,700	31,060	10,800	23,524	6,600	14,661	9,600	23,379	6,700	15,680
1931	10,700	24,877	9,100	21,453	6,100	13,808	9,000	21,916	7,100	16,773
1932	10,000	20,173	8,800	20,560	5,000	11,090	7,600	16,906	6,300	13,606
1933	11,500	23,289	10,400	22,788	6,300	13,789	9,000	19,761	6,900	14,818
1934	12,400	25,176	13,200	25,396	6,700	11,815	9,600	17,976	7,000	13,467
1935	13,400	26,807	13,900	27,792	6,600	13,147	10,500	20,334	6,500	12,982
1936	13,200	29,021	17,000	32,771	4,300	9,284	9,900	19,618	7,000	14,141

^aMan-hours divided by corresponding average annual hours per wage earner (Table A-76).

^bFor details of derivation of the man-hours series, see Part Two: Leather Group.

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Table A-76.- AVERAGE ANNUAL HOURS PER WAGE EARNER IN THE
COMPONENT INDUSTRIES OF THE LEATHER GROUP:
1919 TO 1936^a

Year	Sole and Harness Leather	Side and Uphol- stery Leather	Calfskin	Kid Leather	Sheep and Miscel- laneous Leather
1919	2,548	2,340	2,288	2,496	2,444
1920	-	-	-	-	-
1921	2,548	2,340	2,288	2,496	2,444
1922	2,548	2,340	2,288	2,496	2,444
1923	2,548	2,340	2,288	2,496	2,444
1924	2,548	2,340	2,288	2,652	2,444
1925	2,548	2,340	2,288	2,444	2,392
1926	2,548	2,340	2,288	2,496	2,444
1927	2,652	2,184	2,340	2,444	2,392
1928	2,600	2,236	2,236	2,444	2,392
1929	2,548	2,340	2,184	2,496	2,392
1930	2,444	2,184	2,236	2,444	2,340
1931	2,236	2,288	2,184	2,340	2,288
1932	1,924	2,236	2,132	2,132	2,080
1933	1,976	2,132	2,132	2,132	2,080
1934	2,028	1,924	1,768	1,872	1,924
1935	1,976	1,976	1,976	1,924	1,976
1936	2,080	1,820	2,028	1,872	1,924

^aFor details of derivation of these series of average hours, see Part Two: Leather Group. The figures for most of the years are based on data collected in a field survey made by N.R.P. in cooperation with B.L.S. Estimates were necessary for the earlier years for which no N.R.P.-B.L.S. figures were available.

Table A-77.- PRODUCTION IN SAWMILLS: 1919 TO 1936^a

(Millions of feet, board measure)

Year	Lumber ^b	Lath ^c	Shingles ^c	Logs consumed in veneer production ^d	Tight staves	Tight heading	Slack staves	Slack heading	Hoops	All sawmill products ^e
1919	35,788	345	919	641	354	96	370	174	47	36,734
1920	35,799	391	616	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	36,442
1921	26,961	394	694	456	255	84	295	134	45	29,305
1922	31,569	598	815	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	34,588
1923	37,166	666	751	746	223	76	296	160	51	40,136
1924	35,931	592	666	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	36,735
1925	33,359	632	732	849	240	92	310	142	49	41,595
1926	36,936	617	801	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	40,082
1927	34,532	474	844	1,112	324	104	317	118	45	37,670
1928	34,142	381	560	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	37,153
1929	36,886	341	611	1,290	357	120	345	146	44	40,138
1930	26,051	219	396	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	28,586
1931	16,523	123	271	812	205	80	177	86	31	18,308
1932	10,161	61	211	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	11,531
1933	13,961	82	293	821	155	52	141	74	20	15,599
1934	15,494	85	278	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	17,139
1935	19,539	124	353	967	222	60	145	72	17	21,499
1936	24,355	162	472	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	26,638
Conversion factor ^f	-	0.2	0.1	1.176 ^g	1.0	4.0	0.35	2.0	0.35	-

^aThe products were originally reported in the following units: thousands - lath, shingles, tight and slack staves, and hoops; thousand feet, log scale - veneers; thousand sets - tight and slack heading; and thousand feet, board measure - lumber. Multiplication by indicated conversion factors yielded board-measure equivalents.

^bStatistics for 1919-34 are from Lumber Production: 1869-1934 (U. S. Dept. Agr., Forest Service); for 1935, from Census of Manufactures; and for 1936, from Lumber Production: 1936 (U. S. Forest Service).

^cStatistics for 1930-36 are from Forest Products: 1932 (U. S. Dept. Com., Bur. Cen.), "Lumber, Lath and Shingles," pp. 5-6; ibid.: 1934, p. 4; and ibid.: 1936, p. 6.

^dExcludes imported logs.

^eFor odd-numbered years, totals of quantities in preceding columns; for other years, estimates made by means of the continuous series for lumber, lath, and shingles.

^fComputed from American Forests and Forest Products (U. S. Dept. Agr., Stat. Bull. No. 21), p. 27.

^gOverrun ratio for 1929 derived from Report to the President on Lumber (U. S. Tariff Commission, 2nd Ser., No. 32, 1937). The ratio was computed from regional data representing approximately 30 percent of 1929 logging production.

Table A-78.- PRODUCTION OF LUMBER, BY REGIONS: 1919 TO 1936^a

(Millions of feet, board measure)

Year	All regions	Southern pine	Western pine	Douglas fir	Redwood	Southern hardwood	All other ^b
1919 ^c	35,788	12,774	5,913	6,498	401	3,388	6,814
1920	35,799	11,091	4,326	7,792 ^d	477	3,365 ^e	6,748
1921	26,961	10,960	3,063	5,198	468	2,414	4,868
1922	31,569	11,501	3,933	7,817	566	2,682	5,070
1923	37,166	12,949	4,958	9,309	593	3,420	5,937
1924	35,931	12,487	4,886	8,626	604	3,626	5,902
1925	38,339	13,236	5,262	9,598	511	3,704	6,028
1926	36,936	11,752	5,099	10,332	488	3,801	5,464
1927	34,532	10,891	4,713	9,910	570	3,514	4,934
1928	34,142	10,610	4,900	10,103	487	3,386	4,656
1929	36,886	11,630	5,130	10,274	486	4,191	5,175
1930	28,051	7,450	4,082	7,665	403	2,585	3,866
1931	16,523	4,430	2,729	5,372	211	1,444	2,337
1932	10,151	3,069	1,819	3,131	136	759	1,257
1933	13,961	4,446	2,355	4,308	184	1,246	1,443
1934	16,494	4,473	2,761	4,365	282	1,553	2,070
1935	19,539	5,960	3,672	5,085	329	1,870	2,623
1936	24,355	7,113	4,382	6,794	403	2,396	3,267
Weight ^f	-	36.0	9.4	16.0	1.5	17.9	13.2

^aStatistics for 1919-34 were obtained from Lumber Production, 1869-1934 (U. S. Dept. Agr., Forest Service); for 1935, from Census of Manufactures; and for 1936, from Lumber Production, 1936 (U. S. Forest Service). The several regions are represented by the following series: Southern pine - national output of yellow pine; western pine - national output of white pine, sugar pine, western yellow (ponderosa) pine, and larch; Douglas fir - production of Douglas fir, cedar hemlock, and spruce in North Pacific states (i.e., Washington and Oregon); redwood - national production of redwood; southern hardwood - hardwood output of East Gulf states (Ala., Fla., Ga.), lower Mississippi region (Ark., La., Miss., Okla., Tex.), Kentucky, Tennessee, and West Virginia.

^bFirst column minus sum of succeeding columns.

^cThe figures reported for 1919 were rendered comparable with those for later years by exclusion of the output of all custom mills and of merchant saw-

mills producing less than 50 thousand board feet per year (see Census of Manufactures, 1919, pp. 436-8). The factor applied to each quantity was the ratio of the adjusted to the unadjusted national total.

^dThe figures for each species in this region were adjusted by multiplication by the ratio of a "computed total" (which includes the estimated output of small mills not reporting) to the reported total.

^eAdjusted by ratio of a "computed total" to reported total for national hardwood production (see fn. d).

^fLath and shingles (shown in Table A-77), which are included in the sawmills index, were weighted by 1.5 and 4.5, respectively. These weighting factors, which were applied to the relatives of the 2 production series, were derived by multiplying the output of each product in 1929 by its unit labor requirement in 1935 (B. H. Topik, "Labor Requirements in Lumber Production," Monthly Labor Review, May 1937, pp. 1156-52).

BASIC TABLES: LUMBER AND TIMBER PRODUCTS GROUP 85

Table A-79.- PRODUCTION OF SAW-PLANE MILLS: CENSUS YEARS
1925 TO 1935^a

Year	Dressed lumber	Doors	Sash	Window and door frames
1925	14,336	7,975	7,166	1,954
1927	15,853	4,212	5,650	1,511
1929	13,689	5,209	2,076	971
1931	7,350	3,125	1,264	535
1933	6,042	2,111	863	224
1935	8,248	2,102	817	288
Weight ^b	94.60	4.34	0.43	0.63

^a"Dressed lumber" is quoted in millions of feet, board measure; other products, in thousands of units.

^bThe weights, which were applied to relatives of the production series, were derived by multiplying the output of each product in 1929 by the corresponding unit labor requirement obtained from B. H. Topkis, "Labor Requirements in Lumber Production," Monthly Labor Review, May 1937, pp. 1136-52.

Table A-80.- AVERAGE NUMBER OF WAGE EARNERS IN THE LUMBER AND
TIMBER PRODUCTS GROUP AND COMPONENT
INDUSTRIES: 1919 TO 1936

Year	Lumber and Timber Products group	Logging Camps ^a	Sawmills and Saw- Plane Mills ^a
1919 ^b	469,297	183,683	285,614
1920	431,200 ^c	166,600	264,600
1921	364,247	138,900	225,300
1922	477,300 ^c	179,700	297,700
1923	495,932	184,210	311,722
1924	472,300	175,100	297,200
1925	467,090	172,800	294,300
1926	456,400	168,500	287,800
1927	413,946	152,600	261,400
1928	403,200	148,000	255,200
1929	419,084	153,200	265,900
1930	323,100	118,100	205,000
1931	196,647	71,900	124,800
1932	151,300	55,300	96,000
1933	189,367	69,200	120,100
1934	231,800	84,700	147,000
1935	255,230	93,300	161,900
1936	276,200	101,000	175,200

^a Figures for 1923 were obtained from Census Manufactures: 1923, pp. 444, 446; those for the remaining years were computed from the group employment series and from percentage distributions which were obtained for 1919 from Census of Manufactures: 1919, p. 423; for 1923, from the Census figures; for 1927 and 1929, from Wages and Hours of Labor in the Lumber Industry in the U. S.: 1930 and ibid.: 1933 (B.L.S. Bull. No. 560, p. 25, and Bull. No. 586, p. 22); and for the remaining years before 1929, by straight-line interpolation. The distribution for 1929 was assumed for later years.

^b Adjusted for comparability with later years by exclusion of establishments producing less than 200,000 board feet of lumber or the equivalent thereof.

^c Estimates made by interpolation of number of wage earners reported by the Census by means of a B.L.S. series derived by subtracting employment for "Furniture" industry from that for the Census group, "Lumber and Allied Products."

BASIC TABLES: LUMBER AND TIMBER PRODUCTS GROUP 87

Table A-81.- MAN-HOURS IN THE LUMBER AND TIMBER PRODUCTS GROUP
AND COMPONENT INDUSTRIES: 1919 TO 1936

Year	Millions of man-hours			Average number of hours worked per day ^d		Days of operation per year ^e
	Lumber and Timber Products group ^a	Logging Camps ^b	Sawmills and Saw-Plane Mills ^c	Logging Camps	Sawmills	
1919	1,062	599	653	8.06	8.47	270
1920	1,063	598	665	8.85	9.31	270
1921	785	290	495	8.69	9.15	240
1922	1,133	413	720	9.02	9.48	265
1923	1,244	449	795	9.02	9.44	270
1924	1,183	427	756	9.04	9.42	270
1925	1,194	451	743	9.23	9.60	270
1926	1,149	416	733	9.14	9.45	270
1927	1,045	379	666	9.21	9.44	270
1928	1,026	372	654	9.31	9.50	270
1929	1,050	377	673	9.11	9.38	270
1930	749	270	479	n.a.	n.a.	n.a.
1931	419	151	268	n.a.	n.a.	n.a.
1932	297	107	190	n.a.	n.a.	n.a.
1933	379	156	243	n.a.	n.a.	n.a.
1934	405	146	259	n.a.	n.a.	n.a.
1935	470	169	301	n.a.	n.a.	n.a.
1936	550	198	352	n.a.	n.a.	n.a.

^aFigures for 1919-29 are sums of those in the following 2 columns; those for 1930-36 are the quotients of wages and average hourly earnings (Table A-82).

^bFigures for 1919-29 are the products of employment (Table A-80), average hours per day, and days of operation per year (assumed to be the same as for Sawmills and Saw-Plane Mills); those for 1930-36 were derived by multiplication of man-hours for the Lumber and Timber Products group by the modal ratio (0.56) for the years 1919-29 of man-hours in Logging Camps to those in the group.

^cFor method of computation, see fn. b. The modal ratio for Sawmills and Saw-Plane Mills was 0.64.

^dFigures are quotients of average hours per week and average number of days worked per week. For Sawmills and Saw-Plane Mills, the former was obtained for 1919 from Industrial Survey in Selected Industries in the United States: 1919 (B.L.S. Bull. No. 266), p. 37 (hours per man per day times 5); and for 1921, 1923, 1925, 1926, and 1930 from B.L.S. bulletins usually entitled Wages and Hours of Labor in Lumber Manufacturing (Bull. No. 317, pp. 22-9; Bull. No. 363, pp. 24-32; Bull. No. 413, pp. 53-61; Bull. No. 497, p. 36; and Bull. No. 560, p. 36). These figures, which refer to selected months in each year, were adjusted to represent yearly averages. Adjustment factors for 1921, 1923, 1925, and 1930 were ratios, as computed from W.I.C.B. weekly hours for "Lumber and Millwork", of average weekly hours in the months covered by the B.L.S. studies to the yearly average; and for 1919, the ratio of average output-per-wage-earner for the selected months to the yearly average. No adjustment was possible for 1928, since the months covered by the B.L.S. study were not stated.

For Logging Camps, average hours per week were obtained for several years by multiplying average weekly hours for Sawmills and Saw-Plane Mills by the ratio of prevailing hours for Logging Camps to those for Sawmills and Saw-Plane Mills. Prevailing hours for Logging Camps for 1921, 1925, 1926, and 1930 are from B.L.S. bulletins cited above; the figure for 1919 was derived by multiplying prevailing hours for Sawmills and Saw-Plane Mills by the 1921 ratio of prevailing hours for Logging Camps to those for Sawmills and Saw-Plane Mills; and the one for 1923 was obtained by straight-line interpolation. Prevailing hours for Sawmills and Saw-Plane Mills are from B.L.S. Bull. No. 586, p. 5; the 1919 figure was adjusted by multiplication by the 1921 ratio of hours for all occupations to hours for those occupations represented in 1919.

The W.I.C.B. series for "Lumber and Millwork" was used to complete the average-weekly-hours series for both Logging Camps and Sawmills and Saw-Plane Mills.

The average number of days worked per week in Sawmills and Saw-Plane Mills was derived for 1919, 1921, 1923, 1925, 1926, and 1930 from the B.L.S. bulletins cited above; the 1921 figure was assumed for 1920; and estimates for remaining years were made by straight-line interpolation.

The number of days worked per week in Logging Camps was assumed to be the same as for Sawmills and Saw-Plane Mills in corresponding years.

^eThe figures were estimated for Sawmills and Saw-Plane Mills and assumed to be the same for Logging Camps. The estimates made for calendar years by means of a smooth curve clustered about 270 in all years, except 1921, when the reading was 236. Therefore, the number 270 was assumed for all years but 1921-22; 240 was assumed for 1921; and 255, the average of 240 and 270, was assumed for 1922.

Table A-82.- WAGES AND AVERAGE HOURLY EARNINGS IN THE LUMBER AND TIMBER PRODUCTS GROUP: 1930 TO 1936

Year	Wages (millions of dollars)	Average hourly earnings ^a (dollars)
1930	314	0.419
1931	156	.372
1932	85	.286
1933	113	.298
1934	154	.380
1935	183	.389
1936	224	.407

^a For 1930-32, harmonic means of average hourly earnings for Logging Camps and Sawmills, weighted by 42 and 58, respectively (the modal percentage distribution of wages in 1919-29); for 1933-36, B.L.S. hourly earnings linked to the figure for 1932.

Wages for the 2 component industries for 1919-29 were computed by the multiplication of man-hours (Table A-81) by average hourly earnings. Hourly earnings were derived from B.L.S. studies in a manner analogous to that described for average weekly hours in Table A-81, fn. d (the 1932 figure for Sawmills and Saw-Plane Mills was computed from data published in B.L.S. Bull. No. 586). The 2 series were completed for the period 1919-32 by means of the N.I.C.B. earnings series for "Lumber and Millwork."

Table A-83.- PRODUCTION AND DISTRIBUTION OF MANUFACTURED GAS:
1919 TO 1935

(Millions of cubic feet)

Year	Production ^a	Quantity distributed to ultimate consumers ^b
1919	277,014	278,434
1920	301,124	n.a.
1921	289,259	275,798
1922	289,256	n.a.
1923	295,936	320,388
1924	318,919	n.a.
1925	330,951	337,675
1926	354,594	n.a.
1927	348,839	392,728
1928	357,809	n.a.
1929	347,508	403,119
1930	323,931	n.a.
1931	301,471	367,883
1932	263,532	n.a.
1933	241,043	307,031
1934	245,138	n.a.
1935	241,498	312,224
Weight ^c	2.3	1.0

^aCensus figures for odd-numbered years were interpolated by a continuous American Gas Association series obtained from Annual Statistics of the Manufactured Gas Industry in 1930 (A.G.A., Stat. Bull. No. 9, Oct. 1931), p. 31, and successive annual bulletins (Nos. 10-12, 17, 21).

^bFigures represent difference between total sales and intra-industry sales.

^cThe weights represent the relative number of wage earners required in 1933 for the production and distribution, respectively, of a fixed volume of gas. The number of wage earners required per thousand cu. ft. distributed was determined from a special tabulation provided by the Bureau of the Census for 21 plants engaged principally in gas distribution. These 21 plants accounted for 18 percent of production and 40 percent of sales in 1933. The number of production wage earners (used to calculate the requirement for production) is the difference between the total number of wage earners in the industry and the number engaged in distribution of all gas (i.e., the product of thousands of cu. ft. distributed by the industry and the computed labor requirement for 21 plants).

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Table A-84.- NUMBER OF WAGE EARNERS AND AVERAGE WEEKLY HOURS IN THE MANUFACTURED GAS INDUSTRY: CENSUS YEARS 1919 TO 1935

Year	Average number of wage earners	Average hours worked per week ^a
1919	42,908	51.1
1921	34,956	52.8
1923	42,282	49.9
1925	46,998	47.1
1927	48,497	48.2
1929	43,065	51.4
1931	34,523	50.1
1933	30,586	44.2
1935	30,952 ^b	41.3

^aN.I.C.B. The hours for 1919 were estimated by straight-line interpolation between those for July 1914 and June 1920; those for 1921 refer to December only; the figure for 1923 is an estimate by N.I.C.B.; and those for remaining years are un-weighted averages of hours for January and July.

^bIncludes the estimated number of wage earners (11,211) engaged solely in the distribution of gas, who were excluded by the Census in 1935. The estimate was made on the assumption that the percentage change between 1933 and 1935 in the wage-earner requirement per thousand cu. ft. of gas was the same for distribution as for production. For the 2 1933 wage-earner-requirement ratios, see Table A-83, fn. c; the 1935 requirement ratio for production was computed from Census statistics.

BASIC TABLES: MANUFACTURED ICE

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Table A-85.- PRODUCTION AND SALES OF ICE: 1919 TO 1935

(Thousands of short tons)

Year	Production in Manufactured Ice industry	Sales ^a
1919	25,293	31,616
1920	n.a.	32,641
1921	29,668	35,317
1922	n.a.	36,429
1923	34,032	39,916
1924	n.a.	41,292
1925	38,814	46,864
1926	n.a.	45,927
1927	39,058	47,543
1928	n.a.	50,994
1929	44,477	53,554
1930	n.a.	56,239
1931	42,355	57,365
1932	n.a.	43,625
1933	32,888	39,005
1934	n.a.	39,785
1935	31,855	34,325

^a Figures for 1919-33 were obtained from Horace B. Drury, Production and Capacity Control in the Ice Industry Under the N.R.A. (National Recovery Administration, Division of Review, Mar. 1936), pp. 4-5; those for 1934-35 were supplied by the Ice Publicity Association of Philadelphia.

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Table A-86.- NUMBER OF WAGE EARNERS AND AVERAGE WEEKLY HOURS
IN THE MANUFACTURED ICE INDUSTRY: CENSUS YEARS
1919 TO 1935

Year	Average number of wage earners ^a	Average hours per week ^b
1919	30,247	57.0
1921	24,066	57.1
1923	26,852	57.0
1925	24,915	57.2
1927	22,120	57.3
1929	32,184	57.5
1931	25,217	53.6
1933	21,332	49.7
1935	19,032	49.2

^aThe figures for 1919-23 include some employees engaged in delivery service and hence are not strictly comparable with those for later years (cf. Census of Manufactures: 1925, p. 146).

^bFigures for 1919-23 and 1929 are Census prevailing hours; those for 1933 and 1935 are actual hours computed from Census of Manufactures: 1933, "Man-Hour Statistics for 32 Selected Industries", pp. 2, 39 and from ibid.: 1935, "Man-Hour Statistics for 59 Selected Industries", p. 84; and those for the remaining years are estimates made by straight-line interpolation.

Table A-87.- PRODUCTION OF MOTOR VEHICLES AND CHASSIS: 1919 TO 1936^a

Year	Total ^b	Closed passenger cars			Open passenger cars		Public conveyances and other commercial vehicles					Light trucks (under 1 ton)	Heavy trucks (1 ton and over) and tractor	Searses and lumber wagon	Ambulances	Fire department apparatus	Other vehicles and apparatus	Chassis			
		Total	2-door	4-door	2-door	4-door	Total	Motor buses			Taxicabs and other commercial vehicles							Total	Passenger	Commercial	Bus
								21 pas-enger	21 to 35 pas-enger	35 pas-enger											
1919	1,876,366	167,750	n.a.	n.a.	173,633	1,226,127	2,504	n.a.	n.a.	n.a.	n.a.	19,122	102,437	567	391	769	1,636	192,440	n.a.	n.a.	n.a.
1920	2,176,125	299,716	n.a.	n.a.	335,206	1,329,173	2,994	n.a.	n.a.	n.a.	n.a.	20,834	121,175	698	319	698	1,074	165,940	n.a.	n.a.	n.a.
1921	1,692,570	304,418	n.a.	n.a.	196,577	903,009	2,253 ^c	n.a.	n.a.	n.a.	n.a.	15,065	90,263	519	134	815	192	79,325	39,223	n.a.	n.a.
1922	2,461,591	621,284	n.a.	n.a.	290,921	1,272,332	5,863	n.a.	n.a.	n.a.	n.a.	20,697	150,675	685	167	925	169	117,707	47,234	n.a.	n.a.
1923	2,690,250	1,204,266	n.a.	n.a.	452,152	1,792,592	12,979 ^c	n.a.	n.a.	n.a.	n.a.	29,042	252,563	672	197	910	85	175,273	63,266	n.a.	n.a.
1924	2,498,252	1,415,501	n.a.	n.a.	358,172	1,261,905	12,212	n.a.	n.a.	n.a.	n.a.	27,721	241,189	1,237	143	839	75	179,257	60,219	n.a.	n.a.
1925	4,165,074	2,080,497	n.a.	n.a.	390,052	1,025,126	15,295 ^c	n.a.	n.a.	n.a.	n.a.	35,976	303,224	2,011	129	1,020	54	240,790	67,760	n.a.	n.a.
1926	4,206,894	2,570,410	n.a.	n.a.	321,911	885,633	13,365	n.a.	n.a.	n.a.	n.a.	55,546	321,620	2,404	208	1,236	191	234,256	79,725	n.a.	n.a.
1927	3,336,023	2,406,149	n.a.	n.a.	197,880	211,279	8,968 ^c	n.a.	n.a.	n.a.	n.a.	60,961	266,492	2,300	219	1,145	235	178,497	56,074	n.a.	n.a.
1928	4,291,055	3,136,379	n.a.	n.a.	249,199	196,231	17,699	n.a.	n.a.	n.a.	n.a.	89,641	277,360	2,354	287	1,263	252	322,300	67,027	n.a.	n.a.
1929	5,294,087	3,917,370	2,213,232	1,704,159	298,401	146,444	29,440	5,639	2,332	1,101	20,366	124,414	261,625	2,316	361	1,350	249	512,219	76,401	433,112	2,705
1930	3,270,200	2,482,898	1,408,258	1,079,336	166,219	60,450	16,059	2,569	2,112	1,143	10,242	95,294	197,774	1,531	251	255	255	246,253	28,980	216,787	1,116
1931	2,295,053	1,786,393	1,010,178	776,218	105,947	21,377	9,787	1,147	1,957	1,127	5,545	79,321	164,225	1,145	198	656	292	127,213	7,556	119,266	393
1932	1,317,907	1,053,595	597,948	455,747	55,486	8,223	5,551	474	891	424	3,772	51,055	95,208	623	205	276	100	65,692	5,592	65,412	179
1933	1,848,015	1,516,343	863,234	653,109	10,211	7,812	7,698	407	896	221	6,114 ^d	79,311	134,772 ^d	625	418	244	46	90,743	8,766	81,904	188
1934	2,695,093	2,200,456	1,237,949	962,507	11,364	9,922	7,977	693	1,444	664	5,176	125,000	203,068	1,178	392	362	76	132,366	20,314	111,667	297
1935	3,923,052	3,191,877	1,774,145	1,417,732	11,432	9,625	6,921	1,156	2,325	1,336	2,104	202,197	305,493	1,681	253	538	124	193,010	40,596	151,675	739
1936	6,426,945	5,601,854	2,002,022	1,599,832	12,901	10,750	7,810	1,305	2,623	1,608	2,374	228,169	344,731	1,997	265	607	140	217,801	45,610	171,157	854
Weight 1919-29 ^e	-	926	-	-	562	606	2,368	-	-	-	-	692	1,020	2,218	5,305	8,865	4,189	699	-	-	-
1929-35 ^f	-	-	491	671	529	562	-	1,442	5,205	7,993	1,402	442	695	2,395	2,165	6,147	4,640	-	423	355	1,725

^aFor intercensal years except 1936, total production was distributed in accordance with the average proportions of the components in adjacent census years; the 1935 proportions were assumed for 1936.

