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INVESTIGATIONS IN AGRICULTURAL ECONOMICS

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**INDUSTRIAL PROSPERITY
AND THE FARMER**



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INDUSTRIAL PROSPERITY AND THE FARMER

BY

RUSSELL C. ENGBERG

WITH THE AID OF THE COUNCIL AND STAFF
OF THE INSTITUTE OF ECONOMICS

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DIRECTOR'S PREFACE

It has been rather generally assumed that the farmer marches along with other business men and that his fortunes rise and fall with the general tide of prosperity and depression. Recent conditions in the United States have, however, pretty conclusively shown that it is possible for industry to be exceptionally prosperous while agriculture remains in general depression. Is it also possible that we may some day have a period of farm prosperity while industry is in the doldrums? Are these two great divisions of our economic life closely interwoven, or are they governed by essentially independent streams of economic influence? This analysis seeks to answer one-half of the question, namely, whether the general business cycle exerts an important direct influence upon agriculture. It does not attempt to answer the other half, whether general business fluctuations are, as has frequently been suggested, superinduced by antecedent changes in agricultural conditions.

In this volume Mr. Engberg, who possesses a thorough knowledge of the technical phases of farm organization and management, has assembled the data necessary to test, both analytically and statistically, the effects of industrial changes upon agriculture. He examines the effects of industrial prosperity and depression upon the demand for and price of farm products, and upon the farm-

er's operating costs. The analysis establishes certain definite conclusions with reference to a phase of agricultural organization and farm management which has heretofore been merely a subject of speculation.

HAROLD G. MOULTON,
Director.

Institute of Economics,
June, 1927.

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Acknowledgment is also due to Mordecai Ezekiel and L. H. Bean of the Bureau of Agricultural Economics, United States Department of Agriculture, for time generously given in reading and criticising the manuscript, and to Sewall Wright for suggestions in regard to certain of the statistical problems.

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**INDUSTRIAL PROSPERITY
AND THE FARMER**

INDUSTRIAL PROSPERITY AND THE FARMER

CHAPTER I

THE NATURE OF THE PROBLEM

THE great expansion of commerce and manufacturing during the last two centuries has involved many important changes in American agriculture. These may be characterized in general as a shift from the relatively self-sufficing type of farming to highly specialized and commercialized forms of productive organization. The growth of urban and industrial population in America, Europe, and to some extent elsewhere, has enlarged markets for farm products and created an incentive for continuing the production of various commodities far beyond the requirements of the individual farm family. The commercialization of agriculture has naturally proceeded along lines of geographic specialization in the product for which a given region is particularly well fitted by reason of climate, soil, or other natural resources. At the same time, many processes once performed in the farm home or at

the crossroads village have been concentrated in large factories, often far removed from the producing territory. The local blacksmith shop and community grist mill gave way to the great implement factories and corporate flour mill companies; the kitchen churn was superseded by the creamery and centralizer butter factory; local butchering shrank to a shadow of its former self in the face of big packer development; and even the production of farm power was shifted to a considerable extent to auto, truck, and tractor plants and to the oil wells and refineries.

This specialization and more elaborate economic organization have increased efficiency and produced a larger total volume of goods to be distributed among the whole body of producers participating in a world-wide division of labor. Naturally they have brought about also a great interdependence between the world of business—commerce, manufacturing, and finance—and agriculture. Our whole business system depends constantly and in many ways upon the farmer not only for raw material for factories and food for urban populations, but also for traffic for the railroads and for markets for an important part of the services and finished products which are the city's stock in trade. The farmer's phase of modern economic interdependence is expressed in his need that the industrial world take his surplus products and return fabricated goods for both domestic and farm use and furnish him with

services, entertainment, and whatever else goes to make up his budget of consumption goods.

It has been a striking phenomenon of the growth of this highly organized economic society that business has found itself disturbed by frequently recurring periods of prosperity and depression. During times of prosperity there is great industrial and commercial activity. Manufacturing plants turn out a large volume of goods, employment is at a maximum, and wage disbursements high. Prices are high or rising, and sales run into large figures. People have plenty of money and spend it freely. This state is inevitably followed by one where the situation is reversed. Industry and commerce seem to come to a dead center. Manufacturing slows down, unemployment spreads, and wages are reduced. Quantity sales become impossible at almost any price, and buyers purchase only for their immediate needs. Prices decline. In the course of time this situation is relieved and trade returns to a healthy, active condition. According to one of the foremost students of this phenomenon, there have been 15 such alternations of depression and recovery in the United States since 1811.¹ Nor is there any good reason for believing that we shall not continue to have them in the indefinite future. Instability seems to be a disease to which the present

¹ Mitchell, Wesley C., *Business Cycles and Unemployment*, p. 5. This figure includes only the more important upswings and downswings. For an analysis showing the minor movements see Thorp, Willard L., *Business Annals*, 1926, pp. 94-95 and Chapter I.

order is extremely susceptible and for which economic science so far has been unable to find a cure or even a satisfactory diagnosis.

These facts—that is, the interdependence of agriculture and business and the fluctuating prosperity of the latter—naturally present themselves for consideration when one seeks the causes for the varying fortunes of the farmer. There are two main channels through which the shocks of business cycles might conceivably be transmitted to agriculture. One is by way of variations in the prices which farmers receive for their output; the other is through fluctuations in the availability and prices of the goods and services which farmers buy. It is necessary, therefore, that we analyze the ways in which changes in business activity might be expected to affect either the income or the operating expenses of the farmer, and also that we examine such historical evidence as may be available to see whether such results have actually followed.

Let us begin our analysis with an upswing of business activity. During such a period the prices of farm products might be expected to rise because of an increase in the demand for them. Such an increase might occur either in the final consumer demand, or in the demand of manufacturers for agricultural raw materials, or in both. During this phase of the business cycle the output of firms engaged in manufacturing, mining, and other forms of industrial activity increases with more than aver-

age rapidity. The demand for such farm products as are raw materials of industry must be enhanced by these activities. If, as is often the case, there is a tendency toward forward buying during this phase of the cycle, the market demand for certain agricultural products will expand even more rapidly than the actual consumption of such materials. If conditions of supply remain unchanged, this increase in demand must result in higher prices.

Moreover, the expansion of industrial activity involves an increase in the demand for labor. There is an increase of pay-roll disbursements which affects the purchasing power of the consuming public of the industrial area. Should the recipients of such additional income decide to spend part or all of it for commodities into which farm products enter as raw materials, the increased demand might be expected to work its way back to the raw product and result in higher prices at the farm. The extent to which such an increase will actually take place depends chiefly upon the spending habits of consumers and upon the relative importance of other factors affecting the price of farm products, such as fluctuations in export demand and changes in supply.

Let us turn to the second type of interrelationship between industrial and agricultural conditions, namely, the prices of things bought by farmers. The prices of many commodities which enter into industry, both raw materials and finished products, rise during an upswing of business activity. Farm-

ers, therefore, may have to pay increased prices both for the goods which they require for their own consumption and for those which they use in their farming operations. The rise in industrial wages which characterizes a major upswing of business activity may also affect the cost of labor employed on farms. Interest rates also rise in such periods, with a possible resulting influence on farmers' financial outlays.

During a downswing of business activity we should anticipate effects on agriculture approximately the reverse of those just outlined. Manufacturers make smaller purchases of raw materials and pay out less money in wages. Loans are liquidated and few new ones are made. Unemployment increases. These changes may reduce the demand for farm products on the part of both manufacturers and final consumers. On the other hand, the falling price level may mean a decrease in the cost of articles bought by farmers, and the decreasing competition of industry for labor and capital creates the possibility of lower wage and interest costs in the operation of a farm.

There are two factors, however, which reduce the violence of fluctuations in the prices of goods and the services bought by farmers. One is the tendency for middlemen in various stages of the distributive process to absorb the price changes. Retail prices are more stable than wholesale, and wholesale prices of finished goods are more stable than the prices

of raw materials. The other factor is the immobility of labor, which reduces and delays the effect on farm wages of the rise in city wages. Such factors as distance, lack of information, and the value of acquired skill in farm work or in industrial employment all tend to obstruct the interchange of labor between farm and city. The extent to which all these factors soften the blows that reach agriculture through the medium of cost is one of the questions to which we must seek an answer.

Our first problem, therefore, is to determine the extent to which business cycles react on agricultural prosperity through the channels just outlined. On the basis of these findings we can then determine whether the relations are sufficiently close to justify the adaptation of farm management to changes in the rate of business activity. The analysis should also throw light on the possibility of stabilizing agricultural conditions through an attack on the larger problem of business cycles.

More specifically, answers to the following questions will be sought:

1. To what extent are business cycles responsible for farmers' recurrent financial difficulties?
2. Is it worth while for farmers to attempt to adjust their production policies to changes in demand or costs predicated on business forecasts?
3. Are the remedies suggested for business cycles likely to prove effective in stabilizing agricultural production and prices?

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The treatment in the first part of our text is general rather than specific. No particular commodity or type of farming is analyzed in detail. Illustrations are drawn freely from all classes. To support and illustrate the general discussion, the influence of business cycles on the prices of four representative commodities is discussed in Chapters VII, VIII, and IX. These products are cotton, corn, hogs, and wheat.

CHAPTER II

AGRICULTURAL PRODUCTION AND PRICES

ANY study of the effect of general business conditions on the fortunes of the farmer is naturally directed first to the fluctuations in the prices of things which farmers sell. Such fluctuations are very wide and constitute one of the most important channels through which business conditions may affect farm earnings.

One of the first characteristics that becomes evident upon an examination of such prices is the decided relationship between the changes in the rate of production and in prices. We shall begin the analysis, therefore, by examining in some detail the role that the volume of production plays in agricultural price determination, first, in the case of crops and, second, in the case of livestock and livestock products.

The size of crops is the most important factor in the annual variations of their unit prices. A large output invariably results in relatively low unit prices and a small output in relatively high unit prices. This is readily shown by statistical measurement. When either the farm or the wholesale price

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at or shortly after harvest time is correlated with the volume of production, a Pearsonian coefficient of correlation around—.80 is usually obtained. A summary of published results of such correlation studies may be found in Appendix B. Such a high correlation indicates that other independent factors must necessarily be of minor significance.¹ This relationship is represented graphically in the figure on p. 11, which shows the variations of an index of the size of twelve crops and of prices of the same crops at harvest time during the period from 1879 to 1915.

The American prices of most crops seem to be influenced mainly by the volume of production within the United States. The correlation studies summarized in Appendix A show that this is true of cotton, corn, oats, apples, cabbage, watermelons, hay, and potatoes. The reasons why the domestic output is the chief price factor are not the same for each crop. In the cases of cotton and corn, the United

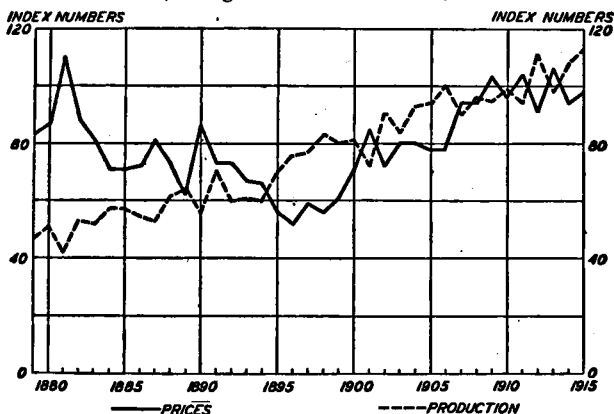
¹The Pearsonian coefficient of correlation is a numerical measure of the closeness of correspondence. If a change in one variable is always accompanied by a corresponding proportional change in the other, the correlation is said to be positive and perfect, and is expressed by the coefficient +1. If a change in one is invariably accompanied by a proportional change in the other in the opposite direction, we have perfect negative correlation, expressed by the coefficient -1. If changes in one are unrelated to changes in the other, the coefficient is zero. Partial correspondence is expressed by positive or negative coefficients between +1 and -1.

The percentage of the variations of a dependent variable which results from the variations of an independent variable equals the square of the coefficient of correlation. Hence when the correlation is—.80, about 64 per cent of the annual variations in price can be said to result from the changes in production, provided other factors are not related to the latter.

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States crop constitutes such a large proportion of the world crop that prices all over the world are greatly influenced by the size of the former. The influence is greatest, however, in the United States. In the

HARVARD INDEXES OF PHYSICAL PRODUCTION AND PRICES OF
TWELVE CROPS, 1879-1915*
(Average for 1909-1913 = 100)



* Data from *Review of Economic Statistics*, January, 1921, Vol. III, p. 34.

cases of potatoes and apples the great bulk in proportion to the value makes the cost of transportation so high that the possibilities of large shipments to or from Europe, except at very high price differentials, are limited. This condition operates to decrease the effect of the variations in the volume of production outside of the United States upon the prices within the United States.

Careful inspection of the price and production data for barley, rice, buckwheat, and many of the fruit and truck crops indicates that the domestic output is the chief factor affecting the price in the United States for these crops also. More detailed studies than we have made might, however, reveal a greater influence on prices in the United States of "outside" production than now appears to be the case. This seems especially probable for rice and flax, since they are relatively high in value for their bulk and since domestic production is only a fraction of the world crop.

In the case of some other crops, however, notably sugar, wheat, and rye, the volume of outside production affects the world prices, including those in the United States, more than does the size of the domestic crop. For these crops the world production is the most significant price factor.²

In examining the relationship between the volume of production and prices, it is necessary, of course, to avoid throwing together into a single classification things which, though popularly called by the same name, are in fact for trade purposes more or less distinct commodities. For example, high pro-

²Killough, Hugh B., *What Makes the Price of Oats?*, U. S. Department of Agriculture Department *Bulletin* No. 1351, September, 1925, p. 23. "Correlations . . . show that the influence of the crop of the United States upon the price of wheat at Chicago is measured by a coefficient of only -0.32 , whereas the influence of the crop of the entire world is measured by a coefficient of -0.71 ." See also U. S. Department of Agriculture, *Foreign Crops and Markets*, September 24, 1924, pp. 313-314.

tein milling wheats, soft wheats, and durum, are almost as distinct as wheat and rye, or even oats and barley. Likewise long-staple and short-staple cotton have quite distinct producing areas, trade uses, and price movements.

It must not be inferred, however, that prices adjust themselves abruptly at harvest time to the change in supplies on hand. All through the year prices are adjusting themselves to information about the size of both old and new crops as it becomes available. At harvest time the most important news is the official government crop estimate. Supplementing this are the estimates of various independent agencies such as trade journals and brokerage houses. As the harvesting and marketing get under way the volume of ginnings, threshing, and market movements furnish an increasing amount of information about the available supply. Hard on the harvest season comes the planting time for the fall crops, winter wheat and rye. The acreage planted, however, has relatively small immediate influence on cash prices of these commodities. Then comes the winter weather, and its probable effect on boll weevil survival and acreage abandonment is discounted. In the spring the sales of fertilizer, the intentions-to-plant reports of the Department of Agriculture, the weather conditions as they encourage or discourage planting, and finally the official estimates of the acreage actually planted, including the estimate of the area aban-

done in the winter wheat regions, are the significant events. These reports are supplemented by private estimates. From this time until the date of the first government condition reports the weather is of chief significance in the markets. Each bad rain or period of drought is given some allowance by the traders in the bidding.

In those cases in which the production of other crops and of crops in other parts of the world is of significance in domestic price-making, the corresponding information concerning their progress is discounted in the same way by the dealers and speculators.

The prices of livestock and livestock products also reflect the volume of production. As a rule, large supplies mean low prices; while prices tend to rise when a shortage develops. In the case of livestock this inverse relationship between market supplies and prices results in a production rate that is cyclical in character. The depressed prices accompanying a large output tend to discourage producers. The consequent decrease in the market supply normally results in higher prices, which again stimulate production, and thus prices are again depressed. The length of these cycles depends chiefly on the time required to change a condition of small supplies into one of large supplies. This cyclical characteristic is discussed in greater detail in the next chapter.⁸

⁸ See pp. 36-39.

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The effect of changes in the volume of production on prices is probably clearest in the case of hogs. The correlation between the percentage changes in the size of the Western winter pack and the average price of live hogs for the period 1881-1913 is $-.75$. The results of this and other correlation studies of hog prices are given in greater detail in Chapter VIII and Appendix A. The price of wool reflects cycles of wool production that have averaged about eight years in length.⁴

The prices of dairy products also are related to the volume of production, especially during the summer months. After the pasture season opens in the spring and continuing until winter feeding is begun, the milk flow is largely determined by the weather conditions. This, in turn, affects the prices in the winter feeding season. However, the rate of production is also greatly influenced by prices. The kind of season likewise affects egg production and egg prices to some extent.

The effects on agricultural prices of changes in production are lessened by the many opportunities for substitution. The high price which results from a shortage in the market supply of any particular commodity is likely to increase the consumer demand for those products which can be used in place of it. The shortage of the one, therefore, is reflected in the prices of all the related products. On the other hand, if the price of some one commodity is

⁴See *ibid.*, "Cycles in the Sheep Industry," p. 3.

low because of a large volume of production, the same tendency appears. Consumers turn to the cheaper product, and the lessened demand for the other products operates to reduce their prices. The price fabric of each group of mutually interchangeable commodities thus reflects the variations in the available supply of each of the component products.

Illustrations may be drawn from almost any group of farm commodities. In the meats, for example, we find that there is considerable price relationship between the different kinds. This is particularly true of beef and pork, because of the tendency of consumers to switch from one to the other when the usual price relationship is disturbed. Mutton is a more specialized product, but has nevertheless considerable relationship with other meat prices.⁵ The price of steers has some effect upon the price of hogs.⁶

In the same way the size of the rye, corn, barley, oats, and potato crops in various parts of the world influences the demand for and the price of wheat. The large crops of corn and rye in 1923, for example, contributed to the low wheat prices in that year because of their importance as bread grains in various parts of Europe. The volume of production of two other leading substitute crops—potatoes (in

⁵ See Wentworth, Edward N., "Are Cattle Prices Affected by the Prices of Hogs or Lambs?" *Monthly Letter to Animal Husbandmen*, July, 1920.

⁶ Haas, G. C., and Ezekiel, M. J. B., *What Makes Hog Prices?* A preliminary report, U. S. Department of Agriculture, March, 1925, p. 3.

Europe) and rice (in Asia)—was relatively small but “not much below average.”⁷ Killough’s statistical analysis of wheat prices shows that the volume of world rye production is a significant wheat price factor. The output of barley and potatoes also shows a small inverse relationship with the fluctuations of the price of wheat.⁸ Wallace has shown that the price of wheat, in turn, affects the price of corn.⁹

The changes in the output of each of the feed crops and the fibre crops likewise affect the price of each related member of the group. For the same reason the prices of certain fruits and vegetables fluctuate together. Dairy products also are interrelated in price, not so much because of direct substitution by the consumer as because of the facility with which milk is diverted from one use to another. Since milk can be sold either as fresh fluid milk, as condensed or evaporated milk, as butter, or as cheese, the prices of these various forms cannot remain out of line for any great length of time and the price fluctuations tend to be similar.¹⁰

Thus we find that the prices of agricultural commodities are greatly influenced by the volume of the

⁷ Food Research Institute, “The World Wheat Situation, 1923-24,” *Wheat Studies*, December, 1924, Vol. I, pp. 7-8.

⁸ *What Makes the Price of Oats?*, p. 24.

⁹ Wallace, H. A., “Forecasting Corn and Hog Prices,” *The Problem of Business Forecasting*, p. 241.

¹⁰ See Ross, H. A., *The Marketing of Milk in the Chicago Dairy District*, Bulletin No. 269, University of Illinois Agricultural Experiment Station, June, 1925.

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production, either in the United States or in the world, of these same commodities or of commodities that may be substituted for them. Since this is the case, it is necessary to analyze some of the more important factors that cause variations in the volume of agricultural production. This is done in Chapter III.

CHAPTER III

SOME FACTORS WHICH AFFECT AGRICULTURAL PRODUCTION

THE most superficial examination of the conditions under which agriculture is carried on discloses the presence of two quite distinct sets of determining forces, each largely independent of the other. On the one hand the output of agriculture, like that of every other type of business, is the result of human planning. Crops are produced only to the extent that men believe it is worth while to plant, tend, and harvest them, and the farmer's decisions as to the volume of production for which he will strive and the particular types of production in which he will specialize are determined by calculations of probable financial gain or loss. On the other hand, agricultural output, much more than that of any other type of economic activity, is in part determined by physical forces—weather, insect activity, and the ravages of plant and animal disease—over which the farmer exercises only slight control. We shall give attention first to the economic forces which determine the amount of agricultural production which farmers attempt to se-

cure, then to the physical limitations which modify the results of their operations.

I. ECONOMIC FACTORS

Like nearly all producers in a society which has passed out of the stage of self-sufficiency and is organized on the basis of production for the market, the results of the farmer's activities are subject to the influence of economic conditions—prices, costs, and his own financial strength and business capacity. Farmers as a group must adjust their activities to the community's demand for their products as expressed in market prices. Lacking a central organization to control this adjustment, the increase and decrease of agricultural output in accordance with the changes in consumer demand must be effected chiefly by individual action.

Such adjustment, however, is more difficult in the case of agriculture than in that of almost any other important industry. Changes which take place progressively over a period of years do register themselves in the volume of agricultural production, but the industry is not organized to adjust itself effectively to year-to-year changes in market conditions. Hence, such changes in demand as appear in the course of the rise and fall of a prosperity movement are only to a slight degree reflected in changes in agricultural output. An explanation of this slight responsiveness of agricultural output to

the short-time changes in demand requires that we examine several characteristics which differentiate the farm business from most branches of industry and commerce with respect to its sensitiveness to market conditions.

The farmer always has a market in which his staple crops can be sold. He does not need a line of regular consumers; he employs no salesmen, and he never worries about finding an outlet for his products. Moreover, in the case of the most important crops the return which he gets for his output does not depend upon his bargaining skill. He must, of course, exercise judgment concerning the best time to sell, but having chosen the time he can count on getting exactly the same price which any one else would get at the same time for the same product. Hence his decision whether or not to cut his acreage in response to slackening demand is always a question of prices *versus* costs—it is never settled for him by the sheer impossibility of finding buyers.

Prices of staple crops are beyond control of the individual producer. Not only are the prices received by the farmer independent of his individual bargaining skill, but they are also independent of his individual decision to increase or decrease his output. He cannot establish a price in the sense that the manufacturer can establish a price for goods which can be identified as his individual output or are produced by only a few competitors. A manu-

facturer of agricultural implements may decide that he will sell a binder at a certain price and adjust his rate of production to the number of binders his market will absorb at that price. The price is, within limits, determined by his actions. The farmer, on the other hand, decides how much acreage to plant and how intensively to cultivate his crops, knowing that his individual decision to try for a large or a small output will have no perceptible influence on the market situation. The relative smallness of the production unit and the impossibility, in most instances, of concerted action to control total output, make it impossible for him to maintain a price policy. Exceptions, such as California fruits and, in certain localities, fluid milk, emphasize the importance of production control as a prerequisite to successful price control. Hence he has much less inducement than does a manufacturer to attempt a nice adjustment of a given year's production to the prospect of a strong or a weak demand.

Even when prices are lowest a farmer can rarely make a net saving by curtailing his individual output. In the face even of such price declines as those of 1920-21 the maximum return for most farmers has been secured by continuing or increasing the volume of production. This fact arises from the peculiar character of farm expenses. In most types of farming the direct expenses—that is, those which vary with the volume of production—constitute a relatively small part of the total cost and of the

value of the product, even during years of low prices. Many of the most important costs of a given crop are paid much more than a year in advance. The farmer cannot escape them by curtailing his activities.

The test whether it pays to curtail production in a given year is not the relation of the total cost to the probable price at market time, but the relation of the anticipated price to those costs which could be cut off by curtailing operations. If a crop can be sold for enough to cover the "direct charges," that is, those costs which are still optional at the time the farmer decides how much to plant, the crop is worth raising; if a crop cannot be sold for enough to cover these costs the operation is unprofitable, quite regardless of the question whether the fixed charges on the individual farm are high or low. But the heavy fixed charges which characterize agriculture do enter along with the direct costs into the determination of the level about which agricultural prices fluctuate. The total costs, and hence the usual range of prices are so much higher than the direct charges that prices rarely drop low enough to make advisable a curtailment of the scope of operations.

This characteristic of farming expenses may be illustrated by a comparison of the total amount of such direct expenses with the value of the products sold from the farm during a year of low prices. The 1923 *Yearbook* of the U. S. Department of Agri-

culture contains a statement of the business details of 14 farms in Ohio for eleven consecutive years ending with 1921-22. The lowest net returns were obtained in 1920-21. The average cash sales of farm products that year amounted to \$777. The sum of all expenses which might conceivably be affected by the volume of production was \$325.¹ Hence even during a disastrous price decline, there was a considerable surplus above the direct expenses to apply toward the fixed charges. With such a distribution of direct and indirect costs, the net returns would have been materially less had the volume of output been contracted.

That this characteristic of farm costs has been a factor in agricultural production is indicated by an examination of production figures during the more important price declines. Indexes of acreage and production from 1880 to 1925 are given on pages 26 and 27. The small effect on the volume of output of the great price decline in 1920-21 is very evident. The decrease in the crop outturn in 1921 was the result of a decline in yields per acre, while the production of animal products increased following the price decline. Day's index of the volume of agricultural production for the four years beginning with 1920 was consecutively 92, 96, 102, and 115.²

¹These included hired labor, repairs and depreciation of machinery, feed, seed, and fertilizer bought, machine work hired, breeding fees, and the cost of spray materials, twine, fuel, and oils.

²Day, E. E., "The Physical Volume of Production in the United

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From 1893 to 1897 the index number of prices of farm products dropped from 70.7 to 59.2 while the indexes of acreage and production increased nine and fourteen points, respectively, between those years. Moreover the falling prices from 1883 to 1886 were accompanied by a gradual expansion of acreage.

Thus while a period of high prices may bring more acres into cultivation there is not necessarily a corresponding decrease in crop area when prices turn downward. After an investment has been made, it is frequently more profitable to stay and get as much as possible out of it than to let it lie idle. There are a number of factors whose effect has been to expand agricultural production regardless of price fluctuations. Such factors are the government land policy, particularly the Homestead Act; the building of the railroads; the "go-West-young-man" tradition; our liberal immigration policy, only abandoned in 1921; the colonization activities of railroads, state immigration commissions, and real estate companies; government and other reclamation projects; and the improvement of agricultural machinery. These all contributed materially to the rapid expansion that occurred between the Civil War and the World War, and contributed largely to the prolonged period of low prices in the nineties. When prices fell, there was nothing else to do but continue producing. The

States for 1923," *Review of Economic Statistics*, July, 1924, Vol. VI, p. 196.

INDEXES OF AGRICULTURAL PRODUCTION, 1880-1925

(1910-1914 = 100 except when otherwise stated)

Year	Crops			Livestock		
	Acreage Har- vested of 10 Leading Crops ¹	Ten Leading Crops ²	Twelve Crops (1909-13 = 100) ³	Hog Pack ⁴	Net Market Receipts of ⁵	
					Cattle and Calves	Sheep
1880	56	...	51	50	18	5
1881	59	...	42	45	21	6
1882	61	...	53	40	25	7
1883	64	...	52	41	30	9
1884	67	...	57	45	34	12
1885	67	...	57	49	36	15
1886	68	...	55	52	38	15
1887	69	...	53	51	48	18
1888	71	...	61	48	50	16
1889	69	...	64	58	57	19
1890	69	55	56	74	72	23
1891	72	70	70	64	70	24
1892	71	62	60	56	80	27
1893	73	61	61	52	82	39
1894	73	62	60	67	79	42
1895	78	71	70	63	73	49
1896	80	77	76	70	74	52
1897	82	75	77	81	77	56
1898	84	85	83	92	76	56
1899	87	82	80	87	81	59
1900	87	81	81	89	81	58
1901	88	74	72	94	87	62
1902	88	91	91	78	85	67
1903	88	84	84	85	94	70
1904	89	92	93	91	91	66
1905	89	94	94	96	102	73
1906	92	99	100	95	106	75
1907	91	89	90	106	107	68
1908	94	94	96	108	102	69
1909	94	94	95	92	109	79
1910	98	97	99	82	110	82
1911	100	91	94	111	103	99
1912	99	110	111	98	101	109
1913	101	95	98	104	95	105
1914	102	107	108	105	90	105

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INDEXES OF AGRICULTURAL PRODUCTION, 1880-1925—Continued

Year	Crops			Livestock		
	Acreage Har- vested of 10 Leading Crops ¹	Ten Leading Crops ²	Twelve Crops (1909-13 = 100) ³	Hog Pack ⁴	Net Market Receipts of ⁵	
					Cattle and Calves	Sheep
1915	105	116	113	121	97	88
1916	105	100	100	127	115	90
1917	108	108	108	104	150	71
1918	110	107	107	130	164	81
1919	110	108	111	120	145	97
1920	109	117	115	115	124	78
1921	109	100	...	114	108	89
1922	110	110	...	136	125	73
1923	110	110	...	161	134	79
1924	108	111	...	156	142	80
1925	110 [*]	112	...	120	148	81

¹ Computed by finding the relative of the sums of the acreage harvested each year of wheat, corn, cotton, oats, barley, rye, hay, buckwheat, potatoes, and tobacco. Data from U. S. Department of Agriculture *Yearbooks*.

² U. S. Department of Agriculture, *Crops and Markets*, monthly supplement, December, 1925, p. 379. Relative of the aggregate of the production in each year of the above crops multiplied by a constant price.

³ Day, Edmund E., "An Index of the Physical Volume of Production," *Review of Economic Statistics*, September 25, 1920, Vol. II, p. 255. Geometric means of the relative production of the same crops plus sugar and rice, weighted on a value basis.

⁴ Relative of total number of hogs packed in the United States. Data for 1880-1915, from Wright, Sewall, *Corn and Hog Correlations*, U. S. Department of Agriculture, Bulletin No. 1300, p. 11; for 1916-1925, from Price Current-Grain Reporter, *Yearbook* for 1926, p. 72.

⁵ Compiled from U. S. Department of Agriculture *Yearbooks*, and from office records of the Bureau of Agricultural Economics, U. S. Department of Agriculture. The period 1880-1887 includes net receipts at Chicago, St. Louis, and Cincinnati, and gross receipts at Kansas City; 1888-1901 includes net receipts at Chicago, St. Louis, Cincinnati, Omaha, St. Paul, Denver, and Sioux City, and gross receipts at Kansas City. In addition to the above markets, gross receipts at Fort Worth, and net receipts at Kansas City and St. Joseph are included for 1902-1925. Cincinnati is omitted.

^{*} Preliminary.

farmers were on their farms; their "stake" was there. To return East was a more formidable undertaking financially than to continue producing at a loss. Consolidation into large tracts for grazing purposes was impracticable. There were many owners, the sod was broken, many farms were fenced, and there was no stock to put on them. So the only recourse was to grow more crops, and the index of the volume of crop production consequently increased from 61 in 1893 to 82 in 1899.

The opportunities for substitution of one crop for another are limited. Although the volume of production may not be appreciably reduced by price declines, there is some change in the kind of products produced. But even such changes are limited in extent. Alternative crops or products are not always readily available. In each region certain crops have attained a dominant place in the cropping system because they are particularly suited to the local conditions. Other crops have been eliminated because of some difficulty, either physical, biological, or economic, in the way of their production or profitable disposal. Among such limiting factors are soil, climate, insects, plant diseases, and transportation costs. Then too, the prices of alternative crops may have declined so much that there is no advantage in changing. Moreover, changes are costly. When a farm has been organized for a certain type of production, it may be unwise to buy new equipment, change the cropping system, and

revamp the farm organization because of a change in price relationship that may or may not be permanent. Finally, the slowness with which farmers make changes is sometimes due to "the psychology of the farmer himself—his apathy in some cases, his conceit in other cases, his refractoriness in others, only his enmeshment of habits, customs, and traditions in other cases." ⁴

Wheat-growing sections provided good illustrations of the difficulty of substitution in the post-war years when wheat slid from the two-dollar level that had prevailed during 1917, 1918, and 1919, to below one dollar in 1921, 1922, and 1923. In spite of this collapse of prices, in central Kansas the acreage of winter wheat in the latter period was 8 per cent larger than in the two-dollar period. Even on the basis of 90-cent wheat, the U. S. Department of Agriculture concluded, after a study of farm organization in that area, that:

Wheat is the best income-producing crop in this district and other lines of production must fit in with it. The first step in planning the farm is to grow as much wheat as possible with good methods without having to hire a great deal of labor for seed-bed preparation and seeding work. The next step is to choose the kinds and quantities of other crops and the kinds and number of livestock that will make the best use of time and equipment when they are not needed on the wheat. The crop grown and the livestock kept must be so selected that

⁴Black, J. D., "The Role of Public Agencies in the Internal Readjustments of Farm," *Journal of Farm Economics*, 1925, Vol. VII, p. 165.

there will be enough feed for the livestock and enough livestock to eat up the feed.⁵

The same difficulty of finding satisfactory substitutes was apparent in North Dakota, where spring wheat provides a major part of the income. In the decade ending with the crop year 1918-19, about 69 per cent of the total receipts came from that source. The table on page 31 indicates the acreage changes of wheat and alternative crops in that state during that trying period when prices broke. The expansion of barley, oat, and hay production was limited by the lack of livestock to consume them, and by the great distance to markets. Corn is also a feed crop and has the additional handicap of a short growing season. Rye was affected in price by the oversupply of wheat. Flax was capable of considerable expansion because of the building boom, and the acreage of the crop did increase materially. The net effect, however, of the sharp drop in wheat prices was not so much a substitution of other crops as an actual increase in wheat acreage. That seemed to be the best way to maintain the farm income in the face of falling prices.

Even when alternative lines of production appear profitable, there is considerable hesitation in revamping an established plan of farm organization. There are several good reasons for such a disinclina-

⁵Tapp, Jesse W., and Grimes, W. E., *More Profit for the Wheat Farmer of Central Kansas*, U. S. Department of Agriculture, Farmers Bulletin No. 1440, November, 1924, p. 7.

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ACREAGE OF PRINCIPAL CROPS IN NORTH DAKOTA, 1919-1924 *
(Thousands of acres)

Year	Wheat	Rye	Barley	Oats	Tame Hay	Corn	Flax	Potatoes
1919 ...	9098	1945	1085	2397	605	432	760	90
1920 ...	8916	974	1085	2518	916	569	761	83
1921 ...	8827	930	1096	2568	961	620	430	124
1922 ...	8980	1800	1008	2388	1028	780	521	210
1923 ...	9650	1320	1250	2388	895	842	1050	158
1924 ...	8685	990	1350	2746	1024	1137	1732	130

* Compiled from *Yearbooks* of the U. S. Department of Agriculture.

tion. In some cases, as has already been indicated, it is practically a physical impossibility to make rapid changes. The time required to grow an orchard or to build up a dairy herd is too long to permit a temporary transition to that type of production. This limitation is too obvious to need further discussion.

Once a new type of farming becomes established it is very difficult to change back to the former status. Various barriers—financial and technical—operate against it. During the war, when the purchasing power of grains rose more rapidly than that of meat animals, 11,000,000 acres of meadow and wild pasture land were plowed up in Nebraska, Kansas, Colorado, Oklahoma, and Texas. Much of this land, which had been in large ranches, was broken up into smaller farms in order to provide a better economic unit for the more intensive type of farming. If and when grazing again becomes more profitable than wheat growing, several difficulties

will appear. Because of the breaking up of the large holdings and the increased number of owners, it will be difficult to consolidate the small units into tracts of sufficient size to be profitable for grazing. This is not an insuperable barrier, but in addition there is the more formidable difficulty of restoring the prairie sod. "It is estimated that 10 to 40 years or more would be required to reestablish naturally a stand of buffalo and other native prairie grasses after they have been completely killed out; and a year or two of cultivation will kill them."⁶ The situation is much the same in western Texas, where, during the recent slump in the cattle industry, vast tracts have been planted to cotton. The problem of reestablishment, should it arise, will be just as difficult.

The farmer's decisions to curtail or expand output must be made many months in advance of the marketing of his products. His decision as to the acreage to be planted almost completely determines his program of operation for the remainder of the crop year. This necessity of making a decision at one particular time which shall control for a whole year introduces an element of inelasticity into his program. Not only does it make it impossible for him to base his decision on price facts which may develop during a period of some months before the

⁶Grimes, W. E., "Some Phases of the Hard Winter Wheat Grower's Problem in Readjustment." *Journal of Farm Economics*, April, 1925, Vol. VII, p. 201.

harvest, but it discourages him from making an adjustment to the price facts which he does have at planting time. Any adjustment of his operations to the price situation must be based not on the price as it will be when the crop comes on the market, but on a forecast of price conditions many months in advance, or on the price realized for the preceding year's crop. To be sure, in the case of a few crops the futures market makes it possible for the farmer to sell part of his crop in advance of planting, but if he sells any considerable proportion this way he takes the risk that a crop failure will make it impossible for him to deliver as much as he has sold, except by buying it in the market. So little use is made of future selling against planting operations that this device may be regarded as of no importance. Practically, an attempt to expand and contract acreage in accordance with prices means in accordance with *anticipated* prices. The anticipations are based chiefly on prices at the time of planting and at the time when the preceding crop was sold.

The effect of these factors, and perhaps of others, upon the responsiveness of acreage changes to price fluctuations is shown in the accompanying table of coefficients of correlation. Changes of prices were correlated with the changes in acreage the following year. For only two crops, cotton and flax, was a significant coefficient obtained.⁷

⁷The size of the probable error in the case of flax makes the

CORRELATION BETWEEN CHANGES IN PRICES AND ACREAGE THE FOLLOWING YEAR*

Crops	Correlation Coefficient	Probable Error	Period Covered
Potatoes	+ .21	±.110	1879-1913
Corn	+ .223	±.105	1879-1916
Oats	+ .02186	±.111	"
Barley	+ .0517	±.1106	"
Rye	+ .243	±.1044	"
Sweet Potatoes	- .2724	±.1615	1901-1916
Hay	- .1193	±.1093	1879-1916
Tobacco	- .0675	±.1733	1901-1916
Flax	+ .4216	±.1540	1903-1916
Cotton.....	+ .62	±.08	1883-1913

* From Black, J. D., "Elasticity of Supply of Farm Products," *Journal of Farm Economics*, April, 1924; Vol. VI, p. 152. Coefficients computed by Holbrook Working.

The production of some farm products shows a definite response to price changes. In spite of the difficulties which we have enumerated, farmers do try to adjust their activities so as to take advantage of favorable prices and avoid adverse situations. In certain lines of farm production, therefore, we find that an increase in price is apt to be followed by an expansion of production, and a decrease in price by a contraction in output.

A few of the clearest cases of the influence of price changes are to be found in the production of

coefficient of + .4216 of doubtful significance, but unpublished studies of the Bureau of Agricultural Economics show very significant correlations between flax prices and flax acreage, when the effects of wheat prices are eliminated. Particularly noteworthy is the result of two successive years of high flax prices in stimulating the planting of flax. (Information obtained through the courtesy of M. B. Ezekiel and L. H. Bean.)

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potatoes, cabbage, cotton, hogs, and dairy products. The accompanying data on the changes in the price of cabbage in New York and the subsequent changes in the commercial acreage illustrate the tendency. In every year the acreage declined when the previous year's price had been low, and increased when it had been high.

COMPARISON BETWEEN CABBAGE PRICE CHANGES AND ACREAGE THE FOLLOWING YEAR *

	Percentage change in price in New York	Percentage change in commercial acreage
1918	- 49	+ 20
1919	+ 107	- 16
1920	- 77	+ 29
1921	+ 284	- 14
1922	- 56	+ 28
1923	+ 32	- 22
1924	- 35	+ 5

* Data from *Farm Economics*, Cornell University, Ithaca, N. Y., March 21, 1925, p. 251.

This same tendency in cotton, corn, wheat, and hog production is discussed in detail in Part II. Here it will be sufficient to say that of the four lines mentioned, cotton and hog production show the greatest response to price changes. In the case of wheat, the spring acreage shows more definite response to previous prices than that sown in the fall. The corn acreage, at least in its short-time changes, shows relatively little response to changes in the price.

Butter production reflects very definitely the ratio

of the price of butter to the cost of feed.⁸ This response is accomplished partly by diverting milk to the churn from the condenseries and cheese factories or *vice versa*, and partly by changes in the number of cows milked and in the way they are fed. Variations in the price of milk similarly offset changes in milk production, the variations in the milk supply arising in much the same way as the variations in the butter supply.⁹

In the lines where considerable responsiveness to price exists, there is a tendency to develop production cycles. This arises from the high inverse relationship, pointed out in Chapter II, between the price of farm products and the supply, the latter consisting mainly of the current production. Thus, if a high price stimulates production to a high level the resulting large supply depresses the price which, in turn, discourages production. When the output is then contracted the price tends to rise and starts the cycle on another round. The length of these

⁸ See a chart showing this relationship for the five years ending with 1924 in *Crops and Markets*, Monthly Supplement, for February, 1926, p. 61. The following comment accompanies it: "The chart shows for the last five years how closely changes in butter production in December and January have corresponded to changes in the profitability of butter production, as measured by the relation of fall butter prices to feed costs. In 1921, for example, when the relative price of butter in October and November was 136 per cent of that of the previous year, the quantity of butter made during December and January was 130.2 per cent of that made during the same months of the previous year."

⁹ For two short articles by Leland Spencer on the effect of changes in the purchasing power of milk on the production in the New York milk-shipping area see *Farm Economics*, Cornell University, Nov. 5, 1925, pp. 358-360, and Feb. 6, 1926, pp. 399-401.

cycles depends upon the time it takes to change a condition of large supplies to one of low supplies. These ups and downs of price and production generate each other, but very frequently other factors lengthen, shorten, or otherwise modify them.

Of the farm products treated in detail in Chapters VII to IX, two have distinct cycles. These are cotton and hogs. The cotton cycle is normally two years in length. A large crop is usually accompanied by a relatively low price. This tends to reduce the acreage so much the next year that unless there is an abnormally large yield the total crop is also materially reduced. The price therefore rises again and the cycle is complete. The charts on pages 149 and 150 show a great deal of regularity in the alternation of large and small crops and acreage from 1898 to 1914. During the last decade new factors, such as the war conditions, the spread of the boll weevil, and the breaking up of the cattle ranches in Texas, have destroyed the regularity of the cycles.

