

U. S. DEPARTMENT OF LABOR  
BUREAU OF LABOR STATISTICS

ROYAL BEEKER, Commissioner

BULLETIN OF THE UNITED STATES  
BUREAU OF LABOR STATISTICS} . . . {WHOLE NUMBER 173

WHOLESALE PRICES SERIES: No. 3

INDEX NUMBERS OF WHOLESALE  
PRICES IN THE UNITED STATES  
AND FOREIGN COUNTRIES



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JULY, 1918

WASHINGTON  
GOVERNMENT PRINTING OFFICE  
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*B.R. Lambertson*

*London*  
*7/7/17*



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**BULLETIN OF THE  
U. S. BUREAU OF LABOR STATISTICS.**

WHOLE NO. 173.

WASHINGTON.

JULY, 1915.

**INDEX NUMBERS OF WHOLESALE PRICES IN THE UNITED STATES  
AND FOREIGN COUNTRIES.**

**PART I.—THE MAKING AND USING OF INDEX  
NUMBERS.**

BY WESLEY C. MITCHELL.<sup>1</sup>

**THE AIM AND SCOPE OF THE PRESENT BULLETIN.**

The aim of this bulletin is to make the index numbers of wholesale prices currently published in the United States and foreign countries more accessible, more intelligible, and therefore more useful.

To this end the leading series of index numbers, compiled by official bureaus, financial journals, and private investigators both at home and abroad are described in detail. The history of each series, the source from which quotations are taken, the number and description of the commodities included, the methods of averaging, the statistical results obtained, etc., are set forth as far as the facts could be learned, so that anyone wishing to use the figures in question may know how they are derived and what they mean. This systematic description of the series now being published is preceded by a critical analysis of the various methods employed to measure changes in the level of prices—an analysis which shows the advantages and the defects of these methods, the purposes for which the different index numbers may properly be employed, the reasons for the discrepancies which usually appear when two or more series for the same time and country are put side by side, the safeguards which are necessary in making comparisons between different series, and the confidence which index numbers merit as measures of price fluctuations.

**I.—THE HISTORY OF INDEX NUMBERS.**

The honor of inventing the device now commonly used to measure changes in the level of prices probably belongs to an Italian, G. R. Carli. In an investigation into the effect of the discovery of America

<sup>1</sup> The writer has received generous help from Prof. Irving Fisher, Prof. Allyn A. Young, Dr. Royal Meeker, and Mr. C. H. Verrill, all of whom read the first draft of this paper and made many effective criticisms. To his wife he is indebted not only for a critical reading of the manuscript, but also for the drawing of the charts.

upon the purchasing power of money, he reduced the prices paid for grain, wine, and oil in 1750 to percentages of change from their prices in 1500, added the percentages together, and divided the sum by three, thus making an exceedingly simple index number. Since his book was first published in 1764, index numbers are now 150 years old.<sup>1</sup>

It was in England, however, where practically the same device had been hit upon by Sir George Schuckburg-Evelyn in 1798,<sup>2</sup> that the theory and practice of index numbers were chiefly developed. The generation that created the classical political economy was deeply interested in the violent price fluctuations that accompanied the Napoleonic wars and the use of an irredeemable paper currency from 1797 to 1821. Several attempts were made to measure these fluctuations, and in 1833 G. Poulett Scrope suggested the establishment of a "tabular standard of value."<sup>3</sup>

Interest in the study of price fluctuations lagged somewhat in the forties; but the great rise of prices after the Californian and Australian gold discoveries started fresh investigations. W. S. Jevons in England and Adolf Soetbeer in Germany gave a powerful impetus to the theoretical discussion and the practical computation of index numbers. The problem changed somewhat in form but received even more attention after 1873, when a prolonged fall of prices began. In the sixties the chief aim of investigation had been to discover the relations between the rise of prices and the increased production of gold; in the seventies and eighties the chief aim was to find the relations between the fall of prices and the restrictions placed upon the free coinage of silver. The weightiest theoretical contributions of this period were made by Prof. F. Y. Edgeworth, who served as secretary of a committee appointed by the British Association for the Advancement of Science "for the purpose of investigating the best methods of ascertaining and measuring variations in the value of the monetary standard."<sup>4</sup>

The problem of price fluctuations did not enter upon its present phase until the world-wide rise of prices which began in 1896-97 had been under way for several years. After 1900, and more insistently after 1910, complaints about the rising cost of living became common in practically all civilized countries. Efforts to measure this increase as well as efforts to explain it multiplied. Index numbers are both

<sup>1</sup> *Del Valore e della Proporzione de' Metalli Monetati con i generi in Italia prima delle Scoperte dell' Indie col confronto del Valore e della Proporzione de' Tempi nostri.* Republished by Custodi in his *Scrittori Italiani de Economia Politica.* Parte Moderna, Vol. XIII, pp. 297-306, especially pp. 335-354.

<sup>2</sup> "An account of some endeavors to ascertain a standard of weight and measure," *Philosophical Transactions of the Royal Society of London*, 1798, Part I, Art. VIII, pp. 133-132, especially pp. 175 and 176.

<sup>3</sup> *Principles of Political Economy*, London, 1833, pp. 405-406.

<sup>4</sup> For the reports of this committee, see the Reports of the British Association, 1877, pp. 247-254; 1888, pp. 181-188; 1889, p. 133; 1890, pp. 435-468. See particularly the memoranda by Prof. Edgeworth subjoined to these reports.



troublesome and expensive to compile, yet now in the United States not less than five series are currently maintained, four of them by financial papers. In England there are three important series; in France two; in Germany three; while the Governments of Italy, Denmark, Netherlands, Russia, Canada, Australia, and Japan publish official index numbers, and private investigators have made series for Belgium, Norway, Austria, Spain, New Zealand, and India. This list may well be incomplete even at present, and is almost certain to require additions within a short time.

Most of the series just mentioned have been established but recently. The oldest—that of the *London Economist*—was begun in 1869.<sup>1</sup> Sauerbeck's English series dates from 1886, Conrad's German series from 1887 (though in a sense it continues investigations made by Laspeyres in 1864), and Bradstreet's American series from 1897. Of the remaining index numbers regularly published at present, all date from years since 1899, and the majority from years since 1909.<sup>2</sup>

With this increase in numbers there has come an improvement in quality. The early index numbers were made by private investigators, at irregular intervals, from such price quotations as chance had preserved. As public appreciation of the importance of measuring changes in price levels has developed, the work has more and more been assumed by financial journals and Government bureaus. This shift has produced a greater measure of continuity in the series, as well as greater frequency, regularity, and promptness in the publication of the results. Even more important is the improvement in the character and the scope of the price quotations from which the index numbers are made. Whereas the individual investigator had to take what he could get in the way of data, financial journals and Government bureaus can collect those current prices that are best adapted for statistical treatment, and can give better assurance of the representative value of their quotations and the uniform quality of the commodities included in successive years.

This improvement in the quantity and quality of index numbers is as marked in the United States as elsewhere. Price quotations had been published with more or less care and system by various newspapers and periodicals for many years before the first effort to compile an average of price variations was made. In 1881, Mr. H. C. Burchard, Director of the Mint, made an index number covering the years 1825 to 1880 from quotations that had been printed in certain reports of the Secretary of the Treasury, supplemented by quotations from a New York newspaper. But his data were of uncertain quality

<sup>1</sup> From 1864 to 1869 the *Economist* published the relative prices of commodities, but such separate figures without a sum or an average do not constitute an index number proper.

<sup>2</sup> The years mentioned are the dates of first publication, not the earliest dates for which relative prices are shown. In most cases the computers carried their investigations back into the past, frequently for a decade or more.

and his series was allowed to lapse after 1884.<sup>1</sup> After an interval of eight years, the Senate Committee on Finance authorized a more ambitious effort. Under the direction of Dr. Roland P. Falkner, the statistician of this committee, the (then) Department of Labor made a huge collection of price quotations, running back as far as 1840, and compiled an index number including more than 200 commodities for the years 1860 to 1891, and 85 commodities for 1840 to, 1891.<sup>2</sup> But this also was a single investigation, and the United States did not have an index number regularly maintained year after year until the establishment of Bradstreet's series in 1897. A quasi continuation of the Senate Finance Committee's work, covering the years 1890-1899, was prepared by Dr. R. P. Falkner, and published by the Department of Labor in March, 1900.<sup>3</sup> Another short-lived series was begun by Prof. John R. Commons and Dr. N. I. Stone in the Quarterly Bulletin of the Bureau of Economic Research later in the same year.<sup>4</sup> In January, 1901, the second continuous American series was started by Dun's Review and gradually carried back to 1860; the third, covering the years 1890 to date, was added by the Federal Department of Labor in March, 1902. Other series of this type were begun by Thomas Gibson's weekly market letters in 1910, and by the New York Times Annalist in 1913.

This recent activity in the making of index numbers has been accompanied by a rapid growth of the literature of the subject. Among the later contributions dealing with theoretical issues, the first place belongs to the work of an American scholar, Mr. C. M. Walsh. His great treatise upon *The Measurement of General Exchange-Value*, published in 1901, is still the most comprehensive book upon the subject. But the bibliographies that aim to cover the field now include hundreds of items, and to them must go the student who wishes a guide to further reading.<sup>5</sup>

## II.—THE DIFFICULTIES OF MEASURING CHANGES IN THE LEVEL OF PRICES.

It is a curious fact that men did not attempt to measure changes in the level of prices until after they had learned to measure such subtle magnitudes as the weight of the atmosphere, the velocity of sound, fluctuations of temperature, and the precession of the equi-

<sup>1</sup> See Finance Reports, 1881, pp. 312-321; 1882, pp. 252-254; 1883, pp. 316-318; Report of the Director of the Mint on the Production of the Precious Metals, 1881, pp. 497-502. Compare the criticism of this series by Prof. J. Laurence Laughlin, Quarterly Journal of Economics, April, 1887, pp. 397 and 398.

<sup>2</sup> See the description given on pp. 128-130.

<sup>3</sup> See Bulletin of the Department of Labor, No. 27, March, 1900.

<sup>4</sup> See the issues for July and October, 1900.