^bThe Census production series for the odd-numbered years was completed by means of an annual sales series compiled by the Automobile Manufacturers Association (Automobile Facts and Figures 1935 and Automotive Industries, Feb. 25, 1936, p. 254). The Survey of Current Business, which also publishes the sales series (with slight discrepancies), describes it as follows: "Automobile production data represent complete manufacturers sales, commonly referred to as production, as compiled since 1921 by the U. S. Department of Commerce, Bureau of the Census, in cooperation with the Automobile Manufacturers Association (formerly known as the National Automobile Chamber of Commerce). The statistics comprise the output of all members of the Automobile Manufacturers Association as well as certain other manufacturers reporting directly to the Bureau of the Census. Included are foreign assemblies from parts made in the United States and reported as complete units or vehicles.... Annual figures through 1921 represent production as compiled on a monthly basis by the National Automobile Chamber of Commerce from the principal producers, covering close to 90 percent of the industry, from quarterly reports of other member companies, and from annual reports of small nonmember companies, covering the balance of the industry." ("1936 Supplement," p. 185, fn. 1 to p. 147.)

^cOther commercial vehicles not reported.

^dTruck tractors included with "taxicabs and other commercial vehicles."

^eAverage unit value (dollars) in census years 1919-29.

^fAverage unit value (dollars) in census years 1929-35.

BASIC TABLES: MOTOR VEHICLES

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Table A-88.- ADJUSTMENT FACTORS FOR PRODUCTION OF MOTOR-VEHICLE REPLACEMENT PARTS: 1919 TO 1936

Year	Value of replacement parts		Value of motor vehicles and chassis ^c	Adjustment factor ^d
	Motor-Vehicle Bodies and Motor-Vehicle Parts branch ^a	Motor Vehicles branch ^b		
	(1)	(2)	(3)	(4)
1919	n.a.	\$615,957	\$1,729,125	84.5
1920	n.a.	675,754	2,252,512	88.2
1921	n.a.	323,349	1,325,559	92.2
1922	n.a.	407,622	1,844,445	93.9
1923	n.a.	515,903	2,611,560	95.8
1924	n.a.	329,066	2,350,471	100.6
1925	\$165,439	237,459	2,946,370	100.9
1926	170,961	253,737	3,082,911	100.8
1927	186,252	286,631	2,540,117	96.7
1928	213,648	308,458	2,986,499	97.6
1929	212,374	287,659	3,410,858	100.0
1930	183,118	223,088	2,042,974	95.6
1931	160,748	174,069	1,366,082	92.3
1932	131,502	146,299	749,958	83.7
1933	146,399	167,253	928,606	85.8
1934	174,688	212,664	1,474,596	90.8
1935	183,979	237,332	2,152,509	95.9
1936	182,510	235,414	2,552,821	98.6

^aFigures for 1929 and 1935, which represent sales, were derived from two Census publications: Fifteenth Census of the United States: 1930, "Distribution of Sales of Manufacturing Plants," pp. 36-9, 54; and Census of Business: 1935, "Distribution of Manufacturers' Sales," p. 185. The totals for these years include sales made by bodies and parts manufacturers to their own wholesale branches, to wholesalers and jobbers, to their own retail stores, to retailers of all types, direct to household consumers, and sales not distributed through the usual channels or not allocated (the last two items, not reported separately in 1929, amounted to only 1.4 percent of total sales in 1935). The following items were excluded: Sales to industrial and other large users (which consist in the main of original equipment for use in motor-vehicle assembly), transfers to other plants in the same organization (which appear to represent intra-industry shipments), and receipts for contract and repair work. For the remaining years of the period 1925-36, estimates were made by means of an index of value of replacement-parts shipments, which was constructed by the Motor and Equipment Manufacturers Association from reports of a representative group of manufacturers and published in the Survey of Current Business, "1936 Supplement," p. 147, and later issues.

^bThe figures for census years were obtained by subtracting the value of assembled vehicles and chassis from the total value of products of the Motor Vehicles branch (for 1919-23, the remainder was adjusted to exclude a small amount of contract and repair work); those for intercensal years 1920-24, by multiplying the value of vehicles and chassis by interpolated census-year ratios of value of replacement parts to value of vehicles and chassis; and those for the remaining years, by interpolation by means of an index of the value of replacement-parts sales (see fn. a).

^cFor census years, reported value of motor vehicles and chassis (trailers produced outside the Motor Vehicles industry were excluded in 1919, 1921, and 1923 on the basis of the 1925 ratio); for intercensal years, estimates made by means of an annual sales (value) series (see Table A-87, fn. b).

^dRelatives (1929 = 100) of ratios of value of motor vehicles and chassis (col. 3) to total value of motor vehicles, chassis, and replacement parts (sum of cols. 1-3).

**Table A-89.- NUMBER OF WAGE EARNERS AND AVERAGE WEEKLY HOURS
IN THE MOTOR VEHICLES INDUSTRY:
1919 TO 1936**

Year	Average number of wage earners	Average hours worked per week ^a
1919	343,115	45.9
1920	354,400	46.1
1921	212,777	44.7
1922	289,100	48.2
1923	404,886	47.7
1924	376,300	45.3
1925	426,110	47.3
1926	421,500	47.7
1927	369,399	46.4
1928	434,500	47.7
1929	447,448	46.3
1930	322,600	39.9
1931	285,515	36.9
1932	243,400	31.3
1933	243,614	35.2
1934	351,700	33.6
1935	387,801	37.3
1936	400,900	38.5

^aFor 1920-31, N.I.C.B.; for 1932-36, B.L.S.; and for 1919, Census prevailing hours multiplied by average of the ratios in 1921 and 1923 of N.I.C.B. actual to Census prevailing hours.

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Table A-90.- CONSUMPTION OF NEWSPRINT: 1919 TO 1936

(Thousands of short tons)

Year	Estimated consumption ^a	Shipments from mills ^b	Imports ^c	Exports ^d	Increase in stocks ^e	
					At publishers	In transit to publishers
	(1)	(2)	(3)	(4)	(5)	(6)
1919	1,957	1,379	628	110	-67	7
1920	2,116	1,503	730	46	80	-10
1921	2,040	1,226	793	17	-28	-10
1922	2,442	1,452	1,029	26	-3	17
1923	2,708	1,477	1,309	16	72	-10
1924	2,835	1,481	1,357	17	-22	8
1925	3,005	1,534	1,448	23	-44	-2
1926	3,435	1,685	1,851	19	69	13
1927	3,404	1,475	1,987	12	39	6
1928	3,566	1,399	2,157	11	-28	7
1929	3,776	1,409	2,423	19	30	7
1930	3,566	1,268	2,280	10	-5	-25
1931	3,241	1,158	2,067	10	-28	2
1932	2,843	1,010	1,792	8	-29	-20
1933	2,681	950	1,794	11	34	17
1934	3,045	967	2,210	23	97	11
1935	3,315	917	2,383	22	-45	9
1936	3,627	916	2,752	n.a.	14	1

^aSum of cols. (2) and (3) minus sum of cols. (4), (5), and (6) for all years except 1936. Consumption in this year was assumed to bear the same relation as in 1935 to an estimate which ignores exports.

^bSurvey of Current Business, "1936 Supplement," p. 131 and Mar. 1937, p. 52. The series was compiled prior to June 1923 . . . by the Federal Trade Commission; since then . . . by the Newsprint Service Bureau. The figures cover practically the entire industry, according to the Census of Manufactures." (Ibid., p. 178, fn. 5 to p. 131.)

^cFrom annual issues of Foreign Commerce and Navigation of the United States (U. S. Dept. Com., Bur. For. and Dom. Com.). The series represents "general imports through 1933 . . . and imports for consumption thereafter." "General imports of merchandise include commodities entered immediately upon arrival into merchandising or consumption channels, plus commodities entered into bonded customs warehouses for storage . . . Imports for consumption include commodities entered immediately upon arrival into merchandising or consumption channels plus commodities withdrawn for consumption from bonded warehouses." (Ibid.) This change in classification probably does not significantly affect the internal comparability of the series.

^dSame source as for imports (fn. c).

^eComputed from stocks series for December of each year raised to represent complete coverage. The figures for 1920-36 were taken from various monthly issues of the Survey of Current Business, from the "1932 Annual Supplement," pp. 242-43, and from the "1936 Supplement," p. 131. The figures, as of the end of the month, are "compiled by the American Newspaper Publishers' Association and are based on the reports of 422 publishers from June 1923 through October 1926, 423 in November and December 1926, 445 from January 1927 through December 1930, and 434 subsequently. According to the association, this series represents approximately 80 percent of all newsprint consumed Earlier data for a larger number of publishers . . . were compiled by the Federal Trade Commission" (Ibid., p. 178, fn. 2 to p. 131.) Figures for 1918 and 1919 were obtained from House Documents (U. S. Library of Congress), Vol. 97, Doc. 696, "Distribution and Consumption of Print Paper in the U. S.," prepared by the Secretary of Commerce for the Committee on Interstate and Foreign Commerce.

The adjustment for coverage was made in two steps. First, the figures previous to June 1923 were multiplied by the May 31, 1923 ratio of the A.N.P.A. to the F.T.C. figure. Second, both series were multiplied in all years by 1.25 since each originally represented but 80 percent of consumption.

BASIC TABLES: NEWSPAPERS AND PERIODICALS 97

Table A-91.- NUMBER OF WAGE EARNERS AND AVERAGE WEEKLY HOURS
IN THE NEWSPAPER AND PERIODICAL PRINTING AND
PUBLISHING INDUSTRY: 1919 TO 1936

Year	Average number of wage earners	Average hours worked per week ^a
1919	120,381	45.1
1920	110,700 ^b	44.6
1921	107,534	44.4
1922	111,100 ^b	44.9
1923	115,646	45.0
1924	118,000	44.9
1925	117,001	45.2
1926	118,800	45.3
1927	119,399	45.7
1928	122,000	45.1
1929	129,660	45.7
1930	128,800	45.2
1931	119,503	43.6
1932	108,900	42.6
1933	109,087	39.6
1934	116,600	37.3
1935	118,684	36.8
1936	123,000	37.0

^aFor 1920-31, N.I.C.B.; 1932-36, B.L.S.; and for 1919, Census prevailing hours adjusted by the 1921 ratio of actual to prevailing hours.

^bComputed from N.I.C.B. employment index.

Table A-92.- PRINCIPAL PRODUCTS OF PRIMARY SMELTERS AND REFINERIES: 1919 TO 1936^a

Year	Copper ^b		Copper sulphate produced at primary copper refineries ^c	Lead			Zinc produced at primary zinc-reduction plants		Nickel ^j	Gold ^k	Silver ^k	Sulphuric acid produced at -		
	Primary	Secondary		Refined primary ^d	Antimonial ^e	Secondary pig ^f	Primary ^g	Redis-tilled secondary ^h				Zinc-blende roasting plants		Copper smelters (byproduct) ⁿ
												From blende ^l	From sulphur ^m	
1919	1,770,168	71,285	31,081	984,440	32,050	25,090	931,486	21,534	1,022	268	32,778	446,518	n.a.	364,991
1920	1,526,165	81,987	29,330	1,059,314	30,360	25,574	926,764	22,040	730	257	35,986	751,702	n.a.	497,806
1921	950,778	106,485	26,098	897,178	24,030	29,598	401,000	17,080	222	119	22,134	282,300	n.a.	296,800
1922	1,255,516	146,011	33,403	1,065,324	17,050	54,098	708,554	30,110	416	195	32,516	n.a.	n.a.	n.a.
1923	1,979,836	131,439	31,555	1,236,644	34,820	73,208	1,020,868	33,650	200	343	42,661	415,100	n.a.	427,000
1924	2,280,076	154,818	22,638	1,380,986	55,790	62,796	1,034,678	28,180	382	391	43,631	520,361	419,865	n.a.
1925	2,204,574	198,360	26,515	1,533,938	59,240	70,292	1,145,892	28,790	544	457	49,560	584,339	517,425	430,200
1926	2,322,485	225,118	33,563	1,597,882	87,710	64,998	1,236,844	27,560	648	479	48,870	595,700	538,755	n.a.
1927	2,325,764	209,869	36,039	1,593,060	67,200	76,848	1,185,032	26,370	1,720	493	47,800	588,544	502,709	469,561
1928	2,487,608	232,646	44,463	1,562,142	92,230	111,860	1,205,162	27,108	1,044	535	46,666	558,537	546,204	603,100
1929	2,740,112	354,158	40,259	1,549,266	86,488	130,718	1,250,894	22,850	680	576	49,707	627,018	646,980	633,438
1930	2,157,059	280,529	36,976	1,286,066	49,594	96,270	996,090	17,000 ^p	616	431	38,940	536,614	474,092	661,702
1931	1,501,442	156,128	35,265	865,528	43,684	87,548	583,992	10,686 ^q	746	300	25,441	426,618	381,216	436,111
1932	680,868	120,455	24,909	563,882	42,048	67,222	414,296	3,192	390	165	15,405	341,340	244,644	258,994
1933	741,579	171,038	25,437	627,352	35,610	83,264	614,864	28,460	252	162	16,039	555,027	242,493	301,075
1934	890,720	246,910	24,863	622,472	33,214	67,114	727,180	9,924	314	205	20,467	406,964	59,162	166,676
1935	1,177,611	298,956	26,508	649,120	32,768	89,496	841,268	26,878	320	306	29,000	443,476	90,894	160,151
1936	1,644,977	265,830	36,445	798,312	46,460	69,112	984,264	44,284	214	456	34,780	605,882	161,169	228,738

^aUnits for first 9 products are thousands of pounds; for gold and silver, thousands of fine ounces; and for sulphuric acid, short tons (80° Baumé).

^bProduced from domestic and foreign ores and blister. Primary includes electrolytic, lake, casting, and best select copper; and secondary, electrolytic and casting copper.

The quantities were derived from Mineral Resources of the United States, 1924 (U. S. Dept. Com., Bur. Mines), Part I, p. 411, and 1928, I, 752; and

Minerals Yearbook: 1932-33 (U. S. Dept. Com., Bur. Mines), p. 89; 1937, p. 153; 1938, p. 90.

^cReported by Mineral Resources of the United States: 1920 (U. S. Dept. Int., U. S. Geological Survey), I, 497; 1922, I, 297; 1924 (U. S. Dept. Com., Bur. Mines), I, 413; 1926, I, 609; 1928, I, 753; 1930, I, 741; and Minerals Yearbook: 1932-33, p. 89; 1934, p. 65; 1935, p. 120; 1937, p. 154; 1938, p. 91.

Footnotes continued on following page

^dSoft and desilvered lead produced from domestic and foreign ores and base bullion. Figures are from Mineral Resources of the United States, 1930, I, 463; and Minerals Yearbook, 1937, p. 175, and 1938, p. 114.

^eProduction at primary lead refineries from domestic and foreign ores and scrap. The series was obtained for 1929-36 from Mineral Resources of the United States, 1931, I, 367; and Minerals Yearbook, 1937, p. 176, and 1938, p. 116. Estimates were made for 1919-28 by the multiplication of annual figures for byproduct antimonial lead by ratios of the antimony content of all (i. e., both byproduct and secondary) antimonial lead made in primary refineries to the antimony content of byproduct antimonial lead only. The production and antimony content of byproduct antimonial lead for these years were reported in Mineral Resources of the United States, 1925, I, 198, and 1930, I, 487. The antimony content of secondary antimonial lead was reported in Mineral Resources of the United States, 1919, I, 71; 1920, I, 107; 1921, I, 161; 1922, I, 186; 1923, I, 271; 1924, I, 228; 1926, I, 292; and 1928, I, 163; and Minerals Yearbook, 1937, p. 734.

^fObtained from Mineral Resources of the United States, 1919 (U. S. Dept. Int., U. S. Geological Survey), I, 69; 1920, I, 105; 1921, I, 160; 1922, I, 184; 1924 (U. S. Dept. Com., Bur. Mines), I, 131; 1926, I, 288; 1928, I, 158; and Minerals Yearbook, 1937, p. 176, and 1938, p. 116.

^gDerived from Mineral Resources of the United States, 1928, I, 365; and Minerals Yearbook, 1937, p. 193, and 1938, p. 137.

^hThe figures for 1919 and 1928-36 were obtained from Mineral Resources of the United States, 1919, I, 71, and Minerals Yearbook, 1932-33, p. 70; 1937, p. 194; and 1938, p. 138; those for 1920-27 were interpolated by means of a series for the entire production of redistilled secondary zinc (Mineral Resources of the United States, 1925, I, 330, and 1930, I, 436.)

^jTotal domestic production of primary nickel, i. e., metallic nickel and the nickel content of nickel salts made as byproducts in copper refining. The figures are reported by Mineral Resources of the United States, 1925, I, 605, and 1930, I, A68; and Minerals Yearbook, 1932-33, p. 371; 1937, p. 642; 1938, p. 552.

^kMine production from copper, lead, zinc, copper-lead, copper-lead-zinc, and lead-zinc ores.

The series for silver was obtained from Mineral Resources of the United States, 1925, I, 760, and 1930, I, 840; and Minerals Yearbook, 1937, p. 154, and 1938, p. 74.

The series for gold was obtained from Mineral Resources of the United States, 1925, I, 754; 1930, I, 834; 1931, I, 684; and Minerals Yearbook, 1937, p. 133, and 1938, p. 73.

^lThe quantities for all years but 1921 and 1925 were obtained from Mineral Resources of the United States, 1919, II, 544; 1920, II, 307; 1924, I, 240; 1925, I, 335; 1926, I, 236; 1927, I, 489; 1928, I, 375; and Minerals Yearbook, 1937, p. 195, and 1938, p. 139. The quantities for 1921 and 1925 were interpolated by means of a series for 1919, 1921, 1923 and 1925 available in Census of Manufactures, 1925, p. 723.

^mThe quantities are reported in Mineral Resources of the United States, 1924, I, 240; 1925, I, 335; 1926, I, 236; 1927, I, 489; 1928, I, 375; and Minerals Yearbook, 1937, p. 196, and 1938, p. 139.

ⁿThis series, which excludes acid produced by Anaconda Copper Co. in 1933-38 and acid produced from pyrites concentrate in Tennessee in 1934-36, was derived for all years but 1921, 1923, and 1925 from Mineral Resources of the United States, 1919, II, 544, and 1920, II, 307; and Minerals Yearbook, 1932-33, p. 672; 1937, p. 1304; and 1938, p. 1164. The figures for 1921, 1923, and 1925 were interpolated by means of a series for the odd numbered years 1919-27 available in Census of Manufactures, 1925, p. 723, and 1927, p. 665.

^oIncludes 23,728 tons of "stronger acids" which could not be reduced to 80° Baume equivalent.

^pIncludes 22 tons of secondary electrolytic zinc.

^qIncludes 512 tons of secondary electrolytic zinc.

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Table A-93.- VALUE ADDED PER UNIT OF THE PRINCIPAL PRODUCTS OF PRIMARY SMELTERS AND REFINERIES IN 1929

Product	Unit	Value (dollars) per unit		Value added (dollars) per unit ^a
		Before processing	After processing	
Copper				
Primary	Pound	0.186 ^b	0.178 ^c	0.040
Secondary	Pound	0.187 ^d	0.176 ^e	0.039
Copper Sulphate	Pound	0.085 ^f	0.065 ^g	0.020
Lead				
Primary	Pound	0.045 ^b	0.063 ^h	0.018
Secondary	Pound	0.065 ^h	0.063 ^h	0.008
Antimonial	Pound	0.045 ^j	0.064 ^k	0.019
Zinc				
Primary	Pound	0.051 ^b	0.066 ^l	0.035
Secondary	Pound	0.032 ^l	0.066 ^l	0.034
Nickel	Pound	0.136 ^g	0.437 ^m	0.301
Gold	Fine ounce	14.356 ⁿ	20.670 ⁿ	6.320
Silver	Fine ounce	0.306 ⁿ	0.533 ⁿ	0.227
Sulphuric acid				
From blends	Short ton	0.000 ^o	9.630 ^t	9.630
From sulphur	Short ton	4.380 ^u	9.630 ^t	5.250

^aDifference between value per unit before and after processing.

^bUnit value at mine, Mines and Quarries: 1929 (U. S. Dept. Com., Bur. Cons.), p. 292.

^cWeighted average price of all grades of primary metal sold, Mineral Resources of the United States: 1930 (U. S. Dept. Com., Bur. Mines), Part I, p. 686.

^dAverage dealers' buying prices at New York for principal grades of copper scrap ("heavy copper" and "No. 1 Composition"), Metal Statistics: 1934 (American Metal Market), p. 288.

^eAssumed to be same as average price of primary metal (see fn. c).

^fMine value of copper content of a pound of copper sulphate. This figure was computed from the ratio (0.2547) in 1929 of total copper content to total copper sulphate produced at copper refineries (Mineral Resources of the United States: 1930, I, 741) and the average mine value of copper.

^gCensus of Manufactures: 1929, II, 655.

^hAverage of New York dealers' (weekly) buying prices for "heavy lead", Mineral Resources of the United States: 1929, I, 188.

ⁱAssumed to be same as unit value at mine for primary lead (see fn. b).

^jMineral Resources of the United States: 1930, I, 487.

^kAverage price at New York for "old zinc", Mineral Resources of the United States: 1929, I, 189.

^lQuotient of total mine value of metal produced by "copper-mining", "lead-mining", and "zinc-mining" enterprises (Census of Mines and Quarries: 1929 (U. S. Dept. Com., Bur. Cons.), p. 292) and total quantity of metal produced from copper ore, lead ore, zinc ore, copper-lead and copper-lead-zinc ores, and lead-zinc ore (Mineral Resources of the United States: 1930, I, 834 and 840).

^mAverage New York price for all silver (for source, see fn. c).

ⁿMint value of fine gold (for source, see fn. c).

^oAssumed to be same as for copper, since nickel which is not recovered reaches market as an impurity in copper.

^pAverage value of metallic nickel and the nickel contained in the salts yielded as byproducts in copper refining. Computed from quantity and value data in Mineral Resources of the United States: 1929, I, A66.

^qAssumed to be negligible.

^rAverage sales value of 60° Baumé acid (Minerals Yearbook: 1937, p. 195).

^sValue of sulphur consumed per ton of 60° Baumé acid. Computed from quoted value of \$18.00 per long ton f.o.b. (Mineral Resources of the United States: 1929, II, 176), and the number of short tons of sulphur consumed per short ton of sulphuric acid (0.2726) at zinc-blende roasting plants (ibid.: 1930, I, 445).

BASIC TABLES: NONFERROUS METALS GROUP 101

Table A-94.- PRINCIPAL PRODUCTS OF SECONDARY SMELTERS AND REFINERIES:
CENSUS YEARS 1927 TO 1935^a

(Quantities in short tons)

Product (ingots and pigs)	Weight ^b	1927	1929	1931	1933	1935
Copper	351.29	16,426	44,215	25,820	29,164	29,147
Brass and bronze	297.77	94,770	112,269	54,156	48,483	61,830 ^c
Lead ^d	138.88	84,429	107,920	87,069	109,208	104,862
Zinc	159.39	48,978	38,184	18,908	22,917	30,500 ^e
Aluminum ^f	409.77	n.a.	18,500	15,410	20,490	29,440 ^{e,g}
Tin	857.64	n.a.	1,361	1,274	1,585	2,524 ^c
Antifriction bearing metal	362.84	15,222	11,611	5,989	4,975	6,589 ^c
Solders	456.06	10,221	15,935	10,859	13,928	16,590 ^c
Type metal	199.86	10,845	11,845	9,627	7,979	10,200 ^c
Miscellaneous metals	328.75	n.a.	n.a.	19,320 ^h	41,740 ^h	44,990 ^c

^aFigures for 1927-29 are from *Census of Manufactures: 1929*, II, 1072; for 1931 and 1933, from *1933*, pp. 617-8; and for 1935, from *1935*, pp. 1014-5.

^bUnit value (dollars) in 1929. The figure for "miscellaneous metals" was derived from statistics for 2 Census industries combined (Smelting and Refining, Metals Other Than Gold, Silver, or Platinum, Not From the Ore; and Nonferrous-Metal Alloys and Products, Not Including Aluminum Products) on the assumption that the 1931 relationship between the unit value for this product and the weighted average unit value for the other 9 metals (1.20) prevailed in 1929.

^cA portion of the output in 1935 was reported by value only for 2 Census industries combined (see fn. b). This figure was divided by the unit value for the amount reported for both industries and then distributed in accordance with the proportions of the quantities reported for each. The percentages of the total value of output for which quantities had to be estimated are:

Brass and bronze	1.4
Antifriction bearing metal	15.4
Solders	10.7
Type metal	4.8
Tin	1.6
Aluminum	0.3
Miscellaneous metals	59.9
All metals in index	10.8

^dIncludes both common and antimonial lead.