The cabbage data given on page 35 show a definite two-year cycle. In the case of most other annual crops such as corn, oats, barley, rye, and tobacco, there is little evidence of such cyclical tendencies. Crops requiring more than a year to come to maturity or into bearing necessarily have longer cycles. The number of apple trees in the United States increased from 1890 to 1900, but since the

latter date has declined. Peach, pear, plum, and prune trees have shown similar tendencies.¹⁰

The length of the cycles of livestock production varies with the class of animals. The main factor determining the length is undoubtedly the time required to bring the animal to the age of maximum usefulness. Thus the horse and beef cattle cycles are longer than those of sheep and hogs. This is not an absolute test, however, since the egg cycles appear to be of about the same length as those of sheep. The accompanying table shows the variations in the different cycles. A detailed discussion of this feature of hog production is given in Chapter VIII.

CYCLES OF LIVESTOCK PRICES *

Commodity	Number of years included	Average period	Length of Period from Low to High or High to Low	Character of the Curves
Horses	46	11 years	10-14 years	Regular
Beef cattle	48	8 years	6-10 years	Very regular
Sheep	49	4.5 years	3-6 years	Fairly regular
Eggs	51	4.5 years	3-6 years	Fairly regular
Hogs	63	32 months	15-65 months	Fairly regular

* *Farm Economics*, Cornell University, April 10, 1925, p. 263.

¹⁰ See Corbett, R. B., "Some Trends in the Numbers of Fruit Trees," *Farm Economics*, Cornell University, August 15, 1925, pp. 327-330. Brief discussions of the inversely related cycles of prices and market receipts for wool, sheep, cattle, and hogs, are given in the following issues of Armour's *Monthly Letter to Animal Husbandmen*: "Cyclical Trends in the Sheep Industry," March, 1925; "Cycles in the Swine Industry," June, 1925; "Cycles in the Cattle Industry," September, 1925; and "Cycles in the Sheep Industry," October, 1925.

In many cases, the cycles are modified or obscured by other factors. This is frequently the effect of the natural forces discussed below. Sometimes a large yield more than offsets a decrease in acreage, or *vice versa*. At other times, some new development causes a temporary modification. The great post-war expansion of the Cotton Belt into the ranch country of western Texas is such an instance. The spread of the boll weevil is another type of factor causing such modification.

II. PHYSICAL FACTORS

Agricultural production, in the main, takes place in the open and therefore is dependent upon and exposed to the vagaries of sun, wind, and rain. In the primary stages, moreover, it is a biological process and thus subject to additional forces of nature. The role played by these forces in the fluctuations of agricultural output is discussed in this section.

The forces of nature are frequently more significant in affecting crop production than is human planning. These limiting factors are varied in their character. Plant diseases are very important with some crops. These include the rusts and smuts on grains, mosaic and "wild fire" on tobacco, and various kinds of rots and scabs. Of those mentioned, stem rust is probable the most important. In 1916 this rust caused a loss of approximately 180 million bushels of hard red spring wheat in the United

States. In 1918, the loss from this cause was estimated at scarcely one million bushels.¹¹ Insect pests also cause important variations in the size of crops. Some of these are the alfalfa weevil, the green bug on oats and other small grains, the European corn borer, the corn-ear worm, the chinch bug on corn and wheat, the Hessian fly on wheat, and the cotton boll weevil. Of these, the last named is the most destructive. In 1921 it was credited with destroying around 3,500,000 bales of cotton or 31 per cent of a full yield.

As a factor affecting production, however, weather is more important than any or even all of the biological forces just outlined. The variations in temperature, wind, and moisture not only influence the growth of plants directly but also indirectly through their effect on insects and plant diseases. A mild winter and a cloudy, wet summer, for instance, invariably result in great damage from the cotton boll weevil. No discussion of the direct effects of weather on crop yields should be necessary because they are well known.¹² The extent and variability of the crop losses resulting from these climatic and biological causes may be compared in the table on p. 41, which shows the range in the percentage reduction from full yield per acre as

¹¹U. S. Department of Agriculture, *Yearbook*, 1921, p. 110. These estimates do not check closely with the estimate of percentage reduction from full yield for various causes, shown in the table on page 41 of this book.

¹²See, however, the article "Weather and Agriculture," *Yearbook*, U. S. Department of Agriculture, 1924, pp. 457-558.

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estimated by the Department of Agriculture. Except in the case of cotton, climatic causes are responsible for the greatest part of the variations in production shown in the table.

RANGE OF CROP LOSSES BY CAUSES AND RANGE OF TOTAL YIELD OF CERTAIN CROPS, 1909-24*

Crop	Range of Crop Losses (percent)			Range of Yield per Acre (millions of bushels)
	Climatic Causes	Plant Diseases	Insect Pests	
Corn	11.3-35.4	1-6	1.4- 4.8	23.1- 31.5
Wheat	13.0-14.4	3-12.5	7- 4.6	12.2- 17.0
Oats	12.9-35.4	8- 5.2	4- 2.2	23.7- 37.8
Apples	15.2-57.7	.8- 5.8	1.9- 5.2	9.9- 25.3 ^a
Barley	8.0-40.7	2- 8.5	2- 4.3	20.9- 32.0
Hay	8.6-31.9	0-2	3- 1.0	1.14- 1.68 ^b
Potatoes	14.0-33.3	1.3-13.0	1.7- 4.8	80.5-127.0
Cotton	13.8-29.2	2- 4.3	6.5-35.4	124.5-209.2 ^c

* From *Crops and Markets*, Monthly Supplement, U. S. Department of Agriculture, January, 1926.

^a No data available on yields per acre, but since the number of apple trees does not vary widely from year to year, most of this range is the result of changes in yield per tree or acre.

^b Tons.

^c Pounds.

The ranges of yields per acre of the same crops are given in the last column of the table. Most of these variations in the yield are the result of natural factors. The year-to-year changes in the amount of labor expended are not great enough to cause significant variations in the yield. A similar statement cannot be made with regard to the amount of fertilizer applied, as fertilizer sales do vary con-

siderably from year to year. In Georgia, for example, sales in 1913 were 1,293,000 tons; in 1915 they were only 739,000 tons. After that year sales increased again, reaching 1,004,000 tons in 1920; but in 1921 only 528,000 tons were sold.¹³ Fertilized crops, however, play a minor role in the total volume of crop production, and even in their case the natural factors are of great influence in determining the yield per acre.

These variations in yield per acre are considerably wider than those of acreage, and therefore are responsible for a greater part of the changes in production. The relative variability from year to year of the acreage and the yield of various crops, are shown by the following coefficients of variation:

VARIABILITY OF YIELD AND ACREAGE OF PRINCIPAL CROPS

Crop	Coefficients of Variation ¹	
	Yield (per cent)	Acreage (per cent)
Corn	18.54	5.14
Oats	18.38	3.85
Cotton	14.60	9.03
Barley	14.77	6.84
Potatoes	24.36	5.94
Hay	10.41	4.13

¹ Coefficients of variation of percentage changes from year to year. The coefficient of variation (the percentage which the standard deviation is of the mean) is a measure of the degree of instability of a series. If the standard deviation (the square root of the average of the squares of the deviations from the mean of the series) is equal to the mean, the coefficient of variation is 100 per cent.

¹³ *Yearbook*, U. S. Department of Agriculture, 1923, p. 1190.

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The forces of nature also affect the acreage materially in some years. This relationship is most marked in the case of winter wheat. The kind of weather in the fall and winter determines the amount of acreage that will be abandoned in the spring and planted to some other crop. The amount so abandoned during the last decade has varied from 1.1 per cent to 28.9 per cent of the planted acreage. The effect of this factor on the acreage planted to other crops is indicated by the fact that in Kansas the largest corn acreage since 1919 came in 1925, a year of high abandonment (24.8 per cent) and of the lowest wheat acreage. The smallest corn acreage occurred in 1919, when the wheat acreage was highest because very little (1.1 per cent) was abandoned.

Weather affects crop acreages in other ways. A succession of heavy rains in May and June in the Mississippi Valley delays corn planting to such an extent that emergency crops have to be substituted for a part of the corn acreage. Lack of rain in the fall or too much rain in the early spring decreases the amount of plowing done and may thus delay planting. A late frost in the spring frequently necessitates replanting with the same crop or with some emergency crop. The acreage of oats is greatly affected by the use of this crop for emergency planting.

Insect pests also play a part in limiting acreage. The depredations of the boll weevil have caused a

great decrease in the cotton area in Georgia and Alabama.¹⁴ In 1907 and in 1910 outbreaks of the green bug in Texas, Oklahoma, Kansas, and Missouri were responsible for the abandonment of at least 50 per cent of the acreage in the districts most severely affected. Growth of the alfalfa area in Idaho, Utah, Nevada, and Colorado has, to some extent, been retarded by the spread of the alfalfa weevil. The advance of the European corn borer is likely to reduce the acreage of corn in the Corn Belt unless effective control measures are perfected and employed.

Natural forces thus play a very important role in year-to-year changes in crop production. They are responsible for the bulk of the variations in the yield which cause the greater part of the changes in production. In addition, weather, insects, and diseases also affect the acreage planted. In the long-time trend of crop production, these influences are of less significance, although even here such factors as the boll weevil and the European corn borer have played or may play important parts.

Livestock production also is greatly affected by the forces of nature. As was shown above, weather, insects, and disease result in variations in the production of grain and forage. Large crops tend to

¹⁴ An interesting memorial of this fact is a monument to the boll weevil erected in Enterprise, Georgia. The reason for so honoring a presumed enemy is that it was responsible for a change in the local type of farming, from the uncertain, one-crop system of cotton farming to a more reliable, diversified system.

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stimulate livestock production and small crops to contract it. One of the clearest cases is found in the relationship between pork production and the yield of corn. Hogs are the most important outlet for corn. A big crop usually results in an increase in hog production. These larger supplies reach market in the first and second years after the big crop. This relationship is shown clearly in the accompanying table of correlation coefficients, which shows the relationship between the yield of corn and the size of the Western and Eastern hog packs from 1889 to 1913.¹⁵ The short corn crop of 1924 provides a recent specific illustration of the effect of the yield of corn on hog production. As soon as it became certain that corn was going to be scarce in

Hog Pack	Correlation of Corn Yield and Hog Pack			
	Preceding Year	Same Year	Following Year	Second Following Year
Western	+ .18	- .14	+ .42	+ .34
Eastern	+ .21	+ .08	+ .38	+ .23

the fall of 1924, large numbers of half-grown and half-fattened hogs were shipped. This hasty selling flooded the market with pork of poor quality and paved the way for a shortage in 1925 and 1926.¹⁶ The high price of corn also discouraged cattle feed-

¹⁵ Wright, Sewall, *Corn and Hog Correlations*, U. S. Department of Agriculture, Bulletin No. 1,300, January, 1925, p. 15.

¹⁶ Compare Chapter VIII.

ing operations and depressed the market for feeder cattle.

Dairy production also is greatly influenced by weather conditions. A late, rainy fall and an open winter result in a large flow of milk; while a hot, dry summer and an early winter with much snow have the opposite effect. The rather cool, damp summer in 1924, for example, was responsible in a large measure for the 4.9 per cent increase over 1923 in butter production. Drouth on the ranges likewise necessitates premature and wholesale marketing of range cattle. Epidemics of foot and mouth disease and cholera sometimes influence the rate of livestock production, though in a diminishing degree in recent years because of more effective control.

In summary, so far as short-time changes in agricultural production are concerned, the forces of nature probably play the leading role. They certainly account for the greater part of such changes in crop production, and through their effect on the supply and price of feed they exert a powerful influence on the production of livestock and livestock products.

The adjustment of agricultural production to the economic situation is a slow, ponderous, and very inexact process. This situation arises from a variety of causes. In the first place, the production period is long, especially as compared with that of most

manufacturing processes. In the case of crops it is an annual period, while in the case of livestock it is a period of several years. Consequently, a deliberate attempt to regulate output in accordance with the needs of the market must be set in motion from one to five years ahead of time, something which very few farmers are able to do with any great degree of skill. But even if farmers had the perspicacity to plan that far ahead, their efforts at adjustment would frequently be thwarted by the effects of weather, insect pests, and plant and animal diseases. These are uncontrollable factors which are just as likely to change the trend of production one way as another.

In addition to these features, the character of the farm business as a unit militates against prompt adjustment. The farmer knows from experience that there is always a market in which his staple products can be sold at some price. The smallness of his individual share in the control of production, and the lack of social machinery to secure concerted action, make it impracticable to curtail production in order to hold up the price. Moreover, the changes in type of production of which the farmer can readily avail himself are limited in number. Economic, biological, and climatic factors are very important in this respect. Even when there are alternative lines of activity, it is not always wise to reorganize the whole business, make new investments, or make changes of other kinds in order to meet a situation

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that may continue only one or two years. And sometimes, of course, it is a pure case of inertia and unwillingness to change to unaccustomed methods and enterprises.

CHAPTER IV

THE DEMAND FOR FARM PRODUCTS

So far we have examined only the supply factors which affect prices of farm products. We now need to turn our attention to the other side of the equation, namely, the demand for farm products. In this study, however, our interest is not centered in a general analysis of the demand for farm products. It is focused rather on the question: To what extent is the demand for farm products likely to vary with the changes in general industrial activity in the United States? In seeking the answer to this problem, we shall examine, first, the final consumer demand; second, the demand of manufacturers and other intermediate agents and; third, the foreign demand.

I. THE FINAL CONSUMER DEMAND

By final consumers we refer to the individuals who purchase the products in their final form over the retail counter. It was pointed out in Chapter I that the demand from this source may vary during the course of a business cycle because of changes

in the money incomes of industrial workers, these incomes increasing with the upswings of the cycles and declining soon after the downturns commence. The particular question to be answered in this connection, therefore, concerns the extent to which such income changes affect the demand for farm products.

In their final uses farm products are chiefly consumers' goods. By consumers' goods we mean commodities that are not used in the manufacturing, storing, or distributing of other goods, but are utilized directly by consumers. A machine lathe, for example, is called a producers' good because it is used in the manufacture of other goods, while a loaf of bread is known as a consumers' good since it is consumed directly by human beings.

An examination of the list of things which farmers have to sell reveals the fact that the great majority of them, when ready for final use, fall in the class of consumers' goods. Almost the entire output of wheat, rye, rice, buckwheat, tobacco, fruits, potatoes, vegetables, beef, pork, mutton, poultry, dairy products, cotton, and wool is used for human consumption either directly or after more or less processing. Of the grain and forage crops used for feeding livestock, a part is fed to meat animals which, in turn, are then transformed into human food. The remainder is fed to breeding and work stock. These of course are a type of producers' goods, but their use is largely for non-industrial pur-

poses.¹ It is obvious that the remaining fraction of the agricultural output which is used in the making of industrial equipment must be relatively small. The most important instances of such uses are flaxseed, out of which is crushed linseed oil, an important constituent of paints and varnishes; cotton, when woven into tire and other fabrics used in automobile construction and when manufactured into webbing, duck, or waste needed in certain industries; and hides, when tanned into leather used in making harness, belting, washers, and packing. Many other instances may be found where products of the farm are used in the construction of buildings, machines, tools, or other equipment of the producer type, but most of these are of minor importance.²

The demand for consumers' goods is less responsive to changes in business activity than is that for producers' goods. Hence, the fact that most farm products are consumed in the raw state or with relatively little processing has an important bearing on the responsiveness of their prices to business conditions. The demand for industrial equipment and building grows during the upswing of a cycle but drops off rapidly after the crest is reached. The

¹ According to the 1920 U. S. Census 82.1 per cent of all horses and 93.5 per cent of all mules were on farms in that year.

² Some of the numerous by-products of the meat packing plants are utilized for "productive" purposes. Such are hair and bristles for plaster and brushes; hoof, horns, and hide scraps for glue; cattle feet for neat's-foot oil; and bones for knife handles. Timber products can scarcely be considered a farm product since only a small fraction is grown on farms in conjunction with farming operations.

wide changes in the demand for such materials as steel, copper, brass, cement, lumber, tin, and so forth, resulting from this situation may be indicated by the changes in the building rate of industrial plants during the last eight years. Illustrative data are given in the table which follows.

INDEXES OF CONTRACTS AWARDED FOR INDUSTRIAL BUILDING CONSTRUCTION, NEW ORDERS RECEIVED FOR MACHINE TOOLS, AND THE MANUFACTURE OF IRON AND STEEL PRODUCTS, 1919-1925

(Base: 1919 = 100)

Calendar Year	Contracts Awarded for Industrial Building Construction ^a	New Orders for Machine Tools ^a	Manufacture of Iron and Steel Products ^b
1919	100	100	100
1920	83	77	102
1921	23	15	80
1922	43	30	104
1923	41	51	124
1924	28	36	115
1925	37	57	129

^a Based on data in *Survey of Current Business*.

^b Published currently in the *Federal Reserve Bulletin*.

Quite different from this is the character of the demand for such goods as are sold to the general public in retail stores—articles that in the main are consumers' goods. The need or desire for these is constantly recurrent and steady, and the expenditure for them does not fluctuate as widely as do income receipts. As a result, retail sales even when measured in dollars show fluctuations of less ampli-

tude than do most other series which are studied in connection with business cycles. When price changes are eliminated, the sales appear even more stable. One writer, after attempting to reduce statistics of department store sales to a physical basis, concluded that "in general, the retail trade line shows a steady volume of purchasing, with little interruption due to changing business conditions, which is thoroughly in keeping with the fact that retail trade deals directly with the consumer whose needs for clothing and other articles are only moderately affected by changes in business."³

This feature of the consumption of farm products does not by any means eliminate the possibility of fluctuations in their demand during successive phases of a business cycle. It merely indicates that the amplitude of those fluctuations is very likely to be less than in the case of materials used more extensively in the manufacture and construction of factory equipment, buildings, and other forms of producers' goods.

The consumer demand for most farm products is relatively inelastic. Of the various types of goods sold for consumption purposes, farm products, and more especially food products, are likely to be steadiest in the rate of consumption. Demand is said to be more or less elastic according as a change in price has a greater or smaller effect on the amount

³Burgess, W. Randolph, "Fluctuations in Retail and Wholesale Trade," in Persons, W. M., and others, *The Problems of Business Forecasting*, 1924, p. 48.

of goods which people will buy. A decline in income amounts to the same thing as an increase in prices since each results in a diminished purchasing power. An increase in payroll disbursements therefore, if not accompanied by an equivalent increase in prices at retail, should increase the sales of goods having an elastic demand more than the sales of those having a relatively inelastic demand and *vice versa*.

An examination of the character of farm products as a class leads to a presumption that the demand is inelastic, especially in comparison with consumers' goods of non-agricultural origin. Let us first consider food products and tobacco. There are several factors which contribute toward making the demand inelastic. The first is the fact that the consumption is regular. The desire for both food and tobacco is recurrent and the demand is therefore continuous. The force of habit is very strong. Changes in price or income affect the consumption of goods which individuals are accustomed to have less than those of things which they are not accustomed to have.⁴ How many men give up smoking or even decrease it materially because of changes in price or income?

Another factor which contributes to inelasticity in the demand for foods is the comparative rigidity of the physical and habitual needs. Food is a prime necessity of life and hence curtailment, at least in terms of energy and heat value, has very sharp

⁴ Compare Angell, James W., "Consumer Demand," *Quarterly Journal of Economics*, 1925, Vol. 39, pp. 584-611.

limitations. Food probably can be spared least of all human wants when strict economy becomes necessary. On the other hand, there is a decided upper limit to the amount which a man can or cares to eat within a given time period.

This characteristic of food expenditures may be illustrated by the budgets of families having incomes of various sizes. The table on page 56, which is representative of results obtained in many other similar studies, indicates the tendency in this respect. It shows by income groups the relative expenditure per family for food in 12,096 American white families in 92 industrial centers in 1918-19. It will be observed that the first advances in income were accompanied by a fairly sharp increase in per capita food expenditure. After the incomes reached \$1,200 per annum, however, the increases diminished rapidly, while after the \$1,800 level was reached there were no increases in food expenditure as the incomes increased, if allowance is made for the greater proportion of adults in the families with the higher incomes.

To a limited extent the increase in expenditure accompanying the first advances in income means that more food is consumed, but chiefly it means that more is being paid for the same amount of subsistence. Variety, quality, and freshness are emphasized as the consumer gains in affluence. To that extent there are changes in the demand for foodstuffs. Even in this case, however, the larger

EXPENDITURES FOR FOOD IN 12,096 AMERICAN WHITE
FAMILIES CLASSIFIED BY INCOMES, 1918-19 *

Income Group	Number of Fam- ilies	Average Num- ber of Persons in Family		Average Yearly Ex- penses for Food		
		Total	Equiv- alent Adult Males	Per Family	Per Person	Per Equiv- alent Adult Male
Under \$900	332	4.3	2.89	\$371.61	\$ 86.42	\$128.58
\$900-1200	2,423	4.5	2.98	456.16	101.37	153.07
1200-1500	3,959	4.7	3.16	515.55	109.69	163.15
1500-1800	2,730	5.0	3.36	571.75	114.35	170.16
1800-2100	1,594	5.2	3.62	626.52	120.48	173.07
2100-2500	705	5.7	4.09	711.86	124.89	174.05
2500 and over...	353	6.4	4.95	859.98	134.37	173.73
Total	12,096	4.9	3.33	\$548.50	\$111.94	\$164.71

* Data from U. S. Bureau of Labor Statistics, *Monthly Labor Review*, August, 1919, p. 118.

part of the change in the cost comes in the amount of wages, rent, and profit that is added to the price paid by the consumer. It makes a considerable difference in the cost to him whether ham is served in the dining room of a downtown hotel, sold at a delicatessen, or purchased at a chain cash-and-carry store and prepared in the home. But from the farmer's standpoint there is only a negligible difference in the demand for the raw product under these various methods of serving the consumer.

In rather a sharp contrast to these features of the demand for food products are the characteristics of the demand for non-agricultural products. Most of

the latter contribute to an elastic demand. Except for clothing, fuel, and shelter, few of them can be classed as necessities of life. Many are conveniences customary to a normal existence, but they do not have that degree of essentiality which is possessed by food products. Neither do they display the constantly recurring demand which characterizes foods. Most of them are more or less durable, a characteristic which tends to result in an irregular demand.⁵ Nor is their consumption limited as a rule by the capacity of individuals to use or enjoy them. Compare, for example, the possibilities for the expansion of the sale of household electrical appliances and jewelry with that of bread, potatoes, meat, and even cotton and woolen clothing. The market for the former class of commodities is limited only by the public purchasing power, while that for foods is limited by the stomach capacity of individuals.

While the elasticity of the demand for food products as a class is slight, there are wide variations among them. Foods that are expensive because of quality or freshness, or because they are out of sea-

⁵ Note, for example, this statement about the demand for automobiles: "The salient feature of the motor industry is the magnitude of the oscillations in demand to which it is subject. The mere fact that an automobile, with ordinary care, will last several years is a sufficient explanation of this variability. Buying of any durable article tends to come in waves rather than to be evenly distributed in time, and it is natural that very many automobiles should be sold in times of prosperity, when wages and profits are high, and few in times of depression." "The Instability of the Automobile Industry," *The Annalist*, October 23, 1925, p. 507.

son, are very likely to have a fairly elastic demand, especially if cheaper substitutes are readily available. The fresh meats, for example, appear to have a relatively elastic demand. They are expensive and can be readily replaced by cheaper cured meats or by other protein foods. Butter provides another illustration. Oleomargarine is a good substitute and usually about a third cheaper. Fresh fruits and salad materials come in this class.

The cheaper staple foods, on the other hand, are likely to be inelastic in demand. Variations in price or purchasing power are likely to affect the demand for such foods the least. Among these products are bread, potatoes, sugar, rice, dried beans and peas, cabbage, and cereal products. The elasticity of demand for milk, cheese, canned fruits, fresh vegetables, and cured meats is intermediate.

Statistical evidence bearing upon the elasticity of demand is extremely scarce, but some investigations can be cited. The Swedish labor office made an investigation of the effect of the increase in prices upon the diet during the early years of the World War.⁶ Data were secured from 601 families in 25 Swedish cities on the food consumption during May, 1914, and May, 1916. During those periods prices of foodstuffs rose rapidly, but the income per adult of 15 or more years of age increased only from 10.67

⁶ *Livsmedelsförbrukningen inom mindre bemedlade hushåll åren 1914 och 1916 av k. socialtyrelsen*, Stockholm, 1917, summarized in U. S. Bureau of Labor Statistics, *Monthly Labor Review*, May, 1918, Vol. III, pp. 109-112.

crowns (\$2.86) to 10.84 (\$2.91). "The results of the inquiry show that between May, 1914, and May, 1916, the tendency was to substitute cheaper for dearer articles of food, and cereals and vegetables for animal foods. There was a decreased consumption of meat, milk, butter, cheese, and eggs and an increased consumption of fish, oleomargarine, bread, flour, cereals, peas, potatoes, and sugar."⁷

A study of food budgets of working class families in Great Britain in 1920 indicated similar tendencies.⁸ The number of families tabulated, however, was only 212, and the data therefore are less representative. There is very little material available to permit the study of the effect of differences in income upon food budgets in the United States. Two budgets cited by Winslow⁹ based on cost data, prepared by the New York State Factory Investigating Commission and the National Industrial Conference Board, offer limited possibilities of comparison. These show the proportion spent for various types of food in 1914 for average weekly food budgets of \$7.25 and \$5.91. These proportions are

⁷ *Ibid.*, p. 110. The influence of size of income upon the food expenditures in Sweden is also discussed by Winslow, Emma A., "Contributions from Budget Studies to the Construction of a Statistical Index of the Purchasing Power of Consumers in the United States," *Purchasing Power of the Consumer*, 1925, pp. 183-185. The effect of variations in the size of income in Sweden upon the rate of consumption of these different types of foods was found to be the same as the effect of price changes.

⁸ Winslow, Emma A., "Changes in Food Consumption Among Working Class Families," *Economica*, October, 1922, pp. 256-271.

⁹ Winslow, Emma A., *Purchasing Power of the Consumer*, p. 187.

shown below in tabular form and indicate results similar to those discussed above.

Foods	Percentage spent when total budget was:	
	\$7.25	\$5.91
Meat, fish, eggs	34.6	18.1
Milk, cheese	20.2	26.1
Bread, cereals	11.3	15.1
Vegetables, fruit	20.8	22.5
Fats	4.7	4.2
Sugar	2.7	6.4
Miscellaneous	5.6	7.6
Total	100.0	100.0

Another approach to the statistical analysis of the elasticity of the demand for farm products has been made through the construction of demand curves from statistical data. Several writers have done pioneer work in this field, but in most cases their results are not comparable with one another because of the differences of technique and because of deficiencies in the data. As far as they have gone the results are in harmony with the conclusions arrived at in the foregoing analysis, but much more work needs to be done before conclusions can safely be drawn from coefficients of elasticity computed from data of prices of consumption or of production.¹⁰

The ability of consumers to substitute a cheap

¹⁰ For results of such studies see: Moore, H. L., *Economic Cycles: Their Law and Cause*, pp. 82-84; Schultz, H. L., "The Statistical Law of Demand as Illustrated by the Demand for

food for a more expensive one, and *vice versa*, operates to increase the elasticity of the demand for particular foods. It does not, however, affect the elasticity of the demand for food as a whole or for certain classes of food. The demand for breadstuffs as a group is clearly inelastic, but the ability to use either rye or wheat or even other grains tends to increase the elasticity of the demand for particular grains.¹¹

When we turn to products other than foods, we may expect to find greater elasticity of demand. Chief among these are the fibre crops and hides. Hides are purchased by consumers chiefly in the form of shoes, while the fibres are bought either as textiles by the yard or as ready-made clothing. The nature of these goods is such as to permit of fairly wide latitude in the amount purchased. People can get along with one pair of shoes or just a few garments, but they can also have a pair of shoes and a dress or suit for every occasion made of appropriate

Sugar," *Journal of Political Economy*, December, 1925, Vol. 33, pp. 577-637, and "The Statistical Measurement of the Elasticity of Demand for Beef," *Journal of Farm Economics*, July, 1924, Vol. 6, pp. 254-278; Working, Holbrook, "The Statistical Determination of Demand Curves," *Quarterly Journal of Economics*, August, 1925, Vol. 39, p. 512; Lehfeldt, R. A., "The Elasticity of Demand for Wheat," *Economic Journal*, June, 1914, Vol. 24, pp. 212-217; Ezekiel, Mordecai, "Correlations with Beef Prices, 1908 to 1914," four typewritten sheets on file in library, Bureau of Agricultural Economics, U. S. Department of Agriculture; Working, E. J., "What Do Statistical Demand Curves Show?," *Quarterly Journal of Economics*, February, 1927, Vol. 41, pp. 212-235. See also Appendix B.

¹¹ Compare with the discussion of the effect of the supply of substitute products in Chapter II, pp. 15-18.

materials and with varying degrees of care. Such goods are relatively durable, moreover, so that the purchase is a postponable event. The same thing is true of the household uses of cotton and wool. The limits of the consumption of bed "linen," towels, curtains, and such materials are far apart.

The table on page 56 shows how food expenditures varied among families having incomes of various sizes. The original source from which the data were taken also shows that the expenditures per person for clothing advanced at practically the same rate as did income. This indicates an elastic demand for clothing. Among the clothing materials, however, the demand for cotton products is probably the least elastic. Cotton is the cheapest of the fibres. When the outlay for clothing increases, the added expenditures are more likely to be for silk, linen, and wool products than for more cotton goods.¹²

Many incomes do not change greatly with business cycles. The money incomes of teachers, ministers, and other professional people, retired business men and retired farmers, annuitants, public servants, and even of salaried clerks and officials in trade and in many manufacturing industries do not fluctuate as widely during business cycles as do the payroll disbursements to wage-earners. This is shown in the table on page 64 which gives the distribution of the gainfully employed in the United States in

¹²The detailed analysis of the final consumer demand in Chapter VII indicates that for cotton products the demand is moderately elastic.

1920 by occupation, together with estimates of the decline in earnings during the change from prosperity in 1920 to depression in 1921-22. The data on earnings are based on reports from over 11,000 farmers and other business proprietors from every section of the United States and every important industrial field. We find that the earnings of employees in commerce and trade, in public, professional, personal and domestic service, and in clerical occupations and hand trades declined very much less than those of employees in agriculture, manufacturing, construction, and transportation.

The stable incomes tend to flatten out the curve of total purchasing power. When prices rise, the purchases of those who receive these incomes decline and this tends to offset the increases on the part of those wage-earners and active business men whose incomes become larger. When prices fall during the depression, the positions of the stable income group and the industrial income group are reversed.

Farmers' purchases also tend to stabilize the final consumer demand. In the table on page 64 the decline in agricultural earnings was shown to be rather large. At that time earnings in agriculture and industry declined at the same time. At other times, however, this has not been the case, nor will it necessarily be the case in the future except by coincidence or when the same circumstances which affect industry also affect agriculture. In 1908 and 1914, years of industrial depression, the total value of

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DISTRIBUTION BY OCCUPATIONS OF PERSONS GAINFULLY EMPLOYED
IN 1920, AND MAXIMUM CYCLICAL DECLINE IN EARNINGS OF
EMPLOYEES IN THE DEPRESSION OF 1921

Occupation	Distribution in 1920 ^a	Maximum Cyclical Decline in Quarterly Earnings ^b
	(per cent)	(per cent)
Agriculture, forestry, and animal husbandry	26.3	19.25
Extraction of minerals	2.6	36.31
Manufacturing and mechanical industries	25.8	37.60
Building and construction	5.0	24.54
Other hand trades	—	1.02
Transportation	7.4	28.11
Trade	10.2	5.41
Public service (not elsewhere classified)	1.9	
Professional service	5.2	+4.27 ^c
Domestic and personal service	8.2	8.15
Clerical occupations	7.4	5.20 ^d

^a Census data given in *Statistical Abstract*, 1924, pp. 47-55.

^b From King, W. I., *Employment Hours and Earnings in Prosperity and Depression*, p. 104. The data show the maximum decline in earnings between any quarter in 1920 (or the first quarter in 1921) and the corresponding quarter a year later. The classification is not strictly comparable with that of the census.

^c Average of public and professional service. This is the minimum increase instead of a decline.

^d Finance only.

agricultural output actually increased.¹³ Moreover, no consistent correlation is found between changes in the relative purchasing power of non-agricultural products, and the fluctuations of industrial activity. This is shown in the table on page 66. There are wide and independent variations both between vari-

¹³ See U. S. Department of Agriculture, *Yearbook*, 1923, pp. 1144-1145, and 1924, p. 1114.

ous groups of farm products and between all groups and the volume of manufacturing. Hence, in many years, as was the case in 1914 and 1924, when wage payments drop off agricultural purchasing power may expand. At other times, as in 1915 and 1916, an advance in industrial wage payments may be partially offset by declines in agricultural purchasing power.

Variations in savings and personal debts may be further stabilizing factors. Mitchell found that "the increase or decrease of savings-bank deposits is clearly correlated with the prosperity or depression of business. In the years immediately following the major crises of 1893 and 1907 depositors drew out more money than they put in."¹⁴ If, as these findings indicate, consumers draw upon their savings during a depression for the purpose of purchasing consumption goods, this also operates to flatten out the variations in consumer demand. And if, in more extreme cases, debts for consumption purposes are contracted or even charity accepted during the period of reduced incomes, the effect is the same. It is impossible to determine, however, to what extent these factors actually influence the demand.

II. THE DEMAND OF INTERMEDIATE AGENCIES

In the long run, of course, it is the variations in consumers' demand which, together with changes

¹⁴ *Business Cycles*, 1913, p. 390.

INDUSTRIAL ACTIVITY COMPARED WITH THE RELATIVE PURCHASING POWER OF FARM PRODUCTS BY GROUPS, 1910-1925

Year	Index of manufacturing ^a	Purchasing Power of Farm Products ^b						
		All Groups	Grains	Fruits and Vegetables	Meat Animals	Dairy and Poultry Products	Cotton and Cotton Seed	Unclassified
1910	101	101	102	89	101	99	111	100
1911	93	99	100	111	91	100	105	108
1912	102	99	105	109	95	102	86	106
1913	102	95	88	88	103	96	93	90
1914	91	105	106	102	115	104	87	97
1915	98	99	119	82	103	98	77	94
1916	112	85	91	89	86	76	86	72
1917	109	97	119	111	95	73	103	71
1918	104	107	121	86	108	86	130	84
1919	98	105	116	95	104	91	124	81
1920	101	85	96	103	72	82	103	63
1921	76	69	67	88	65	90	60	54
1922	99	74	62	90	67	80	93	56
1923	113	79	66	79	62	86	126	64
1924	102	83	80	77	68	85	131	62

^a Matthews, Ada M., "The Physical Volume of Production in the United States for 1924," *Review of Economic Statistics*, July, 1925, Vol. VII, p. 208. Normal = 100.

^b U. S. Department of Agriculture, *The Agricultural Situation*, June, 1925. (Base: August, 1909, to July, 1914 = 100.) Purchasing power computed by dividing an index of agricultural prices by the Bureau of Labor Statistics index of prices of non-agricultural commodities.

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in supply, determine the course of prices. But as a rule the farmer does not sell directly to the consumer; he sells instead to a dealer or a manufacturer. Following the first sale, there usually are many intermediate steps of assembling, grading, storing, manufacturing, processing, and packing before the product is ready for final sale to the consumer. For some products the number of such steps is small, while for others they are numerous. The more steps there are, the greater obviously is the opportunity for stocks to accumulate and thereby to lead to divergences between the final consumer demand and the demand for the raw product as the farmer sells it, and the greater the opportunity for general business conditions to influence accumulations of stocks and thereby the demand for the raw materials. We therefore need to examine this phase of the demand for farm products, with particular reference, of course, to the role played by the cyclical fluctuations of industrial activity.

The middleman's demand for perishable farm products necessarily follows consumer demand closely. This arises from the fact that stocks cannot be held for any great length of time. To prevent deterioration the product must be sold to the final consumer very soon after it has been purchased from the farmer. As a result, whatever changes in consumer demand may occur are promptly reflected in the demands of the middlemen who buy directly from the producer. Among these products are fresh

garden truck such as melons, lettuce, radishes, celery, and tomatoes, and fresh fruit and berries. Except for the variations in the stocks of the canned fruits and vegetables there is no possibility that the demand for such products will respond to business cycles because of stock accumulations. The problem of canned goods is discussed below.

The variations in stocks of semi-perishables may temporarily modify the middleman's demand. Products such as potatoes, butter, cheese, cabbage, meat, lard, and apples may be stored for several months. The variations in such stocks are mainly seasonal, however. They are accumulated during the periods of heavy production and distributed when production ceases for the year or diminishes in volume. There are, however, year-to-year variations in such stocks which influence materially the prices which middlemen are willing to pay for the raw materials. Hence, although there may be no change in the consumer demand, the gradual accumulation of large stocks reduces the demand of the dealers for the farmers' output, and the latter can be sold only at lower prices.

Such variations in stocks, however, are usually not related to business cycles. They are affected by the volume of preceding and current production, by exports and domestic consumption. The variations in output, however, are as a rule much wider than those of the rate of consumption and export. The table on page 69 gives indexes of the annual

THE DEMAND FOR FARM PRODUCTS 69

production and average monthly stocks of several commodities. The wide difference between the variations in stocks of the different products indicates that the quantity of stocks accumulated in any industry depends upon the special conditions prevailing in the industry, rather than upon any common cause such as business cycles.

INDEXES OF THE AVERAGE COLD STORAGE STOCKS OF CERTAIN COMMODITIES, 1919-1925 *

(Base: 1919 = 100)

Calendar Year	Butter	Cheese	Apples	Pork and Lard	Beef	Mutton
1919	100	100	100	100	100	100
1920	89	91	123	98	66	243
1921	84	73	121	83	42	266
1922	89	74	132	70	29	40
1923	70	96	175	91	32	45
1924	109	119	180	90	34	30
1925	92	126	171	82	34	21

* Averages of stocks on first day of each month. Based on data from *Survey of Current Business*.

The case of mutton is exceptional. The stocks in storage during the last half of 1920 and the first half of 1921 were especially heavy—at the peak nearly ten times the normal amounts. This condition resulted from heavy importations of New Zealand frozen mutton diverted from an overstocked market in Europe. Frozen mutton had no established American market and the attempt to develop such a market happened to coincide with rapidly declining business activity. As a result, stor-

age stocks increased rapidly and by January, 1921, amounted to much more than a year's consumption. Drastically lower prices resulted in a rapid reduction of the stocks.¹⁵ Apparent consumption in 1921 was larger than in any other year of which we have record. But re-exports, which were very large throughout the first half of the year, accounted for the greater part of the decline in stocks.¹⁶ The excess was not all worked off till 1922, however.

The business situation may have influenced this sequence of events in either of two ways. First, the relatively good purchasing power of the United States in 1920 may have encouraged shippers of New Zealand mutton to divert their excessive holdings to this market. Second, the business reaction presumably made it necessary to reduce prices more sharply, in order to clear the stocks, than would ordinarily have been the case. We have no way to measure these influences statistically.

Perishability operates to make the rate of consumption reflect the volume of production. Differences between the two rates obviously are possible only through the accumulation of stocks and their subsequent release into the market for consumption. As has been pointed out, some com-

¹⁵ Of the 125,000,000 pounds of New Zealand lamb and mutton imported during 1920 and 1921, 57,000,000 pounds was re-exported. U. S. Department of Agriculture, *The Market Reporter*, January 14, 1922, p. 21. Compare also *ibid.*, January 8, 1921, p. 23; May 7, 1921, p. 304; June 11, 1921, p. 373; Aug. 27, 1921, p. 132.

¹⁶ The apparent consumption was probably swelled somewhat, however, by the spoilage of part of the stock of frozen meat.

modities cannot be stored for any appreciable length of time. Unless there are alternative outlets, the entire output must be consumed within the limits set by the period of storage, if loss through deterioration is to be avoided. The more perishable a product is, therefore, the closer must be the conformity between the rates of consumption and production.

This feature has an important bearing upon the fluctuations of the prices of farm products. When a given supply must be consumed within a limited period, the price must be adjusted accordingly. A large supply calls for reduced prices to attract consumers, while a short supply can be disposed of at higher prices. Wider fluctuations in prices may be expected for perishable than for non-perishable commodities. In the latter case, the speculator can choose between holding his supply until the following year when the crop may be smaller, and marking his price down to a point where it will attract buyers this year. This alternative, which the dealer in perishables does not have, operates to stabilize the price. Grain, cotton, tobacco, and canned goods come in the non-perishable class. But, except for what is canned or otherwise processed or allowed to go to waste, each crop of potatoes, apples, peaches, and other fruits and vegetables must be forced into consumption by price adjustments within a year or less after it has been produced. This is also true of dairy products and even of live hogs and sheep. When the marketable

weight is reached, the most profitable thing for the farmer to do is to dispose of these animals, at least within a few months, regardless of probable future price changes.

The elasticity of the demand affects the extent of the price adjustments which are necessary to move the products into consumers' hands. When the demand is elastic a large supply can be disposed of at a smaller reduction in price than when the demand is inelastic. Comparable data to illustrate the effects of these varying combinations upon the price fluctuations are practically impossible to obtain because of the fact that "other things" are never equal.

Processing makes possible longer storage periods for some perishable products. Milk may be stored in the form of butter or cheese, and as condensed, evaporated, or powdered milk. Fruits and vegetables may be pickled, canned, dried, or preserved. Some meats may be cured and held in cold storage for nearly a year. These uses provide limited alternative outlets for many of the more perishable products and permit a greater equalization of production to the consumers' wants. The canned forms, however, are the only ones which can be carried over into the next year and thus permit equalization between the annual variations in market supply.

As far as milk is concerned, the excess production in the flush season goes into butter and cheese, and to a minor extent into condensed, evaporated, and

powdered milk. While these products in the main effect only a seasonal equalization they admit of storage for periods long enough to even up, to some extent, year-to-year fluctuations in production.

No data are available showing the relative amounts of fruits or vegetables that are consumed fresh or are canned. The writer has been informed at the offices of the National Cannery Association that stocks are related mainly to the size of the pack. The custom is for canners to contract with growers for specific acreages. Aside from variations in the latter, the size of the pack is determined, therefore, by the yield. When the pack is larger than usual, there is a tendency to carry over the surplus stocks and contract for a smaller acreage the next year rather than to force the whole pack into consumption by price adjustments.

Stocks of cereals and tobacco usually are not related to business cycles. The analysis in Chapter IX shows that this is the case for wheat. The variations in stocks naturally result from changes in the volume of production, farmers' sales, consumption, and exports. None of these reflects domestic industrial activity in a marked degree. For similar reasons tobacco stocks show no signs of any influence of changes in business activity. For the feed grains the same thing is true. In the cases of wheat and tobacco consumption is affected to some extent by business cycles. Consumption of feed grains is controlled by the quantity and value of

livestock on the farms, and does not reflect the cycle.