<sup>5</sup> For such bibliographies see Walsh, *The Measurement of General Exchange-Value*, pp. 553-574, and J. L. Laughlin, *Principles of Money*, pp. 221-224. The most important contribution of later date than Laughlin's entries is Prof. Irving Fisher's *Purchasing Power of Money*, pp. 385-429.

noxes. Their tardiness in attacking that problem is the more strange because price changes had frequently been a subject of acrimonious debate among publicists and a cause of popular agitation. Long before the high development of the credit system and the wage-earning class practical issues of grave importance were raised by the instability of prices, as the disturbances created in sixteenth-century Europe by the inflow of American silver and gold abundantly show. Perhaps disinclination on the part of "natural philosophers" to soil their hands with such vulgar subjects as the prices of provisions was partly responsible for the delay;<sup>1</sup> but after all a number of eminently "respectable" men wrote upon economic topics in every generation after the days of Columbus—to go no further back. Nor can the technical difficulties of the problem explain this tardiness; for the mathematical intricacy of index numbers, and even the necessity of allowing for changes in the pure silver content of coins, are obstacles far less formidable than those surmounted long before in other fields of research.

Probably the chief cause of delay was that averages of price fluctuations did not promise to command much confidence after they had been made. The quotations available for use by the early investigators were few in number and often of doubtful accuracy. Carli, for example, dealt with only 3 commodities; Shuckburg-Evelyn with only 12. About the vastly greater number of unrecorded price fluctuations the one firmly established fact was that they exhibited bewildering diversity. Under these circumstances, could an average made from a few samples be accepted as a reliable measure of changes in the general level of prices? And if averages could not be trusted, why trouble to devise a plan of making them? So writers upon prices long contented themselves with statements about the fluctuations of particular commodities, and with indefinite assertions that the purchasing power of money had changed little or changed much. So, also, when certain bold investigators did finally venture to make index numbers, no one was particularly impressed by the significance of their achievement.

This lack of faith in the validity of averages of price variations was overcome rather slowly, partly in consequence of improvements in business organization. The multiplication of commercial news-

<sup>1</sup> One of the early British writers on prices, Bishop Fleetwood, remarked: " \* \* \* as the World now goes, the greatest (tho' I will not think the best) Part of Readers will be rather apt to despise than to commend the Pains that are taken in making Collections of so mean Things as the price of Wheat & Oats, of Poultry, and such like Provisions \* \* \*."—*Chronicon Preciosum*, 1707, 2d ed., 1745, p. 6. Sir G. Shuckburg-Evelyn, in the paper referred to above, also felt himself on the defensive in presenting the first English index number: " \* \* \* However, I may appear to descend below the dignity of philosophy, in such economical researches, I trust I shall find favour with the historian, at least, and the antiquary." Shuckburg-Evelyn's discussion of index numbers, indeed, was merely a minor appendix to his discussion of standards of weights and measures. But it has become his chief claim to remembrance.

papers and the more systematic keeping of private and public records provided a larger and more accurate body of quotations. Improved means of transportation made wholesale prices in the larger cities basic for many local markets. The grading and standardizing of commodities increased the number of articles which could be safely accepted as substantially uniform in quality from one year to the next. More important still was the discovery by statisticians that social phenomena of most kinds, though seeming to result from the uncontrolled choice of individuals, yet reveal a striking regularity when studied in large numbers. The demonstration that a formerly unsuspected regularity lay hidden in one set of numerical data after another encouraged economists to believe that the known price variations might after all be fair samples of the more numerous unknown variations. The general similarity of the results reached by different investigators using dissimilar data confirmed this faith. Thus emboldened, economic statisticians devoted much time to extending the scope and improving the technique of index numbers. And their growing confidence in the trustworthiness of their series was gradually imparted to the public.

To-day few, if any, competent judges doubt the validity of index numbers or the substantial accuracy of the results they show when properly constructed from carefully collected data. Indeed the danger at present is rather that the figures as published will be taken too absolutely as a complete representation of the facts about price fluctuations. It is therefore well to begin a study of index numbers, not by analyzing the finished series, but by inspecting the actual changes in prices from which they are made, and which they purport to summarize. In no other way, indeed, can the value and the limitations of index numbers be learned.

### III.—THE CHARACTERISTICS OF PRICE FLUCTUATIONS.

An excellent collection of materials for the study of changes in wholesale prices is found in the Bulletin of the Bureau of Labor Statistics, No. 149. Here are given the average annual prices at wholesale of more than 230 commodities for a period of almost a quarter of a century. Comparison of the changes in these actual prices is facilitated by the publication of two series of relative prices for each commodity. One series reduces the quotations in dollars and cents to percentages of the average actual prices in the decade 1890-1899. The second series, which may be called "chain relatives,"

shows the percentage by which each article rose or fell in price each year as compared with the year before.<sup>1</sup>

A survey of these relative figures for the 230 commodities throws the diversity of price fluctuations into high relief. (1) During the 24 years 1890-1913 no two of the commodities quoted have undergone the same changes in price. Some articles have risen rather steadily in price and fluctuate on a much higher level in 1913 than in 1890; for example, rosin and crude petroleum. Other articles have fallen much more than they have risen and fluctuate on a much lower level at the end than at the beginning; for example, soda and wood alcohol. Some articles are steady in price, seldom changing from one year to the next; for example, bread and certain kinds of tools. Other articles change in price every year, for example, cotton and pig iron. (2) In every year a considerable proportion of the commodities rise in price, a considerable proportion fall, and a somewhat smaller proportion remain unchanged. (3) The range covered even by the fluctuations from one year to the next is very wide. For example, in 1896 potatoes fell 54.6 per cent, while coke rose 41.5 per cent;

<sup>1</sup> The reader may follow the discussion more easily if he runs over the following sample of the figures referred to:

*Cotton, upland, middling.*

Year.	Average price per pound.	Relative price.	Per cent of increase (+) or decrease (-) compared with preceding year.
<b>Average, 1890-1899.....</b>	<b>\$0.07782</b>	<b>100.0</b>	
1890.....	.11089	142.9	
1891.....	.08096	110.8	-22.4
1892.....	.07586	96.9	-10.7
1893.....	.08310	107.2	+ 8.2
1894.....	.07002	90.2	-15.8
1895.....	.07298	94.0	+ 4.2
1896.....	.07918	102.0	+ 8.5
1897.....	.07153	92.2	- 9.7
1898.....	.05972	76.9	-16.5
1899.....	.06578	84.7	+10.1
1900.....	.09609	123.8	+46.1
1901.....	.08627	111.1	-10.2
1902.....	.08032	115.1	+ 3.5
1903.....	.11235	144.7	+26.8
1904.....	.12100	155.9	+ 7.7
1905.....	.09553	123.1	-21.0
1906.....	.11025	142.0	+15.4
1907.....	.11670	153.0	+ 7.7
1908.....	.10463	134.8	-11.9
1909.....	.12107	156.0	+16.7
1910.....	.13118	168.8	+24.9
1911.....	.13037	168.0	-13.8
1912.....	.11533	148.2	-11.8
1913.....	.12792	164.8	+11.2

in 1899 wheat flour fell 20.2 per cent, while steel billets rose 103.3 per cent; in 1913 onions fell 38.5 per cent, while cabbage rose 58.5 per cent.<sup>1</sup>

Such extreme diversities as have been cited, however, give a misleading impression of chaos among the fluctuations. A just impression can be had only from some scheme of presentation which takes account of all the commodities at once. Table 1 is a first rough approximation toward this end. It shows for each year how many of the commodities quoted rose, remained unchanged, or fell in price, and divides those which rose and those which fell into six groups, according to the magnitude of their fluctuations.

---

<sup>1</sup> All of these figures show percentages of rise or fall from the average prices of the commodities in question in the preceding year.

TABLE 1.—CONSPICUOUS CHANGES IN WHOLESALE PRICES IN THE UNITED STATES, BY YEARS, 1891 TO 1913.

[Based upon the percentages of increase or decrease in price from one year to the next, given in Table II of Bulletin of the United States Bureau of Labor Statistics, No. 149, May, 1914.]

Year.	Total number of commodities quoted each year.	Number of commodities that fell in price.	Number of commodities that fell in price by—					Number of commodities that did not change in price.	Number of commodities that rose in price by—					Number of commodities that rose in price.		
			50.0 per cent. or more.	20.0 to 49.9 per cent.	10.0 to 19.9 per cent.	5.0 to 9.9 per cent.	2.0 to 4.9 per cent.		Less than 2.0 per cent.	Less than 2.0 per cent.	2.0 to 4.9 per cent.	5.0 to 9.9 per cent.	10.0 to 19.9 per cent.		20.0 to 49.9 per cent.	50.0 per cent. or more.
1891.....	232	106	.....	13	26	30	19	18	44	17	17	15	16	16	1	82
1892.....	232	140	.....	11	47	39	27	16	37	19	9	13	12	2	.....	56
1893.....	234	114	.....	5	25	44	25	15	42	15	17	21	10	14	1	78
1894.....	236	102	.....	29	70	44	34	15	25	4	6	3	3	.....	19	
1895.....	237	138	.....	10	35	41	40	12	22	15	18	17	12	13	2	77
1896.....	240	133	.....	1	22	35	22	30	23	34	15	16	18	18	.....	73
1897.....	241	118	.....	1	9	22	35	27	24	31	12	20	30	11	17	92
1898.....	242	73	.....	2	16	21	21	13	34	15	22	34	40	22	2	135
1899.....	242	46	.....	1	7	12	16	10	27	17	28	45	39	26	14	169
1900.....	242	38	.....	3	4	13	9	9	20	7	25	59	57	33	3	184
1901.....	242	128	.....	10	40	32	35	11	25	19	22	16	21	9	2	89
1902.....	242	61	.....	6	13	14	12	16	38	20	31	35	29	27	1	143
1903.....	242	92	.....	9	23	21	22	17	22	16	29	44	29	10	.....	128
1904.....	242	106	.....	12	24	22	28	20	25	27	32	28	10	16	.....	113
1905.....	242	89	.....	3	13	26	24	23	22	22	26	37	31	15	.....	131
1906.....	242	47	.....	5	5	9	13	10	28	13	31	52	52	19	.....	167
1907.....	242	48	.....	2	5	9	18	14	32	27	25	45	45	20	2	162
1908.....	242	153	.....	25	50	32	30	18	4	32	14	14	12	11	4	85
1909.....	253	98	.....	2	15	21	28	52	31	24	24	40	17	16	3	124
1910.....	253	83	.....	3	10	20	22	26	26	24	33	42	25	22	.....	146
1911.....	253	147	.....	18	31	43	30	25	31	19	16	14	13	10	3	75
1912.....	263	80	.....	6	12	18	25	19	36	21	27	34	35	20	.....	137
1913.....	262	84	.....	12	14	16	22	19	35	28	39	30	27	2	.....	133

THE MAKING AND USING OF INDEX NUMBERS.