^eSegregated on the basis of the 1933 relationship from the reported total for the 2 Census industries corresponding to Secondary Smelters and Refineries and Alloyers, Rolling Mills, and Foundries. The figure for zinc is reported in *Census of Manufactures: 1935*; and the figure for aluminum, which is unpublished, was furnished by the Bureau of the Census.

^fThe value for 1929 and the quantities and values for 1931 and 1933 were estimated by subtracting revised figures which exclude aluminum ingots and pigs (shown in *Census of Manufactures: 1935*) from unrevised figures which include them (shown in *Census of Manufactures: 1933*). The quantity for 1929 was estimated by deflation of the value for this year by unit value. The latter was computed on the assumption that the ratio of the unit value of aluminum ingots and pigs made in this industry to the unit value of aluminum ingots and pigs made in both this industry and Alloyers, Rolling Mills, and Foundries was the same in 1929 as in 1931. (An unpublished figure for the total quantity of ingots and pigs made in the 2 industries in 1929 was supplied by the Bureau of the Census.)

^gRevised to exclude aluminum ingots and pigs.

^hA portion of the output (7.8 percent of the total value) was estimated in the manner described in fn. c.

Table A-95.- VALUE OF PRODUCTS AND INDEX OF UNIT VALUES FOR SECONDARY SMELTERS AND REFINERIES:
CENSUS YEARS 1919 TO 1927

Item	1919	1921	1923	1925	1927	Weight ^a
Value of industry's products (thousands of dollars)	50,246	15,150	35,786	82,138	80,771	-
Relatives (1927=100)	62.2	18.8	44.3	101.7	100.0	-
Index of unit values (1927=100) ^b	119.4	81.7	101.4	113.5	100.0	-
Value (dollars) per ton of ^c -						
Aluminum	643	424	508	564	508	18.5
Antimony	163	98	156	350	247	8.9
Brass	304	215	234	232	212	112.3
Copper	372	258	294	284	262	44.2
Lead	106	90	140	174	126	116.4
Tin	1,243	572	838	1,136	1,255	9.3
Zinc	146	100	136	152	128	38.2

^aWeight for every product except brass represents total amount (thousands of tons) produced in 1929, including the estimated quantity of pure metal contained in alloys (Census of Manufactures: 1929, II, 1072). The weight for brass represents the output of brass and bronze.

^bComputed from weights (see fn. a.) and unit values for the 7 metals shown in this table.

^cComputed from quantity and value statistics reported in Mineral Resources of the United States: 1920, Part I, p. 103; 1922, I, 182; 1924, I, 129; 1926, I, 286; and 1928, I, 155.

Table A-96.- PRINCIPAL PRODUCTS OF ALLOYS, ROLLING MILLS, AND FOUNDRIES: CENSUS YEARS 1919 TO 1935^a

(Quantities in short tons)

Product	Weight ^b	1919	1921	1923	1925	1927	1929	1931	1933	1935
Copper										
Ingots and pigs ^c	316	n.a.	n.a.	n.a.	15,017	410	5,907	459	113	134
Plates and sheets	466	43,140 ^d	54,650 ^d	68,660 ^d	82,070 ^d	93,640 ^d	129,223	73,865	70,514	94,782
Seamless tubing and pipe	825	20,100 ^e	9,187 ^e	20,380 ^e	28,977	36,164	49,082	32,252	29,575	33,992
Rods	357	82,430 ^{d,e}	87,560 ^{d,e}	226,800 ^{d,e}	284,300 ^d	275,800 ^d	569,540	201,084	142,946	169,417
Wire, bare	432	49,359	47,125	92,638	95,256 ^f	79,862 ^f	303,808 ^f	n.a.	n.a.	n.a.
Rough castings ^g	549	5,215	1,392	3,889	2,454	2,256	4,899	1,645	1,867	3,542 ^h
Brass and bronze										
Ingots and pigs ^c	305	n.a.	n.a.	n.a.	25,734	30,062	33,231	26,728	10,168	13,570 ^j
Plates and sheets	421	154,300 ^d	67,590 ^d	196,100 ^d	206,500 ^d	179,600 ^d	256,255	125,975	128,194	167,220
Seamless tubing and pipe	508	34,490 ^{d,e}	20,330 ^{d,e}	41,280 ^{d,e}	51,510 ^d	62,670 ^d	71,599	49,312	39,178	46,449
Rods	366	80,470 ^d	28,100 ^d	91,550 ^d	109,300 ^d	124,800 ^d	170,228	143,058	86,638	121,270
Wire, bare	480	21,970 ^e	13,680 ^e	35,560 ^e	42,132 ^f	32,379 ^f	31,822 ^f	n.a.	n.a.	n.a.
Rough castings ^g	478	128,900 ^e	76,370 ^e	157,800 ^e	172,500 ^h	171,900 ^h	206,766	104,633	50,820 ^h	90,180 ^h
Lead										
Ingots and pigs ^{c,k}	145	n.a.	n.a.	n.a.	24,739	24,255	45,122	51,627	13,887	24,550
Plates and sheets	181	n.a.	n.a.	n.a.	25,592	26,295	35,802	16,569	12,284	17,332
Seamless tubing and pipe	189	n.a.	n.a.	n.a.	52,868	43,935	37,026	22,194	13,485	16,329
Zinc										
Ingots and pigs ^c	119	n.a.	n.a.	n.a.	595	856	1,659	236	420	559 ^j
Plates and sheets	176	n.a.	n.a.	n.a.	n.a.	n.a.	54,135	56,562	24,957	49,931
Aluminum										
Ingots and pigs ^c	418	n.a.	n.a.	n.a.	n.a.	n.a.	769 ^m	57 ^m	946 ^m	1,860 ^{j,l}
Rough castings	984	n.a.	n.a.	n.a.	n.a.	n.a.	5,194	2,697	721	4,293 ^h
Tin										
Ingots and pigs ^c	634	n.a.	n.a.	n.a.	n.a.	n.a.	1,795	2,070	1,074	267 ^j
Alloys, other than brass and bronze										
Ingots and pigs ^c										
Antifriction bearing metal	376	n.a.	n.a.	n.a.	35,570	23,524	42,759	6,557	7,859	16,680 ^j
Solders	527	n.a.	n.a.	n.a.	39,312	39,529	40,489	24,218	12,912	27,050 ^j
Type metal	181	n.a.	n.a.	n.a.	25,566	26,290	30,445	19,627	14,449	19,520 ^j
Heat-corrosion-resistant alloys, not including ferro-alloys										
Rough castings	1,190	n.a.	n.a.	n.a.	n.a.	n.a.	1,881 ⁿ	1,464	2,683	1,369 ^h
Nickel-alloy products										
Plates and sheets	675	n.a.	n.a.	n.a.	n.a.	19,850 ^d	27,648	14,682 ^f	10,823	15,264
Seamless tubing and pipe	1,421	n.a.	n.a.	n.a.	n.a.	n.a.	1,799	1,226	792	1,304 ^h
Rods, including some of miscellaneous metals	822	n.a.	n.a.	n.a.	n.a.	n.a.	11,692	5,234	5,468	8,497
Rough castings, other than heat-corrosion-resistant	960	n.a.	n.a.	n.a.	n.a.	n.a.	733 ⁿ	570	630	1,223 ^h
Miscellaneous metals										
Ingots and pigs ^c	329 ^o	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	18,695 ^q	30,390 ^{q,r}	39,720 ^j
Plates and sheets	615	n.a.	n.a.	n.a.	n.a.	n.a.	2,419	2,527	1,487	2,286 ^h
Seamless tubing and pipe	635	n.a.	n.a.	n.a.	n.a.	n.a.	3,666	2,829	1,587	1,289 ^h

Footnotes appear at end of table.

Table A-96.- PRINCIPAL PRODUCTS OF ALLOYERS, ROLLING MILLS, AND FOUNDRIES: CENSUS YEARS 1919 TO 1935^a - Continued

(Quantities in short tons)

Product	Weight ^b	1919	1921	1923	1925	1927	1929	1931	1933	1935
Miscellaneous metals - Continued										
Wire, bare	1,145	n.a.	n.a.	n.a.	773 ^f	1,394 ^f	2,264 ^f	n.a.	n.a.	n.a.
Rough castings	874	n.a.	n.a.	n.a.	n.a.	n.a.	8,809	5,185	1,484	4,062 ^h
All metals										
Tubing, other than seamless	651	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	1,241	1,026	5,929 ^h

^aFigures for 1919 are from Census of Manufactures, 1925, p. 873; for 1921 and 1923, from 1925, p. 955; for 1925 and 1927, from 1931, pp. 907-8; for 1929-35, from 1935, pp. 1014-18.

The quantities for all but the following 7 products represent total production (i.e., the sum of production for sale, interplant transfer, and consumption in the same establishment):

Seamless tubing and pipe	Plates and sheets
Copper	Lead
Lead	Zinc
Nickel-alloy	Miscellaneous-metal
Miscellaneous-metal	

The quantities for these 7 represent production for sale and interplant transfer.

^bUnit value (dollars) in 1929.

^cAlso includes ingots and pigs made in other industries except Secondary Smelters and Refineries.

^dEstimated from production for sale and interplant transfer by means of the ratio of total production to this item in 1929.

^eIn 1929 the Census combined 3 industries into Nonferrous-Metal Alloys and Products, Not including Aluminum Products: (1) Babbitt Metal, White Metal, Type Metal, and Solder; (2) Brass, Bronze, and Other Nonferrous Alloys, and Manufactures of these Alloys and of Copper, Not Specifically Classified; and (3) Lead: Bar, Pipe, and Sheet. Since the production statistics for 1919-25 refer only to the second branch, an adjustment was made on the basis of the ratio in 1926 between the output of all 3 and in this branch only.

^fCensus of Manufactures, II, 1075.

^gReported figures for 1919 and 1921 include finished castings. These were excluded on the assumption that their relationship to the total (i.e., finished and rough) was the same as in 1925 (Census of Manufactures, 1925, p. 873).

^hA portion of the output, reported in terms of value only, was estimated and added to the reported quantity (the same unit value was assumed for both portions).

The products, years, and percentages of total value for which the estimates were required are:

Product	Year	Percent
Rough castings		
Copper	1935	45.5
Brass and bronze	1925	11.9
	1927	10.5
	1933	28.1
	1935	42.7
Aluminum	1935	25.6
Heat-corrosion-resistant	1935	22.4
Nickel-alloy, other than heat-corrosion-resistant	1935	2.4
Miscellaneous-metal	1935	19.2
Miscellaneous metals		
Plates and sheets	1935	23.6
Seamless tubing and pipe	1935	5.5
Tubing, other than seamless, all metals	1935	81.5

^jSee Table A-94, fn. c.

^kIncludes both common and antimonial lead.

^lSee Table A-94, fn. e.

^mEstimated in the same manner as for Secondary Smelters and Refineries. See Table A-94, fn. f.

ⁿEstimated from combined figure for heat-corrosion-resistant and nickel-alloy rough castings on basis of relationship in 1931.

^oSame as for Secondary Smelters and Refineries. See Table A-94, fn. b.

^pRevised to exclude aluminum ingots and pigs.

^qSee Table A-94, fn. h.

Table A-97.- NUMBER OF WAGE EARNERS IN THE NONFERROUS METALS GROUP AND COMPONENT INDUSTRIES: 1919 TO 1936

Year	Nonferrous Metals group ^a	Primary Smelters and Refineries ^b	Secondary Smelters and Refineries	Alloyers, Rolling Mills, and Foundries ^c
1919	118,258	37,579	2,167	78,512
1920	n.a.	39,100	n.a.	n.a.
1921	62,067	18,580	1,200	42,287
1922	n.a.	28,000	n.a.	n.a.
1923	103,765	34,889	1,587	67,289
1924	n.a.	34,400	n.a.	62,900
1925	101,071	32,992	2,944	65,135
1926	n.a.	32,600	n.a.	66,900
1927	99,209	30,510	2,776	65,923
1928	n.a.	30,600	n.a.	69,900
1929	114,298	30,981	4,134	79,183
1930	n.a.	28,300	n.a.	62,900
1931	70,016	18,477	2,626	48,913
1932	n.a.	14,000	n.a.	40,700
1933	65,275	14,567	2,924	47,784
1934	n.a.	19,400	n.a.	56,500
1935	89,175	22,478	3,762	62,935
1936	n.a.	25,000	n.a.	70,300

^aSum of the figures for the 3 component industries.

^bFigures for the odd-numbered years 1919-35 are from Census of Manufactures; those for the even-numbered years 1920-30 are estimates interpolated by means of a series for man-shifts of direct and indirect labor derived from Bureau of Mines data; and those for 1932, 1934, and 1936 are estimates interpolated by means of the B.L.S. index for "Smelting and Refining, Copper, Lead, and Zinc", which corresponds to the N.R.P. industry.

The series for man-shifts includes, in addition to the direct labor at smelters and refineries, the estimated number of man-shifts of indirect labor at "auxiliary works" assignable to this industry. The man-shifts for "auxiliary works" were distributed between smelters and refineries and ore-dressing plants in accordance with the proportions of the man-shifts of direct labor reported separately for both [Accidents at Metallurgical Works in the United States: 1932 (U. S. Dept. Com., Bur. Mines), Technical Paper No. 557, p. 3].

^cFigures for the odd-numbered years 1919-35 are from Census of Manufactures; those for the even-numbered years 1924-36 are estimates interpolated by means of the B.L.S. index for the corresponding industry, "Brass, Bronze, and Copper Products."

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Table A-98.-- MAN-HOURS IN THE NONFERROUS METALS GROUP AND COMPONENT INDUSTRIES: 1919 TO 1936

(Thousands)

Year	Nonferrous Metals group ^a	Primary Smelters and Refineries ^b	Secondary Smelters and Refineries ^c	Alloyers, Rolling Mills and Foundries ^d
1919	317,500	107,500	5,916	204,100
1920	n.a.	112,200	n.a.	n.a.
1921	165,200	53,600	3,351	108,200
1922	n.a.	79,120	n.a.	n.a.
1923	277,900	96,310	4,498	177,100
1924	n.a.	95,220	n.a.	n.a.
1925	271,900	91,500	8,267	172,100
1926	n.a.	90,640	n.a.	n.a.
1927	267,400	84,920	7,708	174,800
1928	n.a.	85,270	n.a.	n.a.
1929	302,200	86,570	11,030	204,600
1930	n.a.	72,800	n.a.	n.a.
1931	146,200	43,370	5,394	97,420
1932	n.a.	29,470	n.a.	n.a.
1933	126,600	31,480	5,656	89,450
1934	n.a.	38,020	n.a.	n.a.
1935	188,700	52,180	7,942	128,600
1936	n.a.	61,820	n.a.	n.a.

^aSum of the figures for the 3 component industries.

^bBureau of Mines man-hours figures for 1931-36 were adjusted in the manner described for man-shifts in Table A-97, fn. b, to include both direct and indirect labor at smelters and refineries. The original series is based on statistics published in Accidents at Metallurgical Works in the United States: 1932, Technical Paper No. 557, pp. 2-3; Accidents at Metallurgical Plants in 1933, No. H.S.S. 186, pp. 2-3; and Employment and Accidents at Metallurgical Plants in the United States: 1935, No. H.S.S. 249, pp. 2-3; and unpublished statistics for 1936.

Figures for 1919, 1921, 1923, and 1929 were estimated by multiplying Census prevailing hours for each of the 3 branches of the industry (Copper, Lead, and Zinc) by 52 times the corresponding Census employment figures; the results for these 3 branches were then totaled. Estimates for the remaining years of the period 1919-30 were interpolated by means of the employment series shown in Table A-97.

^cThe product of employment (see Table A-97), 52 (weeks), and average weekly hours. The weekly hours were computed from the series for Alloyers, Rolling Mills, and Foundries by means of ratios between the prevailing-hours figures for the 2 industries. These ratios were computed for 1919, 1921, 1923, and 1929 from Census figures and for 1925 and 1927 by straight-line interpolation; the 1929 ratio was assumed for 1931, 1933, and 1935.

^dThe product of employment (see Table A-97), 52 (weeks), and average weekly hours. The hours series includes B.L.S. actual hours for 1927 (both actual and prevailing are shown in Monthly Labor Review, Aug. 1928, p. 138), 1933, and 1935; Census prevailing hours for 1919, 1921, 1923, and 1929 reduced to level of actual hours by means of 1927 ratio of B.L.S. actual to prevailing hours; and estimates for 1925 and 1931 made by straight-line interpolation. (The estimate for 1931 was interpolated between the adjusted Census prevailing hours figure for 1929 and a B.L.S. figure for 1932.)

Table A-89.- PRODUCTION OF PRINCIPAL PAINTS AND VARNISHES, CENSUS YEARS 1919 TO 1935^a

Product	Weight ^b	1919	1921	1923	1925	1927	1929	1931	1933	1935
White lead, dry	0.082	80,465	123,868	140,127	142,930	143,305	150,365	125,171	101,679	117,571
Lead oxides	0.082	162,474	129,637	215,847	248,805	232,100	262,069	164,936	164,976	218,040
Zinc oxide	0.062	279,321	117,127	322,557	318,692	346,211	436,715	239,756	246,663	255,676
Lithopone	0.047	154,822	96,435	210,521	246,402	359,759	410,659	307,489	273,306	322,659
Iron oxides	0.032	202,182	86,128	126,908	88,772	108,368	105,627	84,212	65,629	112,423
Chrome yellow, orange, and green	0.151	9,495	13,429	26,317	28,666	33,101	42,706	58,752	37,400	47,130
Pulp colors, sold moist	0.089	20,084	9,524	18,754	16,192	14,407	15,613	10,464	7,862	7,323
All other pigments	0.052	121,055	168,358	250,487	517,641	534,647	494,726	345,225	324,110	418,696
Water paints and calcimines	0.046	106,798	87,748	122,217	110,618	122,466	156,611	122,823	105,092	126,166
Paints in paste form	0.116	398,296	428,166	425,980	434,584	408,722	401,546	242,528	189,464	256,715
Paints mixed, ready for use	1.679	59,647	48,120	71,356	87,639	94,071	106,165	76,249	66,936	87,566
Oleoresinous varnishes	1.229	28,116	22,172	40,424	38,418	33,859	38,843	27,074	25,763	30,379
Spirit varnishes not turpentine	1.854	2,974	3,085	5,606	7,117	6,816	7,560	5,868	5,422	7,916
Varnishes other than oleoresinous and spirit	1.252	6,356	4,294	3,863	4,051	8,936	8,476	5,396	4,929	9,199
Drying japans and driers	0.782	5,941	4,528	7,611	5,764	6,662	5,188	2,461	2,204	1,851
Baking japans	0.862	5,375	3,465	6,471	6,057	4,989	4,039	2,389	2,302	3,523
Other varnishes ^c	1.860	3,099 ^d	8,734 ^d	16,809 ^d	27,283	45,289	62,947	44,981	33,068	71,164
Putty	0.043	66,682	65,896	92,745	101,209	102,703	99,163	69,907	58,798	71,841
Bleached shellac	0.488	8,799	8,601	16,260	11,136	10,611	11,140	10,731	11,156	12,525

^aQuantities for first 11 products and last 2 are in thousands of pounds; for remaining 6 products, in thousands of gallons.

^bValue per unit (dollars) in 1929.

^cIncludes pyroxylin products (clear lacquers, lacquer enamel, and thinners for pyroxylin lacquers) and oil- and varnish-base enamels.

^dOutput of thinners for pyroxylin lacquers, estimated on the basis of the 1925 ratio of the quantity of thinners to clear lacquers and lacquer enamel, was included to maintain comparability with later years. Production of enamels, estimated by means of the 1921 ratio of enamels to clear lacquers and lacquer enamel, was included in 1919 for the same reason.

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Table A-100.- PRODUCTION OF 3 CLASSES OF PAINTS AND VARNISHES:
1920 TO 1927^a

(Quantities in millions)

Year	Paints in oil in -		Varnishes (gallons)	Interpolating index ^b (1923=100)
	Paste form (pounds)	Mixed form (gallons)		
1920	345.7	56.7	52.7	72.7
1921	383.8	45.8	36.1	59.4
1922	436.3	66.1	55.7	83.1
1923	439.2	82.1	70.7	100.0
1924	487.6	88.3	70.5	105.3
1925	465.3	99.7	82.0	116.8
1926	421.6	91.0	97.3	118.1
1927	406.3	97.3	99.1	122.0
Weight ^c	0.116	1.679	1.549	-

^aFor 1920-21, from Census of Manufactures; for 1922-26, from Survey of Current Business, June 1927, p. 22; and for 1927, from Paint and Varnish Production: 1927, Last 6 Months (U. S. Dept. Com., Bur. Cen.). The data for all years were compiled by the Bureau of the Census. "Although returns for 1922 were received from only 426 of 804 establishments covered by the manufactures census for 1921, these 426 establishments represented by far the greater part of the industry, having reported, for 1921, 89 percent of the total production of paste paints in oil, 95 percent of the ready-mixed paints, and 80 percent of the varnishes, japans and lacquers." (Census of Manufactures: 1921, p. 828.)

^bComputed from preceding columns.

^cValue per unit (dollars) in 1929 as computed from Census of Manufactures.

Table A-101.- SALES OF PAINTS AND VARNISHES AND WHOLESALE-PRICE INDEX: 1927 TO 1936

Year	Sales ^a (thousands of dollars)	Index of whole- sale prices ^b (1926=100)	Interpolating index ^c (1929=100)
1927	398,494 ^d	99.5	87.9
1928	420,516	97.4	96.2
1929	434,820	96.9	100.0
1930	348,156	94.5	82.3
1931	278,256	86.4	71.8
1932	202,920	78.8	57.4
1933	220,308	77.1	63.7
1934	276,204	82.7	74.4
1935	334,272	81.4	91.5
1936	382,558	83.5	102.1

^aFor 1928-35, from Survey of Current Business, "1936 Supplement," p. 83; for 1936, Mar. 1937, p. 40. The published monthly averages were multiplied by 12 to obtain annual totals. The data were "compiled by the U. S. Department of Commerce, Bureau of the Census, from reports of 579 establishments, which, according to the Census of Manufactures of 1933, produced about 80 percent of the total value of products of this industry." ("1936 Supp.," p. 168, fn. 12 to p. 83.)

^bArithmetic mean of B.L.S. wholesale-price relatives (on a 1926 base) for the following 19 products weighted by 1926 values in exchange:

Paint, prepared	Porch and deck paints
Enamel	Roof and barn paints
Inside, flat, house	Barytes
Outside, house	Iron oxide, dry
Varnish	Blue, Prussian
Lead, red, dry	Chrome green
Lead, white, in oil	Putty
Litharge	Shellac
Lithopone	Whiting
Zinc oxide	Yellow, chrome, dry

Price relatives and weights (percentage distribution) appear in B.L.S. wholesale-price bulletins. The 19 products cover about 76-86 percent of total value.

^cRelatives of sales deflated by wholesale-price index.

^dEstimated by multiplying Census value of products for 1927 by the 1929 ratio of sales to (Census) value.

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Table A-102.- NUMBER OF WAGE EARNERS AND AVERAGE WEEKLY HOURS
IN THE PAINTS AND VARNISHES INDUSTRY;
1919 TO 1936

Year	Average number of wage earners ^a	Average hours worked per week ^b
1919	21,507	48.4
1920	26,000	49.0
1921	18,015	47.3
1922	19,400	49.8
1923	22,818	49.8
1924	23,300	52.9
1925	25,490	52.7
1926	29,700	50.8
1927	28,061	50.5
1928	28,300	50.8
1929	29,211	51.8
1930	25,300	47.9
1931	22,521	44.4
1932	20,900	40.8
1933	22,880	40.5
1934	26,300	38.1
1935	27,686	39.8
1936	28,900	41.9

^aIntercensal-year figures computed from N.I.C.B. employment index.

^bFor 1919, Census prevailing hours adjusted by the average of the 1921 and 1923 ratios of actual to prevailing; for 1920-31, N.I.C.B. actual hours; and for 1932-36, B.L.S. actual hours.

BASIC TABLES: PAPER AND PULP GROUP

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Table A-103.- PRODUCTION OF PRINCIPAL KINDS OF PAPER: CENSUS YEARS 1919 TO 1935

(Short tons)

Year	Book paper	Writing (fine) paper	Newsprint and similar papers ^a	Tissue paper	Wrapping paper	Paper board
1919	951,274	325,183	1,473,719	190,661	858,464	1,867,064
1921	792,279	230,912	1,329,638	186,800	827,403	1,739,801
1923	1,207,927	377,029	1,687,351	250,616	1,184,234	2,792,832
1925	1,343,310	473,804	1,751,831	281,243	1,292,049	3,286,580
1927	1,328,782	508,808	1,812,925	316,070	1,525,305	3,773,608
1929	1,497,912	607,590	1,772,591	387,811	1,605,783	4,451,187
1931	1,208,674	487,598	1,514,543	394,623	1,401,667	3,847,823
1933	1,080,196	478,366	1,213,096	406,760	1,440,029	4,076,290
1935	1,281,870	507,325	1,221,871	473,214	1,632,054	4,695,890
Weight ^b	2.239 ^c	2.691 ^c	1.000 ^c	1.638 ^c	1.809 ^d	0.580 ^e

^a For 1931-35, as reported by Census of Manufactures; for 1919-27, sums of figures for standard newsprint, hanging papers, and poster, novel, news-tablet, lining, etc.; and for 1929, the total for catalogue paper (which in earlier years had been reported with poster, novel, news-tablet, lining, etc.) and the varieties mentioned above.

^b Relative man-hours per ton (newsprint = 1.000). The derivation of the actual labor-requirement ratios is described in fns. c, d, and e.

^c The man-hours required per ton of book paper, writing paper, newsprint, and tissue paper (42.1, 50.6, 18.8, and 30.8, respectively) were determined from J. P. Hagenauer, "Labor Cost of Production in the Paper and Pulp Industry," Paper Trade Journal, April 25, 1935, p. 36. Each figure, which refers to an unspecified date in the N.R.A. Code period, is an average of man-hour ratios distributed by mill capacity and weighted by the midpoint values of the respective intervals (the open-end class was omitted from the computation).