Stocks of cotton and textiles in mill and other hands show more connection with business cycles. This is brought out in the detailed analysis in Chapter VII. Stocks of raw cotton held by mills, of print cloth, and of finished cotton goods all appear to be related to the fluctuations of general business activity. This fact operates to accentuate the effect of variations in the final consumer demand and to make the demand of those dealers who buy from farmers more responsive to general business conditions.

The effect of business cycles on the speculators' demand for farm products cannot be isolated. The variations in stocks held by manufacturers and middlemen are not the only possible causes of divergencies between the demand of the final consumers and that of the dealers who buy directly from the farmer. Many of the products of the farm have markets in which speculative trading in futures may be carried on. It is frequently suggested that influences related to business cycles affect the prices which prevail in these speculative markets.

One such influence is psychological in nature. The upswing of a cycle is usually characterized by a spirit of optimism over the business situation and a belief that prices will continue upward for some indefinite period. The downswing is similarly featured by pessimism and bearish price sentiment.

These feelings conceivably can spread from the stock exchange to the cotton, grain, and provisions markets and color the judgments of the traders. Many brokerage firms and many speculators do business in both the stock exchanges and the produce exchanges and thus provide easy means of transmitting such influences. The fact that prices of farm products having a speculative market are more highly correlated with an index of business cycles than are prices of products having only a cash market may seem to support such a belief.¹⁷ Except perhaps in the case of wheat, however, such results may be explained on other grounds, such as differences in the elasticity of consumer demand and the comparative effects of business cycles on stock accumulations.

It may also be suggested that the changes in interest rates which accompany business cycles may have some influence on the speculators' demand. The lower cost of funds resulting from low interest rates may stimulate speculative demand and *vice versa*. As has been pointed out by Owens and Hardy,¹⁸ in the speculative security market other

¹⁷ See results of correlations in Appendix C. After the influence of production was eliminated, a higher correlation with pig iron production was found for prices of cotton, hogs, and wheat than for prices of apples and potatoes. See also Dowrie's statement concerning similar results obtained by Holbrook Working in "Did Deflation Ruin the Farmer and Would Inflation Save Him?" *Journal of Farm Economics*, January, 1925, Vol. VI, p. 78.

¹⁸ Owens, Richard N., and Hardy, Charles O. *Interest Rates and Stock Speculation* (Investigations in Finance, Institute of Economics, Washington), Ch. X.

factors overshadow the variations in the cost of money as a motivating factor. If this is the case in the stock market, it must be even more true in the agricultural exchanges. In the grain, cotton, and provisions markets trading can be carried on with smaller funds than in the stock exchange. In the latter, brokers are required to finance the entire value of the securities purchased; that is, they must advance the difference between the margin put up by clients and the total cost of the stocks. This is not required in the agricultural exchanges. The only funds used are those posted as margins. Since trading can therefore be carried on with smaller funds, the rate of interest must be a still less important consideration than in the security markets.

The evidence is inconclusive. If the speculators' demand is affected by industrial conditions through either of the two channels suggested, it clearly must be a short-run influence, because in the end it must conform to the demand of consumers and exporters. Hence, the real effect, if there is any, is to widen the fluctuations of prices. Under the influence of general business optimism and cheap money, prices may be bid up higher than the fundamental supply and demand situation justifies. Sooner or later the errors are discovered and prices drop back. Or, later in the cycle, bearish business sentiment may have the opposite effect and prices may be depressed temporarily as a result.

III. THE FOREIGN DEMAND

Finally, we come to a consideration of the foreign demand for farm products. Changes in foreign demand affect the prices of some products more than others, of course, partly because there are variations in the proportions exported and partly because there are differences in the cost of ocean shipping relative to the value of the product. As was the case in our discussion of domestic demand, the question we are interested in is whether or not changes in foreign demand are likely to be correlated with domestic business cycles.

Demand changes resulting from business cycles in foreign countries are sometimes correlated with business cycles in this country. There is a tendency for the cycles in countries closely connected by trade relations to move together. Divergencies between the movements in this country and those in others have frequently occurred, usually because a minor recession and recovery in business activity in the United States occurs during a prolonged period of prosperity in other industrial countries. More often than not, however, the cycles move together.¹⁹

The variations of the foreign demand for farm

¹⁹ Compare, Thorp, W. L., *Business Annals*; Persons, W. M., Silberling, N. J., and Berridge, W. A., "An Index of British Economic Conditions," *Review of Economic Statistics*, supplement, June, 1922, Vol. IX, p. 174; Axe, Emerson Wirt, and Flinn, Harold M., "An Index of General Business Conditions for Germany, 1898-1914," *Ibid.*, October, 1925, Vol. VII, p. 273.

products resulting from the local business cycles are therefore likely to be similar to the changes accompanying business in the United States. This probability is further indicated by the high correlation between variations in the total volume of exports from the United States and the indexes of business activity (B curve) in Germany and Great Britain. These coefficients are + .643 and + .700 respectively.²⁰

Changes in the foreign demand for cereals are related to the size of crops outside the United States. Europe is the chief importer of grain. The European local crops are not large enough to meet domestic needs and imports are therefore required to supplement the home-grown supply. The quantity which is needed depends, therefore, on the size of the local crops. If crops are small, more is demanded; if large, the quantity is less. The variations in the quantity imported, however, are not in exact inverse proportion to the size of the crop, particularly in the case of wheat. After a short crop greater use is made of cheaper substitutes, and the total consumption of the more expensive cereals declines.²¹

The quantity that Europe imports from the United States depends also upon the size of the crop in other exporting countries. Large crops in other exporting countries obviously reduce the quantity

²⁰ Axe and Flinn, *ibid.*, p. 274.

²¹ Food Research Institute, *Wheat Studies*, June, 1925.

that Europe will demand from the United States.

To some extent the size of the crops of cotton in other parts of the world affects Europe's demand for American cotton. As is pointed out in Chapter VII, there is a certain amount of substitution, especially between the Indian and American crops. The effect of "outside" crops is not as great, however, on cotton as on grains, particularly wheat and rye.

As a result of the erratic fluctuations of yield, we find that in many years European demand for our products, especially for cereals, shows little relationship to domestic or even to foreign business cycles.²²

Changes in the demand in various countries are frequently compensating. A decline in demand in one country may be offset by an increase in demand in another. The result is a reduction in the variations of the total foreign demand. Fifty to sixty per cent of the American cotton crop, for example, is sold abroad. While the major portion of these exports is taken by England and leading Continental countries, the final consumption occurs all over the world, because these countries re-export it in a manufactured state. The diversity of market conditions may be illustrated by the crop-year 1912-13. Exports of manufactured cotton goods from the United

²² This of course is just another way of stating the point brought out in Chapter III that the world supply of these crops is a more important price factor than the size of the crop in a particular country.

States to China, the West Indies, and Central America declined, while those to South America and Canada increased over the previous year. The demand for raw cotton in Great Britain was strong, chiefly as a result of a brisk demand for cotton goods in India following three excellent monsoons. British trade with China was less favorable. On the Continent, however, the demand was only fair. The German demand particularly was indifferent because of unsettled conditions in the Near East.

These illustrations show not only how the changes of the demand in a particular foreign country may vary independently of business cycles in the United States, but also how they frequently operate to stabilize the total demand.

The foreign demand for farm products appears to be fairly elastic. A large proportion of the consuming population in Europe consists of people of relatively low purchasing power and standards of living. The people in many of the countries to which agricultural imports from the United States are re-exported in a manufactured form also have a limited purchasing power. As a result, a rise in prices in the United States is usually accompanied by a decline in the physical volume of exports, while a decline in prices is usually accompanied by an increase in the quantity taken. This has been particularly true of cotton and lard, and to a smaller degree of pork. In the case of wheat, the influence of low purchasing power on our export demand has

not been so evident because of the effect of changes in the available home supplies.

One of the effects of the World War has been an increase in this sensitiveness to prices. Not only have the individual consumers in many European countries been impoverished, but there has been a large increase in the balance of payments which Europe is called upon to make to the United States. These conditions set a premium on keeping the total value of purchases at a minimum.²³

The foreign demand therefore may be found sometimes to vary with business cycles in the United States and sometimes to be unrelated to them. It depends upon whether the cycles in Europe are coincident with the cycles in this country, and upon the time when wars, strikes, small and large crop yields occur. It also depends upon the distribution of such events. Usually factors leading to a low demand in some countries are partly compensated for by a favorable demand in other countries, but sometimes there is a preponderance of one kind or another. Finally, Europe as a rule can be counted upon to purchase large quantities only when prices are relatively low.

²³See Nourse, E. G., *American Agriculture and the European Market* (Investigations in Agricultural Economics, Institute of Economics, Washington), especially pp. 230-232.

CHAPTER V.

BUSINESS CYCLES AND AGRICULTURAL PRICES

WE have seen that at least the main variations of agricultural prices are independent of business cycles. This comes about through the facts: (1) that the dominant price factors are the variations in supply or production, and (2) that the volume of output is governed by natural forces and agricultural conditions rather than by the changes in demand accompanying business cycles. In Chapter IV, however, we saw that there are probably some variations in the demand for farm products resulting from changes in the rate of industrial activity. Since that is the case, we need to determine the extent to which such fluctuations in demand are reflected in agricultural prices.

The effect of business cycles on agricultural prices is considerably less than the effect of changes in supply. This may readily be seen by comparing agricultural prices with prices of commodities which are sensitive to business conditions. For the purpose of such comparison we have selected the period from 1903 to 1913. During this period there were no disturbing wars, the gold standard was firmly estab-

lished, and industrial and urban activity had definitely taken precedence over agriculture both in number of people engaged and in value of output. Hence the period seems especially well adapted to our purpose.

The charts on pages 84 and 85 show the fluctuations of the prices during this period of nine of the leading farm products.¹ The price of cotton is shown in Chapter VII and the price of wheat in Chapter IX. The chart on page 84 also shows the Harvard commodity price index of business cycles to facili-

¹ Sources of data for charts on pp. 84 and 85.

Harvard Ten-Commodity Price Index: *Review of Economic Statistics*, 1921, Vol. III, p. 369.

Tobacco: Burley, dark red, good leaf, average price per 100 pounds at Louisville, Kentucky; U. S. Department of Agriculture, *Yearbook*, 1924, p. 830. Prices not available prior to January, 1907.

Flaxseed: Average closing price per bushel at Minneapolis; U. S. Department of Agriculture, *Yearbook*, 1924, p. 646.

Oats: Number 3 white, weighted average price per bushel at Minneapolis; U. S. Department of Agriculture, *Yearbook*, 1924, p. 628.

Potatoes: "Maine" and "State and Western" average l.c.l. price to jobbers per bushel at New York; U. S. Department of Agriculture, *Yearbook*, 1924, p. 721. Prices not available for June, July, and August of each year.

Wool: Ohio, Pennsylvania and West Virginia, $\frac{3}{8}$ blood unwashed, average price per pound, Boston market; U. S. Department of Agriculture, *Yearbook*, 1924, p. 958.

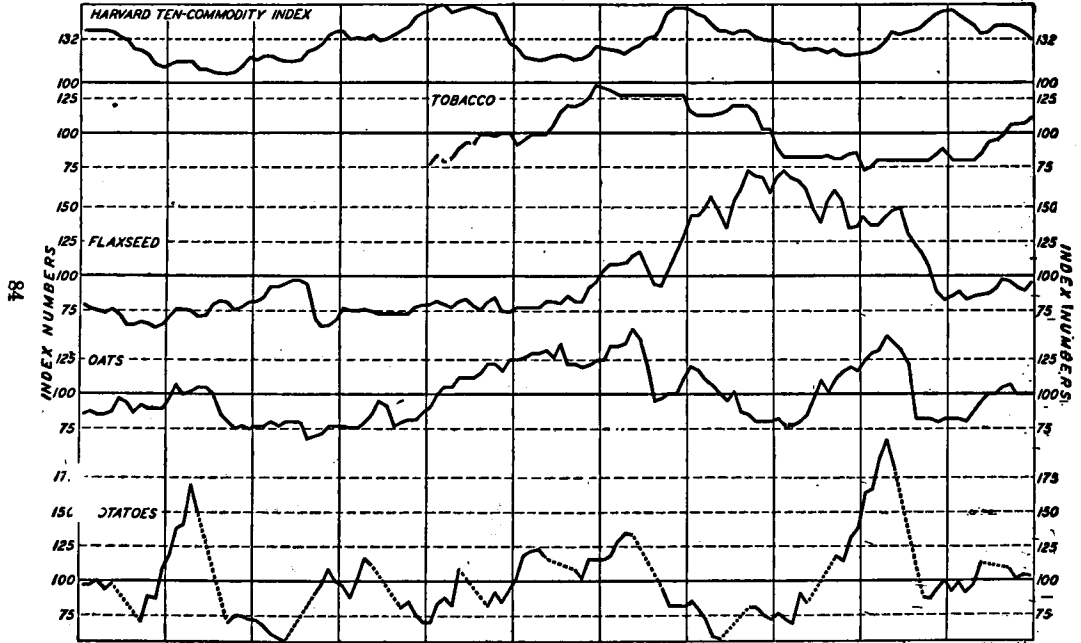
Sheep: 1903-04, aged native sheep at Chicago, average price per 100 pounds; *Drovers' Journal Yearbook*, 1925, p. 59. 1905-1913, native and western at Chicago, average price per 100 pounds; U. S. Department of Agriculture, *Yearbook*, 1924, p. 945.

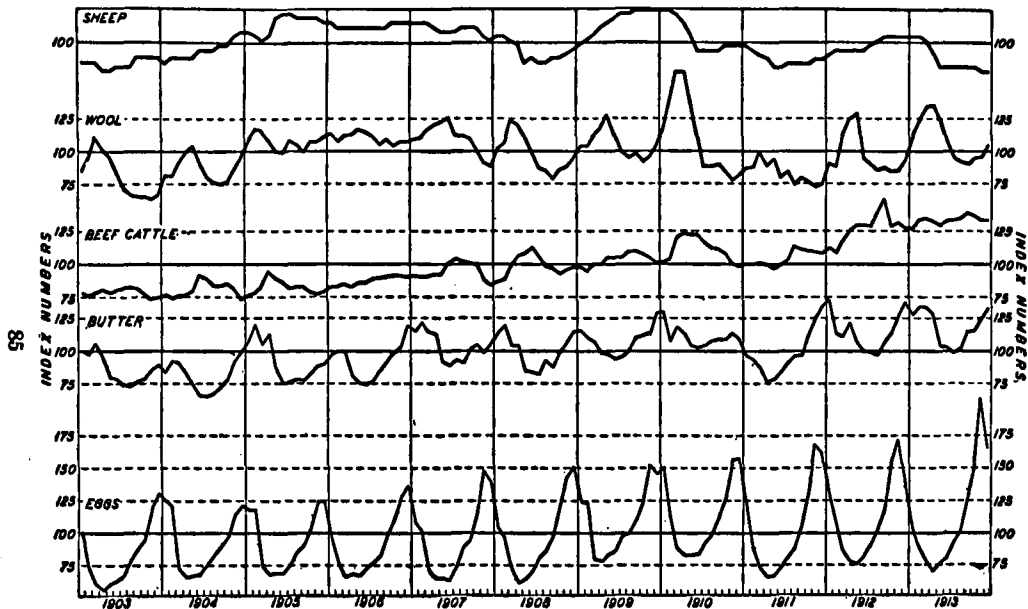
Beef Cattle: Good beef steers, monthly average price per 100 pounds at Chicago; U. S. Department of Agriculture, *Yearbook*, 1924, p. 945.

Butter: New York creamery, average wholesale price per pound; U. S. Bureau of Labor Statistics, *Wholesale Price Bulletins*.

Eggs: Fresh at New York, average wholesale price per dozen; U. S. Bureau of Labor Statistics, *Wholesale Price Bulletins*.

COMPARISON OF PRICE INDEXES OF SELECTED FARM PRODUCTS
WITH THE HARVARD TEN-COMMODITY PRICE INDEX*





* For Ten-Commodity Index, average 1890-1899 = 100; on this base average 1903-1914 = 132.3. For individual commodities average 1903-1914 = 100. For sources see note p. 83.

tate comparison of the agricultural prices with commodity prices that have been selected because of their sensitiveness to business cycles.

These charts reveal both the general independence of the fluctuations of agricultural prices as compared with business cycles and the wide variations between the products themselves. Of all the prices plotted, the price of cotton seems to reflect business conditions most closely, which squares with the results obtained in the correlations summarized in Appendix A and referred to below. Hog prices also show considerable correspondence to business cycles, but as is pointed out in Chapter VIII part of this is the result of accident. After eliminating the effect of changes in production, however, hog prices are more closely correlated with business cycles than are the prices of wheat, potatoes, or apples.

The lack of correlation between most agricultural price series and the movement of business activity was brought out, moreover, in the price analysis that preceded the construction of the Harvard commodity price index. It was found that out of 19 farm products, including butter and cheese, only three—hogs, sheep, and cotton—had fluctuations at all typical of business cycles.²

Correlation studies confirm the idea that business

²Persons, W. M. and Coyle, Eunice S., "A Commodity Price Index of Business Cycles," *Review of Economic Statistics*, Nov. 25, 1921, Vol. III, pp. 353-369.

cycles have little influence on agricultural prices. The point can best be tested by the use of coefficients of partial correlation. This is a measure of the "net" correlation between the fluctuations in two series of data after the influence of changes in one or more other independent factors has been eliminated.³ The results of such a study are given in Appendix A. This covers the prices of seven representative farm commodities: oats, corn, wheat, apples, potatoes, hogs, and cotton. One of each of the important classes of farm commodities, except dairy products, is thus included. Sufficient data are not available to make a comparable study of dairy products. The changes in the price of each of these commodities were correlated, first with the volume of production, business conditions being held constant, and second with an index of business conditions, production being held constant. Other factors affecting the prices were not considered.⁴ The coefficients indicate that only in the case of cotton does the apparent influence of the business cycle approach in magnitude the influence of the volume of production. In the case of hogs, and possibly in that of wheat, the effect of business conditions is visible, but for the other crops the correlation is hardly great enough to be significant.

³For example, partial correlation may be used to separate the influence of the amount of rainfall on crop outturn from that of variations in temperature. See Mills, F. C., *Statistical Methods*, pp. 502-513, or almost any other treatise on statistical methods.

⁴The details of the method are described and the results shown in Appendix A.

The positive correlation between agricultural price changes and domestic business cycles does not necessarily show a real causal influence of the latter.

There are several other possible explanations of this correlation. In the first place, as has been stated, factors affecting farm prices other than the volume of production and domestic business conditions were not considered in the computations. Some such factors may be related to the volume of production or to business cycles either accidentally or in a roundabout way as effects of common causes. Foreign demand, for example, has been a fairly important factor affecting the prices of many farm products. The variations in foreign demand resulting from the conditions of general business in the importing countries may fluctuate in harmony with variations in demand arising from the same cause in this country.⁵ The foreign demand for cotton has probably fluctuated with domestic business cycles more closely for this reason than that for other farm products. The foreign demand for food products is related mainly to the supplies produced at home or in other exporting countries, while that for cotton is more closely connected with the condition of the market which each particular country supplies.

Second, agriculture and industry are sometimes directly influenced by the same causes. The World War is a recent outstanding illustration. The war

⁵ Compare p. 77.

materials needed by the Allies, and at first also by the Central Powers, included both agricultural and industrial products. The demand of the countries at arms was strengthened by large extensions of government and private credit, and by sales of securities and other investments in the United States and other countries. By this means these countries were able to offer prices high enough to draw forth the munitions, military equipment, clothing, and food necessary to carry on the war. The prices of such materials as chemicals, metal products, textiles, and foodstuffs therefore rose to abnormal levels.

Third, agricultural conditions have some influence on industrial activity. Although it is not our purpose in this volume to attempt an estimate of the importance of this factor, it is obvious that it is of some significance. To the extent that an influence passes from agriculture to industry, the significance of correlation as evidence of an influence of industry on agriculture disappears.

In the light of all these considerations it is probable that changes in the volume of industrial activity in the United States from one year to the next have been a less important factor affecting agricultural prices than our correlation studies might seem to indicate. Sometimes the same conditions—foreign, governmental, or technical—have affected both agriculture and industry, and sometimes the agricultural situation has affected industry. Since the

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influence of such factors was not eliminated, their effect has been to raise the correlation coefficients above the figures which would measure the net influence of business activity on agricultural prices.

CHAPTER VI

THE VARIATIONS IN FARM EXPENSES

FARM earnings are affected by variations in the cash outlays as well as by fluctuations of the income. In the preceding chapters the discussion has centered mainly on the incidence of business cycles upon the gross income of the farmer. In Chapter I, however, it was pointed out that the cycles may further affect farm earnings through their influence on costs. Prices of things that the farmer buys are likely to rise during the upswing of the cycle and to fall during the downswing. In this chapter therefore we shall examine the fluctuations of the prices of the main items of farming costs and see to what extent they are related to the oscillations of industrial activity.

The table on page 92 indicates the important causes of cash outlay on farms in the United States. The data are averages of the reports of 16,183 owner operators for the year 1923 and of 15,103 for 1924. On the basis of this distribution it seems necessary to consider the variations in the prices of farm labor, livestock and feed, machinery and tools, materials used in making farm improvements, fertilizer and

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seeds, and the changes in interest and tax rates. Some consideration should also be given to cash rental rates since rent constitutes an important item of cash outlay for some farmers.

CASH EXPENDITURES ON FARMS IN THE UNITED STATES, 1923 AND 1924 *

Item of Expenditure	1923	1924
Hired labor	\$ 350	\$ 384
Livestock bought	240	222
Feed bought	210	248
Interest paid	230	230
Taxes on farm property	190	192
Machinery and tools	110	103
Farm improvements	140	133
Fertilizer	60	66
Seed	40	44
Miscellaneous	150	151
Total	\$1,720	\$1,773

* U. S. Department of Agriculture, *Yearbook*, 1925, p. 1,342.

I. FARM WAGES

The condition of the labor market affects the farmer's fortunes in two ways. In the first place, of course, the level of farm wages has a direct and very important influence on farm earnings. Second, the availability of a supply of labor which can be drawn upon in time of special need affects farmers' decisions as to the type and volume of production to be attempted. The effect of labor conditions on production policies, however, is more likely to show itself in the longer swings of production than

in the fluctuations from year to year. Farmers are apt to put in their usual crops in the spring and trust to luck to be able to get the help to harvest them. Some labor is hired at the beginning of the year, of course, and the cost of this presumably has some influence on production policies. It is quite likely, however, that short time variations in farm wages affect farm earnings more than they affect the volume of production. In this section we shall see to what extent changes in business conditions contribute to these variations in the supply and in the wages of farm labor.

Business cycles affect farm wages by influencing the supply of hands. During a period of reviving business activity, industrial employment increases. When the local labor supply of an industrial center is fully employed, the rising wages begin to attract outside labor from the rural districts and the nearby towns. The longer the period of business prosperity continues, the farther the pull of the urban centers is extended into the country districts. More and more young men decide against farm life in favor of a city career. The floating element of the nation's labor supply also is drawn to the urban jobs. After the crest of the boom is reached and manufacturing activity begins to decline in volume, the pay rolls are cut down and a surplus labor supply develops in the industrial centers. Farm life now appears more attractive than before and although there may be no clearly defined exodus from the

cities, the drift away from the farms becomes less marked.¹

Light may be thrown on the relationship between the farm labor supply and the volume of industrial employment by statistics from several sources, though our information is fragmentary and in considerable part indirect. Data are available from the public employment offices of several states showing the number of applicants for farm jobs during vari-

NUMBER OF MALE APPLICANTS FOR EMPLOYMENT IN AGRICULTURE
AT THE PUBLIC EMPLOYMENT OFFICES IN NEW YORK, PENN-
SYLVANIA, OHIO, ILLINOIS, AND IOWA *

Year	New York ¹	Pennsyl- vania ²	Ohio ³	Illinois ⁴	Iowa ⁵
1921 .....	....	14,314	10,399	.....	6,794
1922 .....	....	7,841	6,644	17,287	18,063
1923	8731	2,236	4,775	10,902	13,901
1924	9579	2,627	6,076	12,310	20,077
1925	8241	2,229	5,455	9,962	20,555

* All data are for calendar years except for Iowa where they are for the twelve months ending June 30 of the year indicated.

¹ Industrial Commissioner of New York, *The Industrial Bulletin*.

² Through the courtesy of Robert J. Peters, Director, Bureau of Employment, Department of Labor and Industry, Harrisburg, Pa.

³ Through the courtesy of O. W. Brach, Chief, Division of Labor Statistics, Department of Industrial Relations, Columbus, Ohio.

⁴ Illinois Department of Labor, *The Labor Bulletin*.

⁵ Iowa Bureau of Labor Statistics, *The State Free Employment Bureau*, for biennium ending June 30, 1922. Also through the courtesy of A. L. Urick, Commissioner, Bureau of Labor, Des Moines, Iowa.

¹ See Young, E. C., *The Movement of Farm Population*, Bulletin 426, Cornell University, Agricultural Experiment Station, pp. 13-14.

ous periods.² These are shown in the table on page 94. It will be noted that in the industrial states the number of applicants was largest in 1921 when the industrial depression was greatest. As industry recovered, there were fewer who wanted to go on the farms. In 1924, the increase in applicants again reflected the minor decline in industrial employment. In Iowa, however, there appeared to be no relation between industrial conditions and fluctuations in the number of the registrations for agricultural employment.

Since 1918, the United States Department of Agriculture has collected reports on the supply of farm labor on the first of every April. The table on page 96 shows the regional indexes of the supply as reported, together with an index of industrial employment for the preceding March. Except in 1926 the supply has been quite consistently lower in years when industrial employment was high, and higher when there was a slackening in industrial activity. The effect of the latter condition on the supply of farm labor has been more marked in the North Atlantic and East North Central areas which lie closer to the manufacturing centers. This was particularly true during the more recent years. The large increase in industrial employment in 1923 with a subsequent decline in 1924 and 1925 resulted in wider deviations in the available supply of farm

²Published reports of other states do not classify the applicants on the basis of kind of work wanted.

labor in the two regions referred to than in the other parts of the country.

INDEXES OF THE REGIONAL SUPPLY OF FARM LABOR AND OF INDUSTRIAL EMPLOYMENT IN THE UNITED STATES, 1918-1926

Year	Index of Industrial Employment ^a (for March)	Indexes of Farm Labor Supply ^b (As of April 1)					
		North Atlantic	South Atlantic	East North Central	West North Central	South Central	Western
1918	116.5	62	73	75	74	74	77
1919	104.0	83	82	87	86	83	90
1920	116.9	62	72	68	78	73	82
1921	83.9	92	94	95	97	94	102
1922	83.2	99	97	101	101	97	107
1923	101.8	73	83	76	89	87	91
1924	96.4	80	77	78	93	83	97
1925	92.3	87	83	90	95	89	100
1926	93.7	88	81	93 ^c	93 ^c	88	98

^a Bureau of Labor Statistics, U. S. Department of Labor, published currently in the *Monthly Labor Review*.

^b U. S. Department of Agriculture, *Yearbook*, 1923, p. 1150; *Crops and Market*, Monthly Supplements, April, 1925, p. 106, and April, 1926, p. 109. The indexes represent the supply of labor "at current wages, in comparison with the normal supply . . . at this season of the year."

^c In 1926 no separate indexes were computed for the East North Central and West North Central areas. The index number 93 represents the relative supply for the entire North Central region.

Changes in the demand for farm labor are usually independent of business cycles. Data from public employment offices shown in the table on page 97, indicate not only that the demand in terms of numbers is not correlated with industrial conditions but also that the fluctuations vary from state to state. The most important factors affecting the demand

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are the volume of agricultural production, particularly the acreage and yield of crops, and the financial returns from farming. In Kansas, for example, the demand for harvest hands in the "header territory" is estimated on the basis of the acreage of wheat to be harvested, the size of the local labor supply, the length of the straw, the date and method of harvesting, and the financial condition of the farmers.³ None of these factors is closely related to the business cycle.

NUMBER OF WORKERS CALLED FOR BY EMPLOYERS IN AGRICULTURE AT THE PUBLIC EMPLOYMENT OFFICES IN NEW YORK, PENNSYLVANIA, OHIO, ILLINOIS, AND IOWA *

Year	New York	Pennsylvania	Ohio	Illinois	Iowa
1921.....	.....	4,729	6,130	.....	5,910
1922.....	.....	3,571	5,058	13,517	11,758
1923.....	8,536	2,588	4,823	11,279	20,222
1924.....	10,394	2,040	4,195	10,659	14,313
1925.....	9,562	1,888	3,746	9,179	10,620

* All data are for calendar years except for Iowa where they apply to the twelve months ending June 30, of the year indicated. Sources are the same as for the data in the table on page 94.

The influence of prices of farm products on the demand for farm labor is indicated in the table on page 98. The fluctuations of the index of the demand on April 1 have not been as wide as those of the index of current prices of farm products but they have always been in the same direction, except in

³ Lescohier, Don D., *Conditions Affecting the Demand for Harvest Labor in the Wheat Belt*, U. S. Department of Agriculture, Bulletin No. 1,230. April, 1924.

1926. When prices of farm products decline, farmers cut down the amount of hired labor by working harder themselves, cooperating more with their neighbors, by making greater use of labor-saving equipment, and by changing to types of farming that require less labor. That farmers economize on labor when prices fall, even when labor can be had relatively cheaper, was indicated in 1921. The index number of farm wages dropped from 239 in 1920 to 150 in 1921, yet farmers hired no more labor in the latter year than before. After an extensive

INDEXES OF THE DEMAND FOR FARM LABOR AND OF PRICES OF FARM PRODUCTS IN THE UNITED STATES ON APRIL 1, 1918 TO 1926.

April first	Index of Prices of Farm Products ¹	Index of Demand for Farm Labor ²
1918	200	101.4
1919	207	101.8
1920	230	105.3
1921	115	87.5
1922	123	89.3
1923	137	94.6
1924	130	90.4
1925	147	90.7
1926	140	91.0

¹U. S. Department of Agriculture, *The Agricultural Situation*, Supplement, June, 1925, pp. 25-27 and *Crops and Markets*, Monthly Supplement, May, 1926, p. 158.

²See footnote on the supply of farm labor under the table on page 96.

study of employment in all industries during that period King states that "there is no evidence of any startling change brought about in that field (agriculture) by the business cycle. There was

apparently a slight tendency for farmers to hire fewer employees during the depression, but in corresponding quarters the number of employees diminished by only about 100,000. In the light of this evidence there is then no reason to believe that the farmers took on any considerable number of the workers whom the factories, mines, and railways laid off." ⁴

Some confirmation of our conclusion is found in studies of the sources of harvest labor, which brought out the fact that the proportion of skilled and semi-skilled workers of urban occupations found among harvest laborers was almost exactly the same in 1921 as in 1919 and 1920.⁵

The correlation between changes in farm wage rates and business cycles is low. This is brought out by a study of the data on farm wages over a long period of years. Other factors apparently have greater influence on the wages paid than the variations in the supply of farm laborers which accompany business cycles. One reason for slight responsiveness is the distance of the main agricultural areas from the largest industrial cities. Another cause for the discrepancy between changes in agricultural and in industrial wages is the fact that changes in demand and other local conditions may

⁴ National Bureau of Economic Research, *Employment, Hours and Earnings in Prosperity and Depression, United States, 1920-1922*, p. 31.

⁵ Lescobier, Don D., *Sources of Supply and Conditions of Employment of Harvest Labor in the Wheat Belt*, U. S. Department of Agriculture, Bulletin No. 1,211, May 23, 1924.

FARM WAGES, 1880-1926 *

General index of rates in the United States and actual rates in one industrial and one non-industrial state.

Year or Month	General Index of Wages (1910-14 = 100)	Wages Per Month With Board (dollars)	
		Massachusetts	Iowa
1880 or 1881	62	15.44	16.38
1881 or 1882	65	18.25	17.95
1884 or 1885	65	17.85	17.00
1887 or 1888	66	18.00	17.34
1889 or 1890	66	18.50	17.00
1891 or 1892	67	18.00	17.75
1893	67	18.55	19.46
1894	61	17.10	17.90
1895	62	17.75	18.15
1898	65	17.64	18.18
1899	68	18.32	19.32
1902	76	19.36	22.14
1906	92	22.69	24.69
1909	96	26.52	28.14
1910	97	22.75	28.00
1911	97	23.80	28.30
1912	101	24.60	29.60
1913	104	25.50	30.70
1914	101	25.00	30.10
1915	102	25.20	31.10
1916	112	30.00	34.10
1917	140	38.00	41.00
1918	176	43.00	50.00
1919	206	45.00	55.00
1920	239	55.00	66.35
1921	150	41.00	39.60
1922	146	41.00	36.80
1923	166	50.00	43.30
1924	166	.....	.....
1925	168	.....	.....
1923—Jan.	137	40.00	35.50
Apr.	148	54.00	42.00
July	169	47.50	46.24
Oct.	174	54.00	44.00
1924—Jan.	159	51.00	39.50
Apr.	163	51.00	45.90
July	168	48.00	45.80
Oct.	171	48.00	44.20
1925—Jan.	156	47.00	37.00
Apr.	163	49.00	47.00
July	170	44.00	46.25
Oct.	173	50.00	45.50
1926—Jan.	159	47.00	37.00
Apr.	166	52.00	47.25

* Data from Bureau of Agricultural Economics, U. S. Department of Agriculture; general index published in *Crops and Markets*, monthly supplement, April, 1926, p. 107.

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be greater than the changes in the supply coming from the industrial centers.

Harvest wage rates in 1923 and 1924 illustrate the latter point. During the spring of 1923, the Federal Reserve index of industrial employment, representing nearly nine million men, gradually rose, reaching a peak of 105.5 in June. During the spring of the following year it declined to a low point of 89.1 in July. The figure for June, 1924, was 92.6, which

FARM WAGES, 1900-1910*

Year	Fargo, North Dakota ¹	Power, North Dakota ²	Vermillion, South Dakota ³	Orion, Illinois ⁴	Henderson, Texas ⁵
1900....	\$20.00	\$20.00	\$18.00	\$24.00	\$10.00
1901....	20.00	20.00	19.00-20.00	24.00	10.00
1902....	21.00	20.00	22.50	27.00	10.00
1903....	21.00	22.00	22.50	26.00	10.00
1904....	23.50	22.50	25.00	25.00	12.50
1905....	23.50	25.00	22.50	27.00	12.50
1906....	23.50	25.00	25.00	30.00	12.50
1907....	32.00	25.00	27.50	33.00	15.00
1908....	32.00	27.50	27.50	32.00	15.00
1909....	32.00	27.50	30.00	32.00	20.00
1910....	32.00	35.00	30.00	35.00	20.00

* Average monthly wages, in addition to board, of regular hands in various parts of the United States as reported in Congressional Hearings.

¹ Testimony of J. H. Sheppard, Dean of the Agricultural College, Fargo, North Dakota, *Investigation Relative to Wages and Prices of Commodities*, Senate Document, No. 847, 61st Congress, 3d Session, 1911, Vol. II, p. 879.

² Testimony of T. B. Power, cattle and grain farmer, *ibid.*, p. 906.

³ Testimony of Peter W. Peterson, cattle and grain farmer, *ibid.*, p. 857.

⁴ Testimony of Daniel L. Keleher, cattle feeder, *ibid.*, p. 1020.

⁵ Testimony of T. C. Hickey, cotton planter, *ibid.*, p. 1038.

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indicated a decrease from the corresponding month in 1923 of over one million men employed. Kansas is a leading state in the employment of harvest hands, and we may therefore take her case as typical. In that state the supply of men in April was 3 per cent larger in 1924 than in 1923, which would be expected in view of declining industrial activity. But Kansas had a big crop to harvest. The acreage of small grain was 11 per cent larger and the total production, in bushels, was about 48 per cent greater than in 1923. Prices, moreover, were higher. The

FARM WAGES IN MINNESOTA, 1904-1912 *

Year	Northfield, Rice County		Marshall, Lyon County		Halstad, Norman Co.		Large Farm in North- western Minnesota	
	July	Dec.	July	Dec.	July	Dec.	July	Dec.
1904 .....	.....	.....	\$29.00	\$13.00	\$25.40	\$11.06	\$25.00	\$15.00
1905	\$25.14	\$13.14	24.86	17.14	25.00	11.66	20.33	16.50
1906	25.17	18.75	27.76	16.47	25.00	12.00	28.00	15.00
1907	29.17	17.37	27.35	22.00	27.50	8.00	30.00	13.00
1908	29.00	17.00	24.93	23.60	26.50	16.25	30.47	14.00
1909	28.33	14.50	27.75	27.33	29.50	20.00	28.00	12.50
1910	29.00	15.33	26.19	25.51	28.33	20.00	.....	.....
1911	28.23	18.66	.....	.....	27.00	17.00	.....	.....
1912	29.40	17.75	.....	.....	28.12	20.00	.....	.....

* Monthly cash wages paid by farmers on the statistical routes of the Minnesota Agricultural Experiment Station and on a large farm in northwestern Minnesota. There were from 8 to 15 farms in each of the three routes. Data for the years from 1904 to 1907 from Parker, Edward C., and Cooper, Thomas P., "The Cost of Producing Minnesota Farm Products, 1902-07," Minnesota Agricultural Experiment Station Bulletin No. 117, p. 10; for 1908-12 from Peck, F. W., "The Cost of Producing Minnesota Farm Products, 1908-12," Bulletin No. 145, p. 18.

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demand for harvest help was therefore very great, and in spite of the greater supply the average day wage at harvest time was nearly 20 per cent higher than in the previous year.

The case just cited illustrates a principle of wider applicability. At least our scanty records of the history of wages give no indication of any tendency for farm wages to reflect changes in industrial prosperity. We may first indicate the nature of the available data.

The table on page 100 shows the general index of farm wages in the United States from 1880 to 1926, prepared by the U. S. Bureau of Agricultural Economics. It also shows the actual monthly wages with board in Massachusetts, an industrial state, and in Iowa, a non-industrial state, during the same period. The Department of Agriculture began collecting quarterly figures on wage rates from all states in October, 1922. From 1909 to 1922 the data are continuously available in annual form only, and prior to 1909 there are frequent breaks in the data. The tables on pages 101 and 102 contain miscellaneous data on farm wages during the years preceding and following the business depression of 1907-8 when a break occurred in the data of the Department of Agriculture. The table on page 104 shows farm wage rates in different sections of the United States compared with an index of industrial employment during the spring of each year since 1923.

FARM WAGES ON APRIL 1ST COMPARED WITH THE VOLUME OF INDUSTRIAL EMPLOYMENT IN MARCH, 1923-1926*

(Yearly average of 1923 = 100)

Employment and Farm Wages	1923	1924	1925	1926
Industrial employment	101.8	96.4	92.3	93.7
Farm wages per month with board:				
United States	93.4	101.5	102.3	103.9
North Atlantic States	96.0	104.2	103.5	106.2
North Central States	95.9	102.7	104.0	105.1
South Atlantic States	90.5	102.7	104.1	107.3
South Central States	91.7	99.9	101.0	101.2
Western States	91.0	97.3	97.7	100.0
Farm wages per day with board:				
United States	87.6	100.0	100.0	100.6
North Atlantic States	87.7	101.5	101.2	101.2
North Central States	85.8	99.1	98.6	98.2
South Atlantic States	89.4	105.7	109.8	109.8
South Central States	88.7	100.8	101.6	102.4
Western States	87.6	92.0	88.4	92.4

* Index of industrial employment compiled by the Bureau of Labor Statistics, U. S. Department of Labor; published currently in the *Monthly Labor Review*; data on farm wages from various issues of *Crops and Markets*, monthly supplements.

In 1881 or 1882,⁶ a period of prosperity in business, the index was 65. In 1884 or 1885, a time of industrial depression, the index was still 65. Wages in both Iowa and Massachusetts declined, less in the latter than in the former. The wage index reflected the general depression in 1894 by declining from 67 in 1893 to 61 in 1894. The decrease in

⁶It is not known whether the data refer to the fall of 1881 or the spring of 1882. This applies to all cases where two years are similarly coupled together. Whichever the case may be, they are presumably comparable for successive years. See *Crops and Markets*, Monthly Supplement, July, 1925, p. 216, for detailed explanation.

Massachusetts, however, was no greater than that in Iowa. There was a small advance in wages in 1895 in conformity with the temporary revival of business in that year, and this advance was slightly greater in Massachusetts than in Iowa. The Department of Agriculture figures are too fragmentary to show what happened to farm wages during the industrial depressions of 1904 and 1908. The scattered data which we have collected (pp. 101-102), indicate no effect in either year, except that the Minnesota wage rates were distinctly lower in the summer of 1908. The smallest change, however, occurred on the farms in Rice county, which were closest to the industrial centers of St. Paul and Minneapolis.

There was a small recession of business activity in 1911 but it was not accompanied by any appreciable change in farm wages. In 1910 a sharp drop was recorded for Massachusetts. This can hardly be attributed to industrial conditions since the business recession did not get under way until the latter part of 1910. There was a general decrease of wages during the depression of 1914, but it was no greater in Massachusetts than in Iowa. The fluctuations of wages during the post-war period were very much wider in Iowa than in Massachusetts. There was no clear reflection of the decline in industrial employment in 1924 in the general index of farm wages. In Massachusetts, however, wages were below those of the previous year from

October, 1924, to July, 1925. Small declines in Iowa were shown in July, 1924, and in January, 1925.

The data given in the table on page 104 show that, whereas the volume of industrial employment declined successively in the springs of 1924 and 1925 and increased only slightly in 1926, all the regional averages of farm wages increased throughout that period. The increases were not visibly related to the proximity to industrial centers. As a matter of fact the increases of wages in the South Central and Western states from 1923 to 1926 were less than those in the North Atlantic industrial states. The rising wages appear to have reflected the gradually improving agricultural situation rather than a diminished competition of industry for labor after 1923.

In summary, it is fairly clear that the volume of industrial employment has some influence on the available supply of farm labor. This is shown both by the annual Department of Agriculture estimates of the supply on April 1 and by registrations at public employment offices in certain states. An examination of the wage data, however, indicates that these variations in supply are probably not as important a factor in wage fluctuations as are some other forces, particularly the volume and value of agricultural production. Without making an exhaustive analysis of all factors affecting the variations in farm wages, it seems certain that in the

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chief agricultural regions the oscillations of industrial employment are not of major significance in determining farm wages. Not only does the general average of farm wages exhibit considerable independence of the volume of industrial employment, but when they move together, the fluctuations are usually no wider in the industrial sections than in the agricultural regions. Although there are some variations in the amount of help which can be hired, the wage rate which farmers offer for that which is available is probably conditioned chiefly by the amount of help they need and by their capacity to pay for it.