A more significant presentation of the same set of price fluctuations is given by Table 2. To make this table a tally sheet was drawn up for each year from 1891 to 1913, on which the changes from prices in the preceding year were entered in the order of their magnitude, beginning with the greatest percentage of fall and running up through "no change" to the greatest percentage of rise. Then the whole number of recorded fluctuations for each year was divided into 10 numerically equal groups, again beginning with the case of greatest fall and counting upward. Finally the nine dividing points between these 10 equal groups were marked off in the percentage scale of fall, "no change," or rise. For example, the tally sheet for 1913 showed how the average prices of 252 commodities in that year differed from their average prices in 1912. One-tenth of these 252 commodities showed a fall of prices ranging between 38.5 per cent and 10.4 per cent, the second tenth ranged between a fall of 10.4 per cent and one of 3.7 per cent; the third tenth ranged between a fall of 3.7 per cent and one of 1 per cent; the fourth tenth between a fall of 1 per cent and "no change"; the fifth tenth between "no change" and a rise of 0.5 per cent, and so on. These dividing points (-10.4 per cent, -3.7 per cent, -1 per cent,  $\pm 0$  per cent, +0.5 per cent, etc.) between the successive tenths into which the data were split are called "decils." The midmost decil, which of course divides the whole number of observations into two equal groups, is called the "median." Table 2 presents the results drawn from the tally sheets—that is, the nine decils for each year, together with the percentages of greatest fall and of greatest rise from prices in the year before.



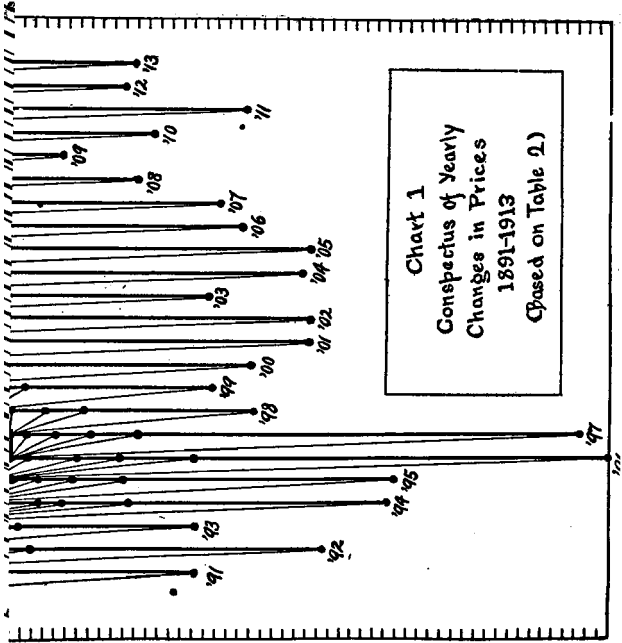


TABLE 2.—CHAIN INDEX NUMBERS OF PRICES AT WHOLESALE IN THE UNITED STATES, BY YEARS, 1891 TO 1913.

[The decils are those points in the percentage scale of rise or fall in price which divide the whole number of price changes recorded each year into 10 equal groups. Based upon the percentages of increase or decrease in price from one year to the next, given in Table II of Bulletin of the United States Bureau of Labor Statistics, No. 149, May, 1914.]

(- indicates a fall; + indicates a rise; ±0 indicates "no change.")

Year.	Greatest fall.	1st decil.	2d decil.	3d decil.	4th decil.	Median.	6th decil.	7th decil.	8th decil.	9th decil.	Greatest rise.
1891.....	Perct.	Perct.	Perct.	Perct.	Perct.	Perct.	Perct.	Perct.	Perct.	Perct.	Perct.
1891.....	-30.5	-13.2	-8.0	-4.8	-1.4	±0	±0	+1.5	+5.0	+15.3	+53.0
1892.....	-41.2	-10.0	-11.2	-8.5	-5.4	-3.1	-0.5	±0	+1.1	+5.5	+28.0
1893.....	-27.5	-11.9	-8.0	-8.5	-2.4	±0	+1.1	+4.8	+11.0	+59.1	+59.1
1894.....	-44.3	-21.4	-15.8	-12.4	-10.8	-7.1	-5.0	-3.2	-1.3	±0	+31.1
1895.....	-38.0	-14.0	-9.6	-6.5	-4.1	-2.4	±0	+7	+4.2	+12.1	+61.9
1896.....	-54.6	-17.8	-11.3	-7.5	-3.0	-1.2	±0	+3	+4.3	+10.2	+41.5
1897.....	-50.9	-11.5	-7.2	-4.4	-1.7	±0	±0	+2.9	+6.2	+12.7	+101.6
1898.....	-21.9	-7.0	-3.3	-4	±0	+1.8	+5.0	+8.3	+13.3	+19.8	+60.4
1899.....	-20.2	-3.8	±0	±0	+2.6	-5.5	+7.6	+10.6	+16.4	+30.8	+103.3
1900.....	-29.2	-3.6	±0	+3.2	+5.1	+7.5	+9.6	+12.7	+17.4	+26.6	+72.8
1901.....	-42.6	-15.0	-10.2	-6.1	-3.7	-1.5	±0	+1.3	+4.9	+13.2	+53.0
1902.....	-40.6	-7.4	-1.6	±0	±0	+2.2	+4.7	+7.1	+12.1	+20.4	+58.9
1903.....	-33.7	-12.6	-5.3	-2.1	±0	+1.3	+3.7	+5.3	+8.3	+14.1	+37.4
1904.....	-43.8	-15.0	-7.0	-3.5	-0.6	±0	+1.3	+3.0	+5.9	+11.7	+39.9
1905.....	-44.9	-7.6	-3.9	-1.0	±0	+7	+3.3	+5.9	+9.6	+15.9	+46.0
1906.....	-39.1	-4.8	±0	±0	+2.8	+1.2	+6.4	+9.7	+14.5	+18.9	+40.7
1907.....	-43.0	-3.2	±0	±0	+1.2	+3.9	+6.6	+8.9	+12.3	+17.6	+67.8
1908.....	-39.5	-21.3	-16.0	-10.8	-5.8	-3.8	-9	±0	+8	+6.2	+44.9
1909.....	-29.8	-7.7	-3.7	-1.4	±0	±0	+1.7	+5.0	+8.1	+16.0	+70.1
1910.....	-37.7	-6.1	-2.4	-4	±0	+1.5	+3.6	+6.3	+9.2	+16.0	+46.5
1911.....	-47.4	-15.1	-9.8	-7.0	-4.2	-9	±0	±0	+2.9	+11.0	+68.1
1912.....	-36.1	-6.8	-2.9	-5	±0	+1.0	+3.6	+6.7	+11.0	+17.7	+46.2
1913.....	-38.5	-10.4	-3.7	-1.0	±0	+5	+2.4	+4.5	+7.5	+12.7	+58.5
Averages..	-38.0	-11.0	-6.2	-3.6	-1.4	+5	+2.3	+4.3	+7.8	+14.6	+57.0

Chart 1, based upon Table 2, gives a more vivid idea of these price fluctuations. It shows for each year the whole range covered by the recorded changes from prices in the preceding year by vertical lines, which connect the points of greatest rise with the points of greatest fall. These lines differ considerably in length, which indicates that price changes cover a wider range in some years than in others. The heavy dots upon the vertical lines show the positions of the decils. One-tenth of the commodities quoted in any given year rose above their prices of the year before by percentages scattered between the top of the line for that year and the highest of the dots. Another tenth fell in price by percentages scattered between the bottom of the line and the lowest of the dots. The fluctuations of the remaining eight-tenths of the commodities were concentrated within the much narrower range between the lowest and the highest dots. The dots grow closer together toward the central dot, which is the median. This concentration indicates, of course, that the number of commodities showing fluctuations of relatively slight extent was much larger than the number showing the wide fluctuations falling outside the highest and lowest decils, or even between these decils and the decils next inside them.

The middle dots or medians in successive years are connected by a heavy black line, which represents the general upward or downward drift of the whole set of fluctuations. To make this drift clear the median of each year is taken as the starting point from which the upward or downward movements in the following year are measured. Hence the chart has no fixed base line. But in this respect it represents faithfully the figures from which it is made; since these figures are percentages of prices in the preceding year, a price fluctuation in any year establishes a new base for computing the percentage of change in the year following. The fact that prices in the preceding year are the units from which all the changes proceed is further emphasized by connecting the nine decils, as well as the points of greatest rise and fall with the median of the year before by light diagonal lines. The chart suggests, and not inaptly, a series of bursting bomb shells, the bombs being represented by the median dots of the years before and the scattering of their fragments by the lines which radiate to the decils and the points of greatest rise and fall.<sup>1</sup>

Time is well spent in studying this chart, because it is capable of giving the mind a more just impression of the characteristics of price changes than any other device.<sup>2</sup> The marked diversity of the fluctuations of different commodities in the same year—some rising, some falling, some remaining unchanged—the wide range covered by these fluctuations, and the erratic occurrence of extremely large changes are strikingly shown; but so also are the much greater frequency of rather small variations, the dense concentration near the center of the field, the existence of a general drift in the whole complex of changes, and the frequent alterations in the direction and the degree of this drift. But if the chart is effective in giving these impressions, it leaves them rather vague. To render certain of them more definite, recourse must be had to the figures from which the chart was drawn.