^d The man-hour requirement for wrapping paper is an average (34.0) of figures derived for Southern states (Kraft) from Hagenauer, *loc. cit.*, and for the Northern states from C. W. Boyce, "Labor Costs and Value of Paper Produced," Paper Mill and Wood Pulp News, Feb. 23, 1935, p. 45. Boyce's figure refers to September 1934. The weights, derived from Census state data, are the relative quantities of wrapping paper produced in the 2 regions in 1929 (North, 7; South, 3).

^e The man-hour requirement per ton of paperboard (10.9) is the average of monthly figures for 1935 supplied by National Paperboard Association.

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Table A-104.- INDEX OF TOTAL PAPER PRODUCTION: 1919 TO 1936*

Year	Short tons	Index (1929=100)
1919	6,098,530	54.7
1920	7,074,232	63.5
1921	5,431,265	48.8
1922	7,070,820	63.5
1923	8,029,482	72.1
1924	7,883,076	70.8
1925	9,182,204	82.4
1926	9,795,924	87.9
1927	10,002,070	89.8
1928	10,403,340	93.4
1929	11,140,235	100.0
1930	10,169,136	91.3
1931	9,381,840	84.2
1932	7,997,868	71.8
1933	9,190,017	82.5
1934	9,186,600	82.5
1935	10,479,095	94.1
1936	11,579,774	103.9

*For 1920, unpublished figure obtained from the U. S. Bur. For. and Dom. Com.; for intercensal years 1922-34, monthly averages in Survey of Current Business, "1936 Supplement," p. 128, multiplied by 12; and for 1936, Survey of Current Business annual quantity ("1936 Supp.," p. 129 and Mar. 1937, p. 51) adjusted by N.R.F. to the 1935 Census level. The Survey of Current Business figures for census years 1919-33 coincide with those of the Census of Manufactures.

The series for 1922-34 was "computed by the U. S. Department of Commerce, Bureau of Foreign and Domestic Commerce, from data compiled by the sources specified below. These data, raised to Census totals represent an attempt to provide a continuous series on paper production from the shifting samples which have been reported. . . . While the results achieved are not entirely satisfactory, they do provide data with some reasonable degree of comparability. . . . The data used in deriving these raised figures were compiled by the following agencies: Prior to June 1923, the Federal Trade Commission; from June 1923 through December 1935, the American Paper and Pulp Association for all items except newsprint, which is supplied by the Newsprint Service Bureau, and paperboard, furnished by the National Paperboard Association since 1933. . . . Back to 1926 the monthly production figures are raised to industry totals according to annual data reported by the Census of Manufactures. . . . In 1922, 1924, and 1926, when no Census was taken, the monthly figures were adjusted to the Census figures for 1921, 1923, and 1925, in accordance with the month-to-month change indicated by the original figures." ("1936 Supp.," p. 178, fn. 2 to p. 128.)

The 1935-36 segment was "computed by the U. S. Department of Commerce, Bureau of Foreign and Domestic Commerce, and represents total paper production as reported by the American Paper and Pulp Association for all items except paperboard, supplied by the Bureau of the Census, and newsprint, obtained from the Newsprint Service Bureau. . . . The present classification of the Association differs from that used [for intercensal years 1922-34]. The industry coverage, however, has been greatly improved. Thus, while the coverage of the old series for total paper production in 1933 was only 52 percent, the 1934 coverage was 87 percent." ("1936 Supp.," p. 178, fn. 1 to p. 129.)

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Table A-105-- PRODUCTION OF WOOD PULP (INCLUDING SCREENINGS): 1919 TO 1936^b

(Short tons)

Year	Sulphite		Sulphate			Groundwood	Soda ^c
	Unbleached	Bleached	Total	Unbleached	Bleached		
1919	931,507	521,732	121,971	n.a.	n.a.	1,551,049	411,493
1920	1,032,719	591,054	190,460	n.a.	n.a.	1,595,128	463,305
1921	787,764	431,273	139,349	n.a.	n.a.	1,267,382	300,533
1922	849,329	524,990	243,691	n.a.	n.a.	1,483,797	419,857
1923	676,046	572,644	314,267	n.a.	n.a.	1,580,553	445,162
1924	780,546	556,005	302,735	n.a.	n.a.	1,643,283	440,697
1925	815,341	631,650	412,590	n.a.	n.a.	1,629,689	472,647
1926	936,066	663,710	523,878	n.a.	n.a.	1,774,192	496,920
1927	892,324	695,808	607,172	n.a.	n.a.	1,618,638	487,478
1928	857,745	740,308	778,650	n.a.	n.a.	1,615,689	488,641
1929	872,743	863,656	916,154	n.a.	n.a.	1,649,112	520,729
1930	835,814	769,477	863,742	886,727	67,015	1,556,832	474,230
1931	893,190	758,969	1,037,258	993,120	54,138	1,459,355	374,054
1932	569,309	609,475	1,031,294	968,896	62,400	1,203,322	290,586
1933	613,215	741,097	1,262,308	1,198,747	63,561	1,201,796	371,725
1934	645,112	831,478	1,249,648	1,153,911	95,737	1,296,204	334,289
1935	647,062	962,641	1,471,083	1,343,332	127,751	1,359,721	393,952
1936	708,929	1,149,102	1,798,516	1,642,606	155,910	1,482,977	452,848
Weight ^d	1.000 ^e	1.152 ^e	1.006 ^e	0.993 ^e	1.135 ^e	0.701 ^e	1.006 ^f

^aQuantities of screenings, as reported or estimated, were added to respective pulp-production figures. No screenings were allocated to soda pulp.

Mechanical (groundwood) screenings were estimated for 1920 by multiplying groundwood-pulp output by the average of the adjacent-year ratios of groundwood screenings to groundwood pulp; and for 1922 and 1924, by multiplying output of groundwood pulp and screenings by the average of adjacent-year ratios of groundwood screenings to groundwood pulp and screenings.

Total chemical (sulphite and sulphate) screenings for 1919, 1921, 1923, and 1925-33 were reported by Census of Manufactures; for 1934, by Forest Products, 1934 (U. S. Dept. Com., Bur. Cen.), "Pulwood Consumption and Wood-Pulp Production," p. 10; and for 1935-36, by Census of Forest Products, 1936 (U. S. Bur. Cen.), "Consumption of Pulwood and Production of Wood Pulp," p. 2. For 1920, an estimate was made by the multiplication of the quantity of sulphite and sulphate pulp by the average of the 1919 and 1921 ratios of screenings to sulphite and sulphate pulp. Estimates were made in a similar manner for 1922 and 1924 by means of averages of adjacent-year ratios of screenings to screenings, sulphite pulp, and sulphate pulp.

The Census reports sulphite and sulphate screenings separately for 1923 and 1925-27. The 1923 proportions were assumed for 1919-22 and the 1927 proportions for 1928-36; averages of those for 1923 and 1925 were assumed for 1924. Finally, sulphite and sulphate screenings were distributed between the unbleached and bleached varieties on the basis of unbleached and bleached pulp proportions in each year.

^bPulp quantities were derived for 1934 from "Pulwood Consumption and Wood-Pulp Production;" for 1935, from "Consumption of Pulwood and Production of Wood Pulp;" and for all other years, from Census of Manufactures.

^cSoda and semichemical pulps, reported in combination for 1932-36, were separated on the basis of their 1931 relationship.

^dRelative man-hours per ton (unbleached sulphite = 1.000). The derivation of the actual figures is described in *Ann. 1* and *2*.

^eNumbers proportional to man-hours per ton were computed for all varieties of pulp except soda (see *Ann. 1*) by (1) deflating regional operating labor costs per ton by regional average hourly earnings and (2) then combining the quotients into national averages by use of capacity weights (the nearest available equivalent to production).

Labor costs (for January-August 1935) and hourly earnings (for May 1935) for occupations typical of each variety of pulp were supplied by the U. S. Tariff Commission in advance of publication of Report to the United States Senate on Wood Pulp and Pulwood (2nd series, No. 126, 1938). The cost figures exclude leaping for all varieties but include bleaching for bleached pulp. Since no figure was reported for sulphate bleaching, the cost was assumed to be the same as for sulphite bleaching. Earnings had to be estimated in several instances before the unweighted regional averages of earnings could be computed.

The regional capacity weights for 1935 (in thousands of pounds per day) were culminated from state figures in O. C. Holleran, *Basic Industrial Markets in the United States: Paper and Pulp Industry* (U. S. Dept. Com., Bur. For. and Dom. Com., Marketing Research Division, Marketing Research Series No. 144, Aug. 1937), pp. 69-78. The basic data, according to Holleran, were "compiled from Directory of the Paper and Allied Industries, 1936 - Lockwood Publishing Company."

^fThe requirement for soda pulp was assumed to be the same as for (all) sulphate pulp on the authority of *Chemical and Metallurgical Flow Sheets of Process Industries* (New York: McGraw-Hill, 2nd ed., of flow sheets reproduced from *Chemical and Metallurgical Engineering*, May 1934 to November 1935), p. 71.

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Table A-106.- NUMBER OF WAGE EARNERS AND MAN-HOURS IN THE PAPER AND PULP INDUSTRIES: 1919 TO 1936

Year	Average number of wage earners ^a		Thousands of man-hours ^b	
	Paper industry	Pulp industry	Paper industry	Pulp industry
1919	90,893	22,866	252,266	62,552
1920	105,000	26,400	274,091	69,570
1921	84,130	21,164	205,040	53,321
1922	87,600	22,000	223,004	59,372
1923	96,421	24,256	233,152	63,659
1924	93,900	23,600	221,049	56,650
1925	98,950	24,892	239,035	61,677
1926	102,100	25,700	252,593	63,369
1927	98,566	24,794	242,732	59,128
1928	97,700	24,000	242,266	56,182
1929	103,320	24,729	260,924	57,512
1930	100,200	23,500	243,771	53,315
1931	87,683	20,219	195,042	42,574
1932	80,300	18,500	166,187	37,075
1933	87,224	20,074	183,314	41,946
1934	100,600	23,100	190,319	43,336
1935	103,344	23,627	207,730	46,942
1936	105,100	24,000	225,950	50,983

^aFor census years 1927-35, the number of wage earners as reported in Census of Manufactures; for census years 1919-25, the reported number in the Paper and Pulp group distributed on the basis of the 1927 proportions; and for intercensal years 1920-36, group totals (derived by means of the B.L.S. index) apportioned in accordance with the averages of ratios in adjacent odd-numbered years of the number in each industry to the group total.

^bMan-hours for 1919 and 1923 were obtained by dividing wages by average hourly earnings (see Table A-107). The figures for 1929 represent the cumulated products of monthly averages of wage earners and hours per man. The Census of Manufactures provided the wage-earner data; and average monthly hours were computed by multiplication of M.I.C.B. average weekly hours for the Paper and Pulp group by the ratio for May of average monthly hours for each industry to average weekly hours for the group. The monthly hours for May were computed from regional statistics of the American Paper and Pulp Association quoted in Brief and Reports Submitted by the Paper Industry Authority to the National Recovery Administration (June 29, 1934). These figures, which are based upon a survey of 209 paper mills and 23 pulp mills, are shown for M.R.A. zones (Northern, Central, and Southern); they were combined into national averages with corresponding wage-earner weights for May, as determined from Census state data. The states were allocated to the zones in accordance with the definitions in Codes of Fair Competition (National Recovery Administration, 1934), III, 122. The A.P.P.A. zonal figures for the Paper industry are: Northern, 209.12 hours per month; Central, 220.67; and Southern, 236.54. The figures for the Pulp industry are: Northern, 205.46, Central, 102.21; and Southern, 271.52.

Man-hours for 1933 and 1935 were computed by cumulation of the products of average monthly wage earners and hours per wage earner. The wage-earner statistics were obtained from the Census of Manufactures; and monthly man-hours from Census of Manufactures: 1933, "Man-Hour Statistics for 32 Selected Industries," p. 2, and from Census of Manufactures: 1935, "Man-Hour Statistics for 59 Selected Industries," p. 4. Since the monthly employment figures for the Paper industry did not include workers in all establishments, the computed man-hours for this industry required adjustment to represent all wage earners. The man-hours sample for the Paper industry represented 84 percent of the total number of wage earners in 1933 and 89 percent in 1935; and for the Pulp industry, 88 percent in each year.

Man-hours for all other years represent averages of 2 estimates (computed from Table A-107): (1) the products of wage earners, average weekly hours and 52 (weeks per year); and (2) the quotients of wages and average hourly earnings.

BASIC TABLES: PAPER AND PULP GROUP

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Table A-107.- AVERAGE WEEKLY HOURS, AVERAGE HOURLY EARNINGS, AND WAGES
IN THE PAPER AND PULP INDUSTRIES: 1919 TO 1936

Year	Weekly hours worked		Average hourly earnings		Wages ^c (thousands)	
	Paper industry ^a	Pulp industry ^a	Paper industry ^b	Pulp industry ^b	Paper industry	Pulp industry
1919	55.4	52.6	\$0.433	\$0.423	\$109,251	\$26,460
1920	53.3	53.8	.597	.570	155,591	37,205
1921	48.7	50.3	.519	.483	102,258	24,771
1922	49.7	52.6	.466	.424	102,373	24,798
1923	46.5	50.6	.523	.464	121,939	29,538
1924	45.1	47.6	.544	.497	120,767	29,254
1925	46.6	47.9	.541	.509	128,917	31,228
1926	47.6	47.6	.535	.518	135,135	32,735
1927	47.4	46.1	.538	.536	130,475	31,527
1928	47.2	44.6	.535	.548	130,915	31,108
1929	48.6	44.7	.538	.568	140,398	32,679
1930	46.7	43.3	.539	.559	131,595	29,673
1931	42.5	40.6	.530	.538	104,042	22,844
1932	39.3	38.3	.467	.465	77,607	17,151
1933	40.4	40.2	.442	.432	81,091	18,103
1934	36.2	35.9	.515	.494	98,506	21,477
1935	38.7	38.2	.530	.499	110,200	23,401
1936	41.4	40.9	.538	.506	121,350	25,741

^aAverage weekly hours for 1919, 1923, 1929, 1933, and 1935 were computed by division of man-hours by the products of wage earners (Table A-106) and 52 (weeks per year). Each series was completed by multiplication of average weekly hours for the Paper and Pulp group by interpolated ratios of the weekly hours for each industry to corresponding hours for the group. The interpolated ratios are geometric means inserted between successive pairs of known ratios (i.e., for 1919, 1923, 1929, 1933, and 1935); the 1935 ratios were assumed for 1936.

The Paper and Pulp hours and earnings series used to interpolate hours and earnings for the component industries (see fn. b) include N.I.C.B. figures for 1919-32, and B.L.S. for 1933-36. The 1919 figures for hours and earnings were computed from Wartime Changes in Wages: September 1914 - March 1919 (Boston: N.I.C.B., 1919), Research Report No. 20, p. 78. Averages for males and females employed in "Paper Manufacturing" (assumed to correspond to the group) in March 1919 were combined with appropriate weights. No adjustment was made since the mean relationship of N.I.C.B. figures for March to the annual average in the period 1921-35 was 1.001 for hours and 0.999 for earnings. The sample represented about 10 percent of group employment in March 1919.

^bHourly earnings for each of the 2 industries were computed for 1919 from Industrial Survey in Selected Industries in the United States, 1919 (B.L.S. Bull. No. 265); and for 1923 from Wages and Hours of Labor in the Paper and Pulp Industry, 1923 (B.L.S. Bull. No. 366). The figures for 1929, 1933, and 1935 are quotients of wages and man-hours (see Table A-106); those for remaining years were estimated in the same manner as average weekly hours (see fn. a). The earnings for each industry in 1919 are averages for selected occupations (weighted by corresponding employment in the B.L.S. sample) adjusted by the ratio in 1923 of the average for all occupations to the average for the same selected ones. The 1923 figures for the Pulp industry was reported in Bull. No. 366, but the average for the Paper industry had to be computed by combining earnings for 4 classes of mills (book paper, newsprint, writing paper, and wrapping paper) in a harmonic mean with estimated wages as weights. The wages were computed from Census statistics on the assumption that the ratio of wages to value is the same for each product. For purposes of comparability with the B.L.S. products, minor adjustments were made in the Census value figures.

^cFor source and methods of derivation, see Table A-106, fn. a.

Table A-108.- CRUDE PETROLEUM REFINED: 1919 TO 1936^a

(Thousands of barrels)

Year	Crude petroleum run to stills	Shortage ^b	Crude petroleum refined
1919	361,520	16,015	345,505
1920	433,915	18,743	415,172
1921	443,363	19,558	423,805
1922	500,706	18,562	482,144
1923	581,238	18,921	562,317
1924	643,719	19,590	624,129
1925	739,920	15,683	724,237
1926	779,264	16,181	763,083
1927	828,835	17,363	811,472
1928	913,295	13,085	900,210
1929	987,708	14,690	973,018
1930	927,447	11,966	915,481
1931	894,608	19,070	875,538
1932	819,997	20,652	799,345
1933	861,254	16,756	844,498
1934	896,636	16,073	879,563
1935	965,790	11,493	954,297
1936	1,068,570	8,719	1,059,851

^aFor 1919-30, Petroleum Refining Statistics: 1930 (U. S. Dept. Com., Bur. Mines Bull. No. 367); for 1931-36, Minerals Yearbook (U. S. Dept. Int., Bur. Mines).

^bData for 1919-24 and 1931-36 represent reported shortage. During the period 1925-30 considerable quantities of still gas, which were burned as fuel at the refineries, were included in shortage; the reported figure was, therefore, adjusted to exclude this item. The estimates of still gas included in shortage were made by multiplying still gas burned in these years (Survey of Fuel Consumption at Refineries in 1931, U. S. Bur. Mines, Report of Investigations No. 3198, pp. 8, 9) by the 1930 ratio (0.8232) of still gas included in shortage to still gas burned. Still gas included in shortage in 1930 was assumed to be the difference between still gas burned and still gas included in "other finished products" (Mineral Resources of the United States: 1931, U. S. Dept. Com., Bur. Mines, Pt. II: Nonmetals, p. 659). The quantities of still gas were reduced to barrels of oil equivalent by multiplication by a conversion factor for 1931 (1 barrel = 3,989 cu. ft.) which was obtained from Minerals Yearbook: 1936, p. 705.

Table A-109.- NUMBER OF WAGE EARNERS AND AVERAGE WEEKLY HOURS
IN THE PETROLEUM REFINING INDUSTRY:
1919 TO 1936

Year	Average number of wage earners	Average hours worked per week ^a
1919	58,889	50.5
1920	n.a.	50.6
1921	63,189	50.7
1922	n.a.	50.4
1923	66,717	50.1
1924	62,301	50.3
1925	65,324	50.5
1926	71,811	50.7
1927	71,234	50.9
1928	67,862	51.1
1929	80,596	51.3
1930	80,918	50.2
1931	68,824	46.3
1932	63,913	42.9
1933	69,047	38.9
1934	77,533	35.6
1935	77,402	35.5
1936	78,420	36.3

^aCensus prevailing hours for 1919, 1921, 1923, and 1929 were adjusted to the level of actual hours by multiplication by the 1929 ratio of actual to prevailing hours. Actual hours were computed for 1929 and 1931 from unpublished Census man-hours data, and for 1933 and 1935, from Census of Manufactures: 1933, "Man-Hour Statistics for 32 Selected Industries," p. 27, and Census of Manufactures: 1935, "Man-Hour Statistics for 59 Selected Industries," p. 87, respectively. The series was completed by means of B.L.S. hours for 1932-36, Pennsylvania figures for 1929-31 (derived from data published in various issues of the Monthly Bulletin of the Pennsylvania Department of Labor and Industry), and estimates made by straight-line interpolation for the remaining years.

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Table A-110.- PRODUCTION IN THE PLANING-MILL PRODUCTS INDUSTRY:
CENSUS YEARS 1925 TO 1935

(Thousands)

Year	Dressed lumber (feet, board measure)	Doors	Sashes	Window and door frames
1925	4,786	15,127	40,655	10,803
1927	3,492	12,138	34,188	10,393
1929	4,107	12,023	27,049	8,204
1931	1,928	5,371	17,461	4,091
1933	1,082	4,147	11,864	2,007
1935	1,760	5,151	19,242	2,990
Weight ^a	51.828	3.670	0.903	3.163

^aValue per unit (dollars) in 1929.

Table A-111.- VALUE OF PLANING-MILL PRODUCTS AND WHOLESALE-PRICE INDEX:
CENSUS YEARS 1919 TO 1935

Year	Value ^a (thousands)	Wholesale- price index ^b (1929 = 100)
1919	\$477,918	119.1
1921	441,830	92.0
1923	661,609	117.8
1925	678,872	105.5
1927	555,460	98.8
1929	528,408	100.0
1931	224,280	73.2
1933	117,442	74.8
1935	183,409	85.8

^aExcludes value of secondary products, which accounted for the following percentages of total value in the odd-numbered years 1929-35:

1929 4.5 1933 5.5
1931 4.8 1935 6.6

The 1929 percentage was assumed in estimating the amounts to be deducted in the earlier years.

^bConstructed from B.L.S. wholesale-price quotations for 16 species weighted by average production in 1927 and 1929. The prices and weights are shown in various issues of the B.L.S. wholesale-price bulletins. The index is composed of two segments which were linked in 1926, their first common year. The 16 species are:

Cypress	Yellow pine, flooring
Douglas fir, no. 1	Yellow pine, timber
Douglas fir, no. 2	Poplar
Gum	Spruce
Hemlock	Cedar, red
Maple	Chestnut
Oak	Ponderosa pine
White pine	Redwood

The first segment includes the first 12, and the second, all 16.

BASIC TABLES: PLANING-MILL PRODUCTS 119

Table A-112.- NUMBER OF WAGE EARNERS AND AVERAGE WEEKLY HOURS
IN THE PLANING-MILL PRODUCTS INDUSTRY:
1919 TO 1936

Year	Average number of wage earners	Average hours worked per week ^a
1919	86,956	49.8
1920	97,300 ^b	48.5
1921	78,033	47.7
1922	95,600 ^b	49.5
1923	103,008	49.5
1924	105,300	48.9
1925	111,329	49.1
1926	109,400	48.0
1927	96,589	47.7
1928	92,400	47.7
1929	90,134	45.5
1930	68,600	44.1
1931	54,493	40.3
1932	37,300	36.5
1933	35,388	36.1
1934	39,700	34.7
1935	48,297	39.5
1936	56,900	43.2

^aFor 1920-32, N.I.C.B.; for 1933-36, B.L.S.; and for 1919, prevailing hours adjusted by the average of the 1921 and 1923 ratios of actual to prevailing hours.

^bN.I.C.B. employment index used for interpolation.

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Table A-113.- PRODUCTION IN THE RAYON INDUSTRY: CENSUS YEARS
1923 TO 1935

(Thousands of pounds)

Year	Rayon yarns				Rayon staple fibre ^a
	Total	Finer than 125 denier	125 to 150 denier	Heavier than 150 denier	
1923	36,477	n.a.	n.a.	n.a.	n.a.
1925	51,902	n.a.	n.a.	n.a.	n.a.
1927	75,555	n.a.	n.a.	n.a.	n.a.
1929 ^b	121,399	13,338	89,025	19,038	500
1931	150,879	32,959	100,023	17,897	880
1933	213,498	61,166	129,539	22,794	2,100
1935	257,557	58,496	152,157	46,905	4,600
Weight ^c	-	1.7	1.2	1.0	0.6 ^d

^aRayon Organon (New York: Textile Economic Bureau, Inc.), Jan. 1938, "Statistical Supplement," p. 16.

^bFor 1929, the Census reported sales rather than production: All yarns, 116,632 thousand pounds; yarns finer than 125 denier, 12,814; yarns of 125-150 denier, 85,529; yarns heavier than 150 denier, 18,290. Each of these figures was adjusted by the ratio (1.04087) of total production in 1929 as reported by Rayon Organon (see fn. a) to the Census total for sales.

^cRelative unit value (dollars) in 1929.

^dWholesale price in 1929 of "1-1/2 inch 1-1/2 denier no." fibre (Rayon Organon, June 1936, p. 97).

Table A-114.- AUXILIARY PRODUCTION SERIES FOR THE RAYON INDUSTRY: 1919 TO 1937

(Thousands of pounds)

Year	Rayon yarns				Rayon staple fibre ^a
	Total ^a	Finer than 113 denier ^b	113 to 162 denier ^b	Heavier than 162 denier ^b	
1919	8,278	n.a.	n.a.	n.a.	n.a.
1920	10,125	n.a.	n.a.	n.a.	n.a.
1921	14,986	n.a.	n.a.	n.a.	n.a.
1922	24,067	n.a.	n.a.	n.a.	n.a.
1923	34,959	n.a.	n.a.	n.a.	n.a.
1924	36,328	n.a.	n.a.	n.a.	n.a.
1925	51,049	n.a.	n.a.	n.a.	n.a.
1926	62,693	n.a.	n.a.	n.a.	n.a.
1927	75,555	6,422	56,138	12,995	(c)
1928	97,232	9,626	71,952	15,654	165
1929	121,399	13,961	88,500	18,938	500
1930	127,333	18,081	91,298	17,954	350
1931	150,879	28,818	104,108	17,955	880
1932	134,670	35,014	87,266	12,390	1,100
1933	213,498	56,363	134,077	23,058	2,100
1934	208,321	55,830	123,951	28,540	2,200
1935	257,557	54,087	159,943	43,527	4,600
1936	277,626	67,463	171,295	38,868	12,300
1937	312,236	77,747	191,088	43,401	20,100
Weight ^d	-	1.7	1.2	1.0	0.6

^aRayon Organon (New York: Textile Economic Bureau, Inc.), Jan. 1938, "Statistical Supplement," p. 16.

^bComputed from total and a percentage distribution, *ibid.*, p. 19.