II. LAND AND INTEREST CHARGES

The land and interest charges consist of taxes, rent, and interest payments on farm mortgages and on short-time loans. The character of the cash land charges varies with the form of tenure. The owner of an unincumbered farm has only taxes to pay. Tenants have to pay neither land taxes nor interest on mortgages, but instead pay either a cash rental or a share of the crop. In 1920, 9.1 per cent of all farmers paid cash rent, and an additional 2 per cent paid part of their rent in cash. If the farm is mortgaged, interest must be paid in addition to taxes. Nearly all farmers do some short-term borrowing on which they pay interest. We shall determine as far as possible from the data available to what ex-

tent business cycles are reflected in the fluctuations of each of these kinds of cash payments.⁷

Tax payments do not show any clear-cut response to business cycles. Data on changes in farm taxes

AN INDEX OF FARM TAXES IN OHIO, 1880-1924*
(1913 = 100)

Year	Farm Taxes in Ohio	Year	Farm Taxes in Ohio
1880	60.0	1903	74.9
1881	61.0	1904	75.2
1882	63.7	1905	77.7
1883	67.3	1906	82.6
1884	69.2	1907	84.8
1885	69.3	1908	93.7
1886	68.8	1909	95.1
1887	69.8	1910	95.2
1888	69.4	1911	86.8
1889	66.7	1912	91.9
1890	69.2	1913	100.0
1891	60.6	1914	101.3
1892	63.8	1915	131.0
1893	63.7	1916	129.1
1894	63.6	1917	130.5
1895	63.5	1918	142.0
1896	62.4	1919	169.7
1897	63.4	1920	197.4
1898	64.9	1921	215.8
1899	67.6	1922	209.9
1900	68.7	1923	217.6
1901	66.1	1924	232.4
1902	65.8		

* From Johnson, O. M., "An Index Number of Farm Taxes in Ohio, 1881-1924, inclusive," *The Bimonthly Bulletin*, Ohio Agricultural Experiment Station, Wooster, Ohio, November-December, 1925. The taxes paid in a selected rural township in each county in Ohio were obtained for the period indicated. The totals for each year thus represent the same area of land throughout.

⁷ Share rent has not been considered, as it seems obvious that it is not correlated in any important way with business cycles.

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are available for several states. Those from Ohio, which cover the longest period, are given on page 108. This index of taxes rose from 60.0 in 1880 to 69.2 in 1884. Except for some minor variations, it remained at that level until 1891, when it dropped back to 60.6. In 1892 it rose to 63.8 and continued at about that point until the latter years of the decade, when it rose, reaching 68.7 in 1900. In 1901 and 1902 small decreases again occurred, after which the index rose rapidly and continuously until 1911, when it dropped from 95.2 to 86.8 in 1912. After that it again increased rapidly, except in 1916 and 1917, to a high point of 215.8 in 1921. The 1922 taxes were slightly lower than those for the year before, but the 1923 and 1924 payments successively set new high marks. The 1924 figure was 100 points higher than that for 1917.

An analysis of these fluctuations indicates that during the early eighties they reflected rising land values; during the latter part of that decade and most of the next they reflected lower land values and lower prices in general; while since 1900 they have reflected higher land values, higher prices, and increasing costs of government. Census data summarized in the table on page 110 indicate that a peak in Ohio land values was reached shortly after 1880. The subsequent decline in value resulted in a lower assessed valuation at the decennial re-assessment in 1890. The 1891 taxes were lower, therefore, because the tax rate was not advanced

enough to compensate for the lower assessment. On account of the low prices of all commodities prevailing during that decade, no great increase in the tax rate became necessary until 1898 and 1899. The re-assessment in 1900 appears to have been downward again. Census reports show that land values had not yet started to rise. The sharp drop of taxes in 1911 resulted from the passage by the state legislature of a law limiting the tax rate to one per cent. Under the necessity of raising greater revenues, the law soon became inoperative. During the war the increase in taxes was accelerated. After prices crashed in 1920-21, only temporary relief was given in 1922.

VALUE OF FARM LAND AND BUILDINGS IN OHIO AND NEW YORK,
1870-1920 *

State	Value per acre					
	1870	1880	1890	1900	1910	1920
Ohio	\$38.85	\$45.97	\$44.96	\$42.31	\$68.62	\$113.18
New York	45.89	44.41	44.08	39.21	53.78	69.07

* *Fourteenth Census of the United States*, Vol. V, p. 58.

The increase of taxes since 1900 has reflected both rising land values and the rising cost of government. Up to 1920, at least, the latter was partly the result of the upward trend of practically all prices. In a perhaps larger measure, however, it was due to the increasing variety and extent of the services performed by the local and state governments. Road

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and school building programs played prominent roles in this respect. The expenditure on schools in all the United States, for example, doubled from 1900 to 1910, and increased 143 per cent in the next ten-year period.⁸ The high cost of government, or rather the inability to reduce the cost during the depression following 1920, arose from the rigid and inflexible character of government expenses. When governmental expenses or functions have once been established it is very difficult to do away with them. Each new bond issue creates a fixed annual payment for interest and amortization. Each additional school building means a practically permanent increase in teachers' salaries.

An index number of farm taxes in New York from 1887 to 1924 has also been published.⁹ This index reached a high point of 57 in 1889 and declined thereafter in a rather irregular fashion, reaching a low point of 41 in 1902. Land values in New York, it will be noted in the table on page 110, were very low in 1900. After 1902 the trend of the tax index was upward, reaching a maximum in 1924. The fluctuations from year to year were generally wider than in the Ohio index, but were not related to business cycles. As in Ohio some small relief was given in 1921 and 1922, but the assessments in 1923

⁸ Englund, Eric, "The Place of Taxation in a Constructive Agricultural Policy," *Journal of Farm Economics*, July, 1925, Vol. VII, p. 308.

⁹ Kendrick, M. Slade, *Farm Economics*, Cornell University, March 10, 1926, pp. 421-422.

and 1924 similarly marked new high levels. Data on taxes in Kansas from 1910 to 1923 show the same tendency during the post-war years.¹⁰

In general we find that the expanding services performed by government, the relative rigidity of the resulting costs when once established, and the effort to relate tax assessments as far as possible to current land values operate against any prompt and distinct reflection of business cycles in the fluctuations of farm taxes. Business conditions undoubtedly affect the wage and material costs of government to some extent, but it is impossible to isolate this influence in the tax indexes. Major cycles may affect land values and through them react on taxes.

Cash rental rates show little reflection of business cycles. The table on page 113 contains indexes of the average rates for 69 farms in Iowa, 27 farms in Ohio, and 12 farms in Wisconsin from 1900 to 1920. No fluctuations or variations in rates of changes which might be attributed to business cycles can be observed. In all three series there was a gradual and continuous increase in the rental rates. There was no perceptible acceleration following the industrial prosperity in 1906 and 1907, for example, nor any marked retardation following the depression of 1908, except that the increase in Wisconsin in 1907 was large compared with the advance during the next four years. The rates rose more rapidly during the war period, of course, especially in Iowa.

¹⁰ Englund, Eric, *ibid.*, p. 316.

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INDEXES OF PRICES OF FARM PRODUCTS AND OF CASH RENTS IN
IOWA, OHIO, AND WISCONSIN, 1900-1920

(Base: 1913 = 100)

Year	Prices of Farm Products ¹	Cash Rent Per Acre ²		
		Iowa 69 Farms	Ohio 27 Farms	Wisconsin 12 Farms
1900	70.4	71.5	84.0	85.8
1901	73.6	71.7	87.0	85.8
1902	81.4	72.0	86.4	86.5
1903	77.2	73.7	87.0	86.5
1904	81.1	76.5	87.2	89.5
1905	78.8	77.6	88.3	89.5
1906	80.3	79.3	90.4	91.3
1907	86.7	81.5	91.5	94.2
1908	86.5	84.3	92.0	94.8
1909	97.0	88.5	93.4	95.0
1910	103.2	91.7	98.4	96.2
1911	93.0	93.5	99.7	97.2
1912	101.3	97.2	100.3	100.0
1913	100.0	100.0	100.0	100.0
1914	102.6	107.6	100.0	105.5
1915	103.9	111.7	103.2	109.5
1916	122.8	118.9	109.8	114.5
1917	189.6	124.6	118.4	115.0
1918	218.5	138.7	122.6	118.2
1919	230.8	155.9	123.9	133.8
1920	217.9	178.0	132.4	138.8

¹ U. S. Department of Labor, Bureau of Labor Statistics, *Wholesale Prices, 1890-1924*, Bulletin No. 390, p. 8.

² Chambers, Clyde R., *Relation of Land Income to Land Value*, U. S. Department of Agriculture, Bulletin No. 1224, June 11, 1924, pp. 19-20.

Cash rents in the main reflect the long-time movement of prices of farm products. The former, however, do not fluctuate widely from year to year, as do the latter. There is a tendency to maintain the rental rate in a community or on a specific farm at a "customary figure" until an advance appears nec-

essary, and this lends a considerable degree of stability to them.

Let us now turn to the interest payments which farmers have to meet and see what influence business cycles may have on, first, the interest rate on farm mortgages and, second, the interest rate on short-time borrowings. Conclusions on these questions will be drawn with considerable difficulty, however, for several reasons. In the first place, data on such interest rates are practically limited to the post-war years. In the second place, the money market was so greatly influenced by the agricultural situation itself in 1920 and 1921 and by the balance of foreign payments since the war that it has been hard to recognize the part contributed by the volume of industrial activity in the United States. In spite of these difficulties, some inferences may be drawn as to the probable influence of the latter upon agricultural interest rates.

There are six general sources from which farmers secure mortgage loans. These are the Federal Farm Loan system, insurance companies, commercial banks and trust companies, farm mortgage companies, private investors, and state funds and state credit agencies. While the data are not complete enough to indicate clearly how these sources rank as to the annual volume of new loans made, it is likely that the order in which they have just been stated is not far from the order of importance. Banks, insurance companies, and private investors

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probably hold more old loans, but the rapid increase in the business of the Federal Farm Loan system since its organization indicates that it may now be the most important source of new loans.¹¹

The loaning rates of the Federal Farm Loan system reflect only the broader changes in the money market. Both the Federal Farm Loan Banks and the Joint Stock Land Banks secure the funds which are loaned to farmers by selling bonds in the open market. The fluctuations of the rate at which the proceeds of these bond sales are loaned to farmers are governed by the condition of the money market. That is, aside from operating expenses, the cost of money to the system determines in general the rate at which the funds can be reloaned. An examination of the variations in the cost of money and in the loaning rates, however, shows that the latter are adjusted only to the wide changes of the former. The table on page 116 shows the relationship between the loaning rates of the 12 Federal Farm Loan Banks and the average yields of 60 high grade bonds and the yield at issue of the Federal Farm Loan-bonds placed on the market from May, 1919, to June, 1925. It is evident that the yield of the latter is related to the general condition of the bond market. Both reflected the tightness of the money market in 1921, which arose from the delay in the liquidation of both agricultural and

¹¹ U. S. Department of Agriculture, "Farm Credit, Farm Insurance, and Farm Taxation," *Yearbook*, 1924, Figure 10, p. 195.

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LOANING RATES OF THE FEDERAL FARM LOAN BANKS, AND YIELDS OF FEDERAL FARM LOAN BONDS, 1919-1925

Dates When Bonds Were Issued or the Loaning Rate Was Changed	Average Yield of 60 High Grade Bonds ¹	Yield at Issue of Federal Farm Loan Bonds ²	Loaning Rate of Federal Farm Loan Banks
1919—May	5.17	4.46	5.50
1921—May	5.91	5.00	.....
June .....	.....	.....	6.00
Nov.	5.50	5.00	.....
1922—Feb.	5.13	4.81	.....
May	4.94	4.50	.....
June .....	.....	.....	5.50
Sept.	4.77	4.38	.....
1923—Jan.	4.86	4.42	.....
Apr.	5.00	4.47	.....
July	5.01	4.48	.....
Oct.	5.02	4.75	.....
1924—Jan.	4.95	4.71	.....
July	4.80	4.62	.....
1925—Jan.	4.78	4.30	.....
June	4.66	4.15	.....

¹Published by Standard Statistics Company, in *Annual Statistical Bulletin*, 1926. Consists of the average yield of 15 industrial, 15 railroad, 15 public utility, and 15 municipal bonds.

²Obtained through the courtesy of Mr. W. J. Neuland, Auditor of the Federal Farm Loan Board.

³In the fall of 1925 the St. Paul rate was reduced to 5, the Omaha rate to 5.25, and the St. Louis rate to 5 in certain territories. In January, 1926, the Louisville rate was reduced to 5.

industrial commodities. They also reflected the general advance in money rates in 1923, which developed from the increase in prices and trade activity in that year. And finally both showed a general downward trend during that seven-year period.

The Federal Farm Loan rates responded to the tightness of the money market in 1921, when the

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rate for all 12 banks was advanced in June from 5 1-2 to 6 per cent. In June, 1922, the 5 1-2 per cent rate was restored as a result of a 1-2 per cent decline in the cost of money. No further changes were made thereafter until the fall of 1925, when additional reductions were made by three banks. The loaning rates therefore were not affected by the higher money rates in 1923, when industrial activity reached a crest.

The experience in these years indicates that there is a tendency to change the loaning rates only when a new level of money costs has prevailed, or it is very evident that it is likely to prevail, for some time. The cost of funds, to the banks, was relatively high in the winter of 1923-24, and was comparatively low in the fall of 1922 and in 1925, but no change in loaning rates was made. Apparently the banks have based their loan rates on averages of the rates they pay over considerable periods.

The loaning rates of the joint-stock land banks have been even less responsive to changes in general money rates. Reports were obtained on the changes in the rates charged to farmers from 51 of the 52 banks in operation in June, 1926. Of these, the changes made by only six could be said to reflect the cyclical fluctuations of interest rates. The same rate was charged continuously from the date of their organization to the date of these reports by 32 banks. The changes of the remaining 13 were all reductions, most of them made in 1925, reflecting the general

downward trend of money rates during the past few years.

Mortgage loan rates of other loaning agencies probably do not respond closely to the condition of the money market. Fragmentary data on the average rate on new loans placed by life insurance companies indicate no close relationship with commercial conditions. The accompanying table shows the rates charged by 52 companies for the new loans placed in 1921, 1922, and 1923, and the average yield of 60 high grade bonds. These loaning rates reflected the trend of money rates rather than the year-to-year fluctuations.

MORTGAGE LOAN RATES OF INSURANCE COMPANIES, COMPARED WITH
MARKET YIELDS OF 60 HIGH GRADE BONDS

Class of Loan	1921	1922	1923
Mortgage Loans ¹	6.46	6.03	5.36
High Grade Bonds ²	5.79	4.94	4.98

¹From addresses by Lee A. Phillips in *Proceedings* of the Seventeenth Annual Meeting of the Association of Life Insurance Presidents, 1923, pp. 145-146, and by Hon. C. Petrus Peterson in *Proceedings* of the Eighteenth Annual Meeting, 1924, pp. 171-172.

²As computed by the Standard Statistics Company.

The rates charged by banks, trust companies, farm mortgage companies and individuals do not fluctuate widely. There is a tendency to charge a customary rate, which does not change in response to moderate changes in the rates charged in larger cities. Money that cannot be placed on acceptable mortgages at that rate is sent to larger cities for investment. The

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Federal Farm Loan system probably has affected the rates charged by the other agencies, and therefore may be operating to introduce fluctuations in the loaning rates of the latter. No data are yet available, however, from which to draw any conclusions on that point.

The rates on short-time agricultural credit are not markedly sensitive to the fluctuations of general money rates. The best available evidence as to the variations of the rates for such credit is found in data on rates charged to customers by member banks of the Federal Reserve system in cities and towns having a population of 15,000 or less.

The table on page 120 shows, first, the average condition of the market for choice, double name, 60-90 day commercial paper in New York City from 1921 to 1925. Then are given the average rediscount rates of the Reserve Banks and the average rates charged customers by member banks in the smaller towns in three agricultural Federal Reserve Bank districts—Minneapolis, Kansas City, and Dallas. These averages represent only the paper rediscounted by the Federal Reserve Banks, and therefore do not cover all loans made by the member banks. The averages, moreover, reflect the time when the paper was rediscounted rather than when the loans were actually made, since banks do not always send their paper in to be rediscounted immediately after receiving it. The date of rediscount may be a month or two after the date of the

notes. In spite of these difficulties, the data should give some indication of the character of the fluctuations in customers' rates, although the period covered is brief.

AVERAGE INTEREST RATES CHARGED CUSTOMERS BY BANKS IN SMALL TOWNS, DISCOUNT RATES OF FEDERAL RESERVE BANKS IN CORRESPONDING DISTRICTS, AND INTEREST RATES IN NEW YORK, 1921-1925

Year	Average Rate on 60-90 Day Paper in New York ^a	Minneapolis F. R. District		Kansas City F. R. District		Dallas F. R. District	
		Average Rediscount Rate ^b	Customers' Rate in Small Towns ^c	Average Rediscount Rate ^b	Customers' Rate in Small Towns ^c	Average Rediscount Rate ^b	Customers' Rate in Small Towns ^c
	per cent	per cent	per cent	per cent	per cent	per cent	per cent
1921 ..	6.53	6.35	8.74	6.14	8.92	6.01	9.69
1922 ..	4.43	4.85	8.98	4.79	8.80	4.86	9.75
1923 ..	4.98	4.50	8.87	4.50	8.61	4.50	9.72
1924 ..	3.91	4.45	8.61	4.40	8.55	4.34	9.82
1925 ..	4.03	4.00	8.16	4.00	8.30	4.00	8.34

^a Standard Statistics Company, *Annual Statistical Bulletin*, 1926, p. 8.

^b Federal Reserve Board, *Tenth Annual Report*, p. 65, and *Twelfth Annual Report*, p. 39.

^c *Federal Reserve Bulletin*, February, 1926, p. 105.

The customers' rates are very stable. There has been practically no reflection of the year-to-year changes either in the condition of the money market in New York City or in the discount rate of the district Federal Reserve Bank. Customers' rates, however, do show a downward tendency during the whole five-year period, and to that extent respond to the easier credit situation that has pre-

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vailed since 1921. These figures indicate, therefore, that the rates on short-time loans to farmers by commercial banks are not materially affected by cyclical fluctuations in the volume of industrial activity or the related condition of the money market. The same conclusion undoubtedly holds with respect to the loans rediscounted with the Federal Intermediate Credit Banks. While their rediscount rates reflect the cost of money to some extent, as is shown in table on page 122, the customers' rates do not necessarily respond to them.

The rates on the direct loans made by the Federal Intermediate Credit Banks to cooperative marketing associations, however, are more closely related to the conditions of the money market. The table on page 122 shows the changes in the rate on such commodity loans and also in the rediscount rate since the date of organization in the summer of 1923. The rates on commodity loans especially have responded fairly closely to changes in the rates they have paid on their debentures, although with considerable lag. Short-term money rates turned downward in the late fall of 1923, but loaning rates were not reduced until the following August. Money rates started upward in the latter part of 1924, but the Federal Intermediate Credit rate on direct loans was not advanced until November, 1925.

FEDERAL INTERMEDIATE CREDIT BANK RATES

Period	Rediscounts	Commodity Loans
	per cent	per cent
From Organization to August 20, 1924..	5½	5½
August 20, 1924 to November 6, 1925...	5	4½
November 6, 1925 to May, 1926.....	5*	5

*In January, 1926, the Bank at Columbia, South Carolina, raised the rediscount rate to 5¼ per cent.

III. LIVESTOCK, FEED, AND SEED EXPENSES

Payments for livestock, feed, and seed constitute 29 per cent of the total expenses shown on page 92. Their composition varies considerably with the region and the type of farming. The livestock purchases may consist of work stock, breeding stock, young animals to be used later as foundation or fattening stock, or feeder stock which will be fattened and sold again within a fairly short period. The feed bought in most sections is largely concentrates, including mill feeds and cottonseed and linseed products. The South buys considerable grain, especially corn, from the Northern states. Many farmers occasionally buy grain, hay, and even silage from their neighbors.

The fluctuations of these items of expense depend upon agricultural rather than upon business conditions. In each case the physical amounts bought depend upon the volume of production which farmers are planning to turn out. Both the number of

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livestock and the quantity of feed purchased are chiefly influenced by current and anticipated agricultural price relationships. The purchases of feeder cattle by Corn Belt farmers are determined largely by the prices of corn, concentrates, and hay, and by the spread between the cost of feeders and the expected price of finished cattle. The purchase of breeding stock similarly is largely conditioned by prospective prices. The quantity of feed bought is also affected by the weather, especially in the winter.

As was pointed out in Chapter II, the prices of both livestock and the farm-grown feeds depend chiefly on supply conditions. General business activity plays a minor rôle as a price factor. The same holds for mill feeds¹² and concentrated by-products, such as cottonseed meal and cake, linseed meal, and tankage. The supply and demand factors are chiefly of agricultural origin.

Seed prices similarly depend upon the quantity

¹²A detailed study of the factors that affect the prices of mill feeds has been made by John J. Scanlan and published in a series of articles in the *Northwestern Miller*. The following summary of his findings appeared with the first article, "The Importance of Mill Feeds," in the issue of May 5, 1926, p. 455: "The following factors, measurably or appreciably, affect prices of Minneapolis wheat mill feeds: (1) The price level of farm products; very important during the war period; (2) The United States production of wheat offal feeds, seasonal effect of production being greater than yearly effect; (3) The price and production of competing feeds; (4) The prices of the end-products, other than as reflected in the farm products price level. Other factors which may, and probably do . . . affect prices, but for which no definite relationship has been found, are prices of wheat and flour, freight rates, imports and exports, speculation, shortage of cars, and foreign trade conditions."

and quality of the available seed, and in determining this the weather at the preceding harvest time is the most important factor.

IV. FARM IMPROVEMENTS, MACHINERY, AND EQUIPMENT

Because of the nature of the costs of farm improvements, machinery, and equipment one might anticipate finding in them a considerable sensitiveness to business cycles. The reason is that most of the materials entering into the construction of these items play an important rôle in the variations of industrial activity. A prominent feature of a business boom usually is an expansion of manufacturing plants and equipment, while depressions are similarly marked by abrupt declines in such activity. This characteristic of industrial construction operates to set up alternate periods of great and small demand for building materials, with corresponding price fluctuations. The building of factories requires lumber, cement, brick, hollow tile, paint, nails, and so forth, which, if we add drain tile, are the same materials as are used in making farm improvements. The equipping of factories with machinery and tools calls for the use of steel, iron, and other metals; for paint, wood, leather, and canvas, most of which are also necessary in the manufacture of the threshing machines, grain binders, mowers, hammers, saws, cream separators, and other equip-

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ment which farmers need. In view of such changes in the industrial demand for the component elements, a fair degree of responsiveness to business conditions might be expected in these expenses.

The available data indicate that farm purchasing power affects these costs at least as much as do business cycles. This appears to be especially true of agricultural implements and equipment, the market for which consists exclusively of farmer buyers. Statistics pieced together from scattered sources show the behavior of the prices farmers had to pay for various kinds of equipment from 1903 to 1925. For

PRICES OF FARM IMPLEMENTS AND TWINE, 1903-1909*

	1903	1904	1905	1906	1907	1908	1909
6-foot binder . . .	\$95.00	\$95.00	\$95.00	\$95.00	\$95.00	\$102.13	\$102.13
7-foot binder . . .	98.00	98.00	98.00	98.00	98.00	104.98	104.98
4½-foot binder . .	34.00	34.00	34.00	34.00	34.00	36.58	36.58
5-foot mower . . .	34.00	34.00	34.00	34.00	34.00	36.58	36.58
5-foot reaper . . .	52.00	50.00	50.00	50.00	50.00	53.68	53.68
10-foot rake . . .	19.00	19.00	19.00	19.00	19.00	20.40	20.40
Corn binder . . .	95.00	95.00	95.00	95.00	95.00	102.13	102.13
Sisal twine (per pound)	—	.10%	.10	.10	.09%	.08%	.07½
Manila twine (per pound) .	—	.12%	.12%	.12	.12%	.11%	.10

* Cash prices f.o.b. Chicago charged by the International Harvester Company to its agents. *Investigation Relative to Wages and Prices of Commodities*, Senate Document No. 847, 61st Congress, 3d Session, 1911, Vol. II, p. 1105.

instance, the prices of selected farming implements and binder twine charged by the International Harvester Company at Chicago from 1903 to 1909 show no reflection of the business recessions in 1904 and

1908.¹³ Fragmentary data from the other sources also indicate no changes in implement prices that appear to be related to the current rate of industrial activity during this period.¹⁴ On these two occasions the Bureau of Labor Statistics index of the prices of metals and metal products, an important element in the cost of manufacturing farm implements, declined from 99.3 in 1903 to 88.0 in 1904, and from 120.9 in 1907 to 95.0 in 1908, and to 93.1 in 1909. The total value of farm products, on the other hand, increased each year from 1903 to 1909. The indications are, therefore, that in these years farmer purchasing power was more influential in determining the selling prices of agricultural implements than were changes in the cost of metal products.

The table on page 127 shows the prices actually paid by farmers all over the United States for various kinds of supplies, including a few implements and pieces of equipment, from 1909 to 1915 and from 1920 to 1925. Of the 18 articles tabulated, the prices of only four declined during the business recession of 1911. These were rope, twine, kerosene, and barbed wire. On the basis of these data, the prices of most articles were sustained in the face of both a mild business recession and a decrease

¹³ See table on p. 125.

¹⁴ Holmes, C. L., *Wages of Farm Labor*, University of Minnesota Technical Bulletin, No. 4, Figure 6. See also *Investigation Relative to Wages and Prices of Commodities*, Senate Document No. 847, 61st Congress, 3d Session, 1911, Vol. II, pp. 864, 882, 906, 965, 976, 1023, 1029, and 1038.

INDEXES OF PRICES OF CERTAIN ARTICLES BOUGHT BY FARMERS*

(Base: Average of 1900-13 = 100)

Article	Unit	1909	1910	1911	1912	1913	1914	1915	1920	1921	1922	1923	1924	1925
Kerosene	gallon	114	94	90	95	106	101	102	181	138	130	130	125	126
Gasoline	"	100	100	100	100	98	89	101	164	132	119	114	92	108
Coffee	pound	84	90	108	116	104	98	99	163	127	131	131	182	185
Sugar	"	94	94	110	103	100	111	119	274	118	145	177	152	118
Brooms	single article	79	111	116	102	91	88	100	227	181	181	197	195	188
Fruit jars	dozen	94	101	103	102	101	95	99	161	149	148	139	134	133
Paint, mixed	gallon	88	102	111	108	94	94	107	232	181	180	178	189	194
Overalls	pair	95	98	102	104	101	103	114	301	183	187	209	216	207
Rubber boots	"	87	104	107	105	98	92	95	130	111	109	109	107	109
Shoes	"	95	95	99	103	109	110	117	238	174	162	171	168	169
Barb wire	100 pounds	97	103	100	101	99	100	114	199	169	154	166	170	164
Pitchforks	single article	100	94	95	99	111	107	116	235	197	199	194	202	207
Mowers	" "	93	95	101	102	103	98	104	185	164	163	169	175	174
Plows	" "	93	94	95	98	120	98	106	187	162	181	158	178	176
Wagons, double	" "	90	99	102	103	106	100	107	212	183	173	178	185	188
Milk cans, 10 gal. .	" "	92	104	104	106	93	94	104	238	204	192	190	190	186
Rope, hemp	pound	99	96	93	104	107	110	126	261	191	191	199	202	231
Twine, binder	"	101	92	90	105	112	110	119	196	157	127	137	140	157
Average of all relatives		94.2	98.1	101.4	103.1	102.9	99.9	108.3	210.2	162.3	159.6	163.7	166.8	167.6

* Based on prices reported by farmers all over the United States in answer to inquiries sent out in the fall of each year by the Bureau of Agricultural Economics, U. S. Department of Agriculture. These are the only items on which comparable prices are available for the whole period. The indexes for the war years have been omitted. The data were obtained through the courtesy of Charles F. Sarle, Division of Crop and Livestock Estimates.

in 1911 of the total value of farm products from 6.6 to 6.2 billions of dollars. In 1914, however, when a business recession was accompanied by generally good farm purchasing power, except in the cotton areas, this table indicates that there were some decreases in the prices farmers paid. On the other hand, the prices of farm implements quoted by the International Harvester Company did not decline in either 1914 or 1915. Of the 16 quotations for April 15 secured by the Joint Commission of Agricultural Inquiry,¹⁵ seven were higher in 1914 than in 1913 and only two were lower, and among 17 quotations secured in 1915 there were no declines and two increases. Metal prices, however, declined 15 per cent in 1914. An index based on ten of those implement quotations, together with the Bureau of Labor Statistics index of the prices of metals and metal products for the previous year, is given on page 129. In the light of these data, the decline in implement prices in 1914, if there was any at all, could not have been very large.

During the war the same index of implement prices increased rapidly, reaching a high level in 1919, with no material change in 1920 or 1921. In the years since 1921 the index of implement prices appears to have reflected both farm income and metal prices. A quarterly index of prices paid by farmers, however, indicates that such prices re-

¹⁵ *The Agricultural Crisis and Its Causes*, 67th Congress, Report 408, Part I, pp. 189-191.

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INDEXES OF IMPLEMENT PRICES AND OF METAL PRICES

Year	Implement Prices *	Metal Prices the Previous Year *
1913	100	99
1914	102	100
1915	102	85
1916	108	99
1917	134	162
1918	175	231
1919	178	187
1920	175	162
1921	176	192
1922	153	129
1923	165	122
1924	186	144
1925	175	135
1926	176	130

* *Farm Economics*, Cornell University, June, 1924, p. 139. The index of implement prices for 1925 is based on April 1 prices and for 1926 on March 1 quotations. These two figures were obtained through the courtesy of Dr. G. F. Warren of the Department of Agricultural Economics and Farm Management of Cornell University.

* Bureau of Labor Statistics index of prices of metals and metal products.

sponded mainly to the changing value of farm products. This index is given in the accompanying table. It shows that whereas metal prices declined from 1923 to 1925, implement and equipment prices rose. The gross cash income from farm sales increased each year during this period.

Nearly all the data cited thus show a very decided influence of farm purchasing power on the prices of farm implements and equipment. This influence is probably on the whole greater than the effect of business cycles on the cost of manufacture.

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The two indexes of prices of building materials given in this table are not strictly comparable, since the Bureau of Labor Statistics index contains quo-

INDEX NUMBERS OF PRICES AT WHOLESALE AND AS PAID BY FARMERS, OF BUILDING MATERIALS, METALS AND METAL PRODUCTS, AND FARM IMPLEMENTS *

Date	Wholesale Price *		Prices Paid by Farmers *	
	Building Materials	Metals and Metal Products	Building Materials	Machinery and Equipment
1923—Jan. ...	98	93	98	97
Apr. ...	107	107	101	99
July ..	100	101	101	102
Oct. ...	95	99	100	102
1924—Jan. ...	95	99	101	104
Apr. ...	95	97	99	104
July ..	88	91	99	105
Oct. ...	90	89	99	106
1925—Jan. ...	94	95	100	105
Apr. ...	91	90	100	106
July ..	89	88	102	106
Oct. ...	91	89	99	106

* Data from U. S. Bureau of Labor Statistics, and U. S. Bureau of Agricultural Economics.

* Average of January, April, July, and October, 1923 = 100.

* Average of January, April, July, and October, 1923 = 100.

These indexes are the simple average of the relatives of prices obtained by the Bureau of Agricultural Economics, United States Department of Agriculture on the following articles: Building Materials—bricks, common; boards rough, 1-inch, feet b.m.; flooring, clear, 1-inch tongue and groove, feet b.m.; 2-inch framing lumber, feet b.m.; house paint, ready mixed; lime, common lump; portland cement; roofing, composition, 3-ply; Machinery and Equipment—barbed wire, galvanized; centrifugal hand cream separator, 250-quart capacity; engines, gasoline, 3 horsepower; grain binders, 7-foot; hay rakes, 2-horse, sulky; harrowers, disk, 7-foot, single; mower, 5-foot; nails, 8d wire; pitchfork, 3 tines; plow, 2-horse walking; plow, riding, horse drawn, 2 bottom poultry netting 5 x 150 feet; wagons, double, complete; and dairy milk cans, 10-gallon.

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tations on a much larger number of materials. The latter index declined in 1924 and 1925, whereas the index of farm prices remained practically stationary. This may reflect a compromise between the effects of the rise in farm purchasing power and the decline in the general average of prices of building materials. However, it is probable that the prices paid by farmers conform to the prices paid by other users of such materials. The rural purchases normally are undoubtedly considerably smaller in volume than those for urban consumption, and for that reason farm purchasing power may be less important as a price factor.

In summary, it is very evident that the value of farm products has a great deal to do with the fluctuations of the prices of farm improvements and equipment. In the case of implements and equipment put out specifically for the farm market, the relative prosperity of agriculture has a greater effect on prices than the variations in the cost of manufacture which are associated with business cycles. In the case of materials having a market considerably wider than the farmer buyers, the influence of variations in farm prosperity is of less importance. This is probably the case with the price of building materials.

V. THE COST OF FERTILIZERS

The relationship of fertilizer prices to business conditions is significant only in those regions where

fertilizer is an important item of cost. The accompanying table shows relative expenditure per farm in the various regions of the United States in 1919, as shown by the Census.

AVERAGE AMOUNT EXPENDED FOR FERTILIZER IN 1919

Region	Dollars per Farm
New England	117
Middle Atlantic	97
East North Central	28
West North Central	6
South Atlantic	160
East South Central	24
West South Central	9
Mountain	3
Pacific	39
United States	51

Commercial fertilizers are applied in various forms and in various combinations. The application may consist of a phosphate, or a nitrate, or a potash, or some mixture of two or all of these constituents. A common mixture in certain parts of the Cotton South, for example, is one containing all three in the proportions 8-2-2. This is applied at the rate of two to three hundred pounds to the acre. But the mixtures vary so widely from place to place and from year to year that comparable prices on a mixed preparation are impossible to obtain over a period of any length. For that reason it is necessary to consider the fluctuations in the prices of the materials used in making the mixtures.

Business cycles are apparently unimportant as a

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factor in the fluctuations in the prices of fertilizers. The prices of four materials are significant. They are phosphate rock, pyrites, muriate of potash, and sodium nitrate. Of these materials the first two are produced in the United States while the other two are imported. The domestic prices of the two phosphate materials and the import values of the potash and nitrate constituents have therefore been examined. It was found that the minor price fluctuations of the four commodities have occurred quite independently of each other. The first major movement was a downward trend continuing from the early eighties to the late nineties. There was no upward movement of fertilizer prices in the latter eighties, except for phosphate rock, to correspond with the upward trend of general business indicators in that period. After 1900 the prices gradually rose, attaining their greatest height in 1908, a year of industrial depression. From that level all gradually declined until 1914 and 1915. Business activity, on the other hand, increased after 1908, reaching one high level in the spring of 1910, and another, after a mild recession, in the winter of 1912-13. The great demand for nitrates and the great decrease in potash imports from Germany were disturbing factors during and just after the war.

Investigations by the Federal Trade Commission,¹⁶ moreover, indicate that many factors affect-

¹⁶ U. S. Federal Trade Commission, *Report on the Fertilizer Industry*, August, 1916.

ing the cost of fertilizer materials is quite independent of business cycles in the United States. Potash prices before the war were fixed by the German Potash Syndicate, a protected monopoly. This monopoly was partly broken by the Treaty of Versailles, by which the potash mines in Alsace Lorraine were ceded to France. The prices of the French division, however, have followed those of the German Syndicate. The prices of the phosphate materials have been greatly influenced on the demand side by the price of cotton, and on the supply side by the tendency toward overproduction of Florida phosphate rock and of sulphuric acid. The cost of nitrogenous materials is affected chiefly by the prices of nitrate of soda and sulphate of ammonia. The prices of these two materials are fixed in the European market where the consumption is greatest. "The prices of the organic materials, such as cottonseed meal, tankage, dried blood, and fish scrap are influenced largely by domestic conditions. Cottonseed prices are especially affected by the prices of corn, with which it competes as a stock food, while the prices of tankage, dried blood, and fish scrap are especially affected by the price of cotton, upon which crop mixed fertilizers containing these materials are most extensively used." ¹⁷

¹⁷ *Ibid.*, p. 17.

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VI. GENERAL SUMMARY

In summary, we find relatively little influence of business cycles on the chief items of farming costs. There is some connection between the supply of farm labor and the volume of industrial employment, but the latter seem to play a minor role in the determination of farm wages. The prices of livestock, feed, and seed depend upon agricultural conditions almost entirely. In the case of farm implements, equipment, and materials used in making farm improvements, industrial conditions have some effect on prices. But here again agricultural purchasing power plays a very important part, particularly in the price of farm implements. Business cycles similarly appear to have little to do with the variations in the land and interest charges. This applies to taxes, cash rent, and interest rates on both mortgages and short-time loans. Finally, very little reflection of industrial conditions is found in the prices of fertilizer.

In the items of expense examined, there are variations in the apparent degree of influence of business cycles, but in no case can it be said that they are a dominant influence. They are rather a minor price factor. There are probably several reasons for this. One is that there is a tendency for all retailers to avoid price changes as much as possible. Many changes in wholesale prices are absorbed by the dealers. In the second place, agricultural purchas-

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ing power is very important as a demand factor, and prices of goods sold to farmers must necessarily be in line with their ability and desire to pay. Finally, other factors such as custom (in land rents and some interest rates), foreign conditions (in prices of fertilizers), the volume of agricultural production (in prices of feed and livestock and in demand for farm labor) are important price factors.

CHAPTER VII

BUSINESS CYCLES AND THE PRICE OF COTTON

IN the preceding chapters the analysis has been general rather than specific. Particular farm commodities have not been discussed in any detail except to illustrate certain points in the argument. In this chapter and the two which follow, the production and prices of three typical farm products will be dealt with more fully in order to show more clearly the effect of the cyclical fluctuations of business activity upon farm receipts from these products.

This chapter is devoted to cotton. Introductory material on the sources of supply, the consuming countries, the distributing processes, and the uses of cotton is given first. The price fluctuations are then analyzed, with particular reference to the volume of production and to business cycles. Finally, explanations are offered for the degree of correlation which prices are shown to have with business cycles.

I. THE COTTON INDUSTRY

As foundation material to the analysis of the effect of business cycles upon the price of cotton, two general aspects of the cotton industry will be

discussed first. One is the position of American production and consumption of cotton in the world trade. The second is a brief survey of the distributive processes of the cotton trade in the United States.

A little over half of the world's cotton supply is produced in the United States. During the 5-year pre-war period, 1909-1913, 62 per cent of the total crop was grown in this country, while for a later period, 1920-1924, the American contribution amounted to 55 per cent. The other important producing countries are India, China, and Egypt. China's crop, however, does not figure in world markets, since it is all consumed within the country.

AVERAGE COTTON PRODUCTION IN LEADING COUNTRIES BEFORE AND AFTER THE WAR*

(Thousands of bales of 500 pounds, gross weight)

Countries	Annual Average. 1909-1913	Annual Average 1920-1924
United States	13,033	10,985
British India	3,585	4,080
China	695	1,978
Egypt	1,453	1,281
Asiatic Russia	953	160
Brasil	376	543
Mexico	193	197
All others	571	801
World total	20,859	20,025

* United States Department of Agriculture, *Yearbook, 1925*, pp. 957-959.

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The American crop is very irregular in size. This irregularity is due partly to variations in acreage and partly to fluctuations in yield, caused largely by differences in weather and in injuries by the boll weevil. In the two decades prior to 1926 the crop varied in size from 8,351,393 bales in 1921 to 16,991,830 bales in 1924. The crop of 1925 amounted to 16.1 million bales and that of 1926 to 18.6 million bales. The uncertainty of yield of American cotton fields has from time to time caused the large importing countries concern on account of short crops and high prices, with the result that they have frequently taken steps (particularly the British Cotton Growing Association) to stimulate cotton production in their colonial possessions. The post-war decline in European purchasing power caused a vigorous renewal of such activities, but the large American crops of the last two years may be expected to retard further development. The table on page 138 indicates that up to 1924, at least, the world's supply has not been greatly augmented in this way. The output in India, Brazil, and other countries has increased, but this has been more than offset by decreases elsewhere.

The decline in American production prior to 1924 was the most important factor in the shrinkage of the world outturn. During four decades following the Civil War the acreage in the United States increased at the rate of about 6,000,000 acres every decade, while average yield per acre showed no

marked change. Thereafter until the World War acreage increased at a more rapid rate, but the ravages of the boll weevil and to some extent a shortage of fertilizer and labor led to a sharp decline in the yield. It was not until 1925 that any marked recovery was to be seen. In spite of a 50 per cent large average acreage, the total of the 1922, 1923, and 1924 crops was but little greater than the combined crops of 1897, 1898, and 1899.

The 1925 crop of 15,603,000 bales closely approached the 1914 level, and the 1926 crop considerably exceeded this former high-water mark. This has been accomplished, however, by a great increase of acreage. The expansion has occurred chiefly in western Texas, where unprofitable cattle ranches have been turned over to cotton production. The total area from which cotton was harvested in the United States was less than 37 millions of acres in 1914, whereas in 1926 it was 47.7 millions. Over 6 millions of this increase came in Texas. The average yield of all the Cotton Belt declined, however, from 209 pounds to the acre in 1914 to 162 pounds in 1925, and to 187 pounds in 1926.

The market for cotton is world-wide. The international trade in raw cotton among the leading countries is shown in the table on page 141. Here, again, the significance of the American crop should be noted. It provides nearly two-thirds of the world's exportable surplus of cotton. This fact shows more clearly the dependence of Europe upon

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American cotton, and suggests why the uncertainty of that crop stimulates foreign buyers to encourage cotton growing in other countries. Great Britain has always been the principal importer.

COTTON: INTERNATIONAL TRADE *

(Averages for years ending July 31, in thousands of bales of 500 pounds gross weight)

Country	Exports		Imports	
	1909-1913	1920-1924	1909-1913	1920-1924
United States	8,840	6,067	232	422
British India	2,154	2,750	57	74
Egypt	1,444	1,229	"	"
United Kingdom ..	.....	.....	4,143	2,736
Germany	221	99	2,142	1,137
France	337	119	1,440	1,167
Japan .....	.....	.....	1,405	2,057
Italy .....	.....	2	902	839
All others	438	578	2,689	2,322
Total	13,434	10,844	13,010	10,754

* U. S. Department of Agriculture, *Yearbook*, 1923, p. 805; 1924, p. 755; 1925, p. 961.

" Less than 500 bales.

From one-half to two-thirds of the American crop is sold abroad. Prior to the war the proportion exported averaged about 69 per cent. Since that time it has fallen to a little more than 50 per cent because of a decline in European purchases and an increase in American mill consumption. The table on page 142 shows the average takings of American cotton by importing countries before the war and in more recent years.