These figures, already given in Table 2, enable us to measure the concentration of the mass of fluctuations about the center of the field. One way to measure this concentration is to compute the differences between the successive decils; that is, to find the range within which successive tenths of the fluctuations fall. This "range" is, of course,

<sup>1</sup> Owing to the constant shifting of the base line, no fixed scale of relative prices can be shown on the margin of the chart. But the offsets on the margin indicate the vertical distances allotted to a rise or fall of 1 per cent from the prices of the preceding year.

The scale used here, that is, the ratio between the horizontal distances which represent one year, and the vertical distances which represent 1 per cent of rise or fall in prices, is the same as that used in the other charts in this bulletin, and in the earlier bulletins in this series. Because of its intricacy, the chart had to be reproduced on a larger scale than in the other cases, but of course that fact does not alter the slant of the lines, and this slant is the matter of importance.

<sup>2</sup> Except, perhaps, a similar chart drawn to a logarithmic scale.

a certain number of points in the percentage scale of change from prices in the year before. When this computation is made for the whole period covered by the table, we get the results presented in Table 3. As heretofore, the successive tenths of the fluctuations represented are reckoned by starting with cases of greatest fall in price and counting upwards to cases of greatest rise. The central division of the table shows that the average range covered by the fluctuations diminishes rapidly as we pass from the cases of greatest fall toward the cases of little change, and then increases still more rapidly as we go onward to the cases of greatest rise. The right-hand group of columns shows how the range increases if we start with the two middle tenths, take in the two tenths just outside them, then the two tenths outside the latter, and so on until we have included the whole body of fluctuations. The left-hand group of columns, on the other hand, combines in succession the two tenths on the outer boundaries, then the two tenths immediately inside them, and so on until we get back again to the two central tenths. Perhaps the most striking single result brought out by this table is that eight tenths of all the fluctuations are concentrated within a range (25.7 per cent) slightly narrower than that covered by the single tenth that represents the heaviest declines (27 per cent), and much narrower than that covered by the single tenth that represents the greatest advances (42.4 per cent).

TABLE 3.—AVERAGE CONCENTRATION OF PRICE FLUCTUATIONS AROUND THE MEDIAN, 1891 TO 1913.

[Based upon Table 2. The fluctuations represent percentage changes from average prices in the preceding year.]

Average range covered by the—										
1st and 10th tenths of the price fluctuations.	2d and 9th tenths of the price fluctuations.	3d and 8th tenths of the price fluctuations.	4th and 7th tenths of the price fluctuations.	5th and 6th tenths of the price fluctuations.	Successive tenths of the price fluctuations.	Central two tenths of the price fluctuations.	Central four tenths of the price fluctuations.	Central six tenths of the price fluctuations.	Central eight tenths of the price fluctuations.	Whole number of the price fluctuations.
68.4	11.8	6.1	4.2	3.0	1st tenth, 27.0	3.6	7.8	13.9	25.7	95.1
					2d tenth, 4.9					
					3d tenth, 2.6					
					4th tenth, 2.2					
					5th tenth, 1.8					
					6th tenth, 1.8					
					7th tenth, 2.0					
					8th tenth, 3.5					
					9th tenth, 6.9					
					10th tenth, 42.4					

Such results as these gain greatly in significance by being put beside corresponding results for other groups of statistical data. The best comparison to make, however, is one between the actual distribution of our price fluctuations about their average and a "normal" distribution of the same data—that is, a distribution according perfectly with the so-called "normal law of error." This law shows how phenomena are distributed about their average when the number of phenomena observed is very large, and when each phenomenon is the resultant of numerous independent factors, none of which is of preponderating importance. It has been found that many kinds of phenomena tend to conform rather closely to this normal distribution; for example, human heights, errors of observation, shots at a target, wage rates in different occupations, etc.<sup>1</sup> When it can be shown that phenomena are distributed approximately in this fashion, their average can safely be accepted as a significant measure of the whole set of variations, since even the deviations from the average are then grouped in a tolerably definite and symmetrical fashion about the average.

With such a comparison in view we may treat each recorded percentage of rise or fall in price as an observation of the degree and direction in which prices vary from one year to the next. Taking all the commodities and all the years covered by the bureau's chain relatives, we have 5,578 observations for analysis. Table 4 shows how these cases are distributed along a percentage scale of rise or fall in prices which jumps two points at a time. The columns headed "number of cases" show how many price variations of the given magnitudes and directions occur, and the columns headed "proportion of cases" show the same numbers in the rather clearer form of percentages of their sum (5,578).

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<sup>1</sup> See, for example, Prof. F. Y. Edgeworth's article "Probability," Part II, *Encyclopædia Britannica*, 11th ed., and the references there given.

TABLE 4.—DISTRIBUTION OF 5,578 CASES OF CHANGE IN THE WHOLESALE PRICES OF COMMODITIES FROM ONE YEAR TO THE NEXT, ACCORDING TO THE MAGNITUDE AND DIRECTION OF THE CHANGES.

[Based upon the chain relatives in Table II of Bulletin of the Bureau of Labor Statistics, No. 149.]

Rising prices.					Falling prices.			
Per cent of change from the average price of the preceding year.	Number of cases.	Proportion of cases.	Per cent of change from the average price of the preceding year.	Number of cases.	Proportion of cases.	Per cent of change from the average price of the preceding year.	Number of cases.	Proportion of cases.
102-103.9	1	0.018	46-47.9	11	0.197	Under 2.	1,405	7.261
100-101.9	1	.018	44-45.9	10	.179	2-3.9	1,375	6.725
98-99.9			42-43.9	6	.103	4-5.9	329	5.898
96-97.9			40-41.9	14	.251	6-7.9	1,238	4.267
94-95.9			38-39.9	17	.305	8-9.9	200	3.585
92-93.9			36-37.9	11	.197	10-11.9	173	3.101
90-91.9			34-35.9	18	.323	12-13.9	1,120	2.151
88-89.9			32-33.9	17	.305	14-15.9	107	1.918
86-87.9	1	.018	30-31.9	22	.394	16-17.9	76	1.362
84-85.9	1	.018	28-29.9	30	.538	18-19.9	71	1.273
82-83.9	1	.018	26-27.9	29	.520	20-21.9	45	.807
80-81.9	1	.018	24-25.9	47	.843	22-23.9	39	.699
78-79.9			22-23.9	45	.807	24-25.9	32	.574
76-77.9			20-21.9	65	1.165	26-27.9	17	.305
74-75.9	1	.018	18-19.9	73	1.308	28-29.9	27	.484
72-73.9	4	.072	16-17.9	1,102	1.928	30-31.9	16	.287
70-71.9	1	.018	14-15.9	106	1.900	32-33.9	7	.125
68-69.9	3	.054	12-13.9	115	2.062	34-35.9	10	.179
66-67.9	4	.072	10-11.9	167	2.994	36-37.9	7	.125
64-65.9			8-9.9	1,237	4.249	38-39.9	5	.090
62-63.9			6-7.9	261	4.679	40-41.9	5	.090
60-61.9	4	.072	4-5.9	1,356	6.382	42-43.9	4	.072
58-59.9	6	.108	2-3.9	355	6.364	44-45.9	2	.036
56-57.9	1	.018	Under 2.	1,410	7.350	46-47.9	1	.018
54-55.9	3	.054	No change.	697	12.494	48-49.9	1	.018
52-53.9	4	.072				50-51.9	1	.018
50-51.9	1	.018				52-53.9		
48-49.9	5	.090				54-55.9	1	.018

## Summary.

	Number of cases.	Proportion of cases.
Rising prices.....	2,567	46.021
No change.....	697	12.494
Falling prices.....	2,314	41.485
Total.....	5,578	100.000

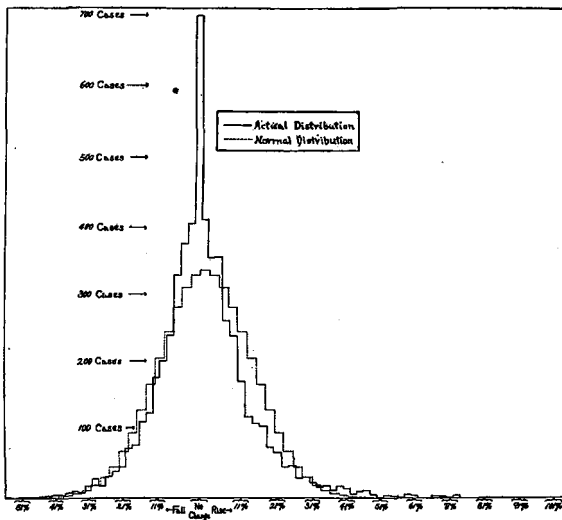
1 Location of the decils.

Such is the actual distribution of the phenomena under analysis. To compare it with the "normal" distribution, we put these figures on a chart, which presents the facts clearly to the eye. Here the horizontal scale represents percentages of rise or fall in price, and the vertical scale represents the number of times each percentage of change is observed. The dotted line shows how our 5,578 cases would have been distributed had they followed strictly the normal law of error. The areas included by the unbroken line and the dotted line are equal.

There are three significant points to notice here: (1) The two forms of distribution, the actual and the "normal," are of the same

type. (2) The concentration about the central tendency is greater in the actual than in the "normal" distribution; but on the other hand, the extreme variations diverge further from this central tendency in the actual distribution than in the other.<sup>1</sup> (3) Unlike the "normal" distribution, the actual distribution is not perfectly symmetrical. Two closely related aspects of this difference may be pointed out: First, the outlying cases of the "normal" distribution

CHART 2.—DISTRIBUTION OF 5,578 PRICE VARIATIONS (PERCENTAGES OF RISE OR FALL FROM PRICES OF PRECEDING YEAR).



extend precisely the same distance from the central tendency in both directions, whereas in the actual distribution the outlying cases run much farther to the right (in the direction of a rise in prices) than to the left (in the direction of a fall).<sup>2</sup> Second, the central tendency

<sup>1</sup> The greater concentration in the actual than in the "normal" distribution is perhaps best shown by the fact that the probable deviation (half of the range between the quartiles) is only 5.6 points in the first case as against 8.9 points in the second. The quartiles correspond in nature to the deciles and medians. They are the points which divide the whole number of observations into four equal parts. In the case of the actual distribution the quartiles are +6.6 and -4.6.