^cQuantity not reported. The noncomparability resulting from the omission of rayon staple fibre from the index in 1927 is probably very small because of its known unimportance in this year with respect to both quantity and weight (wholesale price).

^dAssumed to be same as weights shown in corresponding columns of Table A-113, even though the products are not precisely the same.

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Table A-115.- NUMBER OF WAGE EARNERS AND AVERAGE WEEKLY HOURS IN THE RAYON INDUSTRY: 1923 TO 1937

Year	Average number of wage earners	Average hours worked per week ^a
1923	14,401 ^b	51.8
1924	15,100	50.9
1925	19,128	51.5
1926	19,000 ^c	48.9
1927	26,341	48.7
1928	31,200 ^c	48.8
1929	39,106	49.1
1930	38,800	42.0
1931	38,735	43.0
1932	34,300	43.5
1933	44,306	41.2
1934	46,700	37.0
1935	50,550	37.9
1936	52,300	38.6
1937	58,000	38.8

^aFor 1932-37, B.L.S. actual hours (the average for 1937 was computed from 12 monthly figures published in the Monthly Labor Review); for 1929, Census prevailing hours; for 1923-28, estimates made by means of the 1929 figure and the N.I.C.B. index of weekly hours for the Chemicals industry; for 1930, the product of B.L.S. hours for 1932 and the ratio between hours for 1930 and 1932 computed from statistics published in Wages and Hours of Labor in Rayon and Other Synthetic Yarn Manufacturing, 1932 (B.L.S. Bull. No. 587); and for 1931, an estimate made by means of the B.L.S. figure for 1936 and the N.I.C.B. index of weekly hours for the Chemicals industry for 1931 and 1936.

The B.L.S. study (Bull. No. 587) covered 83 and 74 percent, respectively, of the number of the wage earners in the Rayon industry in 1930 and 1932.

^bCommerce Yearbook, 1932 (U. S. Dept. Com., Bur. For. and Dom. Com.), I, 423. The Bureau of the Census is cited as the source. Figures for subsequent years coincide with those published in the Census of Manufactures.

^cEstimates interpolated by means of an auxiliary employment series which was constructed in the following manner: First, Census value figures for total production were completed by means of a continuous Rayon Organon series; second, this continuous value series was used to complete the Census series for wages; third, annual wages were divided by N.I.C.B. hourly earnings for the Chemicals industry to obtain estimates of man-hours; and finally, these man-hours were divided by average weekly hours to obtain the auxiliary employment series.

BASIC TABLES: RUBBER PRODUCTS GROUP

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Table A-116.- PRODUCTION OF RUBBER TIRES AND INNER TUBES: 1921 TO 1936
(Thousands)

Year	Weight (pounds) ^a		Number	
	Automobile casings	Automobile inner tubes	Solid and cushion tires ^b	Motorcycle and bicycle casings and inner tubes ^c
1921	446,779	71,864	401	1,975
1922	659,624	106,900	696	3,145
1923	714,551	126,476	944	4,511
1924	764,661	146,599	926	5,412
1925	1,017,551	161,088	1,035	2,512
1926	1,090,958	180,559	769	2,779
1927	1,216,985	177,138	613	5,046
1928	1,512,967	214,427	737	5,392
1929	1,480,413	203,618	590	5,737
1930	1,162,913	146,946	295	5,286
1931	1,099,329	129,509	191	2,855
1932	970,844	96,652	145	5,372
1933	1,036,099	115,696	189	3,908
1934	1,175,000	121,700	285	3,957
1935	1,242,000	126,600	377	4,006 ^d
1936	1,404,000	145,600	n.a.	n.a.
Weight ^e	114,916	17,603	3,864	736

^aFor 1921-33, the number produced annually was multiplied by the corresponding average weight (pounds); for 1934-36, the estimated total poundage was allocated to casings and to inner tubes on the basis of their 1933 proportions.

The number produced in intercessal years was obtained from Survey of Current Business, 1936 Supplement, p. 134; the figure for 1934 was adjusted by B.R.P. to Census level. The quantities were "computed by the U. S. Department of Commerce, Bureau of Foreign and Domestic Commerce, from data compiled by the Rubber Manufacturers Association, Inc. These figures . . . are raised to industry totals as shown by the Census of Manufactures in census years, by interpolated census totals in intervening years, and according to the association's estimated percentage of the industry covered by its reporting members subsequent to 1933." The R.M.A. sample included 21-53 companies which accounted for 75-97 percent of pneumatic-casing production and 74-97 percent of inner-tube production. (Ibid., p. 180, fn. 1 to p. 134.)

Average weight of casings for 1921-31 was derived from S. Stern, Labor Productivity in the Automobile Tire Industry (B.L.S. Bull. No. 585), p. 7 (for 1921, a 3-plant series was applied to a 6-plant series which was available for 1922-31); for 1932 and 1933, from L. E. Carlsmith, "Changes in Tire Sizes," Rubber Age, May 1936, p. 65. Average weight of inner tubes for 1922-31, from Stern, *op. cit.*, p. 72; for 1933, from Carlsmith, *loc. cit.*; for 1932, by straight-line interpolation; and for 1921, by straight-line interpolation between a 1920 figure, supplied by Carlsmith, *loc. cit.*, and Stern's 1922 figure. B.L.S. surveyed 6 tire-manufacturing plants (5 for inner tubes) which accounted for 45-59 and 45-68 percent, respectively, of the total production of casings and inner tubes.

Total poundage of casings and tubes combined for 1934-36 was estimated from a series for the consumption of crude and reclaimed rubber and tire fabrics. Separate Census consumption series for crude rubber, reclaimed rubber, and tire fabrics were interpolated for intercessal years by means of comparable R.M.A. statistics (raised to Census totals) published in Survey of Current Business. The 3 consumption series were aggregated without weighting and used to extend the estimates of the total poundage of both casings and tubes to 1936. The total poundage for 1934-36 was then distributed between casings and tubes in accordance with their 1933 proportions.

^bData for odd-numbered years 1921-29 were obtained from Census of Manufactures; estimates for remaining years were made through the use of a comparable R.M.A. series.

^cEstimates for intercessal years were made by straight-line interpolation.

^dThis figure is not strictly comparable with those for other years since it excludes an indeterminate number of motorcycle and bicycle inner tubes.

^eThe weights, which were applied to relatives of the production series, are the estimated man-hours required for the production of the several classes of products in 1929. They were computed in the following manner: The estimated aggregate man-hours required in 1929 to produce all 4 classes were multiplied by the percentages that the value of (1) automobile casings and tubes, (2) solid and cushion tires, and (3) motorcycle and bicycle casings and tubes constituted of their combined value. The man-hours thus allocated to automobile casings and tubes were then apportioned between them by (1) dividing the total poundage of each by the pounds produced per man-hour of direct labor (computed from statistics reported in S. Stern, *op. cit.*, pp. 7 and 72) to obtain an estimate of direct labor, (2) distributing the difference between the aggregate direct man-hours thus obtained and total man-hours for the group (i.e., indirect man-hours) between the 2 classes on the basis of their relative total poundage, and (3) summing direct and indirect man-hours for each.

Table A-117.- PRODUCTION OF PRINCIPAL RUBBER GOODS OTHER THAN TIRES AND INNER TUBES: 1921 TO 1935^a

Product	Unit (thousands)	Weight ^b	1921	1923	1925	1927	1928	1929	1930	1931	1932	1933	1934	1935
Rubber boots	pair	6.1	6,532	9,098	4,739	5,632	5,643	5,454	3,652	1,971	1,920	2,622	2,845	3,029
Shoes and overshoes	pair	24.8	57,181	60,103	52,339	71,577	61,467	51,857	40,931	27,145	25,247	32,984	35,648	37,810
Lumbermen's	pair	1.7	n.a.	n.a.	n.a.	3,775	2,795	1,617	1,467	983	918	1,201	1,536	1,881
Arctics and gaiters	pair	12.2	n.a.	n.a.	n.a.	36,721	27,983	19,245	15,964	10,990	11,160	15,815	17,672	19,346
Other shoes and overshoes	pair	11.2	n.a.	n.a.	n.a.	31,083	30,689	30,295	23,500	15,172	13,169	15,968	16,440	16,583
Canvas footwear	pair	11.7	15,237	26,114	25,000	28,810	36,382	43,954	36,504	28,082	33,635	29,689	24,118	23,955
Reclaimed rubber	pound	9.2	68,277	131,752	245,852	330,436	347,066	365,696	269,733	216,509	127,460	168,757	182,243	202,245
Heels	pair	6.8	137,499	289,222	342,196	318,346	335,126	292,719	237,527	248,257	215,926	273,948	266,770	278,369
Soles	pair	3.5	5,003	13,509	36,064	40,820	53,492	46,189	45,638	69,609	71,933	92,032	86,751	69,656
Auto and carriage fabrics	sq. yd.	4.6	15,645	33,039	25,232	17,363	n.a.	22,408	n.a.	10,425	n.a.	8,620	n.a.	5,227
Rubberized fabrics	sq. yd.	6.8	19,679	18,101	25,840	38,446	n.a.	70,560	n.a.	53,574	n.a.	63,048	n.a.	66,118
Raincoat fabrics	sq. yd.	3.7	n.a.	n.a.	n.a.	23,688	n.a.	25,576	n.a.	15,092	n.a.	18,227	n.a.	19,975
Hospital sheeting	sq. yd.	0.5	n.a.	n.a.	n.a.	3,422	n.a.	3,048	n.a.	2,685	n.a.	2,240	n.a.	2,509
Other rubberized fabrics	sq. yd.	2.7	n.a.	n.a.	n.a.	11,536	n.a.	41,936	n.a.	35,797	n.a.	42,561	n.a.	43,634
Transmission belting	pound	5.0	n.a.	n.a.	n.a.	23,175	n.a.	21,575	n.a.	14,508	n.a.	13,745	n.a.	15,549
All other rubber belting	pound	4.8	n.a.	n.a.	n.a.	20,215	n.a.	23,449	n.a.	16,098	n.a.	16,883	n.a.	32,814
Rubber packing	pound	2.0	n.a.	n.a.	n.a.	15,019	n.a.	17,923	n.a.	9,266	n.a.	9,566	n.a.	11,409
Washers, gaskets, valves, etc.	pound	2.0	n.a.	n.a.	n.a.	12,958	n.a.	13,520	n.a.	5,981	n.a.	4,036	n.a.	5,168
Rubber and friction tape	pound	1.8	n.a.	n.a.	n.a.	16,999	n.a.	20,426	n.a.	14,925	n.a.	11,619	n.a.	12,360
Water bottles and fountain syringes	dozen	1.8	n.a.	n.a.	n.a.	514	n.a.	693	n.a.	487	n.a.	552	n.a.	579
Rubber bands	pound	0.7	n.a.	n.a.	n.a.	1,738	n.a.	3,489	n.a.	3,436	n.a.	3,309	n.a.	3,878
Rubber gloves	doz. pr.	1.2	n.a.	n.a.	n.a.	817	n.a.	1,050	n.a.	997	n.a.	1,125	n.a.	1,288
Rubber cement	gallon	1.8	n.a.	n.a.	n.a.	4,827	n.a.	6,050	n.a.	5,343	n.a.	4,213	n.a.	5,971
Rubber flooring	sq. ft.	1.7	n.a.	n.a.	n.a.	8,778	n.a.	8,566	n.a.	7,524	n.a.	4,325	n.a.	5,906
Rubber thread	pound	2.0	n.a.	n.a.	n.a.	5,262	n.a.	5,726	n.a.	5,498	n.a.	4,809	n.a.	5,415
Jar rings	gross	1.2	n.a.	n.a.	n.a.	6,769	n.a.	6,438	n.a.	10,950	n.a.	7,442	n.a.	7,571
Bathing caps	dozen	0.7	n.a.	n.a.	n.a.	741	n.a.	1,050	n.a.	1,178	n.a.	1,228	n.a.	945

^aEstimates for intercensal years were made by interpolation of Census data through the use of statistics compiled by the Rubber Manufacturers Association and published in the Survey of Current Business, "1936 Supplement." R.M.A. data for 1928 were available only for heels and soles; estimates for the remaining products were, therefore, made by straight-line interpolation. An R.M.A. series for waterproof footwear was used to complete the Census series for boots, lumbermen's shoes and overshoes, arctics and gaiters, and other shoes and overshoes for the period 1929-35. Because of a change in Census classification, reclaimed rubber production for 1935 was estimated by multiplication of the R.M.A. figure for that year by the average of the ratios of the Census to the R.M.A. figures for 1929, 1931, and 1933.

^bThe weights, which were applied to relatives of the production series, represent the percentage that the value of each product comprised of the total value of the products included in 1929 in the index for Other Rubber Goods.

Table A-118.- NUMBER OF WAGE EARNERS IN RUBBER PRODUCTS GROUP AND COMPONENT INDUSTRIES: 1921 TO 1936^a

Year	Rubber Products group	Tires and Inner Tubes ^b	Other Rubber Goods ^c
1921	103,273	44,500	58,700
1922	133,500 ^d	57,500	76,000
1923	137,868	57,900	79,900
1924	123,400	55,900	67,500
1925	141,869	63,200	78,700
1926	141,200	62,200	79,000
1927	141,997	61,300	80,700
1928	149,300	65,100	84,200
1929	149,148	65,000	84,100
1930	115,400	47,200	68,200
1931	99,259	39,200	60,100
1932	90,800	34,900	55,900
1933	106,283	39,400	66,900
1934	118,800	42,800	76,000
1935	114,681	38,700	76,200
1936	121,900	40,400	81,500

^aThe figures for the component industries were rounded off after adjustment for comparability with production. The employment for the group shown in this table is, therefore, not identical with the sum of the estimates for the 2 component industries.

^bCensus statistics for 1921-35 were completed by use of a B.L.S. series for 1923-36 and Ohio State tire-and-tube figures for 1921-23. The completed series was then adjusted for comparability with the production index on the assumptions that the (Census) Tires and Tubes and the Other Rubber Goods industries (1) have the same value productivity for tires and tubes and the same value productivity for other rubber goods, (2) together account for the total output of these 2 types of products, and (3) produce only these 2 types of products. (See note on method in Part Two: Rubber Products Group.)

^cThis series represents the difference between group employment and the preliminary estimates of the number of wage earners for Tires and Inner Tubes after adjustment for comparability with the production index on the assumptions stated in fn. b.

^dObtained by interpolation by means of N.I.C.B. series for 1921-23.

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Table A-119.- MAN-HOURS IN THE RUBBER PRODUCTS INDUSTRIES:
1921 TO 1936

(Thousands)

Year	Rubber Products group ^a	Tires and Inner Tubes ^a	Other Rubber Goods ^b
1921	247,107	94,623	152,484
1922	330,577	126,241	204,336
1923	335,972	123,035	212,937
1924	299,727	117,067	182,660
1925	341,029	130,199	210,830
1926	341,766	129,669	212,097
1927	348,955	130,017	218,938
1928	375,083	142,088	232,995
1929	363,154	137,141	226,013
1930	264,060	95,256	168,804
1931	202,806	71,517	131,289
1932	162,810	54,933	107,877
1933	190,025	59,717	130,308
1934	198,582	62,889	135,693
1935	202,807	59,855	142,952
1936	233,335	68,766	164,569

^aComputed by averaging (1) the quotients of pay rolls and hourly earnings and (2) the products of the employment series (unadjusted series for Tires and Inner Tubes) and average actual hours per man per year (i.e., average weekly hours times 52). The pay-rolls series were obtained in the same manner as employment for 1921 and for 1923-36; the 1922 estimates are based on the N.I.C.B. group index. Average weekly hours and hourly earnings were derived by splicing N.I.C.B. series for 1921-31 to corresponding B.L.S. series for subsequent years. The N.I.C.B. hours and earnings series for the Rubber Products group were used for Tires and Tubes.

The man-hours series for Tires and Tubes was adjusted for comparability with the production index by the method indicated in Table A-118, fn. b.

^bThis series represents the difference between man-hours for the group and the preliminary estimates of man-hours for Tires and Tubes after adjustment for comparability with the production index by the method indicated in Table A-118, fn. b.

Table A-120.- PRODUCTION OF PRINCIPAL SILK AND RAYON
BROAD GOODS; CENSUS YEARS 1919 TO 1929

(Thousands of square yards)

Year	Broad goods (except velvets, plushes, upholsteries, and tapestries)		Velvets	Plushes	Uphol- steries and tap- estries
	All-silk	Mixtures			
1919 ^a	254,220	60,736	9,012	5,778	677
1921	230,903	47,508	6,410	5,501	1,276
1923	271,820	104,402	9,109	7,117	3,799
1925	384,725	98,391	6,078	925	2,675
1927	385,530	127,296	5,484	1,310	3,705
1929	424,607	172,507	9,651	1,957	3,403
Weight ^b	0.909	0.594	2.602	1.957	1.799

^aCensus quantity statistics, reported in linear yards, were converted to square yards on the assumption of the 1921 average widths.

^bValue per unit (dollars) in 1929.

Table A-121.- PRODUCTION OF PRINCIPAL SILK AND RAYON BROAD GOODS: CENSUS YEARS 1929 TO 1935

(Thousands of square yards)

Product	Weight ^a	1929	1931	1933	1935
All-silk ^b	0.179	425,129	586,637	201,604	239,431 ^g
All-rayon and velvets (other than all-silk and silk-and-rayon mixed) ^d	.078	71,530	111,736	274,437 ^g	729,889 ^f
Silk-and-rayon mixed ^e	.262	31,739	13,371	30,183	9,787
Silk-and-cotton mixed and other silk- or rayon-mixed ^e	.190	37,502	16,732	7,482	16,580
Rayon-and-cotton mixed ^e	.078	37,241	41,077	46,955	6,631
Silk-and-rayon mixed velvets	.441	5,823	4,961	6,214	8,032 ^h
Plushes and all-silk velvets	.322	2,278	1,919	1,089 ^g	1,508
Upholsteries other than all-silk	.773	2,347	2,566	1,018	594
Tapestries	.132	534	925	1,712	13,641

^aEstimated employment per square yard in 1935 computed by (1) apportioning the wage earners in each of the industry branches in 1935 (Silk Manufactures and Rayon Manufactures) among the individual products in accordance with the percentages their values constituted of the total value of the primary products of the branch and (2) dividing the total number of wage earners assigned to each product by the corresponding production (number of square yards) in 1935.

^bOther than velvets, plushes, and tapestries.

^cIncludes all-silk tapestries and draperies.

^dOther than plushes, upholsteries, and tapestries.

^eTo establish comparability with other years the quantity of all-silk velvets, which was estimated on the basis of the 1931 ratio of their value to the value of velvets other than silk-and-rayon mixed, was subtracted from the total for all-rayon broad goods and velvets and added to plushes.

^fIncludes all-rayon tapestries and draperies other than Jacquard, upholsteries, and plushes.

^gOther than velvets, plushes, upholsteries, and tapestries.

^hIncludes small amount of silk-and-cotton mixed velvets with silk warp.

Table A-122.- RAW-SILK CONSUMPTION IN THE SILK AND RAYON GOODS INDUSTRY:
1919 TO 1936

(Thousands of pounds)

Year	Silk deliveries ^a	Raw-silk consumption in all textile industries ^b	Raw-silk consumption in the Silk and Rayon Goods industry ^c
1919	n.a.	27,857	25,891
1920	29,452	19,114	17,394
1921	44,257	28,723	25,621
1922	48,618	31,553	27,546
1923	47,401	30,763	26,272
1924	48,550	31,509	26,341
1925	66,303	43,058	35,188
1926	66,330	43,247	35,030
1927	72,919	47,755	38,278
1928	75,516	54,296	44,794
1929	81,962	64,215	54,473
1930	77,000	57,981	48,762
1931	78,674	56,868	47,436
1932	73,243	51,051	41,045
1933	62,082	41,595	32,153
1934	61,061	39,324	29,217 ^d
1935	65,748	40,606	28,896 ^d
1936	60,126	37,158	26,456 ^d

^aFor 1920-35, the figures were computed from silk deliveries (bales) reported in *Survey of Current Business*, "1936 Supplement," p. 143; and for 1936, from statistics shown in *ibid.*, March 1937. The average weight of a bale of silk is 132.25 lbs. (*ibid.*, "1936 Supp.," p. 182).

Silk deliveries, which were compiled monthly by the Commodity Exchange (in earlier years, by the National Federation of Textiles and the Silk Association of America), represent the difference between imports and the change in the United States stock position during the month.

^bFor 1919 and the odd-numbered years 1925-35 except 1933, from Census statistics; for remaining years, estimates made by means of the silk-deliveries series.

"All textile industries" includes: Cotton Goods, Cotton Small Wares, Felt Goods, Knit Goods, Lace Goods, Silk and Rayon Goods, Woolen Goods, and Worsted Goods. Consumption in the Woolen and Worsted Goods group in 1931 was estimated on the basis of the ratio to the combined consumption in the Knit Goods and Silk and Rayon Goods industries in 1929 and 1935.

^cFigures for 1919 and the odd-numbered years 1925-35 were obtained from the *Census of Manufactures*; those for the remaining years are estimates made by multiplication of the total consumption of silk in the textile industries by a series of ratios of consumption in the Silk and Rayon Goods industry to total consumption. The ratios for all years except 1936 were obtained by straight-line interpolation between those computed from Census data; the 1935 ratio was assumed for 1936.

^dNot used for interpolation of N.R.P. production index.

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**Table A-123.- NUMBER OF WAGE EARNERS AND AVERAGE WEEKLY HOURS
IN THE SILK AND RAYON GOODS INDUSTRY: 1919 TO 1936**

Year	Average number of wage earners	Average hours worked per week ^a
1919	126,782	45.5
1920	129,900	41.9
1921	121,378	44.9
1922	118,900	45.7
1923	125,234	46.5
1924	119,100	45.4
1925	132,509	46.9
1926	129,400	45.2
1927	127,643	45.9
1928	127,100	47.3
1929	130,467	47.8
1930	119,500	44.9
1931	109,225	44.3
1932	93,000	38.7
1933	110,322	37.1
1934	119,900	33.4
1935	125,908	34.8
1936	113,200	36.2

^aFor 1919, Census prevailing hours multiplied by the average of the ratios of N.I.C.B. actual to Census prevailing hours in 1921 and 1923; for 1920-31, N.I.C.B. actual hours; and for 1932-36, B.L.S. actual hours.

Table A-184.- PRODUCTION IN THE SLAUGHTERING AND MEAT PACKING INDUSTRY: 1919 TO 1956^a

Product ^b	Weight ^c	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936
Fresh meat																			
(1) Beef	0.188	4,832	4,443	4,212	4,719	4,835	4,959	5,065	5,451	5,070	4,542	4,575	4,529	4,558	4,098	4,614	5,098	4,747	5,530
(2) Veal	0.210	423	444	419	449	499	547	578	579	550	518	511	516	530	497	539	506	562	717
(3) Mutton and lamb	0.242	800	486	568	479	511	516	522	558	547	574	602	724	772	759	745	688	767	744
(4) Pork	0.169	2,098	2,235	2,322	2,604	3,266	3,272	2,828	2,866	3,110	3,548	3,571	3,350	3,467	3,344	3,370	3,182	2,065	2,861
(5) Edible organs, tripe, etc.	0.111	467 ^d	n.a.	354 ^d	416	467 ^d	482	487	517	509	548	569	566	589	485	504	554	544	608
(6) Other fresh meat	0.114	504	n.a.	38 ^d	n.a.	51 ^d	n.a.	55	n.a.	59	n.a.	16	n.a.	29	n.a.	13	n.a.	23	n.a.
Cured meat																			
(7) Pork, smoked, and ham, cooked ^e	0.245	905	(f)	958	(f)	1,258	(f)	1,256	(f)	1,355	(f)	1,649	(f)	1,456	(f)	1,608	(f)	1,047	(f)
(8) Pork, not smoked	0.152	3,241	3,357 ^f	2,037	3,210 ^f	2,642	3,345 ^f	2,060	3,075 ^f	1,913	3,567 ^f	2,131	3,489 ^f	1,707	3,069 ^f	1,597	2,973 ^f	1,039	1,905 ^f
(9) Beef, pickled and other cured	0.304	130	n.a.	59	n.a.	75	n.a.	84	n.a.	103	n.a.	72	n.a.	71	n.a.	61	n.a.	68	n.a.
(10) Canned meat and sausage ^g	0.251	467	171	75	80	95	108	119	121	144	149	169	146	105	117	150	155	202	117
(11) Sausage (not canned), meat puddings, headcheese, etc. ^h	0.222	882	935	872	910	1,158	1,193	1,250	1,256	1,210	1,265	1,306	1,335	1,215	1,217	1,290	1,393	1,331	1,366
(12) Sausage casings ⁱ	0.185	161	n.a.	105	n.a.	133	n.a.	131	n.a.	164	n.a.	174	n.a.	100	n.a.	119	n.a.	126	n.a.
(13) Lard	0.122	1,575	n.a.	1,575	1,761	2,132	2,146	1,672	1,744	1,795	2,023	2,041	1,737	1,750	1,784	1,917	1,694	916	1,375
(14) Oleo oil and stook	0.110	n.a.	n.a.	169	n.a.	170	n.a.	148	n.a.	130	n.a.	113	n.a.	99	n.a.	78	n.a.	74	n.a.
(15) Stearin (oleo and other)	0.099	44	n.a.	28	n.a.	35	n.a.	54	n.a.	44	n.a.	59	n.a.	28	n.a.	31	n.a.	25	n.a.
Hides																			
(16) Cattle hides, cured and uncured	0.150	584	n.a.	484	554	580	605	621	559	617	538	535	520	513	487	512	597	573	556
(17) Calfskins, cured and uncured	0.203	44	44	40	44	47	52	55	55	54	55	51	59	57	55	57	75	74	79
(18) Sheep and lamb pelts cured and uncured	1.757	12	n.a.	12	n.a.	11	n.a.	11	n.a.	9	n.a.	10	n.a.	15	n.a.	15	n.a.	14	n.a.
(19) Pickled sheep and lamb skins	0.305	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	17	n.a.	13	n.a.	23	n.a.	28	n.a.	29	n.a.
(20) Wool	0.553	30	n.a.	32	n.a.	31	n.a.	32	n.a.	30	n.a.	38	n.a.	44	n.a.	50	n.a.	42	n.a.
(21) Hair, hog and other	0.044	60	n.a.	20	n.a.	26	n.a.	27	n.a.	30	n.a.	26	n.a.	16	n.a.	12	n.a.	13	n.a.