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AVERAGE ANNUAL EXPORTS OF AMERICAN COTTON BEFORE AND AFTER THE WORLD WAR *

(In thousands of bales of 500 pounds gross weight)

Country	Period ¹	
	1910-1914	1921-1925
United Kingdom	3,509	1,863
Germany	2,515	1,390
France	1,087	764
Japan	296	713
Italy	501	584
Spain	270	272
All Other Europe ...	451	533
Canada and Mexico..	175	103
All Other Countries..	36	607
Total	8,839	6,386

* U. S. Bureau of Census, *Cotton Production and Distribution, Season of 1924-25*, Bulletin 158, p. 47.

¹ Crop years ending July 31.

Let us now turn to a brief review of the organization of the cotton industry within the United States. We shall begin with the planting of the crop and trace rapidly the most significant steps in the progress of the cotton to the final consumers.

Planting. Planting begins along the Gulf about the latter part of March. In the central part of the Cotton Belt, the last two weeks in April is a common planting time, while in the northern part the season extends into the middle of May. Only a small proportion of the growers finance themselves. From 50 to 90 per cent are obliged to borrow, either to finance planting expenses and fertilizer cost or to tide them over later in the year prior to the sale of

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the crop. Their chief sources of credit are the supply stores. Banks and fertilizer dealers are also important sources.¹

Harvesting. The picking of cotton usually begins in the southern sections during the first week in August. By the third week picking is under way in practically all the Cotton Belt except the northern tier of states—North Carolina, Tennessee, and Oklahoma, where it does not begin until about September first. By the end of December the entire crop has usually been gathered, except the portion in Arkansas and Tennessee where picking continues another two weeks.

Marketing. The sale of the crop proceeds almost as rapidly as does the picking. As a rule the growers are hard pressed for cash, being under pressure to meet the obligations contracted for earlier in the season. The cotton may be bought either by a country merchant in settlement for credit previously advanced, by a country merchant as a cash transaction, or as "wagon cotton" by a local buyer or the representatives of a mill or a larger merchant. In various ways the cotton is assembled in large even-running lots by the big cotton merchants. Some moves to the ports for export; some is sold early in the season to the domestic mills; and the balance is held in storage by the cotton merchants for sale later in the season. The seasonal variations in

¹Carson, W. J., "Financing the Production and Distribution of Cotton," reprinted from the *Federal Reserve Bulletin*, 1923, p. 13.

farmer marketing, mill takings, and exports are illustrated in the table on page 145. Since 1920 the development of cooperative marketing associations in all the important cotton-growing states has resulted in bringing the marketing of well over a million bales under the direction of large-scale producer organizations. These associations have been instrumental in improving conditions of grading, financing, and storage, and in making direct arrangements with the mills for supplying them with even-running lots of cotton in quantities suited to their needs, however large. The associations have also established connections in important European trade centers through which they handle a part of the export business directly.

Manufacture. Several steps are involved in the manufacturing of cotton. The first is the spinning of the yarns. These are spun in a variety of standard counts so that manufacturers can obtain the particular fineness or coarseness needed for their special purposes. These purposes include the making of rugs and carpets, cordage and twine, tire fabric, knit goods, bags and sacks, boat sails, aeroplane wings, and the standard cotton textiles. The latter is the most important of the uses enumerated, since these textiles constitute the bulk of the clothing materials for the world's population. Some cotton yarns, of course, are mixed with silk or wool yarns during the weaving process, but by far the larger portion is woven into all-cotton materials. The

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SEASONAL DISTRIBUTION OF MARKETING, DOMESTIC MILL TAKINGS, AND EXPORTS OF RAW COTTON

(Per cent)

Month	Marketing by Farmers ^a	Purchases by Northern Spinners ^b	Exports ^c
September	13	4	6
October	21	12	11
November	19	18	14
December	14	14	12
January	8	13	11
February	5	10	8
March	5	7	8
April	4	6	7
May	3	5	6
June	3	..	6
July	2	11 ^d	6
August	3	..	5
	100	100	100

^a Average of cotton years 1912-1922; U. S. Department of Agriculture, *Yearbook*, 1923, p. 805.

^b Average of cotton years 1907-1909; Copeland, M. T., *The Cotton Manufacturing Industry of the United States*, p. 181.

^c Bases on Census data for cotton years 1919-1922.

^d Total for June, July, August.

variety of these fabrics is very great, running from the coarsest duck to the finest voiles. Special goods are woven only as the market demands them. The standard materials, however, are always on the market and are quoted in the same way as accepted grades of steel, wheat, chemicals, and other basic products.

The final step in the manufacture of textiles is that of finishing. This includes various combinations of such processes as dyeing, bleaching, printing, mercerizing, and schreinerizing.

Consumption. The uses of cotton are very diverse. A substantial share of the textiles are sold as yard goods over the counter to be made up into clothing and used in other ways at home. A large amount is consumed in the making of various kinds of ready-made clothing, such as shirts, over-alls, underwear, suits, dresses, millinery, and sundry other garments. Another portion is used in making sheets, pillow and cushion coverings, mattress coverings, curtains, towels, and awnings. Other cotton textiles are used in tops, curtains, cushions, and coverings for automobiles; in wrapping tobacco, cheese, and butter; in making typewriter ribbons; and in making bandages and other medical supplies. Finally, cotton is used in making flour and cement sacks; and in webbing, duck, bunting, bandages, explosives, and waste. As between industrial uses and the making of products for direct consumption, the latter take the bulk of the raw lint.²

²It is hardly safe to make a more exact statement of the proportion of cotton used for industrial purposes. Some notion of the probable percentage may be obtained by estimating the amount used for industrial purposes and deducting that from the total consumption. The principal industrial use is in the automobile field. An unpublished estimate of the consumption in this industry in 1923 has been made by Mr. Robert Skliar, of the Textile Division of the United States Department of Commerce, which runs as follows:

<i>Product</i>	<i>Pounds of Raw Cotton</i>
Upholstery	8,813,000
Tops and curtains	14,069,000
Artificial leather	15,499,000
Tires	180,000,000
Total	218,381,000

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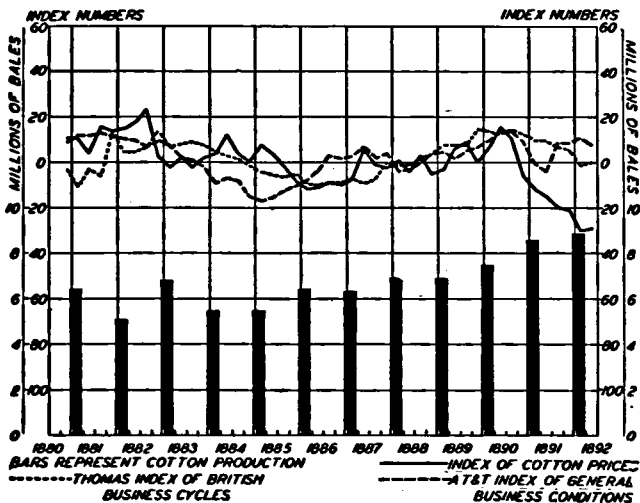
A consideration of the wide variety of uses of cotton indicates that there is considerable opportunity for fluctuations in general manufacturing activity to be reflected in the demand for cotton, especially in the demand for industrial purposes. The standardized character of many of the textiles, moreover, may sometimes invite speculative accumulation of stocks, which is a distributive phenomenon frequently associated with business cycles. With these possibilities in mind, let us now proceed to an examination of the fluctuations of the price of cotton, noting particularly the extent to which they have been correlated with business cycles.

II. STATISTICAL ANALYSIS OF THE PRICE OF COTTON

Tracing the fluctuations of the price of cotton over a considerable period of time, we find several obvious relationships. It is quite clear that the price to some extent reflects business conditions both in the United States and in the importing

This amounts to about 436,000 bales. The next most important use is in the making of cement and flour bags, which together require about 150,000 bales, according to an estimate made by A. R. Marsh ("Cotton Industry's Future in Its Own Hands," *Annalist*, June 23, 1924, p. 725). These two items are the big ones and apparently account for nearly 600,000 bales. There are many other uses for which no data are available. Such are webbing, especially for belting; duck for various purposes, cloth for wrapping tobacco, cheese, and butter; bunting; bandages; explosives; and waste. The consumption for these and other purposes undoubtedly bring the total to well over one million bales. The total consumption of cotton in the United States runs to about 6,000,000 bales yearly.

COTTON PRODUCTION, COTTON PRICES, AND BRITISH AND AMERICAN BUSINESS CONDITIONS, 1880-1892 *



* Cotton Prices: Percentage deviations from the 1880-1892 average of spot prices of middling cotton at New York.

Source of data: 1880 to 1889, *Report of Senate Committee on Agriculture*, 1895, Vol. II; and from 1890 to 1926 *Yearbooks of the U. S. Department of Agriculture and Bureau of Agricultural Economics*.

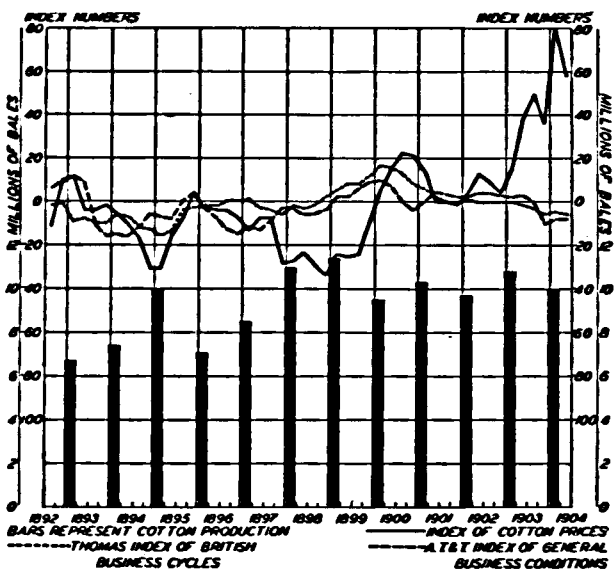
Cotton Production: *Cotton Production and Distribution*, Bulletin 160, pp. 49-50, U. S. Bureau of Census. Bars centered on middle of crop year.

American Telephone and Telegraph Company Index of Business: Quarterly averages of percentage deviations from normal computed from data in Hardy, C. O., and Cox, G. V., *Forecasting Business Conditions*, pp. 340-341.

Dorothy Swaine Thomas Index of British Business Cycles: Percentage deviations of actual items (with seasonal variation allowed for) from secular trend. *Journal of the American Statistical Association*, March, 1926, opposite p. 61.

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COTTON PRODUCTION, COTTON PRICES, AND BRITISH AND AMERICAN BUSINESS CONDITIONS, 1892-1904 *

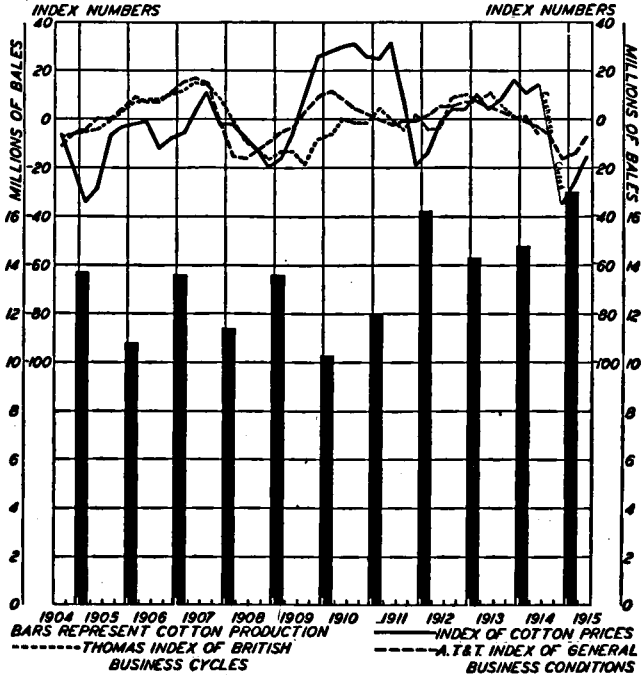


* Cotton Prices: Percentage deviations from the 1892-1904 average of prices. For sources see note to chart, p. 148.

countries. An even more pronounced factor in price, however, is the size of the crop. Let us begin our statistical analysis, therefore, with a consideration of the correlation between the volume of cotton produced and the price of the lint.

The size of the American crop is the most important price factor. A careful examination of the

COTTON PRODUCTION, COTTON PRICES, AND BRITISH AND AMERICAN BUSINESS CONDITIONS, 1904-1915*



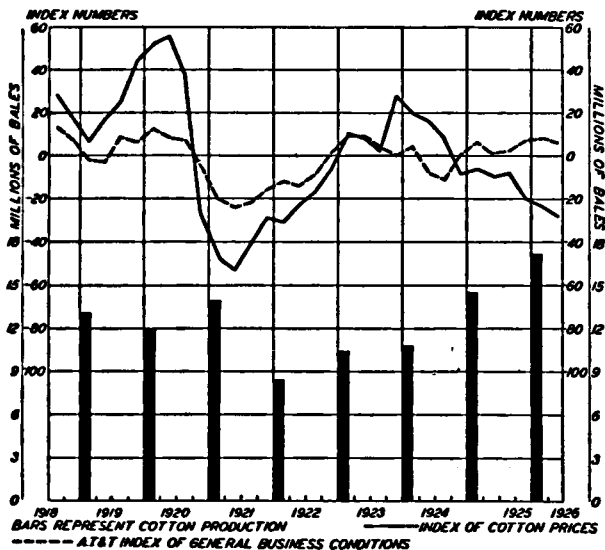
* Cotton Prices: Percentage deviations from the 1904-1915 average of prices. For sources see note to chart, p. 148.

price fluctuations in the figures on pages 148, 149, 150, and 151 shows that a large yield is invariably accompanied by a low price, while a small crop sends the price upward. A perusal of the price discussions

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in the cotton trade journals, moreover, shows much emphasis placed upon the volume of American production. All government reports on the condition

COTTON PRODUCTION, COTTON PRICES, AND AMERICAN BUSINESS CONDITIONS, 1918-1926 *



* Cotton Prices: Percentage deviations from the 1918-1926 average of prices. For source see note to chart, p. 148.

of the cotton crop are promptly reflected in the activities on the cotton exchanges. Private dealers and journals also make their own surveys and forecasts of the cotton crop. From the earliest months, when the new crop is being planted, to the end of

the picking and ginning season, every scrap of information on temperature changes, rain, drouth, boll weevil infestation, fertilizer sales, the extent of the negro migrations to the North, and even on the prices of possible alternative crops and products such as wheat, corn, hogs, or cattle, is avidly pounced upon by the trade and analyzed with respect to its probable bearing on the forthcoming supply of cotton. One cannot help but be impressed with this procedure when following the reports of the cotton trade.

A more exact idea of the relationship between the price and the size of the crop can be given by correlation coefficients. If we take the percentage by which the New York spot price in December changes from that of the preceding year for each year from 1881 to 1913, and correlate these figures with the amount of cotton ginned in corresponding years, a coefficient of $-.778$ is obtained. This correlation is practically as high as the results obtained for other crops, and shows that the volume of production is the major price factor. As will be pointed out later, however, the net relationship between production and price changes is a little less than these coefficients indicate.

The world's annual carryover and the production in other countries are additional factors on the supply side. The fluctuations in carryover depend upon the rate of production and the rate of consumption. Large crops accompanied by small or moderate consumption leave large stocks for the

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next crop year. Outstanding instances of this combination of circumstances are the crop years 1914-15 and 1920-21. From 1921 to 1924 the situation was reversed. There were three years of moderate yields and increasing consumption. As a result the supply on hand on July 31 in the United States diminished from 6,534,000 bales in 1921 to 1,555,000 bales in 1924. This condition was no small factor in explaining the rise in price from 12 cents to 32 cents.

The foreign crops are mostly either longer or shorter in fiber than the bulk of the domestic lint. In 1924 there were 11,792,000 bales of cotton produced outside the United States. Of these only 331,000, or a little less than 3 per cent, were similar in grade to American cotton. The bulk of these crops, about 76 per cent, had a shorter fiber like the Indian cotton, and the balance was made up of the fine long-stapled Egyptian varieties.³

Nevertheless the foreign cottons do compete with the American crop. While it is true that the mills are usually better adapted to one type of cotton than another, there is still considerable substitution of varieties. Although some Egyptian cotton is imported into the United States, the Egyptian crop is not nearly large enough to compensate for fluctuations in American production. The larger Indian crop affects the supply situation more definitely.

³Todd, J. A., "Outside Sources of Raw Cotton," *Manchester Guardian Commercial*, Annual Review, January 29, 1925, p. 67.

"Indian cotton has always been a competitor of short staple American, especially in those years when the American crop is small and the price high. The Manchester and German spinners prior to 1914 would piece out their American supply with Indian cotton, at which they were quite adept. In this manner the consumption of American at high prices was reduced, and on several occasions this proved sufficient to stop a bull market in American cotton, due to the short crop.⁴

The price influence of domestic business cycles is considerably less than that of the size of the crop. This is shown by correlating the New York spot price in December with an index of business conditions and also with the size of the crop. By means of partial correlation the influence of the size of the crop can be held constant and the net influence of business conditions, except for other factors such as demand which are not taken into account, can be determined. Similarly, the net influence of size of crop can be compared. The results, the details of which are given in Appendix C, show that the net effect of domestic business cycles, as measured by the volume of pig iron production about nine months prior to the month of the cotton price, is represented by the coefficient $+.489$, while the net influence of the size of the crop is represented by the coefficient $-.652$. The latter, as noted above, is

⁴Hubbard, Hustace W., *Cotton and the Cotton Market*, 1923, p. 118.

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considerably less than the simple correlation between the crop and price.

If we assume that the other factors which affect the price, such as carryover, are not related to the two considered in these correlations, the squares of the net coefficients may be said to give the percentage of the price fluctuation that each factor is responsible for. On that basis, 42.5 per cent of the variation is the result of variations in the size of crop and 23.9 per cent is caused by business cycles. That, however, is not a strictly valid conclusion. Carryover is related both to the size of the crop and to domestic business cycles. Indian production may be related to domestic production and to British demand for American cotton. Domestic business cycles, on the other hand, are related to European business conditions and to other factors which affect prices, such, for instance, as currency difficulties and wars. Hence, we may only say that the actual influence of business cycles is not greater than 23.9 per cent and may be considerably less than that.

Even if the time should ever come when all the crop is absorbed by the domestic market, it is improbable that the influence of business cycles would be as great as that of variations in the supply. Our reason for this conclusion is not that demand is stable, but that the fluctuations of production are wide and that the supply can be renewed only once a year. Let us next examine,

therefore, the factors that affect the output of American cotton.

Weather is the chief factor affecting yield. The Department of Agriculture has made estimates of the percentage reduction from a full yield of the leading crops which arises from various causes. For cotton the reduction due to adverse weather conditions has varied, since 1909, from 13.1 per cent in 1920 to 29.2 per cent in 1918. The average for the period from 1915 to 1924 was 20.6. Deficient moisture is the most important specific weather condition affecting the yield. The average reduction from this cause was 10 per cent.⁵

During the last decade boll weevil injuries have become an important yield factor. In 1921, when an extremely low yield of cotton was harvested, a reduction from a full yield of 30.98 per cent was attributed to weevil damage. In 1924, a reduction of only 8.01 per cent was reported. The average for the period from 1915 to 1924 was 15.43 per cent.⁶

The amount of weevil damage is closely related to weather conditions. Mild winters and rainy summers are favorable to the weevil. A mild winter favors survival of the insects during hibernation, while a summer with little sunshine permits greater activity. The large damage in 1921 accompanied such weather conditions. In 1918, on the other hand, when only 5.83 per cent reduction from weevil

⁵ *Crops and Markets*, Monthly Supplement, January, 1926, Vol. III, p. 12.

⁶ *ibid.*, p. 23.

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injury was reported, the season was the reverse—a cold winter, followed by a hot, dry summer.

Sometimes the yield is affected by the farmers' financial condition. In certain parts of the South, the amount of fertilizer applied greatly influences the yield of cotton, while in all sections the care and attention given the crop from planting through harvest time are likewise important. The financial condition of the growers frequently has a great deal to do with the amount that can be expended for fertilizer and labor. If little or no cash surplus is left from the last crop after meeting obligations previously contracted for, the expenditure on the next crop is likely to be small, unless the deficiency can be made up by credit advances that are larger than usual. This the storekeepers, banks, and fertilizer companies are usually unwilling to grant, except when price prospects are very favorable. One result is smaller fertilizer applications, and unless this is offset by a very favorable season, the yield is reduced.

In the fall of 1914, for instance, farmers received a disastrously low price, and as a result their purchasing power was sharply reduced. Fertilizer sales in twelve Southern states dropped from 5.5 million tons in 1914 to 3.5 million tons the following spring. Part of the reduction in yield in 1915 was undoubtedly due to the reduced fertilizer application. The same thing happened after the sharp drop of the

price in 1920. Fertilizer sales declined from 5.2 million tons in 1920 to 3.1 million tons in 1921.

The table on page 159 shows the changes in the price of cotton in North Carolina, the state making the largest use of fertilizer for cotton, and the change in total sales of fertilizer in the same state the following spring. In spite of the fact that a large part of this fertilizer is used for crops other than cotton, the direction of change was the same in all but two of the eleven years for which data were available.

The amount of credit which lending agencies feel disposed to extend to cotton producers also will depend somewhat on the price level and on prospects. Cotton prices likewise may affect the yield by the incentive which a high price gives to better care of the crop, whereas a low price is likely to lead to indifferent cultivation and picking.

The acreage is greatly affected by the growers' financial circumstances. As in the case of fertilizer sales, it is a question of ability to finance a large or small crop. As is pointed out above, variations in such ability are partly reflected in the amount of expenditure per acre. More important as a production factor, however, is the effect on acreage. The coefficient of correlation between the percentage change in the price of cotton and the percentage change in acreage harvested the following fall for the period from 1890 to 1913 is $+.595$. It is more than a matter of unit price, however. The total

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CHANGES IN FERTILIZER SALES IN NORTH CAROLINA COMPARED WITH
CHANGES IN THE PRICE OF COTTON THE PRECEDING
FALL, 1915-1925 *

Year	Change in Fertilizer Sales (thousands of short tons)	Change in Cotton Price Previous Fall (cents per pound)
1915	- 216	- 5.7
1916	- 28	+ 4.3
1917	+ 178	+ 8.2
1918	+ 138	+ 8.3
1919	+ 53	- 1.3
1920	+ 113	+ 8.8
1921	- 390	- 20.7
1922	+ 204	+ 1.9
1923	+ 155	+ 8.1
1924	+ 116	+ 6.3
1925	- 89	- 8.2

* U. S. Department of Agriculture, *Yearbook*, 1923; and *Crops and Markets*, Monthly Supplement, August, 1925, p. 256.

income from the preceding crop is also important. Bradford B. Smith⁷ found that nearly all changes in the acreage harvested could be accounted for by the changes in the ratios of the price of raw cotton to other commodity prices and by the changes in the ability of the growers to finance a large or small crop as influenced by the value of the previous year's crop.

Of the two factors, yield and acreage, which make up total production, yield varies the more widely. The coefficient of variability of the percentage changes of yield is 14.60 per cent and that of acreage 9.03 per cent. Probably because of the common

⁷ "Forecasting the Acreage of Cotton," *Journal of the American Statistical Association*, March, 1925, Vol. 20, pp. 31-47.

effects of price changes as pointed out above, yield varies in the same direction as acreage more frequently than in the opposite direction. This is shown by the positive correlation of $+ .31$ between changes in acreage and in yield. As a result we find that variations in total production are as closely associated with changes in acreage (coefficient is $+ .73$) as with changes in yield (coefficient is $+ .72$).^s

CYCLES OF COTTON PRODUCTION IN THE UNITED STATES, 1901-1913 *

Year	Acreage Picked (thousands of acres)	Average Yield per Acre (pounds)	Production of running (thousands bales)	Price on December 1 (cents)
1901	26,774	170.0	9,510	7.0
1902	27,175	187.3	10,631	7.6
1903	27,052	174.3	9,851	10.5
1904	31,215	205.9	13,438	9.0
1905	27,110	186.6	10,575	10.8
1906	31,374	202.5	13,274	9.6
1907	29,660	179.1	11,107	10.4
1908	32,440	194.9	13,242	8.7
1909	30,938	154.3	10,005	13.9
1910	32,403	170.7	11,609	14.1
1911	36,045	207.7	15,693	8.8
1912	34,283	190.9	13,703	11.9
1913	37,089	182.0	14,156	12.2

* U. S. Department of Agriculture, *Yearbook, 1923*, p. 796.

To some small extent the fluctuations of cotton production appear to be influenced by the business cycle. A wide change in price following a major change in business activity is frequently reflected in the acreage and yield. This is shown by the coeffi-

^sThe period covered in all these computations is from 1881 to 1913.

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icients of correlation between the changes in pig iron production (an index of business cycles) and the changes in acreage several months later. The business situation 18 months prior to the fall when the crop is harvested appears to have some influence on the acreage. That is, the business conditions in the spring are reflected in cotton prices the next fall and winter⁹ and these prices, in turn, are reflected in the acreage harvested the second fall. The negative crest of the correlation with the volume of pig iron production a year later than this raises a question which we are unable to answer.

CORRELATION OF PERCENTAGE CHANGES IN THE VOLUME OF PIG IRON PRODUCTION WITH PERCENTAGE CHANGES IN SUBSEQUENT ACREAGE OF COTTON, 1881-1913

When iron production preceded October acreage	21 months	+ .424
" " " " " "	18 "	+ .460
" " " " " "	15 "	+ .249
" " " " " "	12 "	-.076
" " " " " "	9 "	-.444
" " " " " "	6 "	-.632
" " " " " "	3 "	-.608

III. BUSINESS CYCLES AND THE DEMAND FOR COTTON

The analysis in the two preceding sections indicated that business cycles have considerable influence on the price of cotton. A significant correlation was found between changes in price and changes in business conditions. It was shown, however, that because of the probable effect of factors

⁹ Compare Appendix A.

not measured the net influence may be less than these coefficients indicate. For that reason we need to supplement those findings by an analysis of the fluctuations of the demand for raw cotton. It was pointed out on page 146 that cotton is used mainly in the manufacture of consumers' goods. Our first task then is to assemble what evidence is available on the responsiveness to business cycles of the demand of final consumers for cotton products. Following this we shall consider the industrial uses of cotton, the manufacturers' demand, and finally foreign demand.

Sales data indicate a moderate responsiveness of urban consumer demand to business conditions. The Federal Reserve Board has compiled statistics on the wholesale sales of cotton dry goods of seven commission and jobbing concerns in New York City beginning with January, 1919. Data from the same source ¹⁰ indicate that the turnover of cotton goods stocks in retail stores is fairly rapid. The latter figures show that in stores in the Boston Federal Reserve district there were 4.5 turnovers of cotton dress goods in the year 1923 and 4.2 in 1924. With such a quick turnover in retail stores, annual data on wholesale sales may be taken to reflect fairly faithfully the volume of retail sales. Indexes of the annual dollar volume of wholesale sales of the New York stores are therefore given in the following

¹⁰ Obtained through the courtesy of W. J. Carson of the Division of Research and Statistics.

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table, together with annual indexes of prices of cotton goods in New York City and pay-rolls of factories in New York state.

INDEXES OF WHOLESALE SALES AND PRICES OF COTTON GOODS AND OF FACTORY PAY-ROLLS, 1919-1925

(Base: 1919 = 100)

Calendar Year	Dollar Volume of Cotton Goods Sales in New York City ¹	Fairchild Index of Prices of Cotton Goods ²	Factory Pay-Rolls in New York State ³
1919	100.0	100.0	100.0
1920	112.8	118.8	123.9
1921	94.7	59.6	88.3
1922	96.1	68.8	92.5
1923	110.1	78.3	111.7
1924	97.9	73.2	103.3
1925	96.9	69.1	104.7

¹ Wholesale sales of cotton dry goods of seven New York commission and jobbing concerns. Data from the Division of Research and Statistics, Federal Reserve Board.

² Index given in *Survey of Current Business*, February, 1926, p. 31, recomputed to a 1919 base. This index represents average weekly wholesale quotations of 36 standards cloths in the New York market.

³ From *The Industrial Bulletin*, May, 1926, p. 220. Base recomputed to 1919 = 100.

These figures indicate that a smaller physical volume of goods was purchased in 1920 than in 1919, since the dollar volume advanced less than did prices. The larger incomes apparently were expended for other things besides cotton goods. So far, therefore, the data indicate inelasticity of demand. In 1921, prices dropped sharply. The

decline in pay-rolls was less severe than that of prices. The quantity of goods sold apparently increased very considerably, since the dollar volume fell off less than prices. This indicates a rather elastic demand, especially in view of the smaller incomes. This appears also to have been the case in 1922 and 1923, when the dollar volume of sales advanced from the 1921 level less rapidly than prices (thereby indicating a decline in physical volume) in spite of increasing incomes. From 1923 to 1925 on the other hand, physical volume of sales seemed to remain about stationary except for a slight drop in 1924. The increase in quality of goods moved that might be expected to accompany the declining prices was apparently prevented by the smaller incomes.

Taken as they stand, the data show some elasticity in the demand for cotton goods and some influence on sales of the variations in consumers' incomes accompanying business cycles. Other factors besides pay-rolls and prices, of course, have affected the purchases of cotton goods. An important one has probably been the decline in per capita consumption that has accompanied the growing popularity of rayon and the shorter and tighter dresses during the past few years. To some extent this has been offset by the growth of population in the metropolitan area to which these data pertain. The extent to which these and other factors may have affected the volume of demand can hardly be determined.

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Letters received from several department stores, however, indicate that the demand for cotton goods at retail falls off with general business depression and increases with prosperous business conditions. A statement by a firm in the Liverpool cotton trade also indicates a belief in the elastic character of the demand for cotton goods.

Apparently while trade is good all over the world and all industrial branches are fully employed and making money, the calico consumer does not mind buying goods on the basis of six pence per pound, but the moment work begins to get slack and the wage list shows a shrinking movement there is a tendency to bite short, the demand falls away rapidly, and the unfortunate merchant—European, Asiatic, or Indian—who has not detected the cloud on the horizon—is left stranded with a stock of unsalable goods which he cannot dispose of except at a loss which he shrinks to face but in the end he has to submit to.¹¹

On a simple, common-sense basis, moreover, it seems entirely reasonable to suppose that a change in income would affect the purchases of cotton goods more than those of the cheaper food staples, for instance. When times are hard, "clothing can be worn a little longer, or the individual may content himself or herself with less than the usual variety of suits or dresses or hats; or, again, the number of occasions for the display of wearing apparel may be reduced and thus the number of gowns or suits

¹¹ Letter from Ellison and Co., Liverpool, written for the 1908 issue of *Cotton Movement and Fluctuations*, Latham, Alexander and Co., New York.

required be reduced.”¹² And the needs for bed and table “linen,” towels, curtains, and other cotton house furnishings, are more likely to be satisfied when the family incomes are relatively large than when they are small. On the other hand, we would not expect such reactions to income changes to be as wide as those of many other commodities that are more expensive and less of a necessity as, for example, silk goods and jewelry. In fact, there is a considerable substitution of cotton for more expensive textiles in times of depression, and this offsets in part the reduction in consumption effected by more careful use.

Among the factors operating to moderate the changes in consumer demand accompanying business cycles is another fact that will only be mentioned here, since it was discussed more fully in Chapter IV. This is the large number of incomes that do not fluctuate with the cycle. These include the incomes of salaried classes, clerical assistants, farmers, and others.

The industrial uses for cotton also are affected by business cycles. On the basis of the estimate on page 146, the most important uses of this character are those for automobile tire fabrics, artificial leather and fabric for automobiles, and cement and flour sacks. Estimates of other outlets are not available.

¹²Thompson, John G., “The Nature of Demand for Agricultural Products and Some Important Consequences,” *Journal of Political Economy*; February, 1916, Vol. 24, p. 165.

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Cotton consumption for these purposes can be assumed to vary closely with the production rate of tires, automobiles, cement, and flour. Annual indexes of the volume of output of these products from 1919 to 1925 are shown in the accompanying table.

The consumption of the tire fabric has shown a steady increase since 1921, when figures were first collected. No cyclical tendency can be observed in the annual data; at least they do not reflect the boom of 1923 or the business recession in 1924. The monthly figures, however, show that the maximum rate of monthly consumption was reached in March, 1923, which was about two months earlier than the time when the rate of general manufacturing reached

INDEXES OF THE CONSUMPTION OF TIRE FABRIC, AND OF THE PRODUCTION OF AUTOMOBILES, CEMENT, AND FLOUR, 1919-1925 *

(Base: 1921 = 100)

Calendar Year	Consumption of Tire Fabric	Production of		
		Passenger Automobiles	Cement	Flour
1919	(*)	108.0	81.8	109.8
1920	(*)	122.7	101.4	80.5
1921	100.0	100.0	100.0	100.0
1922	138.2	155.4	115.8	103.6
1923	147.3	241.2	139.8	103.7
1924	177.2	212.5	151.4	109.4
1925	209.5	248.7	164.1	103.3

* All indexes computed from data in *Survey of Current Business*.

* No data available.

a maximum. Consumption declined until December, 1924, then increased until April, 1925, and then declined again for three months. Automobile production shows a more marked correlation with general business conditions. Prescott states that since the war a cyclical movement has been evident which precedes the changes in the volume of general manufacture by three to six months and whose fluctuations are more violent.¹³ Except in 1921, cement production has shown no cyclical tendencies since the war. It has reflected rather the general construction boom resulting from the building shortage which was accumulated during the war years. Even in 1921 the decline was very small. After the shortage is more fully relieved, the cyclical tendency may become more pronounced. As is shown on pages 255-257, the rate of flour production is not closely related to business cycles.

The demand for cotton for these purposes is probably rather inelastic, since in all cases the cost of the cotton materials used is but a small fraction of the selling prices of the main products. It would take a very considerable change in the price of cotton to affect the quantity demanded, because of the relatively small influence such changes would have on the cost of putting tires, automobiles, cement, and flour on the market. But, as shown above, there is a tendency for the output of some of

¹³ "Forecasting Automobile Production," in *The Problem of Business Forecasting*, 1924, pp. 106-7.

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these products, especially automobiles, to vary with general business conditions, and thus cause similar variations in the industrial consumption of cotton.

We find, therefore, evidence to show that both the final consumer demand and the demand for industrial purposes tend to vary with the cyclical fluctuations of general business activity. It is difficult to state or describe the degree of this correlation. It is undoubtedly greater than that of the demand for foodstuffs but less than that of most producers' goods and of many consumers' goods in or close to the luxury class. "Moderate" seems to be the most appropriate descriptive term.

We now need to analyze the variations in the mill demand for cotton. The latter, of course, is bound to reflect the fluctuations of the consumer and industrial demand. But if, as in some industries, there is a tendency to pile up stocks of both raw and finished materials during the upswing of the cycle, the variations in the mill demand are likely to be even wider and more closely related to business cycles than the final consumer and industrial demands just discussed.

Both mill activity and mill stocks are related to business cycles. Annual estimates of mill consumption in the United States are available as far back as 1826. The year-to-year variations of mill consumption as shown by these data show considerable correlation with indexes of general business activity. For the period from 1881 to 1913 the

correlation between the percentage changes over the previous year of the annual cotton consumption and pig iron production during the same years is $+0.39$. When the pig iron production six months later is correlated with cotton consumption the coefficient is $+0.79$. When the influence of changes in the yield of cotton is removed by partial correlation, the value of the former coefficient is raised to $+0.58$ and that of the second reduced to $+0.69$. In September, 1913, the U. S. Bureau of the Census began collecting figures on the monthly consumption of cotton by the domestic mills. The fluctuations of these data are also typical of the general business movement, but usually precede the latter by several months.

The table on page 171 shows annual indexes of the total consumption of cotton, the price of cotton, the production of fine cotton goods, and the average stocks of cotton held by the mills during the post-war years. Except in 1920 the indexes of total consumption and of the production of fine goods show fluctuations typical of the movement of general business. Taken in conjunction with the variations in the price of cotton, they show variations in demand, also, that reflect general business conditions.

Data on the monthly stocks of raw cotton held by mills are available since September, 1912. The index of the average stocks held during the post-war period, given in the table, varies with the changes in mill consumption in every year except

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1920, and with the movement of general business for all the years. During the pre-war years, the variations in mill stocks also reflected the general business situation. Stocks were a little larger in the winter of 1912-13, when business reached a minor crest, than in 1913-14 when general business activity was receding. When business expanded upon the receipt of war orders, stocks increased. The largest holdings were in the winter of 1916-17.¹⁴

INDEXES OF THE PRICE, MILL STOCKS, AND MILL CONSUMPTION OF RAW COTTON AND OF THE PRODUCTION OF FINE COTTON GOODS, 1919-1925 *

(Base: 1919 = 100)

Calendar Year	Price of Cotton	Monthly Average of Mill Cotton Stocks	Mill Consumption	Production of Fine Cotton Goods
1919	100.0	100.0	100.0	100.0
1920	104.3	101.5	98.7	85.9
1921	46.8	91.7	91.3	92.4
1922	65.5	101.1	102.8	105.9
1923	90.5	103.4	110.2	114.4
1924	88.3	76.0	95.1	92.3
1925	72.3	89.7	108.6	109.8

* All indexes computed from data in *Survey of Current Business*.

** Variations in stocks of unfinished textiles held by mills and by other hands apparently reflect general business conditions, but in a way just the reverse of that shown in the case of raw cotton. From April, 1883, to December, 1897, weekly reports of stocks of print cloth at Providence and Fall River were published in the *Commercial and Financial Chronicle*. During most of this period, stocks usually were high when business was depressed and low when business was active. The year 1897 was the most important exception to this rule. Stocks continued to increase until the end of that year in spite of the recovery of business. Trade reports indicated that the reduction did not begin until the summer of 1898.

This tendency to hold larger stocks when business is expanding and smaller stocks when it is diminishing in volume operates to make the changes in the mill demand for raw cotton greater than those resulting only from the changes in the consumption rate. Since both the changes in consumption and changes in stocks appear to be related to business conditions, the variations in the mill demand for raw cotton are undoubtedly greater than those of the rate of final consumption.

Fragmentary data are also available on one of the phases intermediate between the spinning and weaving stages of the cotton industry and the final disposition of the cotton goods. These relate to the finishing of the cotton textiles after they come from the mill.

The production, distribution, and stocks of finished cotton goods seem to be related to business cycles. The table on page 174 shows indexes of these activities. Except for the index of prices of cotton cloths, these refer to the business done by cotton finishers—bleachers, printers, dyers, and so on—on order from manufacturers and converters. The index of orders represents orders received from the latter to take gray goods from the warehouses and begin the processing. The index of billings represents the volume of completed work, or production. The index of shipments shows the quantity of finished work shipped out on the order of the owners, who are the manufacturers and con-

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verters; and the index of stocks indicates the quantity still held by the finishers, for which no shipping instructions have yet been received from the owners. These figures on stocks do not necessarily reflect the variations of all stocks of finished goods; they show only the supply in one position. Other stocks may be held by manufacturers, converters, jobbers, or other dealers. The data on orders and production are probably more representative of the total production of finished goods than the indexes of stocks and shipments are of all stocks and shipments in the trade.

For the short period covered and for the concerns represented, the data reflect the general movement of all business. Up to the first half of 1923, production exceeded shipments and consequently stocks began to accumulate. The latter reached a maximum in the latter half of 1923. In 1924 production, shipments, and stocks declined in conformity with general business, recovery beginning again in 1925.

Finally we must consider the foreign demand for cotton. As stated before, exports of American cotton are large, totalling from one-half to two-thirds of the crop. It is important, therefore, to examine the factors influencing the demand from foreign purchasers.

The demand for cotton in a particular foreign country does not necessarily fluctuate with the domestic demand. The mills in each country have

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INDEXES OF PRICES OF COTTON GOODS, AND OF ORDERS, PRODUCTION,
SHIPMENTS, AND STOCKS OF FINISHED COTTON GOODS,
1920-1925 *

(Base: yearly average 1921 = 100)

Period	Prices of Cotton Cloths	Orders Gray Yard- age	Produc- tion (Bill- ings)	Ship- ments	Average Stocks
1920: Oct.-Dec.	184	35	52	48	120
1921: Jan.-June	92	95	89	91	91
July-Dec.	109	106	114	111	111
1922: Jan.-June	124	100	106	104	123
July-Dec.	150	110	114	114	125
1923: Jan.-June	185	109	132	118	120
July-Dec.	193	94	101	96	135
1924: Jan.-June	206	83	95	98	124
July-Dec.	173	85	87	89	114
1925: Jan.-June	159	85	96	101	106
July-Dec.	146	85	106	93	113

* Index of cloth prices from Standard Statistics Company, *Annual Statistical Bulletin*, 1926, p. 78. The original index has been recomputed to the base used above. Other indexes are based on data in *Survey of Current Business*.

built up their own selling areas and the sales in these territories are affected by circumstances not necessarily related to those in the United States. Thus, English mills, the heaviest foreign buyers, are dependent upon export markets for about four-fifths of their output. China and India are the most important customers. Other outlets are the Near East, Central and South America, Europe, and Africa. The Indian monsoon, civil war in China, the price of silver, and similar factors may alter the purchasing power of these markets without reference to the condition of the American domestic market.

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The trend of British cotton consumption has frequently been quite different from that of American mills. The failure of the British industry to participate in the recovery in the United States in 1923 is a recent instance.

The fluctuations of the total foreign demand are smaller than the variations in the demand of individual countries. Except during the cycles of business activity that are very severe and that are world-wide in their scope, not all countries using cotton goods are depressed or prosperous at the same time. A favorable monsoon in India may be offset by Balkan wars; or, a short crop in Europe may be compensated for by peace and prosperity in the Orient. As a result of such neutralizing influences, there is a considerable degree of stability in the export market.

This market, however, is very sensitive to price changes. A considerable proportion of the foreign consuming countries such as China, India, the Near East, and many parts of Europe, have populations with relatively low standards of living. The sales of cotton goods in these countries show a marked falling off when prices are high. The correlation of the percentage changes from year to year of export price and the volume of exports is $-.74$. This is for the period from 1881 to 1913. The correlation of the volume of exports with the size of the crop is even higher, being $+.96$. This relationship was disturbed during the war and post-

war years. The straitened circumstances of the European countries resulting from the World War are likely to make the foreign demand for American cotton even more elastic than it was before the war.

Altogether the factors determining the economic position of the cotton producer appear to be specific conditions in the industry more than general business conditions.