<sup>2</sup> The extremes are +103.3 per cent and -54.6 per cent. From another viewpoint, however, these extremes may be regarded as nearly symmetrical. The greatest rise represents a price of the year before multiplied by 2.033; the greatest fall a price of the year before divided by 2.203. The significance of these two ways of comparing the magnitude of a rise and a fall in prices is discussed in Section IV, subsection 8.

itself is free from ambiguity in one case but not in the other. In the "normal" distribution this tendency may be expressed indifferently by the median, the arithmetic mean, or the mode (the point of greatest density); for these three averages coincide. In the actual distribution, on the contrary, these averages differ slightly; the median and mode stand at  $\pm 0$ , while the arithmetic mean is  $+1.36$  per cent.<sup>1</sup> These departures of the actual distribution from perfect symmetry possess a certain significance; but, after all, they are minor qualifications of the important proposition; namely, year-to-year price fluctuations are grouped about their central tendency in a strikingly regular fashion.

This study of the actual distribution of price fluctuations from one year to the next will be found to throw light upon several problems presently to be faced in discussing the methods of making index numbers. For the moment we have use primarily for the demonstration that these fluctuations are highly concentrated about a central tendency. This conclusion strengthens the hope that we may make measurements of price fluctuations that fairly represent the net resultant of all the changes, miscellaneous as they seem to be. For properly constructed averages have clearly a better chance of being representative and significant when the phenomena for which they stand have a strongly marked central tendency about which deviations are symmetrically grouped than when the phenomena are irregularly scattered over their range.

But it must be remembered, and with the reminder doubt reenters, that the variations just analyzed are percentages of increase or decrease from the prices of the year before. Most index numbers, however, attempt to measure price fluctuations, not with reference to the preceding year, but with reference to a period considerably more remote. For example, the Bureau of Labor Statistics measures prices in 1913 in terms of average prices in the decade 1890-1899. Are price variations computed in this manner highly concentrated around their central tendency like the price variations with which we have been dealing?

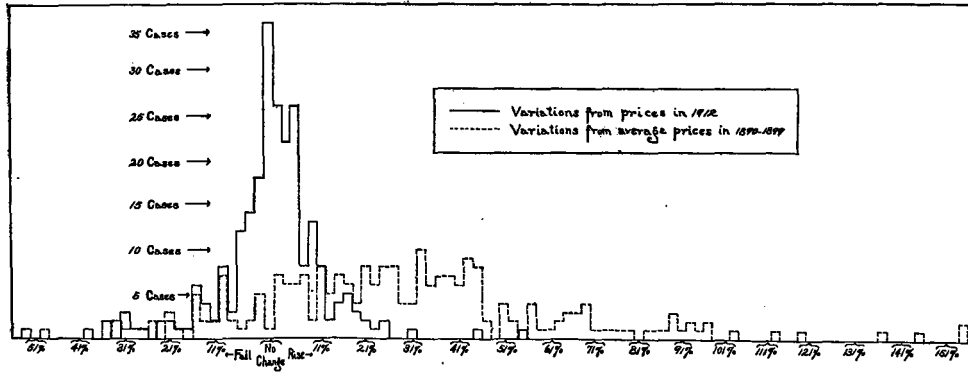
Chart 3 answers this question emphatically in the negative. It represents the distribution of the price variations of 241 commodities quoted by the Bureau of Labor Statistics for the year 1913.<sup>2</sup> These variations are computed in two ways: (1) as percentages of rise or fall from the prices of 1912; (2) as percentages of rise or fall from

<sup>1</sup> That the arithmetic mean is slightly above zero arises partly from the fact that there are 33 percentages of rise greater than any percentage of fall. But it also arises partly from the fact that our data come from a period (1890-1913) when the trend of year-to-year fluctuations was more often upward than downward; there were 2,567 cases of advance in price against 2,314 cases of fall. The median is kept from rising above zero because the cases of "no change," 697 in number, more than offset the difference between the numbers of advances and of declines in price.

<sup>2</sup> The Bureau quotes 252 commodities in 1913; but 11 can not be included in the present comparison because no quotations are given for them in 1890-1899.



CHART 3.—DISTRIBUTION OF THE PRICE VARIATIONS OF 241 COMMODITIES IN 1913 (PERCENTAGES OF RISE OR FALL IN PRICES).



the average prices of 1890-1899. Of course the first set of variations corresponds in character to the variations represented above in Chart 2. The distribution of these variations, shown by the area inclosed by the unbroken line, is similar in type to the actual distribution in Chart 2; although it is less regular—a difference to be expected, since the number of observations is only 241 here as against 5,578 there. But the distribution of the second set of variations (percentages of change from the average prices of 1890-1899) as represented by the area inclosed within the dotted line belongs to a different type. It has no pronounced central tendency; it shows no high degree of concentration around the arithmetic mean (+30.4 per cent) or median (+26 per cent). It is more like an oblong than like the bell-shaped normal curve; it has a range between the greatest fall (52.2 per cent) and greatest rise (234.5 per cent) so extreme that two of the cases could not be represented on the chart; and its probable deviation is five times as great as that of the corresponding variations from 1912 prices—18.5 points as against 3.6.<sup>1</sup>

Price variations, then, become dispersed over a wider range and less concentrated about their mean as the time covered by the variations increases. The cause is simple: With some commodities the trend of successive price changes continues distinctly upward for years at a time; with other commodities there is a consistent downward trend; with still others no definite long-period trend appears. In any large collection of price quotations covering many years each of these types, in moderate and extreme form, and all sorts of crossings among them, are likely to occur. As the years pass by the commodities that have a consistent trend gradually climb far above or subside far below their earlier levels, while the other commodities are scattered between these extremes. Thus the percentages of variation for any given year gradually get strung out in a long, thin, and irregular line, without a marked degree of concentration about any single point.

The consequence is that the measurement of price fluctuations becomes difficult in proportion to the length of time during which the variations to be measured have continued. In other words, the farther apart are the dates for which prices are compared, the wider is the margin of error to which index numbers are subject, the greater the discrepancies likely to appear between index numbers made by different investigators, the wider the divergencies between the averages and the individual variations from which they are computed, and the larger the body of data required to give confidence in the representative value of the results.

From this preliminary survey of the characteristics of price fluctuations it appears (1) that year-to-year changes in the price level

<sup>1</sup> The probable deviation, to repeat, is half the inter-quartile range.

can be measured with good prospects of success, because such variations show a symmetrical distribution and a marked degree of concentration about their central tendency; but (2) that measurements of variations between years far apart have a more problematical value. The practical question whether the index numbers in current use can be trusted, then, may have two answers. Perhaps they give results that are reliable as between successive years, and at the same time doubtful for dates between which 10, 20, or 50 years have intervened.

The best way to test the reassuring conclusion about index numbers for successive years and to resolve the disturbing doubt about index numbers covering long periods is to compare different series of index numbers that purport to measure price changes in the same country during the same time. If the results turn out to be consistent with one another our faith will be confirmed. If the results are not consistent we must find a valid reason for the discrepancies, or become skeptical about the present methods of measuring changes in the price level.

When this test is applied, the first impression is unfavorable. For example, the five currently published American index numbers show the following results for 1912 and 1913:

Year.	Bureau of Labor Statistics' index number.	Bradstreet's index number.	Annalist index number.	Gibson's index number.	Dun's index number.
1912.....	133.6	\$9.1867	143.25	62.6	\$124.44
1913.....	135.2	9.2076	139.98	58.1	120.99
Changes.....	+1.6	+.0209	-3.27	-4.5	-3.56

Here no two of the series are as closely consistent with each other as one could wish. On the contrary, the five series disagree not only as to the degree but also as to the direction of the change in prices. And this is a comparison between successive years, where measurements should be especially accurate.

Such offhand comparisons as the above, however, are not fair, and the conclusion they suggest as to the unreliability of index numbers can not be accepted without further study, for these various index numbers mean different things. They do not all undertake to measure the same quantity, hence they do not all employ the same methods, and hence the discrepancies among their results may reveal no real inconsistency. No valid comparison of index numbers can be made, indeed, without a careful examination of what is measured and how the measurement is made. Such an examination accordingly we must make before we can satisfy our minds upon the question whether index numbers yield trustworthy results.

#### IV.—VARIETIES OF METHODS USED IN MAKING INDEX NUMBERS.

Making an index number involves several distinct operations: (1) Defining the purpose for which the final results are to be used; (2) deciding the numbers and kinds of commodities to be included; (3) determining whether these commodities shall all be treated alike or whether they shall be weighted according to their relative importance; (4) collecting the actual prices of the commodities chosen, and, in case a weighted series is to be made, collecting also data regarding their relative importance; (5) deciding whether to measure the average variations of prices or the variations of a sum of actual prices; (6) in case average variations are to be measured, choosing the base upon which relative prices shall be computed; and (7) settling upon the form of average to be struck.

At each one of these successive steps choice must be made among alternatives that range in number from two to thousands. The possible combinations among the alternatives chosen are indefinitely numerous. Hence there is no assignable limit to the possible varieties of index numbers, and in practice no two of the known series are exactly alike in construction. To canvass even the important variations of method actually in use is not a simple task.

##### 1. THE RELATIONS BETWEEN METHODS AND USES.

The first step, framing a clear idea of the ultimate use of the results, is most important, since it affords the clue to guide the compiler through the labyrinth of subsequent choices. It is, however, the step most frequently omitted.

When the end in view is specific and capable of precise statement the problem of choosing methods is comparatively simple. Straight-forward logic then determines what commodities should be included, what sources of quotations should be drawn upon, and how the original data should be worked up to give the most significant results. Puzzles a-plenty are left, but most of them are limited to finding the best compromise between what logic marks out as desirable and what is feasible in view of the time and money at the investigator's disposal.