^aSheep and lamb pelts are reported in numbers; all other products, in millions of pounds.

^bEleven of the series derived from the Census of Manufactures - for products (1)-(5), (7) and (8) combined, (10), (11), (13), (16), and (17) - were completed for the even-numbered years by means of continuous Department of Agriculture series:

Census series	Department of Agriculture series
(1) Beef, fresh	Dressed weight of cattle slaughtered under Federal inspection
(2) Veal, fresh	Dressed weight of calves slaughtered under Federal inspection
(3) Mutton and lamb, fresh	Dressed weight of sheep and lambs slaughtered under Federal inspection
(4) Pork, fresh	Dressed weight of hogs slaughtered under Federal inspection

Census series

(5) Edible organs, tripe, etc.

(7) Pork, smoked, and ham, cooked
 (8) Pork, not smoked
 (10) Canned meat and sausage
 (11) Sausage (not canned), meat puddings, headcheese, etc.
 (13) Lard

Department of Agriculture series

Edible organs, tripe, etc. (estimated by multiplying live weight of cattle, calves, sheep and lambs, and hogs by respective yields of edible offal per pound live weight and aggregating the products)

Pork placed in cure under Federal inspection

Canned meat prepared under Federal inspection

Sausage prepared under Federal inspection

Lard rendered from hogs slaughtered under Federal inspection

(Footnotes continued on following page.)

Table A-124.- PRODUCTION IN THE SLAUGHTERING AND MEAT PACKING INDUSTRY: 1919 TO 1956^a - Continued

Census series	Department of Agriculture series	Product number	Years	Source
(16) Cattle hides, cured and uncured	Cattle hides (estimated by multiplying total live weight of cattle by yield of hides per pound live weight)	(7) and (8), (10), (11)	1919-26 1927-56	(a) <u>Yearbook of Agriculture, 1931</u> , p. 863 (b) <u>Agricultural Statistics, 1937</u> , p. 287
(17) Calfskins, cured and uncured	Number of calves slaughtered under Federal inspection	(13), (17)	1921-56 for (13) and 1919-56 for (17)	(a) Same as source (c) for products (1)-(4), pp. 21, 76

(The 1921 ratios of Census to Agriculture figures were used to estimate the quantities of "pork, fresh" and "mutton and lamb, fresh" for 1920; Agriculture data were not available for "lard", "edible organs, tripe, etc.", and "cattlehides, cured and uncured" for 1919 and 1920.)
The Agriculture series were derived from the following sources:

Product number	Years	Source
(1)-(4)	1919-20 for (1) and (2) and 1920 for (3)	(a) <u>Market Reviews and Statistical Summaries of Livestock, Meats and Wool</u> (U. S. Dept. Agr., Bur. Agr. Ec.), mimeo. weekly bulletin, June 15, 1936, pp. 498-9
	1920 for (4)	(b) <u>Weather, Crops, and Markets, Monthly Supplement</u> , Feb. 4, 1922, p. 92
	1921-56 for (1)-(4)	(c) <u>Livestock, Meats, and Wool Market Statistics and Related Data, 1937</u> (Bur. Agr. Ec.), May 1938, p. 78
(5), (16)	1921-56	(a) For live weight of animals, same as source (c) for products (1)-(4) (b) For yield ratios, <u>Livestock, Meats, and Wool Market Statistics and Related Data, 1936</u> , Apr. 1937, pp. 162-3

^aUnit value (dollars) in 1929.
^d"Edible organs, tripe, etc." and "other fresh meat", reported in combination for 1919, 1921, and 1923, were separated in accordance with their 1925 proportions.
^eDoes not include all cooked hams prior to 1927.
^fThe figures for intercensal years in line (8) refer to products (7) and (8) combined.
^gDoes not include a small amount of "canned sausage" made in the Census industry "Sausage, Meat Puddings, Headcheese, Etc., and Sausage Casings."
^hIncludes amounts produced in the 2 Census industries "Meat Packing, Wholesale" and "Sausage, Meat Puddings, Headcheese, Etc., and Sausage Casings." The amounts of "sausage (not canned), meat puddings, headcheese, etc." and "sausage casings" made in the latter were reported by the Census for 1929, 1931, and 1935. (The quantity figures for 1935 had to be adjusted to include small additional amounts reported in combination by value only. The combined value was distributed in the same proportion as the values reported separately; the value for each was then deflated by a unit value computed from the separate value and quantity figures.) The quantities for the remaining years were estimated (interpolated and extrapolated) by means of series of deflated values. The necessary value series include Census figures for 1919, 1921, 1927, 1929, 1931, and 1935 (those for 1935 were adjusted in the same manner as the reported quantities) and figures for 1923, 1925, and 1933 interpolated by means of a series for the value of products normally belonging to this Census industry (estimated for 1933 by means of statistics for the total value of this industry's output). The unit values used in deflating the 2 value series were computed from quantity and value data for the same products made in the other Census industry, "Meat Packing, Wholesale".

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Table A-125.- NUMBER OF WAGE EARNERS AND AVERAGE WEEKLY HOURS
IN THE SLAUGHTERING AND MEAT PACKING INDUSTRY:
1919 TO 1936

Year	Number of wage earners	Average hours worked per week ^a
1919	164,467	48.4
1920	143,900	48.5 ^b
1921	120,914	46.9
1922	118,900	49.2 ^c
1923	137,384	49.7
1924	132,000	49.5
1925	125,336	49.5
1926	123,000	49.8
1927	124,062	50.2
1928	125,400	50.6
1929	128,402	50.6
1930	123,000	50.0
1931	112,949	49.0
1932	108,800	48.2
1933	120,990	44.0
1934	149,200	41.1
1935	125,784	40.4
1936	132,500	42.2

^aThe series is based on statistics referring to the Census industry "Meat Packing, Wholesale," which constitutes almost the entire Slaughtering and Meat Packing industry. The figure for 1919 represents Census prevailing hours reduced to the level of actual hours by means of the average of the ratios of N.I.C.B. actual to Census prevailing hours for 1921 and 1923; those for 1920-32, N.I.C.B. actual hours; those for 1933 and 1935, the quotients of Census man-hours for large samples of the industry and 52 times the corresponding number of wage earners; and those for 1934 and 1936, B.L.S. hours adjusted to the level of the Census hours for 1933 and 1935. The Census hours for 1933 and 1935 were computed from Census of Manufactures: 1933, "Man-Hour Statistics for 52 Selected Industries", and Census of Manufactures: 1935, "Man-Hour Statistics for 59 Selected Industries."

^bAverage for 7 months, June to December.

^cAverage for 6 months, July to December.

Table A-126.- PRODUCTION OF PRINCIPAL TOBACCO PRODUCTS:
1919 TO 1936

(Units in millions)

Year	Cigars ^{a,b}	Cigarettes ^a	Chewing and smoking tobacco and snuff ^c (pounds)
1919	7,821	53,152	424
1920	8,770	47,458	413
1921	7,428	52,100	387
1922	7,389	55,780	420
1923	7,493	66,734	413
1924	7,161	72,725	414
1925	6,944	82,265	414
1926	6,940	92,110	411
1927	6,988	99,820	396
1928	6,816	108,716	386
1929	6,964	122,402	381
1930	6,299	123,810	372
1931	5,706	117,069	371
1932	4,687	106,636	347
1933	4,565	114,877	342
1934	4,791	130,065	346
1935	4,913	139,969	343
1936	5,405	158,896	348

^aQuantities for 1919-26 were obtained from Annual Report of the Commissioner of Internal Revenue for the Fiscal Year Ended June 30, 1927 (U. S. Treas. Dept., Bur. Int. Rev.), p. 98; for 1927-36, from ibid.: 1937, p. 106.

^bIncludes large cigars produced in bonded manufacturing warehouses (i.e., factories which make cigars from tobacco imported exclusively from one country, principally Cuba). For 1919 and 1920, the number of such cigars was estimated by the use of the 1921 ratio of bonded-warehouse output to domestic production of large cigars.

^cData for 1919-26, from Annual Report of the Commissioner of Internal Revenue, 1927, p. 98; for 1927-35, from ibid.: 1936, p. 127; and for 1936, from ibid.: 1937, p. 97.

BASIC TABLES: TOBACCO PRODUCTS GROUP 135

Table A-127.- NUMBER OF WAGE EARNERS IN THE TOBACCO PRODUCTS GROUP AND COMPONENT INDUSTRIES: 1919 TO 1936

Year	Tobacco Products group ^a	Cigars ^b	Cigarettes ^c	Chewing and Smoking Tobacco and Snuff ^d
1919	157,100	114,300	21,700	21,100
1920	154,000	114,900	18,800	20,300
1921	150,000	111,900	17,500	20,600
1922	146,400	109,000	16,500	20,900
1923	146,300	108,800	15,900	21,600
1924	136,600	99,700	15,500	21,400
1925	132,100	96,700	15,500	19,900
1926	125,500	91,500	14,800	19,200
1927	129,300	94,600	16,700	18,000
1928	125,700	89,800	18,100	17,800
1929	116,100	84,200	15,900	16,000
1930	108,400	77,600	14,300	16,600
1931	99,800	68,200	14,100	17,600
1932	97,900	67,100	13,700	17,100
1933	99,700	66,900	16,000	16,800
1934	101,000	63,100	19,700	18,200
1935	90,500	56,000	18,100	16,400
1936	90,200	56,000	18,100	16,100

^a Employment was determined for 1920 and 1922 by means of a B.L.S. series and for remaining years by addition of the estimates for the 3 component industries.

^b The number of wage earners for 1925 was estimated by multiplying combined employment in Cigars and Cigarettes establishments by the average of the ratios in 1923 and 1927 of employment for Cigars to that for both Cigars and Cigarettes; the number reported by the Census for 1933 was adjusted for incomplete coverage by the 1933 ratio of Internal Revenue cigar-stamp sales (*Annual Report of the Commissioner of Internal Revenue for the Fiscal Year Ended June 30, 1934, U. S. Treas. Dept., Bur. Int. Rev., p. 101*) to the corresponding figure reported by the Census. Estimates for intercensal years 1923-36 were made through the use of an unpublished B.L.S. employment index for the Cigars industry; and estimates for 1920 and 1922 were made by applying to the number of wage earners in the Tobacco Products group the 1921 ratio (for 1920) and the average of the 1921 and 1923 ratios (for 1922) of Cigars to group employment.

^c The number of wage earners in factories producing both cigars and cigarettes in 1919 (1,832) was included to maintain comparability with the 1921 employment figure. The figures for intercensal years and 1925 were obtained by subtracting employment for Cigars from combined employment for both Cigars and Cigarettes. The latter series was derived from Census data for odd-numbered years, adjusted in 1933 for incomplete coverage in Cigars (see fn. b); from a B.L.S. series for intercensal years except 1920 and 1922; and from the difference between the first and last columns for 1920 and 1922.

The employment series for Cigarettes was adjusted for comparability with the production index on the assumptions that the (Census) Cigarettes and the Chewing and Smoking Tobacco and Snuff industries (1) have the same value productivity for cigarettes and also have the same value productivity for chewing and smoking tobacco and snuff; (2) together account for the total output of these 2 classes of products; and (3) produce only these 2 classes of products. (See note on method in Part Two: Tobacco Products Group.)

^d The figures for 1920 and 1922 were obtained by multiplying group employment by the 1921 ratio (for 1920) and the average of the 1921 and 1923 ratios (for 1922) of employment in the (Census) Chewing and Smoking Tobacco and Snuff industry to group employment. The series was adjusted for comparability with production on the assumptions stated in the second paragraph of fn. c.

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Table A-128.- AVERAGE WEEKLY HOURS WORKED IN THE TOBACCO PRODUCTS INDUSTRIES, 1919 TO 1936^a

Year	Cigars ^b	Cigarettes ^c	Chewing and Smoking Tobacco and Snuff ^d
1919	49.5	45.7	47.9
1920	49.4	49.1	48.8
1921	49.2	45.2	47.6
1922	49.3	45.3	47.7
1923	49.3	45.3	47.7
1924	49.2	45.4	47.6
1925	49.1	45.3	47.5
1926	49.0	45.2	47.4
1927	48.9	45.2	47.2
1928	48.8	45.4	47.1
1929	48.7	45.2	47.0
1930	48.5	45.5	47.3
1931	42.7	41.8	42.0
1932	39.2	38.3	38.5
1933	35.4	32.6	34.5
1934	35.4	35.4	34.5
1935	34.3	36.6	34.9
1936	36.3	34.3	35.7

^aThe weekly-hours series for each industry, which was used to derive unadjusted man-hours, refers to establishments which are engaged primarily in the manufacture of the products which give the industry its name. (After the employment and man-hours have been adjusted for comparability with production, however, each industry refers to the total output, wherever manufactured, of the products which give it its name. For the adjusted series, see Tables A-127 and A-129.)

^bA series for prevailing weekly hours extending from 1919 to 1929 was linked in the latter year to an actual-weekly-hours series for 1929-36.

The prevailing-hours series includes: (1) An unpublished figure for 1929 supplied by the Bureau of the Census; (2) estimates for 1919, 1921, and 1923 secured by multiplying prevailing hours in the Cigars and Cigarettes industries combined for these years by the 1929 ratio of prevailing hours in the Cigars industry to those in the Cigars and Cigarettes industries combined; and (3) estimates for the remaining years of the period 1919-29 obtained by straight-line interpolation.

The actual-weekly-hours series for 1929-36 includes: (1) A figure for 1933 computed from Census of Manufactures: 1933, "Man-Hour Statistics for 32 Selected Industries", by dividing annual man-hours per wage earner by 52.14 weeks; (2) hours for 1929 and 1932 derived from Rosemoore, Robbins and Co., Investigation of the Cigar Manufacturing Industry in re Establishment of a Code of Fair Competition (N.R.A. Files, November 3, 1933, as transcribed by W. D. Evans) and adjusted to the 1933 Census level by multiplication by the ratio for May-July 1933 of the Census to the Rosemoore-Robbins hours; (3) estimates for 1930 and 1931 made by splicing weighted annual averages of the weekly hours for 1929-31 reported in the Monthly Bulletin of the Pennsylvania Department of Labor and Industry to the adjusted Rosemoore-Robbins figure for 1929; (4) unpublished B.L.S. actual hours for 1935 and 1936; and (5) an estimate for 1934 interpolated by a series for Cigars and Cigarettes combined which is based on Census hours for 1933 and B.L.S. hours for 1934 and 1935.

The Rosemoore-Robbins figures are weighted averages of the hours for cigar makers, other processors, and other factory workers in hand and machine factories. The sample (excluding strippers) included 25.3 and 30.3 percent of the total number of wage earners in the industry in 1929 and 1932, respectively. The industry to which the Pennsylvania figures refer is designated as "Cigars and Tobacco" in the Monthly Bulletin, but cigars are the predominate products.

^cPrevailing weekly hours for 1919-29 were first estimated by subtracting prevailing weekly man-hours (product of average prevailing weekly hours and employment) in the Cigars industry from similar man-hours for the Cigars and Cigarettes industries combined and dividing the result by employment in the Cigarettes industry. The prevailing-hours series was then adjusted by the ratio of actual to prevailing hours in 1930, as computed from Wages and Hours of Labor in the Cigarette Manufacturing Industry, 1930 (B.L.S. Bull. No. 532). Strippers were excluded to render the data comparable with Census employment statistics. The B.L.S. survey covered establishments in North Carolina, Kentucky, and Virginia in representative pay-roll periods of March, April, and May, 1930; these establishments employed about half of the wage earners in the industry.

Actual hours for 1933 were derived from Census of Manufactures: 1933, "Man-Hour Statistics for 32 Selected Industries", by dividing annual hours per wage earner by 52.14 (weeks).

Estimates of actual hours for 1931, 1932, and 1934-36 were computed in the same manner as prevailing hours for 1919-29. Actual hours for the Cigars and Cigarettes industries combined for 1934-36 were furnished by B.L.S.; and those for 1931 and 1932 were derived by multiplying actual hours for Cigars by the 1931 ratio of the Census prevailing-hours figure for Cigars and Cigarettes combined to an unpublished Census prevailing-hours figure for Cigars.

^dThe 1933 figure was derived from Census hours (see fn. b and c); those for 1934-36 were obtained from B.L.S.; and estimates for the remaining years of the period 1919-36 were made by multiplying the weekly-hours series for the Cigars and Cigarettes industries combined by the 1933 ratio between (1) hours in the Chewing and Smoking Tobacco and Snuff industry and (2) hours in the Cigars and Cigarettes industries combined.

Table A-129.- WEEKLY MAN-HOURS IN CIGARETTES AND CHEWING AND SMOKING TOBACCO AND SNUFF INDUSTRIES: 1919 TO 1936^a

Year	Cigarettes	Chewing and Smoking Tobacco and Snuff
1919	931,700	1,015,500
1920	897,200	1,020,200
1921	733,500	986,900
1922	688,800	1,001,500
1923	660,300	1,036,100
1924	648,600	1,020,900
1925	650,000	949,000
1926	618,600	914,700
1927	701,300	852,100
1928	765,000	837,300
1929	664,100	757,300
1930	637,200	782,400
1931	587,500	735,200
1932	519,800	662,700
1933	509,000	576,600
1934	694,300	636,300
1935	673,400	573,000
1936	632,400	555,700

^a The unadjusted employment series for the 2 industries were multiplied by corresponding average weekly hours (shown in Table A-128) and then adjusted for comparability with production on the assumptions stated in Table A-127, fn. c, par. 2.

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Table A-130.- PRODUCTION OF WOOLEN AND WORSTED GOODS IN THE WOOLEN AND WORSTED GOODS GROUP: CENSUS YEARS 1919 TO 1927^a

Product	Weight ^b	1919	1921	1923	1925	1927
Woolen goods						
Woven goods						
Suitsings, dress goods over-coatings, and cloakings						
All-wool woolen	1.359	139,410	132,286	172,028	153,323	136,635 ^c
Wool-and-cotton-mixed	0.914	24,615	18,490	24,732	26,124	30,453 ^c
Cotton-warp woolen	0.634	59,147	44,363	63,203	60,934	46,609 ^c
Domest flannels and shirtings						
	0.468	22,224	4,529	6,155	7,206	8,413
Satinets and linseys						
	0.430	4,638	4,523	6,107	11,877	3,974
Blankets						
All-wool	0.924	5,916	6,754	11,872	11,084	17,295
Cotton-mixed	0.648	9,823	3,499	8,854	8,098	12,091
Cotton-warp	0.557	9,244	9,296	12,187	15,070	19,916
Horse blankets	0.648	1,696	1,942	2,475	1,410	1,069
All other woolen woven goods ^d	0.993	17,882	13,754	23,602	14,500	4,826
Yarns for sale						
All-wool	0.821	28,387	30,734	47,943	43,711	41,766
Union or merino ^e	0.834	9,150	2,853	5,530	9,807	6,474
Worsted goods						
Woven goods						
Suitsings, dress goods, over-coatings, and cloakings						
All-wool worsted	1.549	176,506	185,359	210,988	179,163	173,754 ^c
Cotton-warp worsted	0.656	57,897	43,151	41,188	41,379	26,889 ^c
All other worsted woven goods ^d	0.764	26,839	25,813	35,088	31,960	34,617
Yarns for sale						
All-wool	1.787	74,337	85,861	112,933	82,687	81,274
Union or merino ^e	1.855	4,218	2,647	5,635	9,602	3,277
All other ^f	1.414	2,218	3,622	7,414	5,293	12,937
Tops and slubbing, for sale						
Wools and wool waste, for sale	0.373	9,899	10,341	21,120	18,055	18,283
		52,084	40,647	55,110	42,591	48,419

^aFigures for woven goods are in thousands of square yards; for other products, in thousands of pounds.

^bAverage unit value (dollars) for the odd-numbered years 1919-27. See fn. d for method of estimating the quantities and values of "all other woolen woven goods" and "all other worsted woven goods."

^cThe 1927 figures are not strictly comparable with those for earlier years because of a change in the method of reporting; an undistributed class, woolen and worsted "other suitsings, dress goods, cloakings, and overcoatings," reported by the Census for the first time, could not be apportioned.

^dThe Census reports the quantities and values of "all other woolen woven goods" and "all other worsted woven goods" in combination for each of the 2 (Census) industries. The quantities of the 2 types of goods were segregated from the combined totals for each Census industry in accordance with the ratios for each industry of (a) the total quantity of all specified woolen woven goods reported separately and of (b) the total quantity of all specified worsted woven goods reported separately to (c) the combined quantity of (a) and (b) in each year. The quantities of each type made in the 2 industries were then added to yield the group totals shown in the table. The values were derived in a similar manner.

^eReported by the Census for some years as "wool and cotton combined" or "wool-and-cotton-mixed."

^fReported by the Census for some years as "mohair and similar yarns" or "cotton yarn."

BASIC TABLES: WOOLEN AND WORSTED GOODS GROUP 139

Table A-131.- PRODUCTION OF WOOLEN AND WORSTED GOODS IN ALL INDUSTRIES: CENSUS YEARS 1927 TO 1931^a

Product	Weight ^b	1927	1929	1931
Woolen goods				
Woven goods ^c	0.834	304,145	278,561	202,996
Yarns for sale				
All-wool	0.661	41,804	48,835	33,727
Wool and cotton combined	0.635	7,601	6,303	3,226
Wool-card rolls, batts, and batting, for sale	0.772	423	705	716
Worsted goods				
Woven goods ^c	1.198	253,845	235,391	187,158
Yarns for sale				
All-wool	1.400	81,378	89,052	85,737
Wool and cotton combined	1.164	3,309	2,572	3,334
Mohair and similar yarns	1.264	11,670	12,712	15,739
Tops and slubbing, for sale	0.996	18,283	14,004	16,056
Noils and wool waste, for sale	0.307	48,520	46,368	35,594

^a Figures for woven goods are in thousands of square yards; for other products, in thousands of pounds.

^b Average unit value (dollars) for the odd-numbered years 1927-31.

^c The reported quantities and values for 1927, 1929, and 1931 refer to the aggregate amounts of woolen and worsted woven goods made principally in each Census industry. (The Census reports 2 sets of figures for 1927, one including and the other excluding production outside the group.) The quantities shown in the table (and the values used in the computation of the weights) were derived by distributing the reported quantity (and value) for each Census industry in accordance with the ratio of woolen woven goods to worsted woven goods made in each in 1927 (see Table A-130, fn. d).

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Table A-132- PRODUCTION OF WOOLEN AND WORSTED GOODS IN ALL INDUSTRIES:
1931 AND 1933^a

Product	Weight ^b	1931	1933
Woven goods			
Men's-wear fabrics			
Woolen			
Suitings and pantings (except flannels)	0.787	29,404	35,569
Flannel suitings and pantings	0.907	4,699	9,806
Shirtings	0.593	396	351
Topcoatings	1.048	5,027	9,350
Overcoatings	1.299	6,213	16,415
Uniform cloths	1.365	2,421	2,662
Cap cloths	0.849	614	173
Other woolen	0.815	4,724	5,070
Worsted			
Staple suitings and pantings	1.058	53,796	53,425
Fancy suitings and pantings	1.193	52,000	49,227
Tropicals and summer fabrics	0.979	801	1,466
Uniform cloths	1.310	2,452	750
Topcoatings and other worsted, including overcoatings	0.893	3,127 ^c	464
Woolen and worsted made with cotton or manipulated warps			
Suitings and pantings	0.526	20,156	29,423
Linings and interlinings	0.384	2,799	972
Shirtings and flannels	0.259	6,665	3,089
Overcoatings	0.719	4,796	4,808
Cap cloths	0.671	772	680
Other	0.472	2,928	6,618
Worsted warp and woolen filling and other men's-wear fabrics	0.576	2,019	3,649
Women's-wear fabrics			
Woolen			
Dress fabrics and suitings	0.767	19,173	22,441
Coatings	0.706	47,416	51,369
Other	0.565	864	3,080
Worsted			
Dress fabrics and suitings	0.768	28,492	21,282
Other, including coatings	1.223	8,721	9,247
Woolen and worsted made with cotton or manipulated warps			
Dress fabrics and suitings	0.589	2,225	10,072
Coatings and other	0.719	5,272	12,481
Other women's-wear fabrics, including worsted warp and woolen filling	0.738	4,278	2,526
Auto cloths, except pile fabrics			
Woolen			
Worsted, and woolen and worsted made with cotton or manipulated warps	0.701	3,483 ^d	7,280
Blankets			
All-wool	0.671	16,568	13,043
Cotton-and-wool mixed ^e	0.266	14,216	13,543
Cotton warp, all-wool filling ^e	0.780	947	2,692
Upholsteries	0.663	754	275
Other woolen and worsted woven goods (except pile fabrics), including draperies and horse blankets			
Mohair (including combinations with wool) and other pile fabrics (except women's coatings)	0.468	6,207	3,468
Yarns made for sale			
Woolen			
All-wool	0.542	33,727	32,811
Wool-and-cotton combined	0.565	3,226	2,933
Worsted			
All-wool	1.085	85,737	80,128
Wool-and-cotton combined	0.885	3,334	4,764
Mohair	0.791	10,510	10,194
Other yarns	0.303	5,229	6,522
Wool-card rolls, batts, and batting, made for sale			
Tops and slubbing, for sale	0.310	716	194
Noils and wool waste, for sale	0.728	18,056	24,421
	0.203	35,594	41,517

^aFigures for woven goods are in thousands of square yards; for other products, in thousands of pounds

^bUnit value (dollars) in 1931.