CHAPTER VIII

THE CORN-HOG INDUSTRY AND BUSINESS CYCLES

THE purpose of this chapter is to determine to what extent the price and production of pork are affected by business cycles. Since one of the main factors in the production of hogs is the supply of corn, the analysis begins with an examination of that relationship. This is followed in Section II by a study of the factors which influence the production and price of corn. In the third section the fluctuations of pork production are discussed with particular reference to business conditions. The final section is devoted to a study of hog prices, again with special emphasis on the rôle played by business cycles.

I. THE CONNECTION BETWEEN CORN PRODUCTION AND HOG PRODUCTION

The reason for beginning the analysis of hog production with a discussion of corn production is that corn is the feed upon which hog production chiefly depends, so that the fluctuations in the supply of corn are an extremely important factor in hog

production. These statements need some amplification, however, before we proceed to discuss the factors affecting the production and price of corn and the incidence of the latter on the business of raising hogs.

Corn makes up over two-thirds of the feed cost in pork production. It is the most economical feed for hogs obtainable. "Not only is it usually the cheapest carbonaceous feed available in the Corn Belt, but it is exceedingly palatable to swine and produces unrivalled results when fed in properly balanced rations."¹ It is low in protein and calcium, however, and therefore must be supplemented by other feeds, especially during the early stages of a pig's life when it is more important to build bone and muscle than to put on fat. The relative amount of corn and other feeds needed in preparing a young pig for market may be indicated in the following report. Seventeen lots of light hogs at six different experiment stations were allowed to eat all the corn, tankage, and wheat middlings ("cafeteria" style) they cared to. The average amount consumed a day was 5.7 pounds of corn, with only .88 pounds of the combined supplementary feeds.²

A better conception of the importance of corn in pork production may be obtained if the total amount of feed consumed in the twelve-month management period is considered. The table on page 179

¹ Henry, W. A., and Morrison, F. B., *Feeds and Feeding*, 1922, p. 623.

²*ibid.*, p. 614.

gives the quantities of the feeds, other than pasture, required to produce 100 pounds of live pork in 51 droves of hogs in Iowa and Illinois. It will be seen that corn constituted by weight over 85 per cent of feed used. In terms of money cost, corn made up over 67 per cent of the total amount of feed used, including pasture.

AVERAGE AMOUNTS OF FEED OTHER THAN PASTURE, REQUIRED TO PRODUCE 100 POUNDS OF LIVE HOG *

Kind of Feed	Pounds of Feed
Shelled corn	413.6
Other grain (oats, barley, and so forth)	24.8
Tankage, oilmeal, mill feeds	13.5
Skim milk	28.3
Other feeds	1.1
Total	481.3

* Adapted from "Hog Production and Marketing," U. S. Department of Agriculture, *Yearbook*, 1922, p. 222. These amounts include the feed used to carry the sow before and after breeding, that required to raise the young pigs, and the feed used in fattening the hogs for market.

Since corn is such an important item in the cost of hog production, the latter is frequently expressed entirely in terms of corn. According to some estimates the approximate total cost of raising a 225-pound pig under this system is equal to the price of 25.91 bushels of corn. The cost of producing pork per 100 pounds of live weight of pigs is equal on this basis to the price of 11.51 bushels of corn.⁵

⁵ *Ibid.*, p. 707.

That such a formula of hog production costs is not inaccurate is shown by the relationship that corn and hog prices have borne to each other during past years. The average Chicago corn-hog price ratio for four decades were as follows:

1878-1887	11.0
1888-1897	11.8
1898-1907	12.2
1908-1917	11.3

During those 40 years the ratio varied from 7.4 to 16.5, which indicates the range of profits obtained by hog producers who bought their feed. The low ratios indicate a small profit or a loss in feeding corn to hogs; the high ratios indicate that corn could be fed to hogs very profitably.

Because of the abundance and cheapness of corn, hog production is concentrated in the Corn Belt. This is true in spite of the fact that the chief pork consuming section is in the more densely populated Eastern states. Corn, the principal feed, is grown in the upper Mississippi Valley, six states—Iowa, Illinois, Nebraska, Indiana, Ohio, and Missouri—producing about half of the entire domestic supply. Because of the greater bulk of corn, it is more economical to produce the hog near the corn supply than to ship the corn east and raise the hog nearer the market. This advantage is illustrated by the relative prices of corn and hogs in the two sections. On December 15 of 1923 and 1924 the New York

prices were respectively 34 and 22 per cent higher than the Iowa prices of live hogs. On those same dates the New York prices of corn, however, were 68 and 30 per cent higher than the Iowa prices. As a result, the growing of corn and marketing it in the more compact form of pork is a leading enterprise on most Corn Belt farms. The six states previously mentioned, which produced 49.9 per cent of the last three corn crops, also produced 48.2 per cent of all the hogs in the United States during the same period.

In the main Corn Belt states the receipts from swine sales constitute the largest single source of income. The rotation of crops there is designed to support the largest practicable acreage of corn, and hogs furnish the chief outlet for that crop. That rotation, however, necessitates the growing of roughage which hogs cannot make use of, so that some cattle can be kept advantageously. The proportion of the latter varies from farm to farm, as cattle can also utilize corn to good advantage. On many farms the feeding of cattle is a major operation, hogs being used mainly to retrieve feed that would otherwise be wasted. But taking the area as a whole, hogs are the chief source of income. Data from 8,888 farm records in the North Central states indicate that receipts from this source constitute about 29 per cent of the total farm sales.

In other parts of the country hogs are largely supplementary to the major enterprises. In the dairy

regions, where butter-fat is sold, hogs provide an excellent outlet for the skimmed milk. In the cotton South, hogs are an important factor wherever diversification is being attempted. Many of the new crops introduced into the rotation are used as hog pasture. In other parts of the country, particularly in the East and South, only enough hogs are kept to provide for the family needs and these are slaughtered on the farm. About 60 per cent of all farmers reporting hogs for the 1920 census sold none. In such cases the hogs are raised almost entirely on table scraps, refuse of farm crops, and other material of small value.

The most flexible important outlet for corn is through its conversion into pork. According to a Department of Agriculture estimate, the corn crop is disposed of in the following manner:

THE USES OF CORN *
(Percentage classification)

Fed to hogs on farm	40
Fed to horses and mules on farm	20
Fed to cattle on farm	15
Fed to poultry on farm	4
Fed to sheep on farm	1
Human food on farm	3.5
Fed to stock not on farm	5.5
Ground in merchant flour mills	6.5
Exports	1.5
Other uses	3.0
Total	100.0

* U. S. Department of Agriculture, *Yearbook*, 1921, p. 165.

While hog feed is the most important outlet, a more significant fact is the facility with which the number of hogs can be adjusted to the corn supply. The price of corn is not an important factor in the cost of raising horses and mules, and if it were, it would take several years to make a change in consumption of great significance in the corn market. Even in the case of beef cattle it takes considerably longer than in the case of hogs materially to alter the number to be fed, as the periods of gestation and growth for cattle are both relatively long.

The need for beginning the analysis of hog production with a study of factors affecting the production and price of corn should now be clear. The supply of corn is the prime factor controlling the variations in hog raising, both geographically and from year to year.

II. FACTORS AFFECTING THE SUPPLY AND PRICE OF CORN

We turn, therefore, to a consideration of the fluctuations in the supply of corn. The domestic supply during a given crop year beginning with November, when the new crop comes on, consists of the stocks on the farms and the visible supply at the beginning of the year, the imports, and the crop harvested. Normally, the imports are unimportant, though during the war years they were

rather large. For the five years ending with 1913 the average supply (except for imports) was distributed as follows:

Current crop	96.2	per cent
Stocks on farms November 1....	3.7	" "
Visible supply November 1.....	.1	" "
	<hr/>	
Total	100.0	per cent

The average imports during that period were less than the visible supply at the first of the year. During the war years they usually exceeded it, but since the war they have again been only a fraction of the visible supply.

The influence of business cycles on corn production is negligible. The size of the corn crop of course depends upon the acreage harvested and the yield per acre. To understand the causes of the changes in the total corn crop, the factors affecting each of these must be analyzed. The *acreage* of corn is affected by a number of forces. Changes in the price of corn appear to have but little influence on the amount planted. The correlation between the percentage changes in price and acreage the next year for the period from 1890 to 1923 is only $+.227$.⁴ In some states the amount of livestock to be fed is an important factor. Wright found that the number of hogs on hand the previous year accounted for 5 or 10 per cent of the acreage

⁴For comparison with other crops see page 34.

changes.⁵ Corn is habitually grown in rotation with other crops, and this circumstance operates to keep the average changes within a small range. Since 1895 the total acreage in the six leading corn-producing states has varied only from 40,150,000 to 45,000,000 except during one year, when an unusually large amount of winter wheat acreage was abandoned and corn planted in its place. Further indication of this characteristic is found in Wright's correlations, which show that only about 13 per cent of the acreage changes were related to the acreage the year before.

On the fringes of the Corn Belt the price and acreage of competing crops are particularly influential in determining the area planted to corn. Winter wheat abandonment, just mentioned, is one illustration. In Kansas the largest corn acreage since 1919 came in 1925, a year of high abandonment (24.8 per cent) resulting in the lowest wheat acreage. The smallest corn acreage occurred in 1919, when the wheat acreage was highest as a result of a very low abandonment (.4 per cent). The variation in the Kansas corn acreage in that period was 60 per cent, while in Iowa during the same period it was only 11 per cent. In the South, on the other hand, cotton competes with corn. In Texas, for example, the lowest corn acreage since 1919 came in 1925 when the cotton acreage was highest, while in 1921

⁵ Wright, Sewall H., *Corn and Hog Correlations*, U. S. Department of Agriculture, Bulletin No. 1300, p. 22.

the standing was reversed. The variation in corn acreage in Texas was 58 per cent in that same period.

The total acreage of corn, therefore, bears no consistent relationship to any one thing. It is the result of a combination of circumstances which show little relationship to each other or to general business conditions. The lack of relationship to the latter is indicated by an examination of the fluctuations of the total corn acreage. From the Civil War up to the beginning of the World War there was a steady upward trend in the area planted to corn. A chart in Wright's study (page 3) shows the deviations about that trend from 1870 to 1915. These cycles or variations indicate no connection with business cycles in the United States.

The variations in the yield per acre are caused chiefly by weather conditions, particularly rainfall. The relative importance of various causes are shown in the following table.

AVERAGE PERCENTAGE REDUCTION FROM FULL YIELD PER ACRE OF
CORN FROM STATED CAUSES, 1915-1924 *
(Percentage classification)

Deficient moisture	11.8
Excessive moisture	5.0
Frost	3.8
Other climatic causes	3.8
Insect pests	2.6
Plant diseases .....	.4
All other causes .....	.8
Total	28.2

* U. S. Department of Agriculture, *Crops and Markets*, Monthly Supplement, January, 1926, p. 11.

The fluctuations in yield per acre are so much larger than the changes in acreage that they are the most important factor affecting the total corn production. The largest corn crop since 1890 came in 1920 as a result of the maximum yield per acre—31.5 bushels. The smallest came in 1901, when the yield was the lowest in history—17 bushels per acre. According to Wright's estimates, 74 per cent of the fluctuations in the total crop are due to variations in yield per acre, 14 per cent to changes in the acreage, and 12 per cent to their joint action.⁶

After pointing out the factors that affect the corn crop in the United States, it is scarcely necessary to state that business conditions can have but little effect on the volume of production. Even the acreage appears not to be related to business cycles. Two reasons for this may be offered. The most probable paths of influence would be through the prices of corn and of competitive crops. Another possible connection would be through the price of hogs. But corn prices, as has been pointed out, are not extremely important in determining the acreage. The prices of other crops are more important. In the second place, business conditions are a minor influence in the prices of these competing products. This was pointed out in Chapter II and is shown in greater detail in Chapters VII and IX and in Appendix C. Hence, we conclude that the

⁶ *Corn and Hog Correlations*, p. 14.

influence of business cycles on corn production is negligible.

The variations in the other factors affecting the amount of corn available for domestic use either are unimportant or are related to the size of the current crop. The unimportant ones are imports (except during the war) and the visible supply. Farm stocks are closely related to the size of the preceding and the current crop. The exports of corn also affect the amount available for domestic use. They average 1.5 per cent of the total crop during the years from 1909 to 1913 and 1.6 per cent from 1914 to 1920. In 1921 they rose to 5.8 per cent. They were also high from 1895 to 1900, reaching 9.9 per cent of the crop in 1897. These variations, however, are chiefly the result of variations in the size of the crop.

Let us turn now for a moment to a consideration of the factors influencing the value of the grain that is so important in hog production.

The size of the crop is the most important factor affecting the price of corn. As was pointed out in Chapter II, this is the normal relationship with all crops. When long-time trends are removed the simple correlation between corn production and corn prices is about $-.80$, varying slightly with the method of computation and period covered. The published coefficients are given in Appendix B.

The most elaborate statistical study of corn prices

is that of H. A. Wallace.⁷ His conclusion is that the size of the crop "has far more to do with corn prices than all the other factors put together." He points out that rainfall is one of the most important single influences affecting the size of the crop and, through it, the price.

Unless unusual economic forces are at work it takes on the average about one inch of rainfall every ten days during July and early August to hold the December future price of corn steady on the Chicago Board of Trade. More than one inch of rainfall every ten days tends to lower corn prices, 1.4 inches or more tending to cause a drop of two or three cents a bushel. Less than one-half inch of rainfall in ten days tends to cause an advance of three or four cents a bushel. If there has been an average of less than a tenth of an inch of rainfall over the Corn Belt during the ten-day period, and if the mean temperature has averaged above 80, the December future corn price may run up by more than five cents a bushel . . . (The) residue of (price) which cannot be accounted for by size of crop seems to be determined about 4 per cent by the volume of pig-iron production an index of business cycles, about 5 per cent by the price of wheat, and about 4 per cent by the size of the corn crop two years previous.⁸

These results are similar to those obtained by the writer and summarized in Appendix A. Relatively little correlation was found between the changes in the volume of pig iron production and the price of corn. Thus in the case of both the

⁷"Forecasting Corn and Hog Prices," *The Problem of Business Forecasting*; also "The Factors That Make Corn Prices," *Wallace's Farmer*, August 21, 1925.

⁸*The Problem of Business Forecasting*, pp. 239-241.

production and the price of corn we find only a negligible reaction to business cycles.

III. CHARACTERISTICS OF PORK PRODUCTION

We are now ready to see what effect these variations in the production and price of corn, as well as other factors, including business conditions, have upon the supply of hogs available for slaughter and upon the price which the hog raiser receives. First, however, it might be well to refresh our minds as to certain facts about hog production which have a bearing on this phase of the problem. These facts relate to the seasonal features and the rates of growth involved in producing market hogs.

The main farrowing seasons are in the spring and the fall. April is the heaviest month of the spring period, while most of the fall farrowing occurs in September. It will be seen in the table on page 191 that the spring pig crop is considerably larger than that which comes in the autumn. This is partly due to custom, but more largely it is a matter of feed and equipment. Spring pigs can be turned out on pasture when still very young, and in the warm weather do not require very elaborate shelter. Fall pigs, on the other hand, must be warmly housed during the whole winter. Pasture for feed and range for the young pigs is an additional factor.

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DISTRIBUTION OF PIG BIRTHS BY MONTHS, 1920-1923 *

Spring		Summer and Fall		Winter	
Month	Percent- age of births	Month	Percent- age of births	Month	Percent- age of births
March	15.46	July	5.37	November ..	4.32
April	18.31	August	8.08	December ..	2.20
May	11.50	September ..	11.67	January ...	3.58
June	6.32	October ...	7.42	February ..	5.77
Total	51.59	Total ...	32.54	Total	15.87

* Compiled from U. S. Department of Agriculture, *Yearbook*, 1923, tables 476 and 478, pp. 945-946.

It takes from six to nine months to bring a hog to a marketable weight. There is no definite marketable weight, since a hog of almost any size can be sold at some price. There is, however, a preferred weight which usually brings a premium. This is between 180 and 225 pounds. The average weight of hogs bought by packers for slaughter was 226 pounds in 1923 and 224 pounds in 1924. The weight of hogs actually received at the market varies from year to year (depending on the supply and relative price of corn) and from market to market. The hogs received at Chicago, St. Joseph, Omaha and Sioux City, run fairly heavy as a rule—from 225 to 250 pounds. The weight of St. Paul, Wichita, Milwaukee, Kansas City, and St. Louis ranges from 180 to 210 pounds. These latter markets receive a higher proportion of light hogs,

many of which are sold back to other sections for fattening.

The rate at which pigs make gains depends upon their age and upon the type of feeding. During the first four months of their life the gains average about four-fifths of a pound a day. At the end of that period their weight is around 100 pounds. As their frames increase in size the daily gains become larger, so that by the time the hogs attain a marketable weight they are gaining about one and a third pounds a day. A rough rule of average daily gains from birth to market is a pound a day. A pig farrowed in April, therefore, should be ready for market in about seven and a half months. Some hogs are fed to a heavier weight and some are fed less efficiently, so that the peak of receipts at the markets occurs eight to nine months after the peak in farrowing.

The period of gestation for hogs is approximately 112 days. Hence about a year is required from the time a sow is bred to the time when the resulting litter of pigs has reached a marketable weight.

The seasonal character of farrowing results in a rate of marketing that is equally seasonal. The heavy marketing period embraces the winter months with a secondary peak in May and June. The heaviest months are invariably December and January. In the last decade nearly 29 per cent of the receipts at Chicago have come in during these

two months. These peaks come just nine months after March and April, the two heaviest farrowing months. Receipts then drop to a low point in April, but in May and June there is a smaller peak when the pigs farrowed the previous fall are sent to market. The fewest hogs come in during August and September.

The surplus above current consumption during the heavy marketing periods is either exported or placed in storage. The consumers' demand for pork products does not expand and contract with the fluctuations in receipts. It is therefore necessary to accumulate a surplus during the winter months in order to be able to meet the needs of the trade during the period of low receipts in the winter. Some of this is stored as fresh pork, some as lard; but the greater part is cured, since it can be stored more satisfactorily in that form. The surplus begins to accumulate when the winter run commences, usually in November or December. It increases up to May or June, after which it declines until a low point is reached in October or November.

These seasonal movements of receipts and stocks are reflected in the prices paid for live hogs. Prices are ordinarily lowest during the winter runs and highest during the light receipts in the late summer. With the foregoing features in mind let us now turn to the factors affecting the annual variations in hog production.

Hog breeding is influenced largely by the size of the corn crop and by the ratio between corn and hog prices. A large crop must be disposed of in some way. Since the chief use is for animal feed, more livestock must be secured. As was previously pointed out, hogs are not only the most important single outlet, but their number can be increased the most quickly. The crop of pigs following a large corn crop is therefore usually larger. In the same way small crops of corn are necessarily followed by slackened hog feeding.

A further factor is the corn-hog price ratio. A large crop invariably means low prices. Unless hog prices happen to be very low also, corn is cheap in terms of pork. Hence, when there is plenty of corn it is profitable to feed it to hogs. When the yield is short, on the other hand, the ratio is likely to be unfavorable and to operate to check hog raising.

This statement of the relationship of corn production and prices to hog breeding is only a preliminary one. Before the process is discussed in detail another incidental feature should be mentioned.

The supply and price of corn affect not only the number of hogs raised, but also their weight when marketed. As a hog gains in size and weight, additional gains are made at an increasing cost. The following table indicates how the feed requirements advance with the weight.

AVERAGE AMOUNT OF FEED REQUIRED TO PUT GAINS ON HOGS OF VARIOUS WEIGHTS *

Weight of Hogs (pounds)	Feed Required for 100 Pounds of Gain (pounds)
15 to 50	293
50 to 100	400
100 to 150	437
150 to 200	482
200 to 250	498
250 to 300	511
300 to 350	535

* From *Feeds and Feeding*, p. 599.

When the corn supply is short, the feeding period is also shortened, not only because the scarcity of corn makes it necessary but also because the accompanying high price makes it unprofitable to carry the animals to a heavy weight. Conversely, when the corn crop is large, the abundant supply makes it physically possible to feed the hogs longer and the lower price moves the point of maximum returns to a heavier weight.

Let us now return to a more detailed examination of the relationship between corn and hog production. This is provided in a discussion by Sewall Wright which is based on a detailed statistical study of corn and hog data.

In the summer of a big crop there appears to be a withdrawal from slaughter, which may be for either breeding or later feeding, or because of both causes. In spite of this withdrawal the price of hogs begins to drop, presumably either in sympathy with the drop in corn

prices or in expectation of an excess of hogs. Live weights begin to increase. This may be due to either of two causes, an increase in breeding, which withdraws young sows from market, or heavier feeding. Pork production drops in correlation with its major factor, the amount of slaughter.

In the winter following a big crop, slaughter and pork production are about average; the price of hogs continues to drop and live weight continues to increase, the latter reaching its maximum.

In the second summer slaughter and pork production reach a maximum. This condition can be due only to a rather small extent to breeding stimulated by the abundance and cheapness of corn. The hogs bred in the previous fall and farrowed in the spring would not come, in the main, on the market until the second winter (season beginning November 1). Early marketing of hogs that would not be marketed until winter, except for the abundance of corn, is doubtless a factor; but the main element in this heavy slaughter must be looked for in the hogs previously withheld. A tendency to concentrate as much of the slaughter as possible in the summer, if the supply of corn warrants, would be brought about by the higher hog prices which prevail in this season. . . . It is not surprising to find that the price of hogs reaches its minimum in this second summer (relative to the seasonal average). Live weight begins to fall off.

In the second winter slaughter and pork production have fallen off, though still well above the average. Hog prices begin to rise and live weight becomes about normal.

In the third summer heavy slaughter and pork production continue, though prices become about normal. Live weight tends to reverse its previous rise, falling below normal. The continued heavy slaughter in the second winter and third summer must be due to breeding stimulated by the corn crop. In the third winter a distinct second peak is reached by slaughter and pork production.

This must be due to the cumulative effect of heavy breeding. Hog price shows a slight tendency to a second drop, reflecting presumably this secondary rise in slaughter. Live weight continues slightly subnormal.

The fourth summer still shows some effect on slaughter and pork production. Hog prices rise to normal or even above normal, however, and live weight falls well below normal. It is probable that the favorable conditions due to the big crop have stimulated an over-production of hogs and that a reaction has begun. This reaction manifests itself to a greater extent in the fourth winter in which slaughter and pork production have returned to normal; but price has risen distinctly above normal, presumably in expectation of a shortage. Live weight continues below normal.

All the above-mentioned effects are reversed following a crop below instead of above the average.*

As with any other product, large supplies of hogs tend to depress prices and small supplies usually send them upward. The effect upon the price of seasonal variations in market receipts has already been discussed. The same relationship holds in the longer trends. Sometimes anticipated changes in supplies are reflected more strongly in present prices than are current receipts. The charts on pp. 216-219 show the inverse relationship of the slaughter of hogs at public stockyards and the Chicago price of hogs. For example, note the way in which the flood of hogs resulting from four successive years (1920 to 1923) of large corn crops forced the average price in 1923 below that of 1921, the year of great industrial depression. The flood continued until the

* *Corn and Hog Correlations*, p. 26.

winter of 1924-25, but for a different reason. The corn crop that fall—1924—was sharply reduced, and the prospect of short corn supplies caused farmers to ship in early a large number of hogs which otherwise would have been retained for breeding and feeding. This meant that future supplies of hogs would be curtailed, and prices of both live hogs and pork products rose in anticipation of it.

The relationship between the volume of production and the price over a longer period of time may be shown by the correlation coefficient. For the period from 1881 to 1913 the correlation between the percentage changes in the size of the western winter hog pack and the corresponding price is indicated by the coefficient $-.747$ ¹⁰ Wright's coefficients, given in Appendix B, are lower than this.

As a result of these circumstances hog production runs in cycles. This results from the inverse relationship between price and the volume of production and from the fact that the rate of hog production is somewhat responsive to the ratio between the price of corn and the price of hogs. Stated in greater detail, the events usually occur in about the following order. A favorable corn-hog price ratio in the fall results in a withholding of hogs from the market for longer feeding and in withholding breeding sows from slaughter; thus the average weight of those hogs that are marketed is increased. The effects of the favorable ratio which began the cycle continue

¹⁰ See Appendix A, p. 276.

for some time; indeed the resulting heavy weights¹¹ do not reach their climax until nearly a year after the high hog-corn price ratios which furnished the initial stimulus.¹² The resulting flood of hogs depresses their price, thereby reversing the hog-corn ratio. Breeding activity thereupon slackens. Fewer young sows are retained for breeding purposes, and hogs prepared for market are fed a shorter time and sold at a lighter weight. Market receipts and pork production gradually decline in volume. The scarcity of hogs forces prices up and that, in turn, operates to restore the favorable ratio of corn and hog prices, thus completing the cycle.

The cycles are modified by other conditions, particularly the supply and price of corn. A large crop may change an unfavorable ratio into a favorable

¹¹The relation between weight and breeding is very close. "Heavy fall breeding withdraws young sows from the current summer slaughter (season ending October 31) and thus tends to increase the average summer weight. Generally speaking, sows bred in the fall will be slaughtered the next summer after weaning their pigs, when, as relatively old sows, they raise the average summer weight. Heavy spring breeding also tends to increase the average summer weight by withdrawing relatively light sows from slaughter at the beginning of the season and returning some of them at a heavier weight at the end before November 1. Light fall and spring breeding should have the opposite effect. . . . This close relation between summer weight and the relative amount of breeding is brought out even more emphatically by the correlations with following events. The correlation between summer weight and the winter slaughter a year and a half later (-0.78) is one of the closest in the tables. It is confirmed by the even higher correlation of summer weight with the corresponding winter-pork production (+0.83)." Wright, *Corn and Hog Correlations*, p. 39.

¹²*ibid.*

one or a very short crop may have the reverse effect. Favorable ratios, for example, were maintained for over two years during 1920, 1921, and 1922 because of the low price of corn which accompanied the large crops in those years. The subsequent unfavorable ratio in 1923 was prolonged through 1924 and into the early part of 1925 by the sharp cut in size and increase in price of the 1924 crop.

Marked changes in the price of hogs due to abnormal fluctuations of demand also operate to modify the ratio. The drop of hog prices in 1919 and 1920, for example, sent the ratio to a low point of 7.1 in June, 1920. We shall next examine the character of demand for pork products as it affects hog prices.

IV. THE DEMAND FOR PORK PRODUCTS

As with similar studies of other commodities, conclusions as to the relationship between business cycles and the demand for pork products cannot command a great degree of confidence because of the lack of facts to build upon. The best one can do is to call attention to the considerations that seem likely to affect this relationship and then test out these more or less *a priori* conclusions by statistical methods.

Pork is a consumers' good. As was pointed out in Chapter IV, the demand for this class of commodity does not vary as widely during the course of a business cycle as does that for producers' goods. In

the case of pork, therefore, we can at the outset state that the fluctuations in demand are not likely to be very wide.

The pork output of the packing houses goes chiefly into urban consumption and export. Farmers butcher and cure much of their own pork. All over the South and East nearly all the hogs raised are slaughtered and consumed on the farms. It is not ordinarily profitable to raise hogs for market in these sections because of the high cost of feed. Those that are kept are fed with various kinds of waste and refuse materials. Records from 250 farms in Tompkins County, New York, for example, show that an average of 229 pounds of pork was furnished each year by the farm. On 550 farms in Sumter County, Georgia, an average of 832 pounds was butchered. In the Middle West, where hogs are more plentiful, farm butchering is still more extensive. Records from 100 farms in Clinton County, Indiana, showed an average of 1,000 pounds per year. This is equivalent to about four hogs. In 1920, census data show that hogs were slaughtered on 70.8 per cent of all farms, the average number being 3.7 hogs per farm. This accounts for 16.8 millions of hogs or about 27 per cent of the annual pig crop. Not all of these hogs were consumed on the farms where they were slaughtered. The equivalent of about 2.6 millions was sold to neighbors and town residents.

The above facts indicate that the rural require-

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ments are pretty well taken care of by farm slaughter, although the consumption per capita on the farm is very high. The following table shows estimates of annual rural and urban per capita consumption of pork by regions. Since less than 30 per cent of all farmers are dependent upon local

ESTIMATED ANNUAL RURAL AND URBAN CONSUMPTION OF PORK IN THE UNITED STATES, BY REGIONS *

(pounds per capita)

Region	Rural Consumption	Urban Consumption
North Atlantic	85.5	61.5
North Central, east	109.9	69.3
North Central, west	113.1	67.2
South Atlantic	117.6	76.3
South Central	121.3	79.7
Western	81.5	11.2
Total	109.7	66.3

* Data from Wentworth, Edward N., and Ellinger, Tage U. H., *Progressive Hog Raising*, Armour's Livestock Bureau, 1926, p. 130.

butchers or packing houses for their pork supply, it follows that but a small fraction of the output of packing houses enters into rural consumption. Changes in farm demand are reflected in market receipts rather than in demand for pork products. A smaller rural consumption releases more hogs for commercial slaughter, and vice versa. The problem therefore resolves itself into a study of the domestic urban and the export demands for pork products. This portion of the demand is more likely to show

the effect of business conditions than is the rural demand.

It was pointed out in Part I that the domestic market is much more important than the export market. The latter absorbs only about one-fifth of the commercial slaughter. The former therefore will receive priority and greater fullness of treatment.

The consumer demand for all meats is probably influenced by general business conditions. Meat is usually a fairly expensive part of the diet. When purchasing power declines or increases, there is likely to be some reflection of that situation in the retail sales of meat. This is the belief of some of the large meat packers. An Armour publication states that: "In times of general prosperity and full employment at high wages the demand for meat products is strengthened, while periods of depression have a tendency to make the public look for cheaper substitutes."¹³

The demand for pork products is probably more stable with respect to business cycles than is that for other meats. This may be inferred from the fact that pork is really an economical meat. More food value is obtained for the money in pork products than in either beef, veal, mutton, lamb, or fowl. Pork averages 2,465 calories to the dressed pound, while beef assays only about 1,040; mutton,

¹³Wentworth, Edward N., and Ellinger, Tage U. H., *Marketing Livestock and Meats*, Armour's Livestock Bureau, p. 104.

1,215, and poultry, 1,045. Compared with beef, which with pork makes up over 90 per cent of our meat diet, pork therefore contains over twice as much food value in a given weight. But the price of pork is but little higher than that of beef. The accompanying table shows the number of pounds of representative cuts of beef and pork that one dollar would have bought on the basis of average retail prices in the United States from 1920 to 1923. This indicates that when tested by the price per pound, ham, for instance, is about a fourth more expensive than sirloin steak, while pork chops are actually cheaper.

AMOUNT OF SELECTED CUTS OF BEEF AND PORK PURCHASABLE FOR ONE DOLLAR AT AVERAGE RETAIL PRICE IN THE UNITED STATES, 1920-1923 *

Cut	Pounds
Beef:	
Sirloin Steak	2.55
Round Steak	2.87
Rib Roast	3.37
Pork:	
Ham	2.00
Bacon	2.32
Pork Chops	2.90

* U. S. Bureau of Labor Statistics, *Retail Prices, 1913, to December, 1923*, Bulletin No. 366, January, 1925, p. 49.

Because of the economy of pork in comparison with other meats, its proportion in the diet probably increases as purchasing power declines. That is, the demand for all meats drops, but that for pork

less than others. Likewise, when prosperity returns the demand for all meats strengthens but again less in the case of pork. Other meats are generally considered more palatable or at least are valued for variety and hence are substituted to the extent that they can be afforded.

Another factor operating for stability of demand for pork in contrast with beef or mutton is the fact that a larger proportion is cured. Larger pieces can be bought and kept on hand without danger of spoiling, and used from time to time when occasion demands, especially in combination with other foods. A great deal of bacon and lard is used in this way as a sort of "accessory" food. Lard for cooking, and bacon with beans or eggs are common illustrations of such uses. While only a small quantity is used each time, the use for such purposes is very steady and continuous. In fact, lard and bacon are almost indispensable kitchen supplies.

The consumer demand for pork undoubtedly is affected to some extent by changes in pay-roll disbursements accompanying business cycles. But the considerations adduced above indicate that such changes in demand must be rather moderate in extent. They are probably greater than those of breadstuffs but less than those of the other, more expensive meats.

The consumption of pork products is affected more by the volume of pork production than by general business conditions. A consideration of the nature

of pork production and consumption will show that this must be the case. In the first place, the packers have but a limited voice in regulating the rate of pork production. They must slaughter what is shipped to the market. To some extent pork production can be adjusted to the packer's desires by the shipment of hogs back to the country for further fattening, but this procedure has rather narrow limits.

Nor are the receipts themselves determined to any large extent by the current demand. The exact time of shipment, and the weight to which hogs will be fattened, do depend to a considerable extent on prices and price anticipation, but nearly all the season's supply of hogs must be marketed during the season. As we have shown elsewhere,¹⁴ it is the prices of a year or more previous, and the size of the two preceding corn crops, rather than the state of current demand, that controls the number of hogs to be marketed. When the hogs are ready for market, moreover, shipments from the farm cannot profitably be held up for any great length of time.

In the second place, pork products are not carried over in large volume in storage from one season to another. Nine months is usually the time limit. There is some pork in storage the year around because of the necessity of curing, but for all practical purposes it can be stated that each season's

¹⁴ Compare pp. 194-197.

slaughter is consumed before the next big run begins.¹⁵

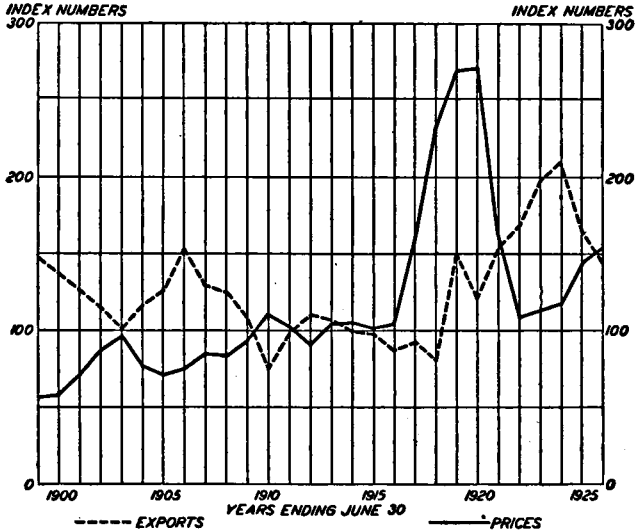
The domestic demand for pork is affected also by the seasonal, racial, and geographic factors in demand, but these are not important to our problem since they are fairly constant from year to year. The considerations discussed so far, however, point in the direction of a very slight responsiveness of the demand for pork to changes in business activity. Before testing this tentative conclusion by statistical analysis, we shall take a look at the part that the export demand may play in the determination of hog prices. The export demand is more important in the market for lard than in that for pork. Since 1907, a third, roughly, of the lard produced has been exported, but only about a tenth of the pork.

The foreign demand for pork products is greatly influenced by their prices. More frequently than not higher prices are accompanied by a decline in the volume exported, and lower prices by larger

¹⁵ Some of the relationships discussed above may be expressed more clearly by correlation coefficients. When we correlate the percentage changes from the preceding year of pork production with the corresponding changes in pork consumption for the years 1907 to 1924 inclusive, the result is $r = +0.95$. The small difference between this figure and perfect correlation is due partly to exports and partly to variations in amount of pork carried over in storage for consumption and following calendar year. The coefficient for lard production and lard consumption is $+0.80$. The larger proportion of lard exported is the explanation for the lower relationship. The coefficient for annual pork consumption and hog receipts at nine markets is $+0.88$. This is less than the coefficient for consumption and production because of variations in average weight and in shipments back to the country.

exports. This is indicated in the figures on pages 208 and 209, which show the volume of exports and

INDEXES OF EXPORTS AND EXPORT PRICES OF LARD, 1899-1926*
(Average 1909-1912 = 100)



* Sources of data:

Exports: U. S. Department of Agriculture, Bureau of Statistics, *Bulletin* 75, pp. 34-35, and U. S. Department of Agriculture *Yearbook*, 1924, p. 1074; subsequent figures compiled from U. S. Department of Commerce, *Monthly Summary of Foreign Commerce of the United States*.

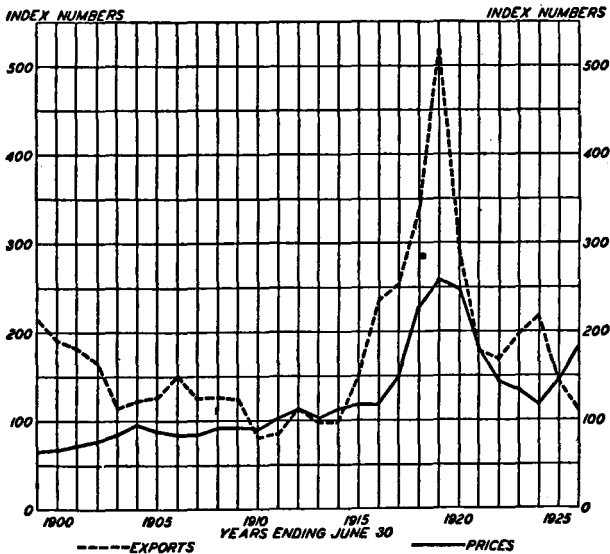
Prices: *Statistical Abstract of the United States*, 1925, p. 621; subsequent figures computed from U. S. Department of Commerce, *Monthly Summary of Foreign Commerce of the United States*.

the prices of lard, bacon, and ham since 1898. Sometimes the export prices purposely are made

lower than the domestic prices. This is most likely to occur at the end of the hog year—July through October—when it is necessary to dissipate heavy

INDEXES OF EXPORTS AND EXPORTS PRICES OF BACON AND HAM, 1899-1926 *

(Average 1909-1913 = 100)



* For source see note to chart p. 208.

stocks in order to avoid depressing the more important domestic market.¹⁶

Economic conditions and tariff policies in the chief

¹⁶ See Clemen, R. A., *The American Livestock and Meat Industry*, 1923, p. 590.

importing countries are additional important factors in the export demand. The influence of the former is not greatly different in the case of pork from that in other products. For this reason the discussion given in Chapter IV need not be repeated here. It may be pointed out, however, that the demand for pork products differs from that of cotton in that the pork which we export is practically all consumed within the importing countries. We saw that a large part of the raw cotton purchased by England and other European countries was manufactured and then re-sold in other parts of the world, so that fluctuations in demand arise from conditions in all these markets. The demand for pork products is chiefly affected by local conditions in the importing countries.

Fluctuating tariff policies of the importing countries have been important in determining the export demand for pork. The agrarian elements in these countries have always objected to foreign competition in meat production, while the urban and industrial classes have favored it. The activities of the former have frequently led to acts which materially reduced American imports of pork and other meats. In the early eighties, for example, under the pretext of danger from trichina, pork imports were restricted for a time in England, Italy, Hungary, Spain, Germany, France, Turkey, Roumania, Greece, and Denmark. Agitation concerning alleged dangers to health has sometimes resulted in

a requirement for rigid tests with high inspection fees which amounted to protective duties and sometimes also has succeeded in frightening the buying public away from American products. Germany discouraged imports of pork quite persistently before the World War, but after the war the great depletion of livestock within Germany made it necessary for her to import as much as her purchasing power would permit. As a result, her imports of bacon from the United States, which before the war were negligible, in the period from 1922 to 1924 comprised from 15 to 19 per cent of the entire amount exported from this country. Lard imports were resumed after the war in much larger volume than before. On October 1, 1925, a new German tariff went into effect which included duties on bacon and lard. This appears to have reduced the German imports materially.

The demand for pork products in foreign countries may or may not fluctuate with general business conditions in the United States. Prices (which, in turn, are chiefly dependent upon the supply), changes in local economic conditions, and modifications of tariff policies are all factors which may either offset or accentuate changes in domestic demand.

Changes in the domestic and foreign demand for pork products are transmitted to the demand for live hogs. Changes in hog supplies are reflected, through live hog prices, in the prices of dressed pork. On the other hand, changes in either the domestic

or the foreign demand for pork products or changes in their price resulting from speculative activity are likewise carried back to the prices of live hogs.

V. BUSINESS CYCLES AND THE PRICE OF HOGS

We have seen in the previous sections that the prices of hogs move strongly in conformity with the swings of a production cycle of hogs, which in turn depend closely upon conditions of corn production; but that fluctuations in demand are much more irregular and less influential in making hog prices.

At certain times a correspondence between cycles of hog prices and general business cycles is apparent. This was brought out in a study of cyclical movements of various price series for the period 1903-1914, made by Persons and Coyle.¹⁷ The prices of bacon, ham, lard, and mess pork were all found to have fluctuations typical of the general business movements during the period studied. The price of mess pork was included as one constituent of the ten-commodity price index of business cycles. However, to see the significance of these data, conditions on both the production and the demand side must be examined. The crop of corn in 1905 exceeded any previous record. The 1906 crop was even larger, and this, combined with the carryover from the previous crop, sent prices to the lowest

¹⁷ *Review of Economic Statistics*, 1921, Vol. III, p. 363.

point since 1900. In the meantime hog prices had advanced as a result of three factors, declining receipts, and stronger demands in both Europe and at home. The result was that the corn-hog ratio began to rise in the winter of 1905-06, averaged 13.4 for all of 1906, was still 13.7 in April, 1907, but declined rapidly thereafter. The resulting breeding activity and longer feeding periods were promptly reflected in the average live weight. The increase began early in 1906 and reached a high point in September, 1907. The stage was set for a flood of hogs scheduled to begin in the winter of 1907-08, a year and a half after the summer of 1906, when the weight began definitely to increase.

In November the price of hogs took a big drop—from \$6.15 to \$4.90. There were several contributing factors. The financial panic which broke out in October in the United States may have been the primary factor determining the precise time of the collapse. But an early price decline was inevitable because of the great number of hogs that were ready for marketing. Pork exports, moreover, began to decline in September and continued to do so until January.

The fall of the price of hogs in November seems to have released the flood, for in December the hogs began to pour into the markets. Except for a slight slackening in late summer, the large volume continued throughout 1908 and through March, 1909. Whatever influence on pork prices the deep

industrial depression may have had at that time was greatly intensified by the size of the supplies which the farmers had to dispose of.

In the meantime the corn-hog ratio had been reversed. Not only had hog values declined, but corn had gone up. The 1907 yield was relatively small, so that corn prices advanced from 39.3 cents in December, 1906, to 50.9 cents in December, 1907. The 1908 crop was also short, bringing the price to 60 cents in December, 1908. The average corn-hog ratio during 1908 was 8.4. Breeding fell off, as was shown by the decline of live weight at Chicago from an average of 231 in 1907 to 216 in 1908, and to 218 in 1909.