Few of the widely-used index numbers, however, are made to serve one special purpose. On the contrary, most of them are "general-purpose" series, designed with no aim more definite than that of measuring changes in the price level. Once published they are used for many ends—to show the depreciation of gold, the rise in the cost of living, the alternations of business prosperity and depression, and the allowance to be made for changed prices in comparing estimates of national wealth or private income at different times. They are

cited to prove that wages ought to be advanced or kept stable; that railway rates ought to be raised or lowered; that "trusts" have manipulated the prices of their products to the benefit or the injury of the public; that tariff changes have helped or harmed producers or consumers; that immigration ought to be encouraged or restricted; that the monetary system ought to be reformed; that natural resources are being depleted or that the national dividend is growing. They are called in to explain why bonds have fallen in price and why interest rates have risen, why public expenditures have increased, why social unrest prevails in certain years, why farmers are prosperous or the reverse, why unemployment fluctuates, why gold is being imported or exported, and why political "landslides" come when they do.

The compiler of a general-purpose index number, then, can not foresee to what uses and misuses his figures will be put. For each of the legitimate uses he might conceivably devise an appropriate series. But he can not conceivably devise a single series that will serve all uses equally well. For the very qualities that make an index number good, say, for the man of affairs concerned with the business outlook, may make it bad for other men interested in the fortunes of farmers, in the effects of the tariff, in the relation between gold output and prices, in comparing changes in price levels in different countries, etc. The day has not yet come when the uses of index numbers are sufficiently differentiated and standardized to secure the regular publication of numerous special-purpose series. Until that day does come the making of general-purpose series will continue and the makers will go on choosing their methods perforce on rather vague and general grounds. So long also must most of the users of index numbers put up with figures imperfectly adapted to their ends.

The critical student of contemporary index numbers is in the same uncomfortable position as the compiler. He has no single rule of right and wrong to apply in judging the different general-purpose series, for methods that are legitimate for certain uses are questionable for others. Nevertheless, it is futile (though not uncommon) for him to discuss methods without reference to uses, since a statistical method has neither merits nor defects except as a means to certain ends. The one course that is open to him is to invert the problem. Instead of studying methods in the light of uses, he must study uses in the light of methods. That is, he must analyze the effect of the different methods followed in practice and so determine what the resulting figures mean and the uses to which they may properly be put.

The following discussion proceeds upon this plan. It deals primarily with the popular general-purpose series and endeavors to show how

the various methods used in constructing these index numbers determine the uses to which they are severally adapted.

## 2. COLLECTING AND PUBLISHING THE ORIGINAL QUOTATIONS.

The reliability of an index number obviously depends upon the judgment and the accuracy with which the original price quotations were collected. This field work is not only fundamental, it is also laborious, expensive, and perplexing beyond any other part of the whole investigation. Only those who have tried to gather from the original sources quotations for many commodities over a long series of years appreciate the difficulties besetting the task. The men who deal with data already published are prone to regard all this preliminary work as a clerical compilation requiring much industry but little skill. To judge from the literature about index numbers, one would think that the difficult and important problems concern methods of weighting and averaging. But those who are practically concerned with the whole process of making an index number from start to finish rate this office work lightly in comparison with the field work of getting the original data.

We commonly speak of *the* wholesale price of articles like pig iron, cotton, or beef as if there were only one unambiguous price for any one thing on a given day, however this price may vary from one day to another. In fact there are many different prices for every great staple on every day it is dealt in, and most of these differences are of the sort that tend to maintain themselves even when markets are highly organized and competition is keen. Of course varying grades command varying prices, and so as a rule do large lots and small lots; for the same grade in the same quantities, different prices are paid by the manufacturer, jobber, and local buyer; in different localities the prices paid by these various dealers are not the same; even in the same locality different dealers of the same class do not all pay the same price to everyone from whom they buy the same grade in the same quantity on the same day. To find what really was the price of cotton, for example, on February 1, 1915, would require an elaborate investigation, and would result in showing a multitude of different prices covering a considerable range.

Now the field worker collecting data for an index number must select from among all these different prices for each of his commodities the one or the few series of quotations that make the most representative sample of the whole. He must find the most reliable source of information, the most representative market, the most typical brands or grades, and the class of dealers who stand in the most influential position. He must have sufficient technical knowledge to be sure that his quotations are for uniform qualities, or to

make the necessary adjustments if changes in quality have occurred in the markets and require recognition in the statistical office. He must be able to recognize anything suspicious in the data offered him and to get at the facts. He must know how commodities are made and must seek comparable information concerning the prices of raw materials and their manufactured products, concerning articles that are substituted for one another, used in connection with one another, or turned out as joint products of the same process. He must guard against the pitfalls of cash discounts, premiums, rebates, deferred payments, and allowances of all sorts. And he must know whether his quotations for different articles are all on the same basis, or whether concealed factors must be allowed for in comparing the prices of different articles on a given date.

Difficult as it is to secure satisfactory price quotations, it is still more difficult to secure satisfactory statistics concerning the relative importance of the various commodities quoted. What is wanted is an accurate census of the quantities of the important staples, at least, that are annually produced, exchanged, or consumed. To take such a census is altogether beyond the power of the private investigators or even of the Government bureaus now engaged in making index numbers. Hence the compilers are forced to confine themselves for the most part to extracting such information as they can from statistics already gathered by other hands and for other purposes than theirs. In the United States, for example, estimates of production, consumption, or exchange come from most miscellaneous sources: From the Department of Agriculture, the Census Office, the Treasury Department, the Bureau of Mines, the Geological Survey, the Internal Revenue Office, the Mint, associations of manufacturers or dealers, trade papers, produce exchanges, traffic records of canals and railways, etc. The man who assembles and compares estimates made by these various organizations finds among them many glaring discrepancies for which it is difficult to account. Such conflict of evidence when two or more independent estimates of the same quantity are available throws doubt also upon the seemingly plausible figures coming from a single source for other articles. To extract acceptable results from this mass of heterogeneous data requires intimate familiarity with the statistical methods by which they were made; endless patience, and critical judgment of a high order, not to speak of tactful diplomacy in dealing with the authorities whose figures are questioned. The keenest investigator, after long labor, can seldom attain more than a rough approximation to the facts. Yet it is only by critical use of the data now available that current index numbers can be weighted, and the best hope of

improving weights in the future lies in demonstrating not only the imperfections of our present statistics of production, consumption, and exchange, but also the importance of making them better.

When all this preliminary work has been done, the original quotations and the weights should be published at length. Unfortunately, many compilers of index numbers publish only the final results of their computations, upon the ground of expense or lack of interest in the detailed information. But much is sacrificed by taking this easy course. First, the reputation of the index number itself is compromised, and deservedly. No one can really test whether a series is accurately compiled from representative quotations unless the data and their sources are given in full. Second, and more important, the publication of actual quotations greatly extends the usefulness of an investigation into prices. Men with quite other ends in view than those of the original compilers can make index numbers of their own adapted to their peculiar purposes if provided with the original data.

Nor is the importance of such unplanned uses to be rated lightly. If we are ever to make the money economy under which we live highly efficient in promoting social welfare we must learn how to control its workings. What wares our business enterprises produce and what goods our families consume are largely determined by existing prices, and the production and consumption of goods are altered by every price fluctuation. What we waste and what we save, how we divide the burden of labor and how we distribute its rewards, whether business enjoys prosperity or suffers depression, whether debts of long standing become easier or harder to pay—all these and many other issues turn in no small measure upon what things are cheap and what are dear, upon the maintenance of a due balance within the system of prices, upon the upward or downward trend of the price changes that are always taking place. But if the prices of yesterday are powerful factors in determining what we shall do and how we shall fare to-day, what we do and how we fare to-day are powerful factors in determining what prices shall be to-morrow. If prices control us, we also control them. To control them so that they shall react favorably upon our economic fortunes we need more insight than we have at present. It is, then, one of the great tasks of the future to master the complicated system of prices which we have gradually developed—to find how prices are interconnected, how and why they change, and what consequences each change entails. For when men have learned these things they will be vastly more skillful in mending what they find amiss in economic life, and in reenforcing what they find good. As yet our



knowledge is fragmentary and uncertain. But of all the efforts being made to extend it none is so certain to prove fruitful as the effort to record the actual prices at which large numbers of commodities are bought and sold. For such data are the materials with which all investigators must deal, and without which no bits of insight can be tested. Indeed, it is probable that long after the best index numbers we can make to-day have been superseded, the data from which they were compiled will be among the sources from which men will be extracting knowledge which we do not know enough to find.

### 3. MARKET PRICES, CONTRACT PRICES, AND IMPORT-EXPORT VALUES.

All the American index numbers are made from "market prices." These prices are usually obtained directly from manufacturers, selling agents, or wholesale merchants; from the records of produce exchanges and the like; or from trade journals and newspapers which make a specialty of market reporting in their respective fields.

Several of the important foreign index numbers are made wholly or partly from "import and export values"; that is, from the average prices of important articles of merchandise as officially declared by the importing or exporting firms, or as determined by governmental commissions. For example, Soetbeer's celebrated German series, and the British Board of Trade's official series are made mainly from such material, and the official French series was made wholly from import values until 1911.

A third source of quotations often drawn upon in Europe is the "contract prices" paid for supplies by such institutions as hospitals, normal schools, poorhouses, army posts, and the like. The official Italian series, Alberti's series for Trieste, and Lévassour's French series are examples.

These three classes of quotations—market prices, import and export values, and contract prices—usually differ somewhat, not only with respect to the prices prevailing on a given date, but also with respect to the degree of change from time to time. Accordingly it is desirable to inquire into the several advantages possessed by each source of quotations.

Contract prices may be set aside promptly, because index numbers made from them have a limited range of usefulness. Though the institutions whose records are drawn upon often make purchases on a considerable scale, yet the common description of their contract rates as "semiwholesale" prices points to the peculiar and therefore unrepresentative character of such data. Moreover, there is

often more doubt about the strictly uniform character of the supplies furnished to these institutions than about the uniformity of the standardized goods which are usually quoted in the market reports. If the aim of the investigation is to find the average variations in the cost of supplies to public institutions, doubtless contract prices are the best data to use. But if the aim is to measure the average variations in the wholesale prices paid by the business world at large, then market prices are distinctly the better source. Indeed, contract prices are seldom used for the latter purpose except when well-authenticated market quotations can not be had.