^cIncludes data for a small amount of worsted auto cloths.

^dExcludes data for a small amount of worsted auto cloths. See fn. c.

^eProduction in the Woolen Goods and Worsted Goods industries only.

BASIC TABLES: WOOLEN AND WORSTED GOODS GROUP 141

Table A-133.- PRODUCTION OF WOOLEN AND WORSTED GOODS IN ALL INDUSTRIES: 1933 AND 1935^a

Product	1933	1935
Total	423,295	558,948
Men's-wear fabrics	231,967	317,998
Women's-wear fabrics	128,799	158,885
Auto cloths, without pile and with napped pile	9,710	19,471
Billiard cloths	3,468	344
Other nonapparel fabrics		1,375
Blankets, except cribs: 98% or more of wool or similar fibers	49,351	19,974
25-97% of wool or similar fibers		5,630
Less than 25% of wool or similar fibers		33,718
Crib blankets		61
Blanketing		832
Motor and steamer robes		660

^aUnits in thousands of square yards.

Table A-134.- INDEX OF MACHINERY ACTIVITY IN THE PRODUCTION OF WOOL: 1919 TO 1936^a

Year	Index (1929 = 100)	Year	Index (1929 = 100)
1919	111	1928	96
1920	98	1929	100
1921	108	1930	75
1922	110	1931	84
1923	127	1932	73
1924	104	1933	99
1925	106	1934	80
1926	98	1935	122
1927	98	1936	119

^aData for 1919-35 are from Federal Reserve Index of Industrial Production, mimeo., April 1936, pp. 19-20; for 1936 from Federal Reserve Bulletin, March 1937, p. 256. F.R.B. figures were converted to a 1929 base.

The index is based on the percentage of loom and spindle hours active. The data were compiled by the Bureau of the Census.

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Table A-135.- NUMBER OF WAGE EARNERS AND WEEKLY MAN-HOURS FOR THE WOOLEN AND WORSTED GOODS INDUSTRIES: 1919 TO 1936

Year	Average number of wage earners			Average hours worked per week in the Woolen and Worsted Goods group ^c	Weekly man-hours		
	Woolen and Worsted Goods group ^a	Woolen Goods industry ^b	Worsted Goods industry ^b		Woolen and Worsted Goods group ^d	Woolen Goods industry ^e	Worsted Goods industry ^e
1919	166,787	73,049	93,738	46.5	7,755,596	3,488,375	4,267,221
1920	150,300	-	-	41.8	6,284,170	-	-
1921	162,364	63,430	98,934	45.8	7,436,271	2,969,388	4,466,883
1922	166,800	-	-	47.5	7,922,905	-	-
1923	194,552	78,380	116,172	47.4	9,221,765	3,910,197	5,311,568
1924	174,300	-	-	43.3	7,546,887	-	-
1925	165,224	67,664	97,560	44.0	7,269,856	3,091,890	4,187,461
1926	149,800	-	-	45.1	6,753,770	-	-
1927	154,361	63,784	90,577	45.0	6,946,245	2,948,268	3,997,977
1928	147,800	-	-	44.3	6,549,356	-	-
1929	146,959	60,099	86,860	46.3	6,804,202	2,822,238	3,981,964
1930	119,800	-	-	41.5	4,970,538	-	-
1931	119,537	44,559	74,978	41.7	4,984,693	1,882,763	3,101,930
1932	99,800	-	-	39.2	3,911,572	-	-
1933	127,227	-	-	39.4	5,012,744	-	-
1934	119,500	-	-	32.6	3,894,983	-	-
1935	158,604	-	-	36.0	5,709,744	-	-
1936	151,500	-	-	35.4	5,363,631	-	-

^aFigures for 1920 and 1922 were computed from N.I.C.B. index numbers readjusted to the Census level.

^bThe Census wage-earners series for the Woolen Goods and Worsted Goods industries were adjusted to correspond exactly to the production indexes in scope on the basis of the assumptions that both (Census) industries: (1) have the same value output per wage earner for woolen goods and yarns and for worsted goods and yarns; (2) together account for the total output of such woolen and worsted products; and (3) produce only these 2 types of products. (See note on method in Part Two: Woolen and Worsted Goods Group.)

^cFor 1933 and 1935, actual hours computed from Census of Manufactures: 1933, "Man-Hour Statistics for 32 Selected Industries," and Census of Manufactures: 1935, "Man-Hour Statistics for 59 Selected Industries"; for 1920-32, 1934, and 1936, N.I.C.B. figures adjusted to the level of the Census hours for 1933 and 1935; and for 1919, Census prevailing hours reduced to actual by means of the average of the ratios of N.I.C.B. actual to Census prevailing hours in 1921, 1923, and 1929.

^dObtained by multiplication of average number of wage earners for the group by average actual weekly hours.

^eWeekly man-hours were computed by first conforming the products of Census employment and average actual weekly hours for each Census industry to the group totals and then redistributing these adjusted products in the manner indicated for employment (see fn. b and note on method in Part Two). The 2 series of average weekly hours were obtained by applying to the group figures described in fn. c (1) the ratio of Census prevailing hours for each industry to Census prevailing hours for the group in 1919, 1921, 1923, and 1929; (2) similar ratios for 1925 and 1927 obtained by straight-line interpolation; and (3) ratios for 1931 derived by straight-line interpolation between the ratios for 1929 and ratios (based on actual hours) for 1933. The 1933 actual hours for each industry were computed from Census of Manufactures: 1933, "Man-Hour Statistics for 32 Selected Industries."

APPENDIX B

ELECTRIC LIGHT AND POWER AND TELEPHONES INDUSTRIES

ELECTRIC LIGHT AND POWER

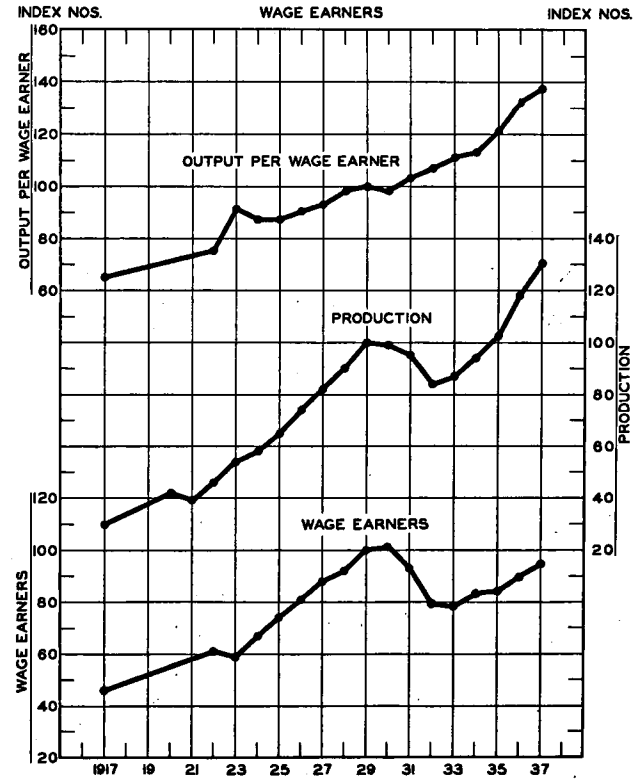
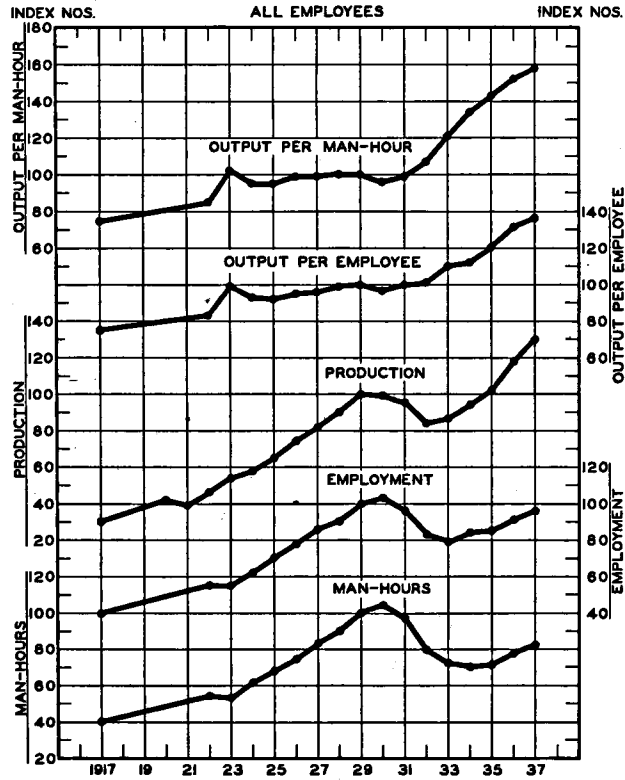
The scope of this study of the Electric Light and Power industry is the same as that considered by the Bureau of the Census in its quinquennial *Census of Electrical Industries*, "Central Electric Light and Power Stations." This industry consists principally of commercial and municipal utilities which are engaged in the generation and distribution of electric current for sale to public or private consumers; in the generation of current for sale to other light and power establishments for distribution; or in the distribution of current generated by plants under other ownership. It does not include establishments which are operated by the Federal or a State government, electric railways, mines, manufacturing concerns, hotels, office buildings, etc. unless they sell some of their energy, in which case the Census endeavors to obtain data for their electrical activities only.

The Electric Light and Power industry increased in importance throughout the period of interest. Between 1917 and 1932 total employment more than doubled. In 1929 the number of employees approached 300,000; about four-sevenths of these were wage earners. In 1919 the horsepower of motors driven by purchased energy in manufacturing establishments was only one-third greater than the horsepower of motors driven by generated energy; by 1929 the ratio had increased to almost 2 to 1. It is significant in this connection that the kilowatt capacity of electric generators in central stations more than doubled during the period 1922-32.

Production

The NRP production index is based on the estimated total number (without duplication) of kilowatt-hours of current distributed. The necessary data for 1917, 1922, 1927, and 1932 were supplied by the quinquennial *Census of Electrical Industries*, "Central Electric Light and Power Stations." The procedure was, first, to add the current generated within the industry and that received from outside (including imports from Canada) and then to subtract from this sum transmission, conversion, distribution, and other

Figure B-1.- SUMMARY INDEXES FOR THE ELECTRIC LIGHT AND POWER INDUSTRY: 1917 AND 1920-37



power losses. The remainder, however, had to be adjusted since some electric-railway power plants, which reported revenue from sales of generated current, did not report the corresponding number of kilowatt-hours. Current generated by such plants was estimated on the assumption that their revenue per kilowatt-hour was the same as for those stations which reported quantity and value statistics.¹

The series was completed for the period 1920-37 by raising estimates made by *Electrical World*² for 1920, 1921, and 1923-26 and by the Edison Electric Institute³ for the remaining years to the level of the adjusted Census totals, with which they were in close accord. No satisfactory data were available for 1918 and 1919.⁴

If labor-requirement weights had been available, the index for this industry would have been constructed by the combination of the series for distribution and another for current generated. Since the 2 series are almost identical, however, the NRP index may be regarded as equivalent to the composite measure:⁵

Year	Index of -		Year	Index of -	
	Current distrib-uted (NRP)	Current gener-ated		Current distrib-uted (NRP)	Current gener-ated
1917	29.8	30.2	1920	41.7	42.5
1918	n.a.	n.a.	1921	39.3	39.9
1919	n.a.	n.a.	1922	45.9	46.5 [Con.]

¹These electric-railway plants either could not segregate figures for light-and-power departments or did not maintain such separate departments at all. The percentages of total revenue accounted for by their sales were as follows:

1917	....	10.6	1927	....	0.9
1922	....	8.1	1932	....	.5

²*Electrical World* does not describe the method used to obtain its series for current distributed to ultimate consumers but indicates that it is based on production of central stations (as reported by the U. S. Geological Survey), imports from Canada (published in *Canada Year Book*), and *Electrical World's* own estimates of line losses and current consumed by companies. (Cf. *Electrical World*, Jan. 3, 1931, pp. 28-9.)

³Edison Electric Institute data collected, since 1926, represent "94 percent of the private utility industry and 25 percent of the municipal plants or a total cross-section of over 90 percent." The remaining 10 percent is estimated from the quinquennial Census and reports of State public-service commissions and the Federal Power Commission. (Cf. EEI, *The Electric Light and Power Industry in the United States, 1936*, Statistical Bull. No. 4, pp. 1, 26.)

⁴The attempt to estimate current distributed in these years through the use of a continuous series of significant operating ratios (revenue per customer, revenue per kilowatt-hour, and kilowatt-hours per customer) for "composite" (i. e., gas-electric) companies in conjunction with similar Census series for all companies ended in failure because of the differences in trends. The annual operating ratios were developed by W. W. Handy in his *Yardstick of Public Utility Operations and Construction Costs* (Baltimore: Williams and Wilkins Co., 1929).

Footnote 5 appears on following page.

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[Con.]		Index of -		Index of -	
Year	Current distrib- uted (NRP)	Current gener- ated	Year	Current distrib- uted (NRP)	Current gener- ated
1923	54.2	54.8	1930	99.4	97.4
1924	57.9	58.4	1931	95.2	94.2
1925	64.7	65.5	1932	84.2	85.0
1926	73.5	73.5	1933	86.9	87.3
1927	82.2	80.0	1934	93.7	93.8
1928	89.6	88.9	1935	102.1	102.2
1929	100.0	100.0	1936	118.1	116.9

Employment and Man-hours

The essential activities of the Electric Light and Power industry comprise not only the generation and distribution of current but also the installation and extension of power lines, meter installation and meter reading, billing and bill collection, etc. Salaried employees, who constituted almost half of the total employment in 1929, are engaged in many such activities.⁶ As will be seen in the discussion of productivity, a crude general measure of the output of salaried employees could be constructed for only a few years. The NRP distribution series may, however, be regarded as indicative of the movement of the output of all employees as well as of wage earners; hence 2 NRP employment indexes were constructed, one for wage earners and the other for all employees.

Census wage-earner and total-employment figures for 1917, 1922, 1927, and 1932 were, like production, adjusted for incompleteness of coverage. Estimates of total employment were made for 1923-26 and 1928 by means of EEI statistics⁷ and for 1929-31 and 1933-37

⁶The index for current generated is based on Census data (adjusted for incompleteness of coverage) and on data compiled by U. S. Geological Survey. Wage-earner weights for the generation and distribution series could possibly have been approximated for 1930 from occupational statistics available in *Fifteenth Census of the United States: 1930, V, pp. 128-30*. No data at all were available for the computation of total employment weights, which in any case would not be meaningful.

⁶The Census reports figures for both wage earners and salaried employees. Although the line of demarcation between them is not clear, the former probably consist principally of operatives and the construction and maintenance force while the latter probably include all office workers and a considerable proportion of the supervisory and technical employees.

⁷The employment data of the Institute, available annually since 1923, include both salaried workers and wage earners. They are based on accident reports from 477 companies, supplemented by estimates for all nonreporting companies made on the assumption that the accident experience of those reporting was representative of the industry as a whole. Since EEI data refer to commercial establishments only, they are not strictly comparable with Census statistics which also include municipal plants. The latter, however, employed but 9.7 and 6.5 percent, respectively, of the totals in 1922 and 1927.

by means of the BLS employment index for the Electric Light and Power and Manufactured Gas industries combined.⁸ The number of wage earners in intercensal years was derived by applying to the total-employment series the interpolated ratios of the number of wage earners to all employees. The ratio obtained from an EEI survey for 1933⁹ was assumed to prevail in all years subsequent to 1932. No satisfactory basis was found for estimating either total or wage-earner employment in the years 1918-21.

The man-hours series for all employees was constructed from the index of total employment and an annual series of average actual weekly hours. The hours series was derived from BLS statistics for 1932-37, NICB figures for 1914, 1920, 1921, 1923, and 1925-31 (adjusted by the average of the ratios of BLS to NICB hours in the years 1932-35), and estimates made by straight-line interpolation for all other years for which both the employment and production indexes were available.¹⁰ The absence of a suitable weekly-hours series precluded the construction of a man-hours index for wage earners only.

Productivity

The distribution series was used in the construction of indexes of output per wage earner and output per employee. Obviously a productivity index based on current distributed is not so appropriate for salaried workers as for either wage earners alone or all employees. An index of customers served per salaried worker, which could be constructed for quinquennial census years only, is, perhaps, a more satisfactory general measure for these employees. Such an index was combined with the NRP index of

⁸In 1927 the ratio of employment in the Electric Light and Power industry to that in the Electric Light and Power and Manufactured Gas industries combined was 0.77. If this ratio was observed in the BLS sampling procedure, the index probably approximates the movement of employment in the Electric Light and Power industry. There is no assurance that such is the case, but it may be noted that the Department of Commerce utilized this index in a similar fashion to estimate employment for commercial establishments. (Cf. Bur. For. and Dom. Com., *National Income in the United States: 1929-35*, pp. 94, 247.)

Data for several water companies were included in the BLS canvass in the earlier years of the period 1929-36. The effect of the inclusion of the small number of employees of such companies is negligible. The several changes in the BLS designation, moreover, did not signify changes in coverage.

⁹Cited by NRA, Division of Review, *Wages and Hours in American Industry: NRA Source Material* (Work Materials No. 9), III, 1235. The employment data are based upon a canvass of 223 companies in June and December, 1933. These companies employed about 68 percent of the total number of salaried and wage workers.

¹⁰NICB figures, which represent either averages for but 2 months, January and July, or reports for only 1, are also available for 1932-37; BLS hours statistics, which share the defects of BLS employment data (see fn. 8), are superior to the NICB figures, for they are probably based on a larger sample and refer to each month in the year.

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current distributed per wage earner (translated to the base 1932) in a harmonic mean with 1932 labor weights; the resulting composite index differs but slightly from the NRP series for current distributed per employee:

Year	Index of output per employee	
	NRP	Composite
1917	73.7	72.3
1922	81.8	83.5
1927	94.8	92.4
1932	100.0	100.0

Detailed Census production and employment statistics permitted the construction of comparative productivity indexes for commercial and municipal establishments. The predominance of commercial establishments is reflected in the similarity of the trends of their output-per-wage-earner and per-employee ratios to those for the entire industry:¹¹

	1917	1922	1927	1932
Output per wage earner				
Entire industry (NRP)	60.8	70.7	87.3	100.0
Commercial establishments	63.6	72.8	83.2	100.0
Municipal establishments	37.7	53.8	91.5	100.0
Output per employee				
Entire industry (NRP)	73.7	81.8	94.8	100.0
Commercial establishments	76.8	83.9	90.5	100.0
Municipal establishments	46.2	61.5	100.0	100.0

Productivity ratios for operating and maintenance workers engaged in the generation, transmission, and distribution of electric power were computed by BLS for 9 systems. These ratios, which differ not only in absolute level but also in trend, most probably reflect differences in size and type of generating unit:¹²

System	Kilowatt-hours per man-hour				
	1917	1922	1927	1929	1931
A	n.a.	127	140	153	n.a.
B	n.a.	389	437	481	n.a. [con.]

¹¹The series for commercial and municipal establishments refer to current generated since the necessary statistics for distribution are not available for 1917 and 1922. As was pointed out in the discussion of production, however, the relatives for current generated and distributed by the industry as a whole are almost identical, so that the series for the 2 types of establishments may be compared with the corresponding NRP indexes.

¹²Cf. "Labor Productivity and Displacement in the Electric Light and Power Industry," *Monthly Labor Review*, August 1932, p. 254. The annual series (apparently based on current generated), which are not complete for all systems, are shown above for only selected years.

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[Con.] System	Kilowatt-hours per man-hour				
	1917	1922	1927	1929	1931
C	429	607	620	601	125
D	n.a.	n.a.	180	166	144
E	n.a.	175	249	320	329
F	133	143	195	280	304
G	n.a.	n.a.	254	307	281
H	n.a.	n.a.	421	506	607
I	n.a.	n.a.	709	722	828

Table B-1.- SUMMARY INDEXES FOR THE ELECTRIC LIGHT AND POWER INDUSTRY,
ALL EMPLOYEES: 1917 AND 1920-37

(1929 = 100)

Year	Production	Employment	Man-hours	Output per -	
				Employee	Man-hour
1917	29.8	39.9	39.5	74.7	75.4
1920	41.7	n.a.	n.a.	-	-
1921	39.3	n.a.	n.a.	-	-
1922	45.9	55.4	54.3	82.9	84.5
1923	54.2	54.7	53.3	99.1	101.7
1924	57.9	62.2	60.7	93.1	95.4
1925	64.7	70.0	68.3	92.4	94.7
1926	73.5	77.7	74.2	94.6	99.1
1927	82.2	85.5	83.3	96.1	98.7
1928	89.6	90.2	89.7	99.3	99.9
1929	100.0	100.0	100.0	100.0	100.0
1930	99.4	103.0	103.6	96.5	95.9
1931	95.2	95.6	96.5	99.6	98.7
1932	84.2	83.0	76.9	101.4	106.7
1933	86.9	76.6	71.6	110.3	121.4
1934	93.7	83.8	69.8	111.8	134.2
1935	102.1	84.8	71.4	120.4	143.0
1936	118.1	90.5	77.9	130.5	151.6
1937	130.2	95.6	82.3	136.2	158.2

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**Table B-2.- SUMMARY INDEXES FOR THE ELECTRIC LIGHT AND POWER INDUSTRY,
WAGE EARNERS: 1917 AND 1920-37**

(1929 = 100)

Year	Production	Employment	Output per wage earner
1917	29.8	45.9	64.9
1920	41.7	n. a.	-
1921	39.3	n. a.	-
1922	45.9	60.9	75.4
1923	54.2	59.4	91.2
1924	57.9	66.7	86.8
1925	64.7	74.1	87.3
1926	73.5	81.4	90.3
1927	82.2	88.3	93.1
1928	89.6	91.6	97.8
1929	100.0	100.0	100.0
1930	99.4	101.2	98.2
1931	95.2	92.5	102.9
1932	84.2	78.9	106.7
1933	86.9	78.2	111.1
1934	93.7	83.2	112.6
1935	102.1	84.2	121.3
1936	118.1	89.8	131.5
1937	130.2	94.9	137.2

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Table B-3.- CURRENT DISTRIBUTED TO ULTIMATE CONSUMERS BY THE ELECTRIC LIGHT AND POWER INDUSTRY: 1917 TO 1937

(Millions of kilowatt-hours)

Year	Census ^a	Edison Electric Institute ^b	Electrical World ^c	N.R.P. ^d
1917	24,135	n.a.	n.a.	24,135
1918	n.a.	n.a.	n.a.	n.a.
1919	n.a.	n.a.	n.a.	n.a.
1920	n.a.	n.a.	32,530	33,734
1921	n.a.	n.a.	30,700	31,836
1922	37,130	n.a.	35,822	37,130
1923	n.a.	n.a.	42,220	43,867
1924	n.a.	n.a.	45,000	46,845
1925	n.a.	n.a.	50,221	52,381
1926	n.a.	58,642	56,964	59,527
1927	66,581	63,710	63,612	66,581
1928	n.a.	69,552	68,695	72,543
1929	n.a.	77,774	77,062	80,963
1930	n.a.	77,396	n.a.	80,492
1931	n.a.	74,238	n.a.	77,059
1932	68,192	65,829	n.a.	68,192
1933	n.a.	67,888	n.a.	70,332
1934	n.a.	73,235	n.a.	75,871
1935	n.a.	79,764	n.a.	82,636
1936	n.a.	92,321	n.a.	95,645
1937	n.a.	101,769	n.a.	105,433

^aThe basic statistics for the distribution figure for 1917 were derived from Census of Electrical Industries: 1917 (U. S. Dept. Com., Bur. Cen.), "Central Electric Light and Power Stations," p. 82; those for 1922, 1927, and 1932, from ibid.: 1932, pp. 15, 21. The amount of current distributed was computed by deducting from the total current available for distribution (i.e., the sum of the amount generated and the amount purchased from outside the industry; the latter was assumed to bear the same proportion to the sum in 1917 as in 1922) the amounts lost in transmission, distribution, conversion, etc. and then adjusting this difference to include the kilowatt-hours sold by some electric-railway power plants which reported only value of sales (the unit value was assumed to be the same as for the remainder of the industry).

^bStatistics from The Electric Light and Power Industry in the United States: 1937 (Edison Electric Institute, Stat. Bull. No. 5), pp. 2, 3.

^cFigures from Electrical World, Vol. 97, No. 1 (Jan. 3, 1931), pp. 28-9.

^dFor 1917, 1922, 1927, and 1932, Census figures, col. (1); for 1920-21 and 1923-26, estimates extrapolated and interpolated by means of the Electrical World series; and for 1928-31 and 1933-37, estimates interpolated and extrapolated by means of the Edison Electrical Institute series.