The diminished breeding activity was soon reflected in declining market receipts and rising hog prices. The trough of the former and the crest of the latter were reached in 1910. But by that time the hog-corn ratio was again reversed. Hogs were high in price, and by a strange coincidence a record crop of corn sent prices down from 58.6 cents in 1909 to 48.0 in 1910. The ratio in the latter year was 15.2. Heavier live weight again revealed extensive breeding activity, the fruits of which in 1911 and 1912 again sent prices of hogs downward.

A comparison of these events with the cyclical fluctuations of general business activity during the same period indicates that the coincidence of the two cycles was largely accidental. In both 1906 and

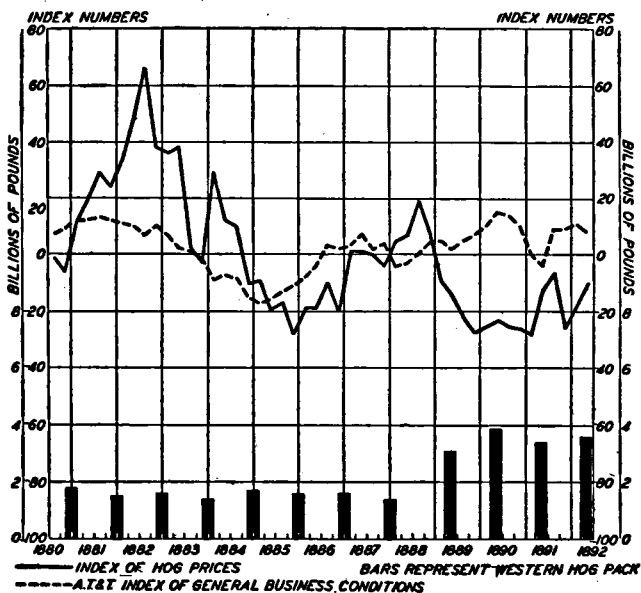
1910 the concurrence of low receipts of hogs and big corn crops resulted in favorable price ratios which, in turn, brought out a large volume of market hogs. Industrial prices declined in 1907 and 1908. So did the price of hogs and, therefore, pork products. When business and general prices recovered in 1909 and reached a peak in 1910, the flood of hogs had been spent, and the shortage which culminated in 1910 brought about a peak in hog and in pork prices at the same time. The recession of general prices in 1911 was accompanied by declining pork prices due primarily to increasing supplies.

The fact that hog and business cycles have during certain periods displayed an inverse movement may be observed in the figures on pages 216 to 219, which show the fluctuations of the total number of hogs packed and those of the production of pig iron from 1879 to 1915. The same relationship occurred in the period just discussed, from 1906 to 1911, and also from 1881 to 1887; from 1894 to 1897, and from 1902 to 1904. The hog cycle is usually about four years in length—that is, four years from one period of high production to another. Since 1900 periods of high market receipts have been 1901-02, 1905-06, 1908, 1911-12, 1916, 1918-19, and 1923-24. Business cycles in the United States also have averaged close to four years in length. Hence if they fall into step they may march along together for some time.

At other times, however, hog production has run

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HOG PRICES, HOG PACK, AND AMERICAN BUSINESS CONDITIONS, 1880-1892 *



* Hog Prices: Percentage deviations from the 1880-1892 average of heavy hog prices at Chicago.

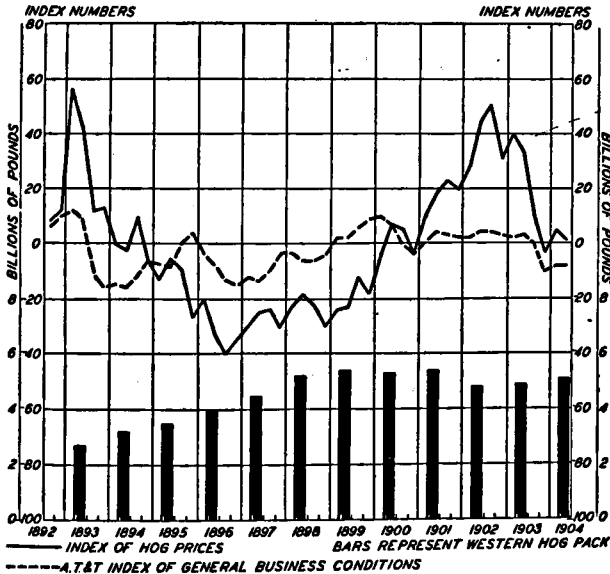
Source of data: *Chicago Drivers' Journal Yearbook*, 1925, p. 55.

Hog Pack: 1880-1888 bars represent winter pack only; weight of summer pack not available. After 1888 the bars represent total weight of winter and summer pack. Bars centered at middle of year ending October 31. Sources: 1880-1915, Wright, Sewall, *Corn and Hog Correlations, Bulletin*, No. 1,300, U. S. Department of Agriculture, p. 11; 1916-1925, compiled from *Price Current Grain Reporter Yearbook*, 1926, pp. 74 and 79.

American Telephone and Telegraph Company Index of Business: For sources see note to chart, p. 148.

parallel with business activity. This was true from 1888 to 1893 and on other occasions. Since the war there has been considerable parallelism between the

HOG PRICES, HOG PACK, AND AMERICAN BUSINESS CONDITIONS, 1892-1904 *



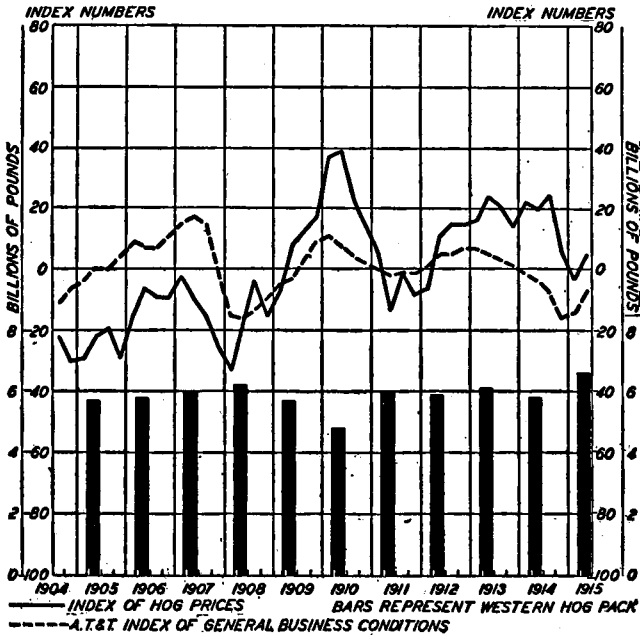
* Hog Prices: Percentage deviations from the 1892-1904 average of prices. For sources see note to chart, p. 216.

fluctuations of the volume of pork production and of general business activity. Four successive large crops of corn ending in 1923 resulted in an increasing volume of market hogs. The downward trend

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did not come until after the corn crop of 1924, and hence lagged a whole year after the industrial depression in 1924.

HOG PRICES, HOG PACK, AND AMERICAN BUSINESS CONDITIONS, 1904-1915 *

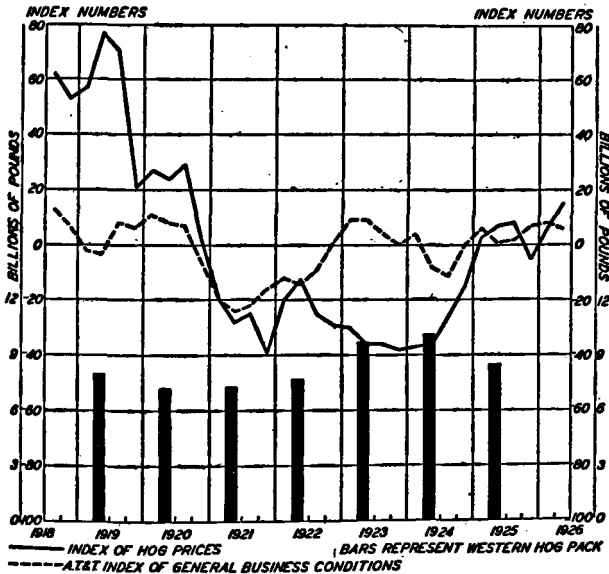


* Hog Prices: Percentage deviations from the 1904-1915 average of prices. For sources see note to chart, p. 216.

The corn-hog cycles arise mainly from agricultural conditions. Business cycles might influence such production by their effect on the corn-hog

price ratio, that is, by modifying either the price of corn or the price of hogs sufficiently to change the ratio. We already have seen that the price of

HOG PRICES, HOG PACK, AND AMERICAN BUSINESS CONDITIONS, 1918-1926 *



* Hog Prices: Percentage deviations from the 1918-1926 average of prices. For sources see note to chart, p. 216.

corn is not related to business cycles. We have also seen that the volume of pork production is the chief factor affecting the price of hogs. It is clear, therefore, that the relationship between the corn-hog

cycle and the business cycle must be largely accidental.

Let us now see whether statistical analysis will enable us to put these qualitative conclusions in quantitative terms. With that end in view two separate statistical studies have been made by the writer. In one the purpose was to find the relationship between domestic purchasing power and the demand for pork; in the other it was to measure the relationship between business activity and the price of hogs, with the influence of the price of pork eliminated. The results of several other studies along similar lines have been published, but in only one case were they applicable to the present problem. That study will be discussed along with the two made by the writer.

The small price influence of business cycles on hog prices is shown by statistical measurement. Several detailed statistical studies of hog prices have been made. Most of these have been made for forecasting purposes, and for that reason the current market supply of hogs has not been used as one of the variables.¹⁸ This is a disadvantage for present purposes, since it does not afford a direct comparison of the influence on price of hog supply, the chief factor, with that of business cycles. A

¹⁸ Among such studies are Sarle, Charles F., "Forecasting the Price of Hogs," *American Economic Review*, Supplement No. 2, Vol. 15, September, 1925; and Wallace, H. A., "Forecasting Corn and Hog Prices," *The Problem of Business Forecasting*.

study made by Haas and Ezekiel,¹⁹ however, includes both a supply variable and one reflecting business conditions. In addition to these, the effects of stocks of pork in storage, the trend of demand, the value of the dollar, the export demand, and the price of steers are measured.

Supply was found to be the greatest single factor affecting the price of hogs. "The slaughter during any one month and the quantity of pork and pork products held in storage both had some effect upon the price, but the average slaughter over a period of several months had a much greater effect upon the price than did differences in slaughter or in storage from month to month."²⁰

On the demand side the most important variable was the export demand.

Compared to the differences in the supply, however, this was a relatively unimportant factor, having only about one-tenth as much an influence upon price during the period as did changes in the supply. Since the consumer can readily substitute beef for pork, the price of steers has some effect upon the price of hogs. During the period studied, however, changes in the price of steers had a less important effect upon the price of hogs than did changes in export demand. Changes in the general prosperity of city people, because of changes in business conditions, have often been thought to have a large influence upon the price of farm products. But as far as shown by this study, changes in business activity have only a very small effect upon the price of hogs, being less

¹⁹ U. S. Department of Agriculture, *What Makes Hog Prices?* preliminary report, March, 1925.

²⁰ *ibid.*, p. 2.

important than any of the other factors already named. Very active business conditions increased prices slightly, but under depressed conditions hog prices were as good as with moderately active business. That is, only during the very active phase of the "business cycle" is there any measurable effect of business conditions upon hog prices.²¹

Some doubt is thrown upon the above conclusions respecting the effect of business cycles upon the price, however, because of the fact that the value of the dollar has been included as a variable. The fluctuations of the general level of prices, which determine the value of the dollar, are frequently associated with business cycles. As a result, the real influence of business cycles may be hidden.

A statistical analysis made by the writer on a slightly different basis, the details of which are given in Appendix A, shows that the effect of the volume of production upon the money prices is practically five times as great as that of domestic business cycles. The price of the Western winter hog pack was correlated with the size of the pack and with the volume of pig iron production. The net correlation between price and pork production was $-.76$, which indicates an influence of 58 per cent. The net correlation between price and pig iron production was $+.35$, which indicates an influence of only 12 per cent. Since, however, other factors, such as the price of other meats, the export

²¹ *ibid.*, p. 3.

demand, and circumstances affecting both prices and industrial activity such as wars, currency difficulties, and others, were not considered, the influence may be less than figures indicate. This is especially likely to be true of the effect of business cycles, since the cycles frequently are inter-related with wars, currency difficulties, and foreign business conditions.

In spite of the limitations of these statistical studies, one conclusion appears certain. That is that the volume of pork production is by far the most important single factor affecting the unit price of hogs, and that domestic business cycles are of relatively minor significance as a price factor.

CHAPTER IX

BUSINESS CYCLES AND THE PRICE OF WHEAT

EVERYONE knows in a general way that wheat is the universal breadstuff, that there are hard and soft varieties, that we export a large quantity of it, and that sometimes it is necessary to import a little. "General" knowledge on these and other points is hardly precise enough, however, for an understanding of the possible effects of business cycles in the United States on the price of wheat. Hence this descriptive, introductory section.

I. A PRELIMINARY VIEW OF THE WHEAT INDUSTRY

Wheat is grown and consumed all over the civilized world. As an article of daily consumption, it ranks very high everywhere except in the tropics, the Polar regions, and the Orient. The widespread area of consumption is indicated in the table on the opposite page.

Production is equally universal throughout the temperate climates, as is illustrated by the fact that wheat is harvested somewhere on the globe during every month of the year. The table on page

BUSINESS CYCLES AND PRICE OF WHEAT 225

ESTIMATED ANNUAL PER CAPITA CONSUMPTION OF WHEAT IN VARIOUS COUNTRIES *

(bushels)

Canada	9.5	Netherlands	4.2
Belgium	8.3	Roumania	4.0
France	7.9	Denmark	3.5
Spain	6.1	Chile	3.4
United Kingdom	6.0	Germany	3.2
Switzerland	6.0	Russia	2.7
Australia	5.5	Serbia	2.5
Italy	5.4	Sweden	2.5
United States	5.3	Egypt	2.5
Uruguay	5.3	Portugal	1.8
Argentina	5.2	British India .....	.8
Bulgaria	5.0	Mexico .....	.8
Austria-Hungary	4.3	Japan .....	.5

* U. S. Department of Agriculture; published in *The Miller's Almanack*, 1925, p. 105.

226 shows the average size of the crops in the more important wheat-producing countries.

Wheat enters freely into international trade. Some countries produce more than they need, while others must import to make up their deficits. The exchange between surplus and deficit areas is facilitated by the nature of the grain. It is fairly high in value for its bulk and weight. It can be stored for indefinite periods. It also can be graded accurately so that it can be sold on the basis of certified and established grades.

The result is a world market for wheat, with the major fluctuations of wheat prices at Liverpool, Chicago, Buenos Aires, and Winnipeg following each other very closely. The correlation between the price at Chicago and the price at Liverpool for the

years from 1890 to 1921 is $+.93$.¹ Since Liverpool is chiefly a buying market—that is, it acts as a con-

PRODUCTION, EXPORTS AND IMPORTS OF WHEAT (INCLUDING FLOUR),
BY PRINCIPAL COUNTRIES *
(millions of bushels)

Countries	Average of 1910-1914*			Average of 1921-1925		
	Produc- tion	Ex- ports	Im- ports	Produc- tion	Ex- ports	Im- ports
United States	690	105	2	802	255	20
Canada	197	94	c	370	236	c
Russia	608	165	1	257	10 ^d	...
Hungary	71	49	7	60	11 ^b	c
Rumania	159 ^b	55	c	90	4	1*
British India	352	51	c	336	21	5
Germany	131	23	92	99	2	55
France	326	1	44	291	2	41
Italy	184	4	56	198	3	99
Netherlands	5	58	81	6	4	27
United Kingdom	60	4	219	61	10	212
Chile	20	3	c	26	3	c
Argentina	147	85	c	203	122	c
Australia	90	50	c	127	98	c
Estimated world total †	3,765	790	689	3,557	801	679

* Compiled from U. S. Department of Agriculture *Yearbooks* and from data obtained from U. S. Bureau of Agricultural Economics.

^a Production figures are for period 1909-1914.

^b Four-year average.

^c Less than 500,000.

^d Three-year average.

^e One year only.

[†] Excluding a few minor countries which do not enter into world trade or for which no estimates are available.

centration point for imports—prices are highest there. The prices at the other markets are about

¹ Killough, Hugh B., "What Makes the Price of Oats," U. S. Department of Agriculture, *Bulletin* No. 1351, p. 23.

as much lower as the cost of transferring the grain to Liverpool.

The United States contributes an important share of the world's exportable surplus of wheat. The average exports and imports before and after the war are shown by countries in the table on page 226. Before the war this country supplied about 13 per cent of the wheat imported by the deficit countries. At that time Russia had the largest surplus. The average annual exports during the period 1909-1914 from Russia were 165 million bushels, while those from the United States averaged 105 million bushels. After the war Russia dropped out of the picture, while the exports from the United States for a time greatly increased. In 1920-21 our exports amounted to 361.8 million bushels, or 43 per cent of the world's total export trade in wheat. In 1924 we exported 156.4 million bushels in a total world's trade of 879.4 million bushels—less than 18 per cent. This followed a short crop year in the United States, and there has subsequently been some recovery in exports. Canada, Argentine, and Australia are the other important exporting areas.

It is important to distinguish between the types of wheat grown in the United States. There are five general classes of wheat. These are (1) hard red spring, (2) hard red winter, (3) soft red winter, (4) durum, and (5) the white wheats. The table on page 229 shows estimates of the production and exports of each type during recent years. As will

be observed, the most important classes are the hard red spring and the two types of winter wheat. The hard red spring produces a flour which usually commands a premium over other flours. It is also used for mixing with the softer wheats. Very little of it is exported; on the contrary, the supply of the best grades is sometimes so limited that considerable quantities are imported from Canada in spite of the tariff.²

Hence it may be expected that the price of this type of wheat, especially when the importations are large in volume, will exhibit a price behavior somewhat different from that of wheats grown in part for export. Canada is the only foreign producer of this type of wheat.

The hard red winter also is a wheat of high gluten content, and therefore makes a good bread-baking flour. Like the hard spring wheat, the darker grades are used for mixing with the softer wheats and hence supplement the former when the crop is short. The

²By executive order the tariff on wheat has been 42 cents a bushel since March 7, 1924. Other tariff rates have been as follows:

<i>Year</i>	<i>Rate (cts. per bushel)</i>
Law of 1922	30
Emergency law of 1921	35
Underwood Law of 1913	free, except for 10 cents on imports from countries imposing a duty on United States exports.
Payne-Aldrich Law of 1909	25

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crops of Russia, the lower Danube basin, and Argentina are of this type. The soft red winter wheat is used in making pastry flours and in bread-making.

PRODUCTION IN THE UNITED STATES AND INSPECTIONS FOR EXPORT OF WHEAT, BY CLASSES, JULY 1, 1920, TO JUNE 30, 1925 *

(millions of bushels)

Type of Wheat	Year Beginning July 1			
	Average 1920-1923		1924	
	Estimated Production ¹	Inspections for Export	Estimated Production ²	Inspections for Export
Hard red spring	141.6	10.0	197.7	16.8
Durum	63.8	7.7 ³	67.4	5.9 ³
Hard red winter	278.6	70.6	313.5	90.8
Soft red winter	251.1	21.0	236.8	6.9
White	92.9	8.5	57.3	10.1
Mixed .....	....	29.5	....	9.4
Flour as wheat .....	....	72.1	....	61.0
Other wheat ³ .....	....	36.5	....	54.1
Total	828.0	255.9	872.7	255.0

* U. S. Department of Agriculture, *Crops and Markets*, Monthly Supplement, July, 1925, p. 232.

¹Based on estimate of percentage classification by states as reported to Division of Crop and Livestock Estimates.

²Exports of wheat other than reported as Federal inspected.

³These figures understate durum exports. In 1920-21 over 20 million bushels of durum exported were mixed with spring wheat. In other years, 70 per cent of mixed wheat was durum. Moreover, durum passing from lake ports via Montreal escapes classification.

When devoted to the latter purpose, it is usually mixed with some harder variety, as is suggested above. Most of the European grown wheat and some of the Argentine crop is of this type.

Durum is a very hard spring wheat, which is used in making macaroni, spaghetti, vermicelli, and other edible pastes. Durum wheat is also grown in Canada, Russia, and North Africa.

White club wheat, grown only in the Pacific Coast states, and common white wheat, grown largely in the same area but also in New York, Michigan, and some other sections, are used in making pastry flours, breakfast foods, and to a small extent for bread-making. Australia and India grow similar white wheats.

As is shown in the table on page 229, the hard red winter is the largest crop. Part of it is moved to Northern states to mix with the hard red spring wheat, part of it goes to the soft winter states also for mixing, and a considerable surplus is left for export. Comparatively little of the hard red spring is exported. Some of the soft red winter, but not nearly as much as of the hard red winter, is available for export. About half of the durum crop is exported, chiefly to South European countries demanding a cheap wheat. The white wheats are largely exported to Asiatic countries.

We may note also a few facts regarding the disposition of the United States wheat crop.

About two-thirds of the domestic wheat crop is milled within the country. Flour, of course, is the chief product of the milling process. There are, however, important by-products which are used as feed for animals. The way in which wheat is broken

up into different products has been described as follows:

In modern milling, flour is produced by passing the thoroughly cleaned wheat through a series of steel rollers, each succeeding pair being set a little nearer together so that the kernels are gradually crushed into smaller and smaller particles. After passing through each pair of rollers or "breaks," the flour is removed by sifting or passing the material over bolting cloth, and finally only the by-products remain. The terms employed to designate the various mill products differ somewhat in various sections of the country, but those most commonly used are wheat bran, standard middlings or shorts, white or flour middlings, red dog flour, and wheat mixed feed. In the manufacture of flour from 20 to 30 per cent of the weight of the wheat grain remains as bran, middlings, and so forth.*

As the table on page 232 shows, in the five census years covered, the value of the bran and middlings averaged about 15 per cent of the value of the flour milled. This does not include the value of wheat screenings and feeds prepared and mixed by the flour mills, since they are not listed separately in the census reports.

Flour also figures in the wheat exports. On the basis of the five census years shown in the table, about 18 per cent of the flour milled in the United States was exported. Of all wheat exported in the same years about one-third was shipped in the form of flour. A small quantity of flour is usually imported from Canada.

* Henry, W. A., and Morrison, F. B., *Feeds and Feeding*, 1922, pp. 158-9. (Italics removed from the original.)

WHEAT PRODUCED AND MILLED, AND VALUE OF FLOUR AND BRAN AND MIDDINGS GROUND IN THE UNITED STATES, 1914-1925*

Census Year	Production (millions of bushels)		Value of Milled Product (millions of dollars)	
	Harvested	Milled	Flour	Bran and Middlings
1925	676	531	905	137
1923	797	538	663	118
1921	815	521	872	106
1919	968	613	1,436	211
1914	891	546	544	105
Average	868	554	879	135

* Data on total crop from U. S. Department of Agriculture, *Yearbook*, 1924, p. 560. Other figures from U. S. Bureau of Census, "Flour-mill and Grain-mill Products and Bread and Other Bakery Products," *Census of Manufacturers*, 1923, p. 10. Figures for 1925 from press release of February 7, 1927, U. S. Bureau of Census.

A very important portion of the flour consumed in the United States is baked in commercial bakeries. The total domestic flour consumption in 1923 appears to have been about 104,000,000 barrels.⁴ of which about 35,000,000 barrels were consumed by the commercial bakeries having an output valued at \$5,000 or more each. As the number of smaller bakeries is large, the proportion baked in homes must be considerably less than two-thirds. The accompanying table shows the variety of ways in which flour enters into consumption:

⁴U. S. Bureau of Census, "Flour-mill and Grain-mill Products and Bread and Other Bakery Products," *Census of Manufactures*, 1923, p. 6. Comparable figures for later years are not available.

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VALUE OF PRODUCTS OF COMMERCIAL BAKERIES IN 1925 * (millions of dollars)

Product	Value
Bread and rolls	594
Biscuits, crackers, and cookies	243
Cake, doughnuts, and so forth	170
Pies and other pastry	55
Pretzels	5
All other products	7
Total	1,074

* U. S. Bureau of the Census, "Flour-mill and Grain-mill Products and Bread and Other Bakery Products," *Census of Manufactures, 1925* (preliminary release).

Besides using the by-products of flour milling as feed for livestock, the farm provides two other outlets for wheat. One is feed in the unground form. The amount of whole wheat fed is small, however, averaging about 2 per cent of the crop. The other use is for seed. This item is larger, running close to 8 per cent of the crop.

The disposition of the domestic wheat crop may be summarized in the following figures, which are estimates of the amounts used in different ways in 1919:

ESTIMATED DISPOSITION OF THE WHEAT CROP OF THE UNITED STATES, 1919

Use	Amount (millions of tons)
Domestic consumption (human)	14.8
Fed to livestock	6.6
Seeded	2.8
Exported (wheat and flour)	6.6

After this brief preliminary survey of the industry, we shall now proceed to an analysis of the price problem.

II. THE VOLUME OF PRODUCTION AND THE PRICE OF WHEAT

It is clear from the foregoing description of wheat prices that the size of the world crop is a leading factor affecting the fluctuations in prices. We shall therefore continue our price discussion by examining this relationship in greater detail.

The world supply of wheat is the chief factor affecting its price. This is shown in several statistical studies of wheat prices. For the period from 1897 to 1914, C. C. Bosland⁵ found a correlation coefficient of $-.74$ between changes in the deviations of supply (current world production plus world carryover) from trend and the changes in the deviations of purchasing power (crop-year average of cash wheat in the Chicago market divided by the Bureau of Labor Statistics index of wholesale prices) from trend. Hugh B. Killough obtained a coefficient of $-.80$ by correlating similar data for the period from 1891 to 1913.⁶ The size of these coefficients shows that the world supply is the dominant factor affecting the annual price. The world carryover averages only about 5 per cent of the

⁵"Forecasting the Price of Wheat," *Journal of the American Statistical Association*, June, 1926, Vol. 21, pp. 149-161.

⁶*What Makes the Price of Oats*, U. S. Department of Agriculture, *Bulletin* No. 1351, September, 1925, p. 24.

world crop, and the variations of the latter are very much wider in absolute quantities than the former. For that reason, the changes in current production constitute the most important feature of the supply changes.

The world crop does not all come upon the market at the same season of the year; in fact, wheat is harvested in some part of the world in every month of the year. Most of the wheat, however, is grown in the Northern hemisphere and comes upon the market from June to September. About 70 per cent of the world crop is harvested during these months. The crop of the Southern hemisphere begins to mature in December, and the harvest continues in various countries through February. From March through May the harvest advances from northern Africa to southern Asia and Mexico. Harvest begins as early as May even in some of the Southern states of this country.

The price reflects the size of these various crops as they come upon the markets. Correlation coefficients show that of the wheat grown in the Northern hemisphere the volume of the European output affects the price the most. This is to be expected because of its greater size. During the five years from 1910 to 1914 it averaged 2,087 million bushels and the North American crop only 762 million bushels. During the war, production in North America increased, while that in Europe declined, so that the two have become more nearly equal. From

1920 to 1923 the European average was 1,336 million bushels, compared with 1,198 in America. The European outturn as a rule affects the Chicago price most from June to August. The effect of the North American crop is most marked about one month later, that is, from July to September. But even during the latter period the size of the European crop is more strongly reflected than that of the yield in North America.

Coefficients of correlation between changes in the Chicago price and changes in the size of the crop in Europe and in North America, as computed by the Department of Agriculture, are given in the table below. The data cover the period from 1886 to 1923, except the years from 1915 to 1920. These coefficients show the relative influence of each of these two crops on the Chicago price at various periods of the harvest season.

CORRELATION BETWEEN THE CHICAGO PRICE OF WHEAT AND THE VOLUME OF WHEAT PRODUCTION IN EUROPE AND NORTH AMERICA *

Price Period	Coefficient when Price Is Correlated With:		
	European Crop	American Crop	Both Crops †
April-June	-.16	-.24	.33
May-July	-.49	-.25	.57
June-August	-.56	-.26	.69
July-September	-.43	-.35	.63
August-October	-.09	-.28	.33
September-November	-.14	+.39	.39
October-December	-.08	+.34	.33

* U. S. Department of Agriculture, *Foreign Crops and Markets*, September 24, 1924, pp. 313-314.

† Coefficient of multiple correlation.

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In November the influence of the crops in the Southern hemisphere becomes apparent, since the probable yield is reflected in the condition reports. This continues when the harvest begins in December and runs through January and February. By the time the Southern crop is harvested, condition and acreage reports of the Northern crops begin to show in the trend of prices.

The effect of the size of Southern hemisphere crops was well illustrated in 1925. Early in November a bumper crop of around 270 million bushels was expected by the trade. The official forecast on November 13, however, was 235 million bushels. This was cut to 215 millions in mid-December and to 191 millions on April 10. Prices in Buenos Aires, Liverpool, Chicago, and Winnipeg began to rise about the middle of November and climbed rapidly to a high point about December 10. The rise of 43 cents in Buenos Aires was greatest, although in Liverpool, where shipments from Argentina had been heavily counted on, the advance was 40 cents.⁷

The yield of substitute crops is also a significant price factor, especially in years of short wheat crops. This is especially true of rye, which is an important breadstuff in Europe. Killough found that when only the supply and price of wheat were correlated a coefficient of $-.80$ was obtained but when data on

⁷ Food Research Institute, *Wheat Studies*, May, 1926, pp. 206 and 219.

world rye outturn were added as a third variable, the coefficient of multiple correlation was .86.⁸

In parts of southern Europe, in many subtropical countries, and even in the Southern states in this country corn is readily substituted for wheat. In the Orient rice is of course the chief competitor of wheat, while in many parts of Europe consumers depend on potatoes when wheat becomes high in price.⁹

The variations in the distribution of the crop not only between countries but also between types are further price factors. The effect on prices of such variations may be illustrated by the situation during the crop years 1923-24 and 1924-5. In 1923 the world wheat crops were large as a result of generally good yields. The supply of hard and semi-hard wheats was particularly large, Canada having a very large supply available for export. Her crop of 474 million bushels was nearly 40 per cent greater than the average for the years 1920 to 1924. The United States crop was smaller than usual, the hard spring type being particularly short. In 1924, on the other hand, the situation was reversed. The Canadian crop dropped 262 million bushels. The United States production of hard red spring wheat increased from 127 million bushels to 198 million bushels.

⁸ *What Makes the Price of Oats*, p. 24.

⁹ See, for example, the discussion of the supply situation during the wheat crop year 1924-25 by the Food Research Institute in the following issues of *Wheat Studies*: December, 1924, pp. 7-8; February, 1925, p. 80; and April, 1925, p. 150.

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This change in the distribution of supplies was reflected in the prices. In 1923 the average price of No. 1 Dark Northern in Minneapolis during the months from September through December exceeded the price of No. 1 Manitoba in Winnipeg. The respective prices were \$1.23 and 96 cents a bushel. During the corresponding months in 1924 the Winnipeg price exceeded the Minneapolis price for the same classes of wheat. The Winnipeg price was \$1.61, the Minneapolis price \$1.53. The scarcity of Canadian wheat was also reflected in the Liverpool market, where No. 1 Manitoba sold at a considerable premium over No. 2 Hard Winter, whereas the opposite had been true during most of the previous year.

In these two years there was also reversal of the relative supply of soft and hard red winter wheats in the United States. The table on page 240 shows the estimated production of these wheats in 1923 and 1924 and the average price during the four months from September through December. The shortage of the soft wheat in 1924 is shown by the high premium over the hard variety.

Thus we find that, while the total world supply of wheat influences in an important way the fluctuations of all wheat prices, the variations in harvest time, the supply of substitute crops, and the distribution of supplies between countries and types of wheat are modifying factors. The price in any

particular country and for a particular type of wheat reflects, therefore, not only the world supply situation but also the particular supply situation for that country and type of wheat.

ESTIMATED PRODUCTION AND AVERAGE PRICE OF HARD RED AND SOFT RED WINTER WHEATS IN THE UNITED STATES, 1923 AND 1924.

Year	Hard Red Winter Wheat		Soft Red Winter Wheat	
	Production ¹ (millions of bu.)	Price ² (cents per bu.)	Production ¹ (millions of bu.)	Price ² (cents per bu.)
1923..	242	109	272	108
1924..	314	140	237	160

¹ Data for 1923 from U. S. Department of Agriculture, *Yearbook*, 1924, p. 579, and for 1924 from *Crops and Markets*, monthly supplement, July, 1925, p. 232.

² Average price computed from data by Food Research Institute, *Wheat Studies*, December, 1924, p. 58, and November, 1925, p. 63. The prices are for No. 2 grade in each case and are the average for the four months September through December.

Climatic conditions are the chief factors affecting the supply of wheat. As with any other crop, the size of the total outturn is the product of the number of acres harvested and the yield per acre. The yield per acre depends almost entirely upon the kind of weather and the amount of damage from insects and plant diseases. The estimated average reduction from full yield from various causes is shown in the table on the opposite page.

From 1909 to 1924 the loss due to weather changes varied from 13 per cent in 1915 to 34.4 per cent in 1917.

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AVERAGE PERCENTAGE REDUCTION OF WHEAT CROP FROM FULL YIELD FROM STATED CAUSES, 1915-1924 *

<i>Cause</i>	<i>Per Cent</i>
Deficient moisture	10.7
Excessive moisture	3.1
Frost or freeze	4.0
Other climatic causes	3.8
Insect pests	3.0
Plant diseases	5.1
Other causes .....	.6
Total	30.3

* U. S. Department of Agriculture, *Crops and Markets*, Monthly Supplement, January, 1925, p. 11.

The losses from plant diseases, such as stem rust, bunt, and scab, and from insects, the most important of which is the Hessian fly, are not so great. The former have varied from .3 per cent reduction in 1913 to 12.5 per cent in 1916. The latter have varied only from .7 per cent in 1917 to 4.6 per cent in 1923.

The varying effects of weather, insects, and other such factors result in wide fluctuations in the yield. The yields of spring wheat in the United States since 1910 have ranged from 8.2 bushels in 1919 to 18.4 bushels per acre in 1915. The variations of the yield of winter wheat have not been so wide. The range in the same period has been from 13.8 in 1916, 1921, and 1922 to 19 bushels per acre in 1914. The highest average yield of all wheat in the United States was 17 bushels in 1915; the lowest was 10.2 bushels in 1881.

The acreage planted and harvested depends both

on the price of wheat and on the weather. The price of wheat before and during planting time plays a considerable part in farmers' decisions as to how large an acreage is to be sowed each fall and spring. This appears to be particularly true in the case of the spring wheat growers.¹⁰ The price of alternative crops is also a determining factor. The value of oats, barley, flax, corn, cotton, tobacco, or whatever the competing crops may be affects the relative profitableness of wheat, and hence the acreage that is sown. The condition of the weather at seeding time also causes last minute changes. As a result, the acreage planted varies considerably from year to year. These variations have been exceptionally wide during the past decade as a result of the expansion of wheat production during the war.

The area sown and the area harvested, however, are by no means the same. This is particularly true of the winter wheat acreage, which always exceeds in the United States that sown in the spring, recently by over 100 per cent. An unfavorable winter and fall may kill so many of the wheat plants that the land is replanted to some other crop in the

¹⁰ See Lyon, Leverett S., and Rassieur, T. Edward, "The Price Responsiveness of Wheat Growers," *Journal of Political Economy*, Vol. 32, 1924, pp. 707-721. This study showed that during the period from 1896 to 1921 the spring wheat acreage reflected the direction of change in price during the previous year in 84 per cent of the years. In the case of winter wheat, however, the change in acreage corresponded in direction to the change in price in only 50 per cent of the years.

spring. Abandonment because of winter-killing has varied from as little as 1.1 per cent in 1919 to as high as 28.9 per cent in 1917. The effect of the weather on the total acreage actually harvested is thus very great. In 1917, for example, over 56 million acres of winter and spring wheat were sown, but only 45 millions harvested; in 1912, 52 millions were sown and 46 millions harvested.

Nature therefore has a chance to play her cards twice; once during the winter, when the large winter wheat crop is dormant, and again when the crop is growing and maturing. The result is that the growers have comparatively little control over the volume of production except in its long-time trends. A decrease in acreage planted may even be followed by a larger crop. Such was the case in 1912, 1913, 1917, and 1924. At other times a larger area planted produces a smaller crop. During the periods of rapid expansion accompanying the war and of subsequent contraction, the changes in area planted were so great that the acreage and the total crop usually varied in the same direction. The changes in the latter, however, were by no means proportionate to the former.

The forces of nature are also important factors determining the size of the crop in other countries. The variations in the weather and in injury from various insects and plant diseases play the same role everywhere. The yields per acre in western Canada since 1909 have ranged from 10.5 bushels in 1919

to 27.8 bushels in 1915. In Australia, we find such wide variations as a crop of 25 million bushels in 1915 followed by a crop of 179 millions the next year; and again 46 millions in 1919 and 146 millions the next year—changes due chiefly to differences in the yield per acre. Russia, which was the greatest exporter of wheat when producing at its normal rate before the war, presents similar variations. The 1913 crop exceeded that of 1911 by 82 per cent, whereas the increase in acreage was only 4 per cent. Turning to a deficit country, we find Italy harvesting 30 per cent more wheat in 1913 than in 1912, with no important change in acreage.

To a certain extent these variations in the yield in different parts of the world offset one another. In 1911, for example, Russia, the United States, and Australia had very poor crops, which greatly reduced the usual exportable surplus. But not only did Canada, Argentina, and India have surpluses larger than usual that year, but western Europe also was required to import less because of excellent crops of her own. The year before it had been the other way; Europe and Canada had small crops, while most of the rest of the world had good crops. The world production for those two years was just about the same.

But in many other years the counter-balancing is not as perfect as that, and world surpluses or shortages arise. The crops in both hemispheres may be better than average; or it may happen that the

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areas of the earth's surface which receive favorable weather embrace the most important wheat-producing countries. As a result, we find variations in the world crop, although they are not as wide as those in a single area. In the ten-year period preceding the outbreak of the war the range in the (estimated) world crops was from 2,852 million bushels in 1907 to 3,695 million bushels in 1913. Since 1920 the range has been from 2,893 to 3,491 million bushels.

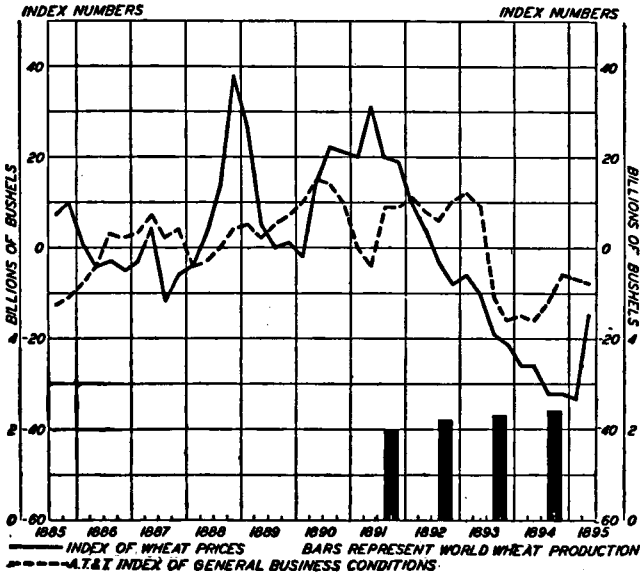
III. BUSINESS CYCLES AND THE PRICE OF WHEAT

It is clear from the foregoing analysis that the main variations in the production and price of wheat take place independently of the condition of general business activity in any one particular country. The fluctuations of supply are a result chiefly of the combination of growing conditions imposed by nature on all the various wheat producing areas. These changes in supply, both in the world and in particular areas of particular types, in turn are the dominant factors affecting the price in any time or place. On the surface, therefore, it does not seem likely that business cycles in the United States have any appreciable degree of influence on domestic wheat prices. Let us see whether this really is the case.

We find relatively little reflection of business cycles in the price of wheat. The comparison between the indexes of the Chicago price of spring

wheat and domestic business conditions in the figures on pages 246 to 249 shows very little

WHEAT PRICES, WORLD WHEAT PRODUCTION, AND AMERICAN BUSINESS CONDITIONS, 1885-1895 *



* Wheat Prices: Percentage deviations from the 1885-1895 average of prices of Spring Wheat at Chicago. Sources of data: Bureau of Agricultural Economics, U. S. Department of Agriculture.

Wheat Production: 1891 to 1914, Killough, Hugh B., *What Makes the Price of Oats?*, Bulletin No. 1351, U. S. Department of Agriculture; 1919-1925, *Wheat Studies*, December, 1926, p. 83.

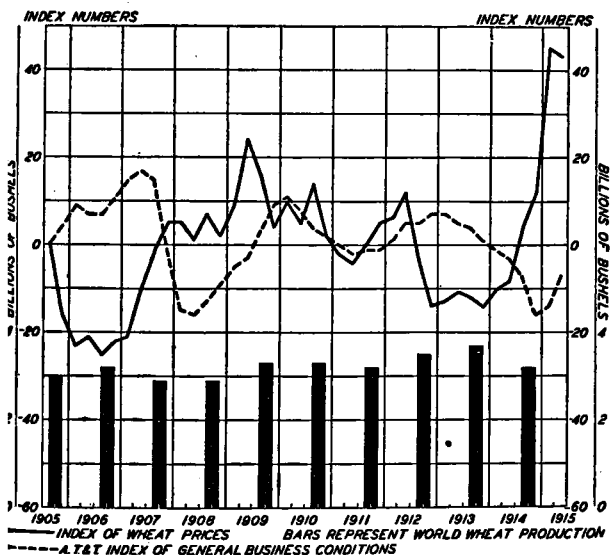
American Telephone and Telegraph Company Index of Business. For source see note to chart, p. 148.

correlation between the two. In many years, such as 1889, 1892, 1899, 1903, 1904, 1906, 1907, 1908,

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1912, 1914, and 1923, the movement of the price was exactly opposite to the changes in the volume of

WHEAT PRICES, WORLD WHEAT PRODUCTION, AND AMERICAN BUSINESS CONDITIONS, 1905-1915 *

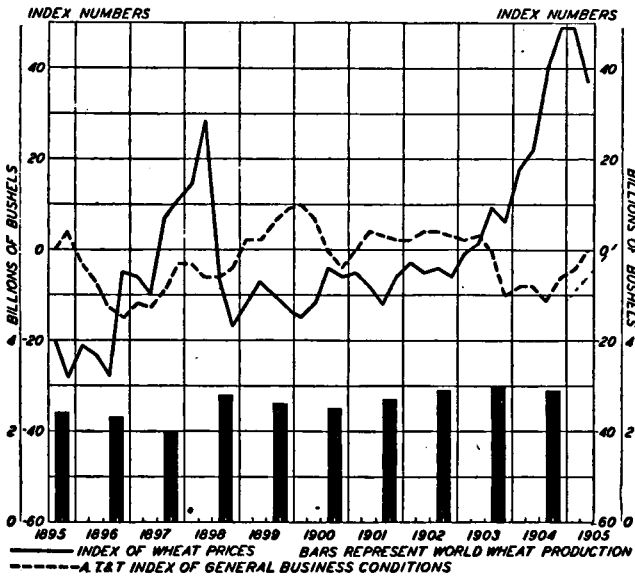


* Wheat Prices: Percentage deviation from 1905-1915 average of prices. For sources see note to chart p. 246.

industrial activity. When the percentage changes of annual wheat prices in the fall are correlated with the changes in the annual pig iron production, an

index of business conditions, no significant coefficient is obtained.¹¹

WHEAT PRICES, WORLD WHEAT PRODUCTION, AND AMERICAN BUSINESS CONDITIONS, 1895-1905 *



* Wheat Prices: Percentage deviations from 1895-1905 average of prices. For sources see note to chart p. 246.