The theory on which import and export values are sometimes preferred to market prices is that the former figures show more nearly the variations in the prices actually paid or received by a country for the great staples which it buys and sells than do market quotations for particular brands or grades of these commodities. For example, England buys several different kinds of cotton in proportions that vary from year to year. A price obtained by dividing the total declared values of all the cotton consignments imported by their total weight will show the average cost per pound actually paid by Englishmen for cotton with more certainty than will Liverpool market quotations for a single grade of cotton like "Middling American"—provided always that the "declared values" are trustworthy. Now, if the aim of the investigation is to find out the variations in the average prices paid or received for staples—irrespective of minor changes in their qualities—then the preference for import and export values is clearly justified, again granted the trustworthiness of the returns. But if the aim is to measure just one thing—the average variation in prices—market prices for uniform grades are clearly better data. For index numbers made from import and export values measure the net resultant of two sets of changes, and one can not tell from the published figures what part of the fluctuations is due to changes in prices and what part is due to changes in the qualities of the goods bought and sold.

As might be expected, import and export series generally pursue a more even course than market-price series. But this difference may be due less to the sources from which the quotations are obtained than to differences in the lists of commodities used. Fortunately, we can arrange a more certain test than any of the common series provide. In 1903 the British Board of Trade published the average import or export prices of 25 commodities for which Mr. Sauerbeck

has published market prices.<sup>1</sup> Index numbers made from these two sets of data for the same commodities for the years 1871 to 1902 are given in Table 5. The results confirm the expectation: As compared with the import and export index number, the market-price index number starts on a higher level in 1871, falls to a lower point during the middle nineties, rises to a higher level in 1900, and again drops to as low a level in 1902.

TABLE 5.—COMPARISON OF INDEX NUMBERS MADE FROM IMPORT AND EXPORT VALUES WITH INDEX NUMBERS MADE FROM THE MARKET PRICES OF THE SAME COMMODITIES, BY YEARS, 1871 TO 1902.

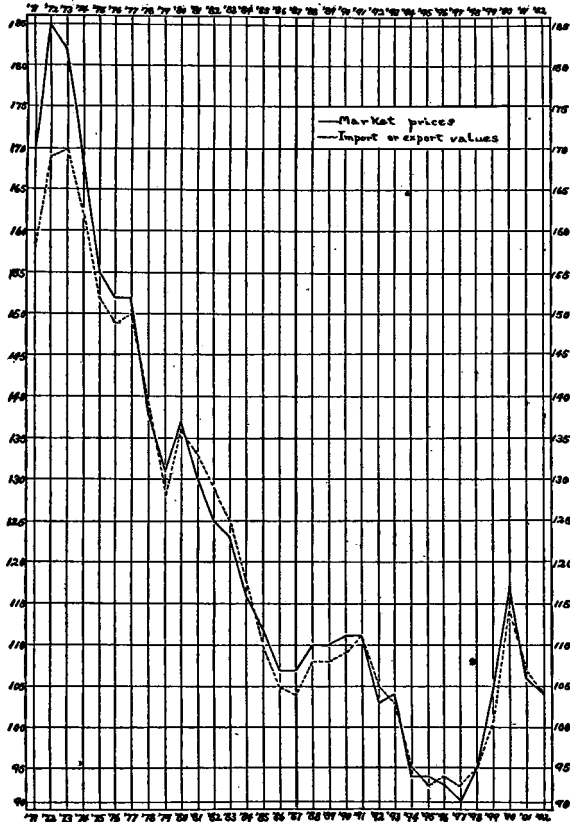
[Data from the British Board of Trade and from Sauerbeck.]  
(Arithmetic means of relative prices. Average prices in 1890-1899=100. 25 commodities.)

Year.	Import and export values.	Market prices.	Year.	Import and export values.	Market prices.
1871.....	158	170	1887.....	104	107
1872.....	169	185	1888.....	108	110
1873.....	170	182	1889.....	108	110
1874.....	162	186	1890.....	109	111
1875.....	152	155	1891.....	111	111
1876.....	149	152	1892.....	105	103
1877.....	150	152	1893.....	103	104
1878.....	139	138	1894.....	93	93
1879.....	128	131	1895.....	93	94
1880.....	136	137	1896.....	94	93
1881.....	133	130	1897.....	93	91
1882.....	129	125	1898.....	95	95
1883.....	125	123	1899.....	101	105
1884.....	118	116	1900.....	114	117
1885.....	110	112	1901.....	107	106
1886.....	105	107	1902.....	104	104

<sup>1</sup> Wholesale and Retail Prices. Return to an Order of the . . . House of Commons . . . for "Report on Wholesale and Retail Prices in the United Kingdom in 1902, with Comparative Statistical Tables for a Series of Years." For Sauerbeck's figures see his annual articles in the Journal of the Royal Statistical Society. The list of commodities in question is as follows:

Commodity.	Quotations given by Board of Trade.	Brands quoted by Sauerbeck.
Bacon.....	Average import values	Waterford.
Barley.....	do	English Garrett.
Coal.....	Average export values	Walsend, Hetton, in London.
Coffee.....	Average import values	Rio, good channel.
Copper.....	do	Chile bars.
Cotton.....	do	Middling-American.
Flax.....	do	St. Petersburg.
Hides.....	do	River Plata, dry.
Iron, pig.....	Average export values	Scotch pig.
Jute.....	Average import values	Good medium.
Lead.....	do	English pig.
Linseed.....	do	Linseed.
Maize.....	do	American mixed.
Oats.....	do	English Gazette.
Oil, olive.....	do	Olive oil.
Oil, palm.....	do	Palm oil.
Petroleum.....	do	Petroleum, refined.
Rice.....	do	Hampoon, cargoes to arrive.
Silk.....	do	Tattee.
Sugar, refined.....	do	Java, floating cargoes.
Tea.....	do	Congou, common.
Tin.....	do	Straits.
Wheat.....	do	English Gazette.
Wool.....	do	Merino, Adelaide, average grease.
Do.....	Average export values.	English, Lincoln, half hogs.

CHART 4.—INDEX NUMBERS MADE FROM THE MARKET PRICES AND FROM THE IMPORT AND EXPORT VALUES OF IDENTICAL LISTS OF COMMODITIES. ENGLAND, 1871-1902. (BASED ON TABLE 5.)



## 4. RELATIVE VERSUS ACTUAL PRICES.

In February, 1864, Hunt's Merchants' Magazine published the following statement to show how rapidly prices rose after the suspension of specie payments in December, 1861, and the issue of the irredeemable United States notes.<sup>1</sup> These figures are the total prices of 55 articles quoted by their customary commercial units.

*Value of 55 leading articles of New York commerce.*

January, 1862.....	\$804
April, 1862.....	844
January, 1863.....	1,312
March, 1863.....	1,524
July, 1863.....	1,324
October, 1863.....	1,455
January, 1864.....	1,693

For example, in January, 1862, coal oil is entered as 30 cents per gallon and pig iron as \$24 per ton; molasses is entered as 42½ cents per gallon and whalebone as \$69 per ton; oats is entered as 38 cents per bushel and corn as \$59.25 per hundred bushels, etc.<sup>2</sup>

Clearly, this simple method of measuring changes in the price level by casting sums of actual prices is not trustworthy. For a relatively slight fall in the quotation for whalebone would affect the total, as Hunt's Merchants' Magazine computes it, much more than a relatively enormous increase in the price of molasses. The fact that corn happens to be quoted by the hundred bushels makes a 1 per cent change from its price in January, 1862, equal to a 43 per cent change in the price of wheat and to a 156 per cent change in the price of oats, both of which are quoted by the bushel.

It was to avoid such patent absurdities that Carli threw his actual prices of grain, wine, and olives in 1750 into the form of percentages of rise or fall from their prices in 1500, and then struck the average of the three percentages. When this operation is performed it makes no difference whether the commodities are quoted by large or by small units. The obvious common sense of this precedent has caused it to be followed or reinvented by most makers of index numbers to this day—with one slight modification. To avoid the awkwardness of the plus and minus signs necessary to indicate whether prices have advanced or receded, it is usual to substitute for percentages of rise or fall relative prices on the scale of 100. For example, a rise of 10 per cent and a fall of 10 per cent are expressed by relatives of 110 and 90, respectively. Occasionally, however, percentages of rise or fall are still used as by Carli; as, for instance, in the chain relatives published by the Bureau of Labor Statistics in Bulletin No. 149 and

<sup>1</sup> Vol. 50, p. 132.<sup>2</sup> See vol. 48, p. 122.

averaged in the first four tables of this bulletin. A second unimportant variant, long practiced by the *Economist*, but now seldom used, is to publish as the final result the sums of relative prices, instead of their averages.<sup>1</sup>

In recent years a few statisticians have gone back from the use of relative to the use of actual prices, adopting various devices to avoid such crude errors as those perpetrated in the figures cited from Hunt's *Merchants' Magazine*. In 1897 Bradstreet's began reducing all its original quotations by the gallon, ton, dozen, square yard, etc., to prices by the pound, and presenting as its index number the aggregate prices per pound of 98 articles.<sup>2</sup> Four years later, Dun's *Review* followed this lead, with an important difference. Instead of reducing actual quotations to quotations by the pound, it multiplied the actual quotation for each article included by the quantity of that article supposed to be consumed in the course of a year by the average individual. These products were then cast up, and the sums, in dollars and cents, were presented as an index number purporting to show the changes in the per capita cost of a year's supplies.<sup>3</sup>

Still later (1912), the method practiced by Dun was adopted by the Commonwealth statistician of Australia as the basis of his official series. However, after he had calculated the aggregate expenditure of Australians upon his bill of goods in terms of pounds sterling, he threw these pecuniary sums back into the form of relative numbers on the scale of 1,000.

Accordingly, three types of index numbers are now in general use: (1) Averages of relative prices or average percentages of change in prices; (2) sums in dollars and cents showing changes in the aggregate cost of certain definite quantities of certain commodities; (3) relative figures made from series of the second sort. The first type shows average variations, the second type shows the variations of an aggregate, the third type turns these variations of an aggregate into percentages of the aggregate itself as it stood at some selected time. Certain of the advantages and shortcomings of the several types can be brought out in connection with the next topic, base periods; but the relation between average variations<sup>4</sup> of relative prices and the variations of aggregate actual prices can not be adequately treated until we reach the section devoted to forms of averages.