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Table B-4.- NUMBER OF WAGE EARNERS AND ALL EMPLOYEES AND AVERAGE WEEKLY HOURS IN THE ELECTRIC LIGHT AND POWER INDUSTRY: 1917 TO 1937

Year	Number of wage earners ^a	Total employment			Estimated number of		Average weekly hours worked (all employees) ^f
		Census ^a	B.L.S. index ^b (1932=100)	Edison Electric Institute ^c	Wage earners ^d	All employees ^e	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1917	70,135	105,541	n.a.	n.a.	78,500	118,100	46.3
1918	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1919	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1920	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	44.6
1921	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	46.0
1922	95,650	150,762	n.a.	n.a.	104,100	164,100	45.8
1923	n.a.	n.a.	n.a.	176,000	101,500	162,100	45.5
1924	n.a.	n.a.	n.a.	200,000	114,000	184,200	45.6
1925	n.a.	n.a.	n.a.	225,000	126,600	207,200	45.6
1926	n.a.	n.a.	n.a.	250,000	139,100	230,300	44.6
1927	149,605	251,020	n.a.	275,000	151,000	253,300	45.5
1928	n.a.	n.a.	n.a.	290,000	156,600	267,100	46.4
1929	n.a.	n.a.	120.5	285,000	170,900	296,200	46.7
1930	n.a.	n.a.	124.1	285,000	173,000	305,000	47.0
1931	n.a.	n.a.	115.2	265,000	158,000	283,200	47.1
1932	134,120	244,573	100.0	236,000	134,800	245,800	44.4
1933	n.a.	n.a.	94.9	216,000	135,700	233,300	42.4
1934	n.a.	n.a.	101.0	226,000	142,300	248,300	38.9
1935	n.a.	n.a.	102.2	237,000	144,000	251,200	39.3
1936	n.a.	n.a.	109.0	n.a.	153,500	267,900	40.2
1937	n.a.	n.a.	115.2	n.a.	162,300	283,200	40.2

^aFor 1917, 1922 and 1927, Census of Electrical Industries: 1927 (U. S. Dept. Com., Bur. Cen.), "Central Electric Light and Power Stations," pp. 24-5; for 1932, ibid.: 1932, pp. 15, 63.

^bIncludes salaried workers and wage earners in both the Electric Light and Power and Manufactured Gas industries.

^cThe Electric Light and Power Industry in 1935 (Edison Electric Institute, Stat. Bull. No. 3), p. 10. E.E.I. statistics refer to commercial establishments only and are not strictly comparable with Census figures, which include municipal plants. The latter employed only 9.7 and 6.5 percent, respectively, of the totals in 1922 and 1927.

^dEstimated by multiplication of the number of all employees, shown in col. (6), by a series of ratios obtained as follows: for 1917, 1922, 1927, and 1932, by division of col. (1) by col. (2); for the intervening years, by straight-line interpolation; and for 1933-37, by means of statistics collected in an E.E.I. survey for 1933 (cited by N.R.A. Division of Review, Wages and Hours in American Industry, Work Materials No. 9, Vol. III, Mar. 1936, p. 1235).

^eFigures for 1917, 1922, 1927, and 1932 are Census statistics in col. (1) adjusted on value basis for incompleteness of coverage (see Table B-3, fn. a). The series was completed by means of E.E.I. statistics for 1923-28 and the B.L.S. index for 1929-37.

^fN.I.C.B. figures for 1920-21, 1923, and 1925-31 and estimates made by straight-line interpolation for 1917 (between July 1914 and June 1920), 1922, and 1924 were adjusted to the level of the B.L.S. series for Electric Light and Power and Manufactured Gas for 1932-37 by means of the average relationship in 1932-35. The N.I.C.B. figures refer to but 1 or 2 months in each year. The B.L.S. hours for 1932-36 were furnished in an unpublished report which antedates the version that supplied the figures for manufacturing industries for the same years; the average for 1937 was computed from 12 monthly figures published in the Monthly Labor Review.

TELEPHONES

This study is restricted to the Bell System, which constitutes the major part of the Telephones industry canvassed quinquennially by the Bureau of the Census. The production and employment indexes for this System were not used for completing relatives for the entire Census industry since there were significant differences in common years. The employment figures for the Bell System, furthermore, could more readily be converted to the desired annual averages, and an additional employment index, for operators only, could be constructed for the Bell System but not for the entire industry.

The Bell System accounted for the following percentages of the total number of employees, originating calls, and total operating revenue in the census years 1922, 1927, and 1932:¹

Item	Percent of total		
	1922	1927	1932
Employees	77.8	82.3	84.2
Originating calls	67.2	74.9	83.4
Operating revenue	83.1	87.9	90.4

Production

The NRP production index for the Bell System, which extends from 1919 to 1937, is based upon weighted aggregates of the average monthly number of originating (i. e., completed and uncompleted) exchange and toll calls.² The weights represent relative revenue per exchange and toll call in 1929 (approximately, exchange, 1; toll, 12). Whether or not these weights accurately reflect relative unit labor requirements cannot be determined, but the labor time expended per toll call is doubtless greater than the expenditure per exchange call.

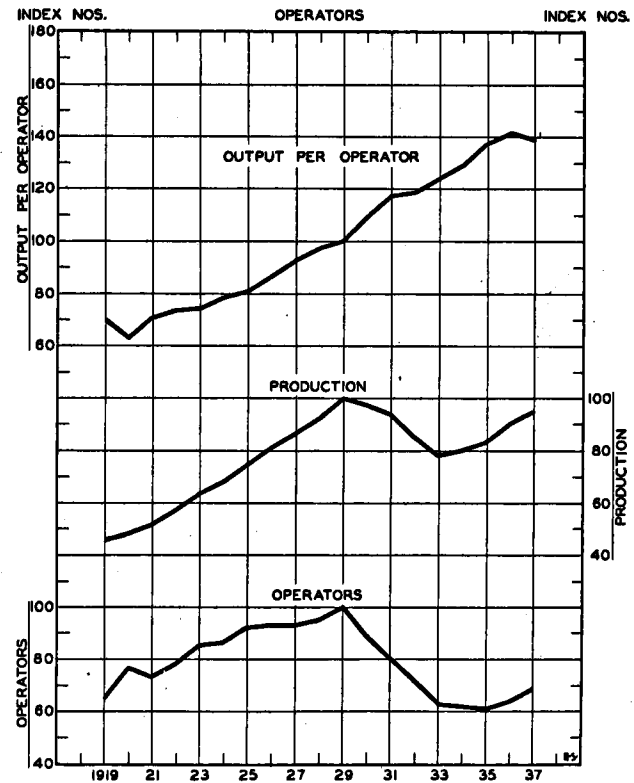
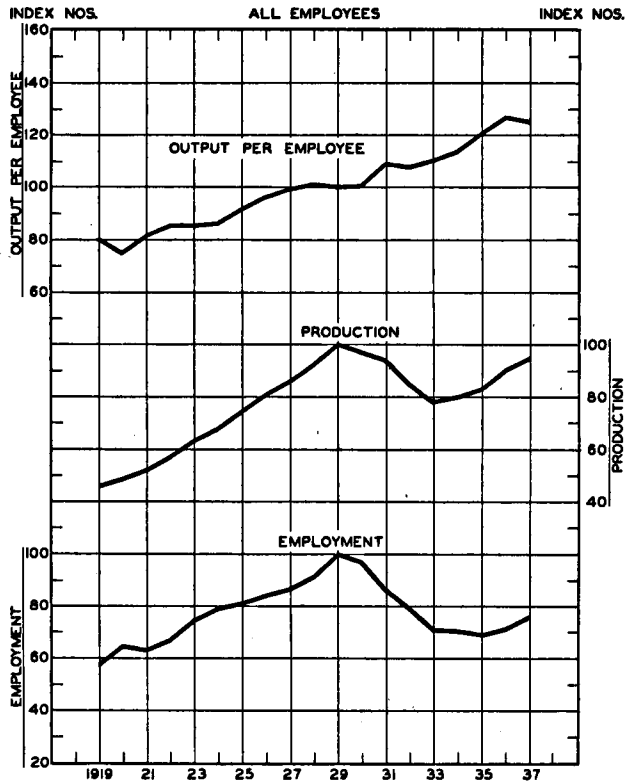
The statistics for the number of calls were transcribed for 1927-37 from annual reports made by the individual Bell telephone

¹The figures on which the tabulation is based were derived from *Census of Electrical Industries, "Telephones [and Telegraphs]."* All the employment statistics except those for the Bell System for 1927 and 1932 refer to June 30; the Bell System figures for these years are annual averages.

²Both the Bell System and the larger non-Bell systems ordinarily make actual counts of their calls at least as often as one day in each month, and their estimates, therefore, may be considered as fairly close approximations to accuracy. . . .

³Calls originating and terminating within central offices of a local area are counted as exchange calls, and those which involve any interchange of business between separate companies or between different localities, and which are therefore subject to toll charges, are counted as long-distance or toll calls." (*Census of Electrical Industries: 1927, "Telephones,"* p. 24.)

Figure B-2.- SUMMARY INDEXES FOR THE TELEPHONES INDUSTRY: 1919-37



companies to the Interstate Commerce Commission (until 1933) and the Federal Communications Commission (1934-37). Comparable figures for 1921-26 were obtained from a BLS study published in *Monthly Labor Review*.³ Estimates for 1919 and 1920 were extrapolated by means of figures for connecting (i. e., completed) calls available in *Annual Reports of the American Telephone and Telegraph Company*, which is also the source of the revenue statistics necessary for the computation of the weights.

Relatives of exchange and toll calls show little resemblance. Both series rise before 1929, but the slope of the latter is steeper; both decline from 1929 to 1933 and then rise, the former to a new peak by 1937 while the latter remains far below the level of 1929:

Year	Index for -		
	All calls (NRP)	Exchange calls	Toll calls
1919	45.9	49.5	38.9
1920	48.4	53.3	38.8
1921	51.7	56.4	42.5
1922	57.3	61.8	48.3
1923	63.5	68.9	53.0
1924	68.0	73.2	57.9
1925	74.5	78.2	67.1
1926	81.1	83.8	75.7
1927	86.2	87.5	83.5
1928	92.5	92.9	91.7
1929	100.0	100.0	100.0
1930	97.4	100.9	90.5
1931	94.0	99.3	83.8
1932	85.0	93.3	68.7
1933	77.9	86.1	61.8
1934	80.0	88.2	63.7
1935	83.3	92.1	66.0
1936	90.5	98.9	74.0
1937	95.1	105.1	75.3

The index for the Bell System differs considerably from an index of originating exchange and toll calls for all lines and systems computed from statistics presented in the quinquennial *Census of Electrical Industries (1922=100)*:⁴

³The Dial Telephone and Unemployment, * *Monthly Labor Review*, February 1932, pp. 235-47.

⁴The weight applied to relatives for each type of call represents the average revenue derived from the same type in 1922, 1927, and 1932. The index for the Bell System with such weights is almost identical with the NRP index converted to the base 1922.

[Continued]

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Year	Index of production for -	
	All lines and systems	Bell System
1922	100.0	100.0
1927	137.4	150.6
1932	132.2	148.4

The NRP index is not only a measure of the ultimate production of all the employees of the Bell System but also a measure of the specific output of one functional group, operators. A more satisfactory index for all employees, based on the specific output of other important functional classes (e. g., the construction and maintenance force, supervisors and technicians, and clerical and office staff) in addition to operators, could not be constructed.⁵

Employment and Man-hours

Since the NRP production index measures the output of both all employees and operators only, 2 indexes of employment were constructed for the Bell System for the years 1919-37; one of these refers to all employees and the other to operators (experienced and in training).

Figures for all employees were obtained for December 31 of each year from *Annual Reports of the American Telephone and Telegraph Company*.⁶ These were converted to annual averages by multiplication by ratios of annual averages to December figures; the ratios were computed for 1929-37 from BLS monthly relatives for Telephones and Telegraphs⁷ and for 1919-28 from statistics for individual Bell companies reporting to ICC.⁸ The adjustment

⁴ [Continued]

Exchange and toll calls for all lines and systems, reported in combination for 1932, were separated on the basis of the proportions for the Bell System in this year.

⁵ Figures for value of plant, miles of wire, and number of telephones, available in *Annual Reports*, are, at best, crude indicators of the work performed by construction and maintenance employees. Since these figures represent "stock", not gross additions for replacement and new investment, the net differences between successive year-end figures are sometimes negative. During the period of expansion (1919-29), however, the Bell index of toll calls bears a striking resemblance to indexes of value of total plant and miles of wire; the Bell index of exchange calls resembles the series for the number of telephones. Only the relationship between exchange calls and telephones persists after 1929.

⁶ The scope of the reported employment figures was changed slightly in 1936. An adjustment for comparability of the figures for 1936 and 1937 with those for earlier years, however, could be made on the assumption that the 1935 relationship between the revised and unrevised figures prevailed thereafter. (A similar adjustment was not required for production since the NRP statistics for these years were not obtained from the *Annual Reports*.)

⁷ Use of the BLS figures, which are published in *Monthly Labor Review*, is justified by the fact that the Telephones industry accounts for over four-fifths of the employment for Telephones and Telegraphs combined.

Footnote 8 appears on following page.

of the annual averages to the levels of Census figures for the Bell System for 1922,⁹ 1927, and 1932 yielded the final employment series.

The series for operators was obtained for 1921-30 from the same BLS study which provided the production statistics for 1921-26. It was extended back to 1919 and forward to 1937 by means of estimates obtained by the multiplication of the annual averages for all employees by the percentages comprised by operators as determined from ICC and FCC statistics.¹⁰

The indexes for all employees and for operators only show the same general movement throughout the whole period. The former, however, rises more rapidly before 1929 and declines by a smaller percentage thereafter. The difference between them is reflected in the changing composition of employment. Between 1919 and 1937 the percentage of operators declined from 56 to 44, while the percentages for salaried employees and for construction and maintenance workers rose from 18 to 24 and from 17 to 22, respectively:

Percentage distribution of employees¹¹

Year	Officials and super- vising foremen	Salaried employees (clerical and office staff, engineers, etc.)	Oper- ators	Construc- tion and maintenance force	All others
1919	2.3	17.8	56.2	17.4	6.2
1920	2.3	16.9	58.4	16.6	5.9
1921	2.5	17.6	57.1	16.7	6.1
1922	2.4	17.7	55.0	19.0	5.9
1923	2.2	17.7	54.4	19.8	5.9

[Con]

⁸The 2 series of ratios were linked in 1929. The ICC statistics, reported for the end of June and mid-December (the figure for December 1929 refers to the end of the month), refer to the entire Bell System in 1927-29 and to practically the entire System in earlier years. The average for each year was computed in the same manner as the average for 1922 (see fn. 9).

⁹The reported Census figure for 1922 refers to June 30. A better approximation to the annual average was obtained by the use of Bell figures for December 31, 1921 and December 31, 1922 published in the *Annual Reports*. By means of straight-line interpolation (each of the 3 figures was assumed to be typical of the whole month), estimates were made for the other 10 months of 1922; the average for the year was obtained from these 12 monthly figures.

¹⁰The estimates for 1931-37 were linked to the BLS figures on the assumption that the average relation between the 2 series in 1928-30 prevailed in subsequent years.

The percentage of total employment accounted for by operators in each year except 1933 was computed from figures for June and December (see fn. 8). The percentage for 1933 refers to December only.

Footnote 11 appears on following page.

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[Con.] Percentage distribution of employees¹¹

Year	Officials and supervising foremen	Salaried employees (clerical and office staff, engineers, etc.)	Operators	Construction and maintenance force	All others
1924	2.2	18.8	53.0	20.2	5.8
1925	2.3	19.1	53.3	19.5	5.8
1926	2.5	19.5	53.3	18.9	5.8
1927	2.7	20.7	51.7	19.0	5.9
1928	3.0	21.6	49.8	19.7	5.9
1929	3.3	22.4	47.5	20.9	5.9
1930	3.7	23.5	46.9	19.8	6.1
1931	4.0	24.5	45.8	19.5	6.2
1932	4.2	25.0	44.4	19.9	6.5
1933	4.2	25.6	43.5	20.3	6.5
1934	4.3	26.0	43.1	20.3	6.4
1935	4.4	25.5	43.0	20.6	6.5
1936	4.3	25.0	43.7	20.9	6.1
1937	4.2	24.4	44.1	21.5	5.9

Even within the class of operators, there has been a significant change in composition. Experienced operators, who had been about twice as numerous as operators in training in 1919, were about 6 times as numerous by 1937:¹²

¹¹The distribution is based on averages for June and December (December only in 1933) of figures for the following groups of employees transcribed from reports of individual Bell companies to ICC and FCC:

1. General officers and assistants
2. Operation officials and assistants
3. Attorneys and right-of-way agents
4. Engineers
5. Draftsmen, surveyors, and student engineers
6. Accountants
7. Clerical employees
8. Local managers
9. Commercial agents
10. Experienced switchboard operators
11. Operators in training
12. Service inspectors
13. Supervising foremen
14. Central-office installation and maintenance men
15. Line and station construction, installation, and maintenance men
16. Cable and conduit construction and maintenance men
17. All other employees (chauffeurs, carpenters, painters, janitors, porters, cooks, waitresses, doctors, nurses, etc.)

Officials and supervising foremen includes items 1, 2, 8, and 13; *salaried employees* includes items 3-7, 9, and 12; *operators* includes items 10 and 11; and *construction and maintenance force* includes items 14-16.

¹²The percentage of operators in training tends to be high during a period of expansion such as 1919-29; it tends to decline during periods of depression largely because of the accumulation of a reserve of experienced operators (in part a consequence of the trend toward dialization, discussed later), the diminished demand for new operators in training, and the decrease in number of voluntary separations of experienced operators from the pay roll. An additional factor tending to depress the proportion of operators in training from 1933 to 1935 was the NRA agreement to limit their number to 5 percent of all operators.

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Year	Percentage distribution of operators	
	Experienced	In training
1919	68.8	31.2
1920	62.9	37.1
1921	75.4	24.6
1922	76.8	23.2
1923	70.8	29.2
1924	75.5	24.5
1925	76.1	23.9
1926	76.7	23.3
1927	80.3	19.7
1928	81.4	18.6
1929	79.1	20.9
1930	88.7	11.3
1931	97.5	2.5
1932	99.2	0.8
1933	97.9	2.1
1934	95.8	4.2
1935	95.3	4.7
1936	88.9	11.1
1937	85.9	14.1

The index for the average number of employees in the Bell System compares as follows with an index for the number employed on June 30 in the entire Census industry (1922=100):¹³

Year	Index of employment for -	
	All lines and systems	Bell System
1922	100.0	100.0
1927	120.3	129.3
1932	107.1	117.6

Statistics were not available for the construction of indexes of man-hours for the period 1919-37. BLS averages of actual weekly hours for Telephones and Telegraphs for 1932-37,¹⁴ however, permitted the construction of a man-hours series for all employees for the same years (1932=100):

Year	Index of man-hours
1932	100.0
1933	83.8
1934	85.0

[con.]

¹³See ftm. 1.

¹⁴The BLS figures for 1932-36 were obtained from an unpublished report; the monthly figures for 1937 were published in *Monthly Labor Review*. (See ftm. 7.)

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[con.]	Year	Index of man-hours
	1935	84.1
	1936	88.0
	1937	94.0

Productivity

The indexes of output per employee and output per employee-man-hour both increase during the 6-year period for which the latter could be computed:

Year	Index of output per -	
	Employee	Employee-man-hour
1932	100.0	100.0
1933	102.2	109.3
1934	105.5	110.7
1935	111.9	116.5
1936	117.8	121.0
1937	115.9	119.0

As may be seen from the summary tables, the indexes of productivity for all employees and operators show a considerable rise throughout the period; the average rate of increase is much greater for operators because of the progress of dialization. In 1920 practically all telephones owned by the Bell System were manual; by 1937, however, almost half of them had been dialized:

Year	Percentage distribution of Bell telephones ¹⁵	
	Manual	Dial
1920	98.1	1.9
1921	97.3	2.7
1922	96.4	3.6
1923	94.5	5.5
1924	91.4	8.6
1925	87.6	12.4
1926	84.6	15.4
1927	81.4	18.6
1928	78.3	21.7
1929	74.0	26.0
1930	68.3	31.7
1931	62.8	37.2
1932	57.5	42.5
1935	52.0	48.0

Footnote 15 appears on following page.

Indexes of output per employee were computed for the Bell System and the Census industry from the production and employment relatives shown earlier. If the relatives of the Census employment figures for June 30 are representative of the entire year, it appears that the NRP productivity measure for the Bell System is typical of all lines and systems (1922=100):

Year	Index of output per employee for -	
	All lines and systems	Bell System
1922	100.0	100.0
1927	114.2	116.5
1932	123.4	126.2

Table B-5.- SUMMARY INDEXES FOR THE TELEPHONES INDUSTRY (BELL SYSTEM), ALL EMPLOYEES: 1919-37

(1929 = 100)

Year	Production	Employment	Output per employee
1919	45.9	57.3	80.1
1920	48.4	64.6	74.9
1921	51.7	63.3	81.7
1922	57.3	67.0	85.5
1923	63.5	74.3	85.5
1924	69.0	79.1	86.0
1925	74.5	81.2	91.7
1926	81.1	84.2	96.3
1927	86.2	86.6	99.5
1928	92.5	91.6	101.0
1929	100.0	100.0	100.0
1930	97.4	97.0	100.4
1931	94.0	86.0	109.3
1932	85.0	78.8	107.9
1933	77.9	70.6	110.3
1934	80.0	70.3	113.8
1935	83.3	69.0	120.7
1936	90.5	71.2	127.1
1937	95.1	76.0	125.1

¹⁵The percentages were computed for 1921 from *Bell System Technical Journal*, January 1921, p. 19; for 1922 from *Monthly Labor Review*, February 1932, p. 237; for 1935 from *The Telephone in America* (American Telephone and Telegraph Co., Information Dept., 1936), p. 44; and for remaining years from the *Annual Reports*.

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Table B-8.- SUMMARY INDEXES FOR THE TELEPHONES INDUSTRY (BELL SYSTEM),
OPERATORS: 1919-37

(1929 = 100)

Year	Production	Number of operators	Output per operator
1919	45.9	65.3	70.3
1920	48.4	76.6	63.2
1921	51.7	73.3	70.5
1922	57.3	78.0	73.5
1923	63.5	85.6	74.2
1924	68.0	86.5	78.6
1925	74.5	92.1	80.9
1926	81.1	93.2	87.0
1927	86.2	93.0	92.7
1928	92.5	94.8	97.6
1929	100.0	100.0	100.0
1930	97.4	89.1	109.3
1931	94.0	80.5	116.8
1932	85.0	71.7	118.5
1933	77.9	62.8	124.0
1934	80.0	61.9	129.2
1935	83.3	60.7	137.2
1936	90.5	63.7	142.1
1937	95.1	68.5	138.8

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Table B-7.- AVERAGE MONTHLY NUMBER OF ORIGINATING CALLS IN THE BELL TELEPHONE SYSTEM: 1919 TO 1937^a

(Thousands)

Year	Exchange	Toll	Year	Exchange	Toll
1919	1,071,586	36,501	1929	2,165,801	93,893
1920	1,154,019	36,442	1930	2,185,812	84,944
1921	1,220,672	39,948	1931	2,150,077	78,701
1922	1,339,085	45,361	1932	2,020,575	64,503
1923	1,493,179	49,769	1933	1,864,590	57,999
1924	1,585,420	54,365	1934	1,911,278	59,842
1925	1,694,319	63,044	1935	1,994,468	61,974
1926	1,815,408	71,121	1936	2,141,404	69,498
1927	1,896,002	78,416	1937	2,277,025	70,747
1928	2,012,971	86,133	Weight ^b	1.0	11.8

^aFigures for 1927-37 were transcribed from reports of individual companies of the Bell System to the Interstate Commerce Commission (until 1933) and the Federal Communications Commission (1934-37). Comparable statistics for 1921-26 were obtained from Monthly Labor Review, Feb. 1932, p. 245. The figures for 1919-20 were extrapolated by means of statistics for the average daily number of connecting exchange and toll calls published in Annual Reports of the American Telephone and Telegraph Company.

^bRelative value per exchange call and per toll call in 1929, as computed from Annual Report of the American Telephone and Telegraph Company for 1929.

Table B-8.- AVERAGE NUMBER OF EMPLOYEES AND OPERATORS IN THE BELL TELEPHONE SYSTEM: 1919 TO 1937

Year	All employees ^a	Operators ^b	Year	All employees ^a	Operators ^b
1919	204,397	105,650	1929	356,850	161,669
1920	230,665	123,787	1930	346,034	143,979
1921	225,875	118,470	1931	308,746	130,191
1922	236,972	126,080	1932	281,350	115,891
1923	264,962	138,436	1933	251,798	101,478
1924	282,350	139,891	1934	250,822	100,131
1925	289,892	146,856	1935	246,090	98,150
1926	300,568	150,753	1936	254,238	103,003
1927	308,866	150,301	1937	271,287	110,815
1928	326,995	153,260			

^aThe figures for all employees are annual averages derived from statistics for Dec. 31 published in Annual Reports of the American Telephone and Telegraph Company. (The data for Dec. 1936 and 1937 were first rendered comparable with those for earlier years by means of a minor adjustment based on information from the same source.) The December figures for 1929-37 were converted to annual averages by multiplication by ratios of B.L.S. annual averages to December relatives for Telephones and Telegraphs; the employment series was then extended back to 1919 by means of ratios computed from Interstate Commerce Commission statistics for individual companies comprising essentially the entire Bell System. (The I.C.C. employment data, which refer to June and December of each year, were converted to annual averages after estimates had been made for the other 10 months of each year of the period 1919-29 by means of straight-line interpolation.) The final series shown in the table was obtained by the adjustment of the annual averages to the levels of Census figures for the Bell System for 1922, 1927, and 1932. Annual averages for 1927 and 1932 and a figure for June 30, 1922 were reported in Census of Electrical Industries, "Telephones [and Telegraphs]" (U. S. Dept. Com., Bur. Cen.); before the adjustment was made to Census levels the 1922 Census figure for June was averaged with estimates for the other months of the year obtained by straight-line interpolation between the Census figure and the Bell figures for Dec. 1921 and Dec. 1922.

^bThe series for operators was obtained for 1921-30 from Monthly Labor Review, Feb. 1932, p. 243, and extended back to 1919 and forward to 1937 by means of estimates derived by multiplication of the series for all employees by ratios of operators to all employees. These ratios were computed from detailed employment statistics for the Bell companies transcribed from reports to the Interstate Commerce Commission (until 1933) and Federal Communications Commission (1934-37). The percentage for each year but 1933 is an average for June and December; the percentage for 1933 refers to December only. The 1921 relationship between the Monthly Labor Review and computed series was used in the extrapolation back to 1919, and the average for 1928-30 in the extrapolation forward to 1937.