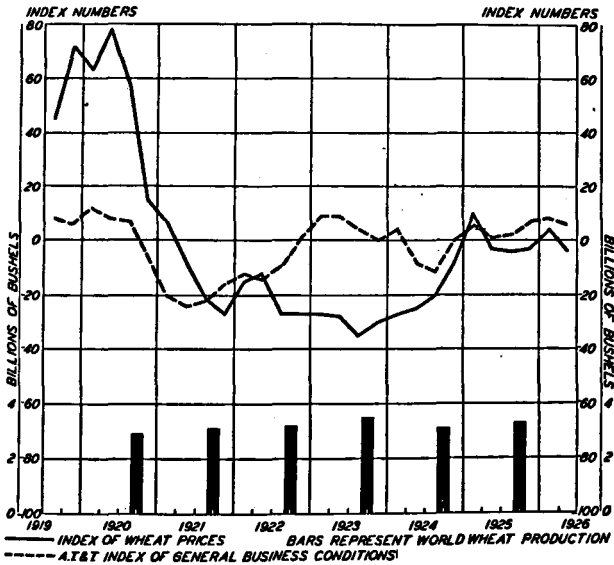
When the influence of changes in supply are eliminated, however, a small positive correlation is

¹¹ Persons and Coyle note that the fluctuations of the prices of wheat and wheat flour have not been typical of the general movement of business. "A Commodity Price Index of Business Cycles," *Review of Economic Statistics*, September, 1921, Vol. III, p. 363.

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found. But this is by no means as large as the correlation of price with supply when business conditions are held constant. In the first case the net

WHEAT PRICES, WORLD WHEAT PRODUCTION, AND AMERICAN BUSINESS CONDITIONS, 1919-1926 *



* Wheat Prices: Percentage deviation from 1919-1926 average of prices. For sources see note to chart p. 246.

correlation is $+0.292$, while in the second it is -0.691 .¹² On the basis of the squares of these coefficients an influence of supply five times greater

¹²The details of this study are given in Appendix A.

than that of business cycles is indicated. It is probably even greater than that, however, because in some years the correlation of business cycles with wheat prices has not been the result of a causal influence of the former on the latter. Indeed, in some years, as in 1891 and 1897, when large American crops coincided with small crops in Europe and American farmers received a high price for their crop, the increased rural purchasing power had a very stimulating influence on domestic business activity. In 1891 and in other years, moreover, large wheat exports eased an uncertain currency situation by stemming the flow of gold away from the United States.

At other times the same conditions have affected the prices of both wheat and industrial products. The competitive bidding of the Allies for war materials in 1915-16 and in later years resulted in general advances in the prices of other commodities as well as wheat. The inevitable deflation of credit following the war similarly affected wheat and other commodity prices.

In general we find that the influence of world conditions on the price of wheat overshadows whatever effects variations in domestic demand may have. The price in Liverpool, for example, reflects supply and demand conditions in exporting and importing countries in all parts of the world, and except for relatively minor variations prices in other countries,

including the United States, are closely related to those in Liverpool.

Even the domestic demand in the United States, however, is not greatly affected by changes in the general business situation. The demand of both consumers and millers appears to be relatively stable, while that for farm uses varies independently of business cycles.

The demand for wheat for farm uses depends upon agricultural conditions. The amount used for seed each year is determined by the acreage seeded. The amount of seed used per acre does not change appreciably from year to year. The variations in the acreage planted each year already have been discussed. It was pointed out that the price of wheat in relation to the prices of alternative crops is the chief determining factor in these variations. These ratios, in turn, are dependent upon the supplies of those crops.

The whole wheat fed on the farms is not large in volume. A considerable part of it is fed to poultry, especially in the Eastern states. Its use as feed for other livestock depends on its relative cheapness as compared with other feeds.

In short, the demand for wheat in its farm uses depends upon the current prices of many farm commodities. This price structure is determined, in the main, by the current and prospective supplies of the corresponding farm commodities. The influ-

ence of business cycles is so remote as to be negligible.

The final consumer demand for wheat products going into human consumption is inelastic. This is indicated both by an examination of the best available statistics of consumption and by what economic theory tells us about the demand for a consumer's good of this kind. Several estimates of annual wheat consumption in the United States have been made. Most of these, however, are of practically no value for showing the variations in consumption from year to year because they are based on so many other estimated and unknown elements.¹³ Probably the only estimate that approaches usefulness for present purposes is that based on data on the production, stocks, imports, and exports of flour. Indexes of these estimates, for the years 1919 to 1925 inclusive, together with indexes of the prices of bread in leading cities and of pay-roll disbursements, are given in the table on page 253. These data show, first of all, an upward trend in the rate of consumption per capita during this period. They further indicate a strengthening in the demand for bread during a decrease in wage income and a weakening when the income increases. In 1920 and again in 1923 consumption of bread dropped slightly while pay-rolls were increasing, though in the one case the price of bread had in-

¹³ For a critical appraisal of such estimates see Food Research Institute, *Wheat Studies*, August, 1925.

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creased less than had pay-rolls and in the other it had not changed at all. Conversely, in 1921 and 1924 decreases in income were accompanied by increases in bread consumption, though in the one case the prices of bread decreased less than did incomes and in the other case it actually increased. In 1925 the higher bread prices and the increase in pay-rolls were accompanied by a smaller volume of consumption.

INDEXES OF PAY-ROLL DISBURSEMENTS, THE RETAIL PRICE OF BREAD,
AND THE CONSUMPTION OF WHEAT FLOUR IN THE
UNITED STATES, 1919-1925

(Base: monthly average for 1919 = 100)

Calendar Year	Pay-Rolls ¹	Price of Bread ²	Consumption of Flour per Capita ³
1919	100.0	100.0	100.0
1920	123.5	115.0	99.7
1921	83.6	99.0	102.3
1922	89.2	87.0	109.5
1923	113.2	87.0	107.3
1924	104.1	88.0	111.7
1925	107.2	94.0	107.8

¹ From *Federal Reserve Bulletin*, February, 1926, p. 110.

² Average retail price in leading cities. Data from U. S. Department of Agriculture, *Yearbook*, 1924, p. 591.

³ Data from *Survey of Current Business*, February, 1926, p. 78; reduced to per capita basis.

The most probable conclusion from these facts is that the demand for and the consumption of bread and breadstuffs are quite stable and that the changes, if there are any, stand in an inverse rela-

tionship to the changes in purchasing power accompanying business cycles. As far as the United States is concerned, this theory concerning the demand seems to represent the facts. The data given on consumption per capita of wheat and on bread prices seem to support it, although some reservations are necessary because of the wide margin of error in the consumption figures.

Changes in the price of bread do not reflect business cycles. The Bureau of Labor Statistics has collected data on the price charged by members of the Bakers' Association in New York City from 1890 to date. This Association has included the leading large bread-makers in New York City, Brooklyn, and a few in New Jersey. The price per loaf as so reported was maintained unchanged at four cents from 1890 to 1912. From 1890 to January, 1904, no change in the weight of the standard loaf was made, so that the price per ounce was the same during all that period. Decreases in weight were made in January, 1904, August, 1904, and October, 1904. In January, 1905, the weight was increased to the August, 1904, level, where it remained until January, 1908. It was then reduced to the October, 1904, figure. There was no further change in the price (or weight) until January, 1912, when the price per loaf was raised. The new level was maintained until January, 1914. During the war period the price rose quite rapidly with the cost of flour. The highest price came in the summer and fall of

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1920. Since then there has been some decline with some minor local fluctuations.¹⁴

These changes indicate no relationship with business cycles. There was no change one way or another during the difficulties of the nineties. The price (per ounce) was raised in 1904—a year of mild depression. No changes occurred from 1905 to 1907, a period of world-wide prosperity. The price was again increased in 1908—a year of industrial depression. It was again raised in 1912—a prosperous period. Further advances came in 1914—a period of depression.

Bread prices show more relationship to the cost of flour. This was particularly evident during the war, when the variations were very wide. Indexes of the average annual prices of wheat, flour, and bread from 1919 to 1925 are given in the table on page 256.

Millers' takings are related both to supply and demand factors. The volume of flour production indicates fairly closely the amount of wheat which millers take. This, together with the changes in the price of wheat, provides a basis for estimating the fluctuations of millers' demand. These data are given in index form in the table on page 257. In-

¹⁴Local conditions, such as wages, agreements between the commercial bakers, and other factors, are important in affecting bread prices. This is indicated by the fact that since 1921 prices in such widely separated cities as New York, San Francisco, Chicago, Cincinnati, and New Orleans have not fluctuated together or even in the same direction.

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dexes of relevant supply and demand factors are also shown. Scrutiny of these indexes indicates that while millers' demand declined in 1921 in conformity with the general business situation, it actually in-

INDEXES OF THE ANNUAL PRICES OF WHEAT, WHEAT FLOUR, AND BREAD IN THE UNITED STATES, 1919-1925

(Base: 1919 = 100)

Calendar Year	Price of Bread ¹	Price of Flour ²		Price of Wheat ²	
		Standard Patents	Winter Straights	No. 1 Northern Spring	No. 2 Red Winter
1919.....	100.0	100.0	100.0	100.0	100.0
1920.....	115.0	105.7	108.2	101.6	107.7
1921.....	99.0	69.5	65.9	57.4	61.5
1922.....	87.0	60.8	57.3	50.0	53.0
1923.....	87.0	53.2	50.1	45.3	50.0
1924.....	88.0	59.8	55.9	51.2	54.7
1925.....	94.0	73.6	71.7	65.2	75.6

¹ Average retail price in leading cities. Data from U. S. Department of Agriculture, *Yearbook*, 1924, p. 591.

² Data from *Survey of Current Business*, February, 1926, pp. 78-79.

creased during the minor depression in 1924. More wheat was ground than in 1924 than in the peak year of 1923, and it was sold at a higher price. The decrease in quantity ground in 1925 was proportionately less than the increase in price. In all of the years except 1921 the volume of flour production reflected the supply of wheat. It also appears to have been related to the volume of domestic consumption.

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INDEXES OF SUPPLY AND DEMAND FACTORS RELATED TO FLOUR
PRODUCTION IN THE UNITED STATES, 1919-1925*

(Base: 1919 = 100)

Calendar Year	Flour Production	Price of Wheat	Demand Factors			Supply Factors	
			Domestic Consumption of Flour	Exports of Flour		Visible Supply of Wheat	Monthly Stocks of Flour
				Quantity	Price		
1919 ...	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1920 ...	82.5	104.6	101.0	75.0	101.9	53.7	94.8
1921 ...	91.1	59.4	105.1	63.5	63.2	47.0	75.8
1922 ...	94.4	51.5	113.9	56.8	51.3	47.5	76.6
1923 ...	94.5	47.6	113.1	61.7	48.7	73.6	81.6
1924 ...	99.6	52.9	119.2	60.5	51.4	91.7	77.9
1925 ...	94.1	70.4	116.6	42.1	....	65.5	74.7

* All indexes except that of export price are based on data from *Survey of Current Business*, February, 1926, pp. 78-9. Export price of flour from *Statistical Abstract*, 1924, p. 314. The wheat price is the average of No. 1 northern spring and No. 2 red winter.

In general, a major crisis undoubtedly affects the millers' demand for wheat, although even for such a period as 1920-21 it is hard to draw the line between the part played by the domestic situation and that played by the collapse of the European market. In 1920 a small increase in export price was accompanied by a sharp reduction in the quantity exported, while in 1921 and 1922 still less was taken at very much lower prices. The minor business variations seem to have no appreciable effect on the millers' demand.

To conclude, examination of the fluctuations of wheat prices shows that they exhibit no consistent

correlation with indexes of business cycles. Actual correlation shows only a small influence of the latter, accounting at the most for about 9 per cent of the annual price changes. During the war and immediate post-war years the relation between the two appeared to be very close, but except for such times, the relative supply of wheat and the distribution of that supply are the chief price factors, and these are mainly determined by the forces of nature.

An analysis of the demand for wheat, moreover, indicates that little influence should logically be expected. In the first place, the price is affected by world forces, and the total demand is a resultant of conditions in all parts of the world. The fluctuations of the demand in one part of the globe, therefore, are not likely to cause wide changes in the world price.

In the second place, final consumer demand, as shown by both theoretical analysis and by the available data, is inelastic, and the changes in consumers' incomes accompanying business cycles therefore are not accompanied by marked changes in demand. Neither does millers' demand for wheat show any great correlation with general business conditions.

In a word, therefore, we find very little effect of business cycles in the United States on the price of wheat.

CHAPTER X

SUMMARY AND CONCLUSIONS

WE are now ready to return to the questions which we raised in Chapter I. Before stating our conclusions on these questions, however, we shall summarize the analysis presented in the preceding chapters.

I. GENERAL SUMMARY

We began by pointing out the ways in which business cycles might conceivably affect the earnings of the farmer. One was through the prices which he receives for his products. The changes in pay-roll disbursements may result in variations in the demand of consumers, and the fluctuating demand of manufacturers and other intermediate agencies for many raw materials, characteristic of business cycles, may also apply to farm products, since the latter are in the main raw materials. A second channel through which general business conditions might be expected to affect the farmer is through his farm operating costs. The fluctuations of prices of industrial commodities and of wages might be transmitted to the farmer through the prices of things he has to buy.

We found the correlation between changes in the volume of agricultural production and changes in the prices of agricultural products to be sufficiently high in most cases to establish the volume as a main causal factor in the annual fluctuations of farm prices, the supply of substitute crops also being a factor of some importance. This relationship led us to examine the factors affecting the volume of agricultural production. Most of these factors were shown to be independent of general business conditions. Among the most important of these are the influences on both yield and acreage exerted by natural forces and conditions—weather, insects, and plant diseases. Price changes are important also, but the adjustment of production to them is neither as prompt nor as close as might be expected. This is particularly true when prices decline. The large proportion of fixed charges places a premium on continuous output of some kind. Furthermore, alternative lines of production are limited by economic, biological, and climatic factors and by the expense and delay in readjusting the internal organization of the farm. Finally, the farmer knows that his product can usually be sold for some price, and inertia and the peculiar difficulties of the situation in a characteristically unorganized industry prevent the devising of a new combination promptly or skilfully.

For some products, however, the response of production to price changes is greater than for others.

Where the reaction is most marked, a tendency to develop independent cycles of production becomes evident. High prices, no matter how caused, ordinarily stimulate production. When the expanded output is marketed, prices are depressed. This price depression tends to result in a contracted supply and higher prices. Then the cycle begins all over again. One of the most evident production cycles is that for hogs, while the cycles for cattle, cotton, cabbage, and other products are fairly discernible. Such cycles are largely independent of business cycles, although sometimes they run parallel for a time.

On the demand side we find greater evidence of the effect of business cycles. Consumer demand for farm products appears to increase during the upward phases of business cycles and to decline during the descending stages. But there are several factors which operate in varying degrees to reduce such fluctuations to a fairly small range. In the first place, farm products in their finished form are mainly consumers' goods, and the demand for these goods is rather inelastic. This is especially true of staple food products. These conditions result in a demand that is fairly regular and continuous during the changes in industrial activity. Different products exhibit different degrees of responsiveness; the demand for the fibre crops, for example, is moderately sensitive, while bread crops, pork products, and potatoes have a demand that is more stable.

Similar variations were indicated by the analysis of the demand of manufacturers and other intermediaries. A greater tendency toward stock accumulations that were related to business cycles was found for cotton than for the food crops. The effect of business cycles on the speculative market could not be definitely determined.

Foreign demand ordinarily is affected chiefly by the supplies in other parts of the world and by the price. Since 1917, furthermore, the foreign demand has fluctuated widely because of changes in purchasing power. The changes in the foreign demand for farm products, however, are not necessarily related to domestic business cycles.

The result of the wide seasonal variations in supply of agricultural products and of the relatively small changes in demand which accompany business cycles is that the price fluctuations reflect the former very much more than the latter. This was shown both by correlation coefficients and by an examination of prices during a period when there were few disturbing causes of other kinds.

Similarly, changes in industrial activity were found to have great effect on the cash expenditures of the farmer. Distinct effects were found on the supply of farm labor, but wages seemed to be governed mainly by agricultural conditions. Practically no influence was found on taxes and rent and very little on interest rates. The cost of machinery, equipment, and building material was more visibly

affected, while the prices of feeds and fertilizers were affected not at all.

II. CONCLUSIONS

In the light of our analysis as summarized above, the answers to the questions raised in the first chapter should now be fairly evident.

1. *To what extent are business cycles responsible for the farmer's financial difficulties?* It cannot be said that the fluctuations in domestic business conditions have been demonstrably the cause of agricultural depressions. The demand for food and even clothing materials does not vary sufficiently from industrial prosperity to depression to result in similar changes for agriculture. There is, of course, some influence. A period of business prosperity results in better prices, other things being equal, than a period of depression. But it also leads to higher prices of some things which the farmer buys. These high costs, moreover, are likely to continue well into the subsequent business depression, when the demand may have been slackened somewhat. This naturally operates to reduce farm earnings. But our analysis indicates that this effect is not great enough to reduce agriculture to a state of depression.

The fact that agriculture and business were both depressed in 1920-21 does not necessarily show that the agricultural depression was caused by the indus-

trial crisis. That event may be used with equal or even greater facility to prove that the causation ran the other way, since agricultural prices were the first to fall. The industrial prosperity of 1922-23 and 1925-26 did not restore agriculture to a flourishing condition. The years 1907 and 1908 afford a more satisfactory testing period because there was a minimum of other important disturbing influences at that time. We saw that the total money incomes of agriculture actually increased in the panic year of 1907 and in 1908, the year of depression. The statistical correlation of most agricultural prices with an index of business conditions, moreover, is too low to support a belief that business cycles have a very depressing effect upon agriculture.

2. *Is it worth while for farmers to attempt to adjust their production policies to changes in demand or costs predicated on business forecasts?* The answer to this question is clearly in the negative. There are at least four reasons why this is so. In the first place, such adjustments necessarily would be based on forecasts of business cycles. These forecasts would have to be made for a period so long that their accuracy, which is low enough even for short periods, would not be great enough to warrant their use. The hog producer, for instance, would need a forecast at least twelve months ahead when deciding on the number of gilts to retain for breeding. The winter wheat grower would need one nine months ahead, the cotton

grower one nearly as long, and the apple grower a forecast about eight or ten years ahead. For many products the production period is shorter. With spring grains, for example, it is about four months. Forecasts of that length presumably would be more dependable.

In the second place, assuming that dependable forecasts of business conditions could be made, there would be great difficulty in estimating what the actual changes in demand would be. There are several reasons for this. Our evidence shows that the actual changes in demand are relatively small, especially for the cheaper foodstuffs. The statistical study of cotton prices in Chapter VII indicates that the effect of business cycles on the demand for the fibres is more pronounced. But even should the purchasing power of the industrial population vary considerably because of changes in wages or in steadiness of employment, the demands of the large salaried class and of the larger agricultural class are likely to be a steadying influence. Statistical studies of a very comprehensive nature for each product would be necessary in order to discover the net change of domestic demand that accompanies a given change in pay-roll disbursements.

But for some commodities, notably cotton, wheat, and pork products, the demand is really a world demand, of which the domestic industrial needs are but a part. For such commodities, of course, it would be necessary to estimate or forecast yields

and stocks in all parts of the globe, the small changes in domestic demand being still less significant. An acreage adjusted for a given domestic demand, for example, might be found to be badly out of line at the end of the season as a result of an unusually large or small crop in other parts of the world.

A third serious difficulty is that an adjustment made by individual farmers for expected changes in demand is very likely to miscarry as a result of changes in production. At the time plans are made for the forthcoming year's operations, but little is positively known about the intentions of other producers and absolutely nothing about the kind of season that will be experienced. A reduction of output in conformity with an expected decrease in demand might prove to have been a great mistake because of low yields in other producing areas, and *vice versa*. The changes in livestock production are not so sudden and erratic, of course, as those of crops. But they are wider apparently than the changes in the demand resulting from business cycles and consequently are more important factors to keep in mind when considering changes in production policy.

Finally, there is the question of the advisability of attempting to change the farm organization materially from year to year. This depends a good deal on the flexibility of the scheme of organization. When a well-knit business has been evolved, where

the equipment and crop rotation are designed for a particular volume and type of livestock production, and where the latter provide a market for by-products such as corn stalks and skim milk which are not otherwise marketable, it is very doubtful whether it would pay to make any changes unless they are to be permanent. Because of the high overhead expense, a reduction in output would not be profitable. It is only infrequently the case that something else, which is not similarly affected by the business cycle and which does not require a large new investment, can be grown temporarily.

It may be suggested, however, that after a product has been produced, the marketing policy may be governed by the prospective business situation. For instance, if the outlook is for continued improvement, it would appear that a higher price might be obtainable by delaying the date of sale of commodities that are not perishable. The reverse policy might be proposed when business activity is on the downgrade. In some years a marketing policy based on such a theory might be profitable. There are many other factors, however, such as misjudgments of the size of the crop, changes in foreign demand, or unexpected developments in the domestic situation which might operate to give opposite results. Such a policy resolves itself into the speculative game of trying to outguess the market—a very dubious practice.

3. *Are the remedies suggested for business cycles likely to prove effective in stabilizing agricultural production and prices?* It is obvious that the flattening out of the business cycles, when and if that is ever accomplished, will help the farmer but little. It would probably make the demand for his products a little more uniform and reduce somewhat the variations in his costs. The effect, however, on the fluctuations of the supply that is produced would be very small. As a result, the farmer would still have to expect sharp price changes, arising from the inevitable changes in production, and obviously such efforts would have no power to take care of changes in prices that accompany wars or variations in foreign demand.

Nor do the leading remedies advanced for moderating or eliminating business cycles¹ offer much toward the solution of this problem. Most of them are designed to flatten out the cycles of industrial unemployment. Aside from steadying the demand very slightly, there would be no significant effect upon agriculture. This is true of the proposals to fill in the slack periods with construction work, to install a better system of employment offices, and to provide unemployment insurance. Remedies of another type are the financial devices which aim to control credit or to stabilize the dollar. As far as credit is concerned, it would be extremely difficult to regulate the agricultural output by manipulating

¹See *Business Cycles and Unemployment*, Part III.

the discount rates or the credit policies of the lending institutions. Such devices would not affect the weather. Each locality, moreover, would require individual treatment. When the cotton country required restricted credit to reduce the acreage, the Corn Belt might need liberal credit to hold over a big corn crop to a short year; and so forth. The impracticability of such a plan is obvious. Nor would the proposed stabilization of the dollar meet the problem of controlling the market supplies. The same erratic fluctuations still would continue.

Only one of the remedies generally proposed appears to be of any definite help in correcting the maladjustment of agriculture. That is the suggestion that the necessary data be made available, chiefly by public agencies, so that producers can study the statistical position of the commodities involved and then proceed to neutralize the tendency toward distinctive cycles by expanding and contracting agricultural production in anticipation of the situations which now lead to cyclical oscillations.

Such data are, of course, already available to a very considerable extent. Federal and state governments, colleges, newspapers, farmers' organizations, and other agencies are preparing and disseminating a wide variety of reports on production, consumption, stocks, European supply and demand conditions, intentions of farmers to plant and to

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breed, business conditions, and prices. The broadcasting of such information can be shown to have had a beneficial effect in certain instances, and the extension and improvement of such services should be encouraged.

APPENDIX A

CORRELATIONS: AGRICULTURAL PRICES, VOLUME OF PRODUCTION, BUSINESS ACTIVITY

THIS appendix contains some details as to methods and results of multiple correlation studies of the prices of five representative farm products. The objective in view when the studies were planned was to obtain some quantitative criteria of the relative influence of the fluctuations of domestic industrial activity and of the size of the current crop upon the annual prices of these commodities. No effort was made to account completely by statistical methods for all the variations in these prices. The amount of labor involved in such a comprehensive analysis probably would have made it necessary to reduce very considerably the number of products treated and thereby increased the hazards in drawing conclusions. Briefly, the method of attack laid down at the beginning was as follows: to select first a statistical series available in monthly or quarterly form back to 1880, if possible, which would serve as a general measure of the fluctuations of the phenomena associated with business cycles; and second, to secure production data for representative farm commodities and price quotations related to that volume of output. The next step was to correlate the three variables for each commodity in a manner permitting conclusions as to the relative degree of association of the dependent variable, price, with each of the two

independent variables. Several details of that procedure require explanation before the resulting correlation coefficients, which are given below, can be interpreted.

Several specifications were laid down for the index of business cycles. It should reflect changes in the purchasing power of industrial employees because that is one channel of influence of business cycles on the prices of farm products. It should reflect changes in manufacturing activity, since that may affect the manufacturers' demand for certain products. It should be available in monthly or quarterly form, so that various lags of prices after business could be tested. The raw data, moreover, should be accessible so that the series could be expressed in whatever form seemed best for the problem at hand. Finally, the index should be available for a long enough period, say back to 1880, to offer a reasonably large sample of observations.

Of the series published at the time this study was begun, pig iron production seemed to meet these requirements most satisfactorily. Data on industrial pay rolls available since the war have fluctuated in the same direction and at about the same time with pig iron production, though the variations of the latter have been considerably wider. As for its reflection of industrial activity, Edmund E. Day found that when correlated with his annual index of manufacturing at large, a coefficient of $+0.97$ was secured, and concluded that pig iron production gave "an amazingly accurate picture of the year-to-year fluctuations of physical production in manufacturing.¹ Its fluctuations, moreover, have been closely related to those of statistical series representing other

¹"An Index of the Physical Volume of Production," *Review of Economic Statistics*, 1920, Vol. II, p. 367.

phases of business cycles, such as commodity prices (Bradstreet's index), imports, banks clearings in and outside New York, business failures, and interest rates.² Monthly data on pig iron production are available back to 1884 and quarterly figures to 1877.

Bank clearings outside New York were considered as a possible measure and had many points in their favor. Since, however, they are probably weighted fairly heavily with agricultural transactions, pig iron production was thought to be a better measure of non-agricultural business activity. The business curve of the American Telephone and Telegraph Company also was a possibility. The fact that it is a composite of several series was in its favor, but its availability only in the refined form—as monthly percentage deviations from “normal”—was a disadvantage.

The same sources of the raw data on pig iron production were employed as those used by the Harvard Committee on Economic Research in constructing their monthly index of pig iron production.³ Only four years

² Harvard Committee on Economic Research, “Indices of Business Conditions,” *Review of Economic Statistics*, 1919, Vol. I, pp. 184-187.

³ See “Money Rates and Pig Iron Production 1877-1924,” *Review of Economic Statistics*, 1925, Vol. VII, p. 44. These sources included quarterly estimates made by the Committee for the period 1877 to 1883 based on the weekly capacity of furnaces in blast on the first day of each quarter; the data prepared by Margaret G. Myers, “Monthly Production of Pig Iron, 1884-1902,” *Journal of the American Statistical Association*, June, 1922, Vol. 18, p. 249; and for the period 1903-1914 from the *Iron Age*, reprinted by the Committee in “Indices of Business Conditions,” *Review of Economic Statistics*, 1919, Vol. I, p. 66. The use of the more satisfactory series for the period 1884-1902 published by Holbrook Working in “Monthly Pig Iron Production, 1884-1902: An Analysis of a Problem in Correlation,” *Journal of the American Statistical Association*, 1924, Vol. 19, pp. 381-86, would have made no significant difference in the results.

of the quarterly figures, 1880 to 1883 inclusive, were used. For those years data for the intervening months were interpolated.

The next step was to select the method of correlation. Linearity of relationship was assumed. It was decided to correlate the series with seven different assumptions as to the time relationship of changes in pig iron production and the agricultural price. It was believed that the maximum degree of relationship was likely to fall within this range of a year and a half. These lags were so chosen that in five or six of the seven comparisons the pig iron series preceded the price quotations and in one or two it followed. The distribution varied somewhat with different commodities. The fact that in each case the correlations of price and pig iron production first increased with successive quarters and then declined indicates that the maximum degree of relationship was probably found for all commodities.

Two methods of expressing the variables were tried for the first commodity worked with, namely, cotton. In the first the data were reduced to percentage deviations from the secular trends of the price and production of cotton and of the quarterly totals of pig iron production. For the second computation there were used the percentage changes from the preceding year of the price and production of cotton and of the annual production of pig iron for years ending with December 31, March 31, June 30, and September 30. In each case seven different lags (or leads) of the pig iron data were used in comparison with the other two variables.

The second method was adopted for the other commodities. Not only did it give better results in that it

accounted more completely for the changes in the price of cotton, but it had other advantages as well. The use of percentage changes simplified the computation and assured greater comparability of treatment for all commodities than would be secured by computing a separate secular trend for each series. The changes in the annual production of pig iron, moreover, probably gave a more representative picture of the changes in the business situation than did the changes in the production in corresponding quarters.

The results of the correlations for the seven commodities are given in the tables on pages 276-277. The seven positions of the pig iron data with respect to the price are indicated by showing the midpoint of the years used. Thus, the earliest one in each case is October 1. This means that the percentage change over the previous year of the amount of pig iron produced in the year ending on each March 31 (the midpoint of which is October 1) is correlated with the percentage changes of crop production and price the following fall. Similarly the changes in pig iron production for years ending on six successive quarterly dates are correlated with the same crop data.

The following subscripts are used for the coefficients:

w = price

s = supply, or size of the crop

i = pig iron production

CORRELATION: PRICE AND PRODUCTION OF SELECTED COMMODITIES
WITH PIG IRON PRODUCTION *

Iron Output for Year Ending	Coefficients				
	rwi	rws	R	rwi s	rws i
POTATOES: ¹					
Mar. 31.....	-.009	-.857	.858	-.077	-.858
June 30.....	-.008	-.857	.860	+ .125	-.860
Sept. 30.....	-.109	-.865	.866	+ .057	-.864
Dec. 31.....	-.011	-.865	.870	+ .178	-.870
Mar. 31.....	-.041	-.864	.870	+ .197	-.869
June 30.....	-.106	-.864	.865	+ .096	-.864
Sept. 30.....	-.102	-.864	.864	-.034	-.863
Hogs: ²					
Mar. 31.....	-.014	-.736	.745	-.173	-.745
June 30.....	+ .104	-.736	.749	-.208	-.746
Sept. 30.....	+ .163	-.747	.755	-.166	-.748
Dec. 31.....	+ .292	-.747	.749	+ .065	-.721
Mar. 31.....	+ .337	-.747	.765	+ .248	-.730
June 30.....	+ .284	-.747	.783	+ .349	-.760
Sept. 30.....	+ .210	-.747	.763	+ .228	-.750
CORN: ³					
Mar. 31.....	-.061	-.698	.699	+ .067	-.698
June 30.....	-.207	-.698	.698	-.011	-.681
Sept. 30.....	-.193	-.720	.720	+ .005	-.707
Dec. 31.....	-.043	-.720	.720	+ .034	-.719
Mar. 31.....	+ .030	-.709	.713	+ .102	-.712
June 30.....	+ .099	-.709	.723	+ .199	-.719
Sept. 30.....	+ .157	-.709	.728	+ .235	-.720

* Subscripts.

w = price.

s = production of agricultural commodity.

i = pig iron production.

¹ POTATOES: Period: 1881-1913. Production: Total annual production in the United States. *Yearbook*, 1923, p. 759. Price: Farm price on December 1. *ibid*.² Hogs: Period: 1881-1913. Production: Total weight of hogs packed by Western packers during the four winter months, November to February, inclusive. Data from Sewall Wright, *Corn and Hog Correlations*, Bulletin No. 1300. U. S. Department of Agriculture, Jan., 1925, p. 11. Price: Average price per 100 pounds live weight of Western winter pack. *ibid*.³ CORN: Period: 1881-1913. Production: Annual production in the United States, *Yearbook*, 1923, p. 662. Prices: December price at Chicago. *Agricultural Prices*, Henry A. Wallace, pp. 118-119.

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Iron Output for Year Ending	Coefficients				
	rwi	rws	R	rwi.s	rws.i
OATS: ^a					
Dec. 31.....	+ .058	— .762	.772	— .191	— .771
Mar. 31.....	— .075	— .762	.777	— .231	— .775
June 30.....	— .154	— .762	.775	— .220	— .769
Sept. 30.....	— .147	— .750	.752	— .076	— .746
Dec. 31.....	— .053	— .750	.758	+ .159	— .757
Mar. 31.....	— .058	— .747	.770	+ .286	— .770
June 30.....	— .111	— .747	.774	+ .308	— .771
COTTON: ^b					
Mar. 31.....	+ .114	— .802	.811	+ .202	— .808
June 30.....	+ .476	— .802	.828	+ .349	— .771
Sept. 30.....	+ .692	— .779	.837	+ .489	— .652
Dec. 31.....	+ .664	— .779	.831	+ .462	— .668
Mar. 31.....	+ .447	— .779	.801	+ .299	— .743
June 30.....	+ .114	— .779	.784	+ .143	— .781
Sept. 30.....	— .227	— .779	.779	+ .030	— .765
WHEAT: ^c					
Dec. 31.....	— .071	— .656	.660	— .099	— .658
Mar. 31.....	— .120	— .656	.661	— .108	— .657
June 30.....	— .079	— .656	.664	+ .137	— .661
Sept. 30.....	— .044	— .656	.692	+ .292	— .691
Dec. 31.....	— .036	— .656	.690	+ .283	— .689
Mar. 31.....	+ .037	— .656	.689	+ .280	— .689
June 30.....	+ .051	— .656	.670	+ .181	— .669
APPLES: ^d					
Mar. 31.....	— .179	— .800	.815	— .263	— .808
June 30.....	— .076	— .800	.814	— .249	— .812
Sept. 30.....	+ .020	— .800	.806	— .173	— .806
Dec. 31.....	+ .120	— .800	.800	— .057	— .797
Mar. 31.....	+ .036	— .800	.801	+ .058	— .800
June 30.....	— .118	— .800	.804	+ .137	— .801
Sept. 30.....	— .170	— .800	.803	+ .118	— .796

^aOATS: Period, 1881-1913. Production: Annual production in the United States, *Yearbook*, 1923, pp. 679-680. Prices: September price at Chicago. *Agricultural Prices*, Henry A. Wallace, pp. 121-122.

^bCOTTON: Period: 1881-1913. Production: Production in the United States of 500-pound bales. Data from Bureau of Census, *Cotton Production and Distribution, Season of 1924-25*, Bulletin 158, pp. 49-50. Price of cotton: December price of spot middling upland cotton in New York. Data for 1880 to 1889 from *Report*

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of the Senate Committee on Agriculture and Forestry, 1895, Vol. II, pp. 377-404; for 1890 to 1913 from the Bureau of Agricultural Economics, U. S. Department of Agriculture. The figures from 1900 to 1923 are published in the *Yearbook* for 1923, p. 809.

* WHEAT: Period: 1892-1914. Production: Annual world production in Northern Hemisphere, plus carryover on July 1. Obtained by deducting from the total world output the reported production in the Southern Hemisphere. World production and carryover data from Killough, Hugh B. *What Makes the Price of Oats*, Bulletin No. 1351, U. S. Department of Agriculture, Sept., 1925, p. 36. Production in Southern Hemisphere from *Yearbook* 1924, p. 569. Price: Average Chicago price of wheat during July, August, September and October, the months when the bulk of the crops in the Northern Hemisphere come on the market. Data obtained from the Bureau of Agricultural Economics through the courtesy of E. M. Daggitt.

' APPLES: Period: 1890-1913. Production: Annual crop in the United States, *Yearbook*, 1924, p. 664. Price: Average of New York wholesale prices on October 15, January 1, and March 1, of each year, *ibid.*, p. 673.

APPENDIX B

RESULTS OF STATISTICAL STUDIES OF THE RELATIONSHIP BETWEEN THE SUPPLY AND PRICE OF FARM PRODUCTS

CORN

Wright, Sewall, *Corn and Hog Correlations*, U. S. Department of Agriculture, Bulletin No. 1300, January, 1925, p. 16:

Correlated trend deviations of production and December 1 price, 1871-1913; $r = -.80$. Also correlated yield per acre with December 1 price, same period; $r = -.77$.

Moore, Henry Ludwell, *Generating Economic Cycles*, 1923, p. 23:

Correlated trend deviations of yield per acre and December farm price, 1880-1914; $r = -.78$.

Moore, Henry Ludwell, *Economic Cycles: Their Law and Cause*, 1914, p. 95:

Correlated relative change in production and December 1 price, 1866-1911; $r = -.789$. Also changes in yield per acre and price, same period; $r = -.815$.

Persons, W. M., "The Correlation of Economic Statistics," *Publications of the American Statistical Association*, December, 1910, Vol. 92, p. 314:

Correlated first differences of production and December farm price in United States, 1866-1906; $r = -.833$. Also percentage changes, same period; $r = -.794$.

Wallace, H. A., "The Factors That Make Corn Prices," *Wallace's Farmer*, August 21, 1925:

Multiple correlation study of prices using size of crop, oats prices, business conditions, wheat prices, and number of hogs slaughtered. Correlation coefficients not given. "The dominating force making corn prices is the size of crop." The net relationship of these two variables expressed as follows:

Size of Corn Crop	Corn prices at Chicago during winter
25 per cent below normal.	.32 per cent above normal
20 per cent below normal.	.24 per cent above normal
15 per cent below normal.	.16 per cent above normal
10 per cent below normal.	.8 per cent above normal
5 per cent below normal.	.1 per cent above normal
5 per cent above normal.	.7 per cent below normal
10 per cent above normal.	.10 per cent below normal
15 per cent above normal.	.12 per cent below normal

OATS

Moore, Henry Ludwell, *Economic Cycles: Their Law and Cause*, 1914, p. 95:

Correlated relative change in production and December 1 price, 1866-1911; $r = -.722$. Also changes in yield per acre and price, same period; $r = -.718$.

Killough, Hugh B., *What Makes the Price of Oats?*

U. S. Department of Agriculture, Bulletin No. 1351, September, 1925:

Correlated trend ratios of United States production and Chicago price, 1881-1913, $r = -.82$. Multiple correlation of percentage changes over preceding years of: (1) Chicago price of oats; (2) index of prices of farm products; and (3) United States production plus carry-over of oats, 1896-1915, 1921, 1922. Coefficient of multiple correlation = .86.

HAY

Moore, Henry Ludwell, *Economic Cycles: Their Law and Cause*, 1914, p. 95:

Correlated relative changes in production and December 1 price, 1866-1911; $r = -.715$. Also changes in yield per acre and price, same period; $r = -.656$.

POTATOES

Moore, Henry Ludwell, *Economic Cycles: Their Law and Cause*, 1914, p. 95:

Correlated relative changes in production and December 1 price, 1866-1911; $r = -.856$. Also changes in yield per acre and price, same period; $r = -.873$.

Moore, Henry Ludwell, "Elasticity of Demand and Flexibility of Prices," *Journal of the American Statistical Association*, March, 1922, Vol. 18, p. 14:

Correlated trend ratios of production and December farm price in the United States, 1881-1913; $r = -.84$.

Working, Holbrook, *Factors Affecting the Price of Minnesota Potatoes*, Minnesota Agricultural Experiment Station, Technical Bulletin No. 29, October, 1925, p. 13:

Multiple correlation study of five factors. Net effect of variations in supply on price expressed as follows:

When production is above normal (per cent)	Price will probably be below normal (per cent)
20	29
10	17
0	0
below normal	above normal
10	26
20	70

WATERMELONS

Hedden, W. P., *Measuring the Melon Market*, A preliminary report, Bureau of Agricultural Economics, U. S. Department of Agriculture, August, 1914, p. 8:

Correlated trend deviations of number of cars on track in New York, N. Y., and price per car; $r = -.88 \pm .02$.

COTTON

Moore, Henry Ludwell, *Forecasting the Yield and the Price of Cotton*, 1917:

Correlated ratios to progressive averages of annual production of cotton and the price, 1890-1913; $r = -.706$. Also percentage change of production and price, same period; $r = .819$.

WHEAT

Killough, Hugh B., *What Makes the Price of Oats?* U. S. Department of Agriculture, Bulletin No. 1351, September, 1925:

Correlated trend ratios of Chicago price of wheat and United States production, 1891-1913; $r = -.32$; same price with world production; $r = -.71$; same price with world production plus carry-over; $r = -.80$. Multiple correlation of trend ratios of: (1) Chicago price, (2) world production plus carry-over, and (3) world production of rye; $r = .86$.

Bosland, C. C., "Forecasting the Price of Wheat," *Journal of the American Statistical Association*, June, 1926, Vol. 21, pp. 149-61:

Correlated world production plus carry-over and Chicago price (deflated), 1896-1920. The maximum correlation of $-.74$ was obtained by using the first differences of the percentage deviations from trend for the pre-war years only.

CABBAGE

Misner, E. A., *Rainfall and the Production and Price of Cabbage, Potatoes, Apples, and Cannery Peas*, Mimeographed circular, Department of Agricultural Economics and Farm Management, Cornell University:

Correlated inches of rainfall and November price of cabbage, 1894-1923; $r = -.572$.

HOGS

Wright, Sewall, *Corn and Hog Correlations*, U. S. Department of Agriculture Bulletin No. 1300, January, 1925, pp. 40-41:

Correlated trend deviations of hogs packed and corresponding prices. Coefficient for summer pack, $-.63$; for winter pack, $-.68$.

ALL CROPS

Committee on Economic Research, Harvard University,
"Production, Prices and Aggregate Values of Crops,"
Review of Economic Statistics, Preliminary Volume
III, 1921, pp. 34-6:

Indexes consisting of the weighted geometric means of the production and December 1 prices of the 12 leading farm crops in the United States from 1879 to 1920 were constructed. The correlation between the first differences of these indexes of aggregate production and unit prices for the period 1879 to 1914 was $-.82$. When corrected for secular trend this correlation between the corrected figures was $-.79$; and between the first differences of the corrected figures the correlation was $-.88$.

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