<sup>1</sup> Gibson's index number is such a sum. See p. 94. The difference between sums of relative prices and these sums divided by the number of articles included is, of course, purely formal. Averages have displaced sums in current use mainly because it is easier to make comparisons on the scale of 100 than on the scale of 2,300, or whatever number is given by the addition of relative prices.

<sup>2</sup> For a criticism of this method, see p. 101.

<sup>3</sup> The confidence merited by this index number is discussed in Section V.

## 5. BASE PERIODS.

When relative prices are used it is necessary to select the quotations of some given period as a base. The actual prices in this base period are called 100; all antecedent and subsequent prices are divided by the base prices, and the quotients, multiplied by 100, make the relatives which are usually summed and divided by the number of commodities to get the final index number.

In some cases the prices of a single day have been used as the base, but as a rule average prices for a year, five years, a decade, or an even longer period have been preferred. For this preference there is a simple justification when arithmetic means are used as averages of the relative prices.<sup>1</sup> If the price of any commodity happens to be unusually high or unusually low in the base period, its relative prices at other periods will be correspondingly high or low, and very high relative prices, especially, may exercise an undue influence upon arithmetic means. If an appreciable proportion of the commodities in the list be very high or very low, the final index number may be distorted. Though numerically correct, the results have less significance than if they showed changes in terms of prices that men consider "normal."<sup>2</sup> Of course exceptionally high or exceptionally low quotations are less likely to last for a year than for a day, and less likely to last for a decade than for a year.

The period chosen as base should be that period with which accurate comparisons are most significant for the purpose in hand. Probably most users of general-purpose index numbers prefer to make their comparisons with recent dates. Hence the case for "chain" indexes is very strong—that is, for indexes like the medians of Table 2, which show the average rise or fall of prices on the basis of prices in the preceding year.<sup>3</sup> Hence, also, any index number with a fixed base becomes in one respect less significant the longer it is maintained. For example, when the Bureau of Labor Statistics' series was established in 1902, the public was interested to know how much prices in that year had changed in terms of average prices in the decade 1890-99. In 1915, however, we care less about a measurement of change in terms of what prices were 16 to 25 years ago than we care about how much prices have changed with reference to 1914. Similarly, Sauerbeck's index number suffers in significance now because it forces one to make all comparisons in terms of prices in a

<sup>1</sup> If geometric means are used the ratios between the index numbers for different dates are not influenced at all by the selection of the base, and if medians are used they are likely to be affected but slightly, provided the number of commodities included be large. See the discussion of forms of averages, subsec. 8.

<sup>2</sup> The selection of a proper base period, however, does not guarantee immunity from the exercise of undue influence by certain articles. More important than the base is the choice of proper weights. See subsec. 7.

<sup>3</sup> This form of index number was invented by Prof. Alfred Marshall. See *Contemporary Review*, March, 1887.

period that ended before most of the people now living were old enough to know the meaning of prices.

A further advantage of chain index numbers is that they make the dropping of obsolescent and the adding of new commodities especially easy. It is difficult to keep the list of commodities included in a fixed-base system really representative of the markets over a long period of time. Barring perhaps thirty or so staple raw materials that hold their importance for centuries at a time, most commodities have their day of favor and then yield to new products. Consequently the compilers can hardly let two decades pass without revising their lists, in certain details, or seeing them lose in significance. But since a chain index does not profess to give accurate comparisons except between successive years the compiler feels himself free to improve his list whenever he can. It is very much easier to include many commodities on this plan. And if the index number be weighted, the chain index has a similar advantage in facilitating the frequent revision of the weights.<sup>1</sup>

Once more, year-to-year variations of prices can be measured with a closer approach to accuracy than variations covering a longer period of time. For, as was shown in Section III of this bulletin, the former variations are highly concentrated about their central tendency while the variations from what prices used to be years ago are widely dispersed. The longer a fixed-base system is maintained, indeed, the more scattered become the relative prices as a rule. Hence the variations are less and less aptly represented by any average that can be devised, and the margin of error to which the results are subject grows wider. In other words, with a given body of quotations to build upon, chain relatives are more trustworthy than their rivals; and, as has just been said, it is feasible to provide a larger body of quotations for chain relatives than for a fixed-base series.

Finally, another aspect of the wide dispersion that becomes characteristic of fixed-base relatives with the lapse of years merits separate mention. The commodities that have a consistent long-period trend gradually climb far above or fall far below the average relative prices.<sup>2</sup> Then the high relative prices of the first group come to exercise much more influence upon the position of the average itself than do the low relative prices of the second group.<sup>3</sup> A 10 per cent change in the price of an article whose price has already doubled will count four times as much as a 10 per cent change in the price of an article whose price has dropped by half. For most purposes, this

<sup>1</sup> Compare Irving Fisher, *The Purchasing Power of Money*, revised edition, p. 204. On weighting, see subsec. 7 of this bulletin.

<sup>2</sup> Compare p. 23.

<sup>3</sup> Medians and geometric means are not distorted by such cases, as are the much commoner arithmetic means. See subsec. 8.



development is to be regarded as a defect of the fixed-base series. For commodities seldom gain in importance because of a great rise in price; on the contrary, the commodities that become cheaper are likely to be consumed and produced on an increasing scale.<sup>1</sup> Against this danger of magnifying the influence of articles that are becoming costly and minimizing the influence of articles that are becoming cheap, no care in the selection of a base avails for long if the base be fixed.<sup>2</sup>

Chain relatives have their drawbacks also. Makers of index numbers find them more laborious to compute than fixed-base series, since most of the actual prices used as divisors change every year. And users of index numbers find a chain series difficult to interpret when they seek to know how much prices have risen or fallen over considerable periods of time. Of course, chain relatives for successive years can be multiplied together to form a continuous series, but it is not easy to give the later members of the series a concrete meaning. To know, for example, that in 1891 prices fell, on the average, 0.2 per cent below their level in 1890; that in 1892 they fell 4.4 per cent below their new level in 1891, and so on through ups and downs on an ever-changing base for every year to 1915, enables one to make a series beginning, say, with 100 in 1890 and running on with 99.8 in 1891, 95.4 in 1892, etc., to some result for 1915.<sup>3</sup> But such a series does not enable one to say in terms of what a comparison is made between prices in 1915 and in 1890. Any fixed-base series covering these years, on the contrary, would show the level of prices both in 1890 and in 1915 in terms of a common denominator—namely, the level at which prices stood in the base period, whatever that was. Hence it is an excellent plan to make from the original quotations two series of index numbers—one a chain index and the other a fixed-base series.

Even this combination, however, is far from meeting all the needs of users of index numbers. For certain users may require for special purposes accurate measurements of price fluctuations in terms of the price level in any given month or year, or any given stretch of time in the whole period covered by the investigation. If such users are few as compared with all the people who note or quote the popular index numbers, they are precisely the few most interested in price fluctuations and most likely to increase knowledge by their use of the figures. But of course compilers can not foresee what base periods would serve best all these special purposes, and they can not be

<sup>1</sup> Compare, A. W. Flux, "Modes of constructing index numbers," *Quarterly Journal of Economics*, August, 1907. Vol. 21, p. 615. See pp. 38 and 39 of this bulletin.

<sup>2</sup> In other words, the objection stated on p. 36 to accepting as the base a period when prices were not "normal" extends in a measure to accepting any long-past period as a base for measuring current fluctuations of prices.

<sup>3</sup> For an example of this method see pp. 42 to 44.

expected to work out index numbers on all the bases made possible by their original data. It is therefore highly desirable to have index numbers that can be shifted from one base to another both readily and accurately.

It is this desideratum, in large part, that has led to the recent reaction against index numbers made by striking arithmetic means of relative prices and in favor of index numbers made by adding actual prices. For the latter form of index, being a sum of dollars and cents, can be thrown into the form of a series of relative prices upon any base that is desired, with slight labor and without inaccuracy; whereas arithmetic means of relative prices can not consistently be shifted to a new base without recomputing the relative prices, commodity by commodity, and striking new averages from these new relatives.<sup>1</sup> Such recomputations are so laborious that a short method of shifting the base of this kind of index numbers is often practised even by persons quite aware of the ambiguity of the new results. This method consists in dividing the figures for other dates by the figures for the date desired as base and multiplying the quotients by 100. Of course this process results in a relative price of 100 for the new base period, and the other figures look as if they showed average relative prices as percentages of prices at this period. But there is no mathematical justification for assuming that results reached in this way must agree with results reached by recomputing relative prices for each commodity on the new base. For such recomputation usually alters considerably the relative influence exercised upon the arithmetic means by the price fluctuations of certain commodities. Those articles which are cheaper in the new than in the old base period get higher relative prices and therefore increased influence. Vice versa, articles that are dearer in the new base period get lower relative prices and therefore diminished influence. Of course the short method of shifting the base, which retains the old relative prices, does not permit any such alteration in the influence exercised by the fluctuations of different commodities. Hence the two methods of shifting the base seldom yield precisely the same results. To present a series of arithmetic means shifted by the short method as showing what the index numbers would have been if they had been computed upon the new base is therefore misleading.

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<sup>1</sup> On the forms of index numbers that can be shifted from one base to another without altering the ratios between the successive members of the series, see Irving Fisher, *Purchasing Power of Money*, table opposite p. 418, test 7.

It is easy to arrange examples in which wide discrepancies appear between the results of the two methods of shifting the base.<sup>1</sup> But the difficult and the important thing is to find out how serious the discrepancies are in actual practice. For to use index numbers effectively, it is often necessary to shift the base, and sometimes the short method must be followed, either because recomputation in full requires a prohibitive amount of labor, or because the original data necessary for recomputation have not been published. The next table gives three pertinent examples. In the first case when Sauerbeck's index is shifted from 1867-1877=100 to 1890-1899=100 the discrepancies are fairly regular and rather small both absolutely and relatively. In the last case, when the same series is shifted to 1860=100, the discrepancies are highly irregular from year to year, and are rather large both absolutely and relatively—several times exceeding 5 per cent of the recomputed figures. In the remaining case the discrepancies are small absolutely, though often large relatively to the recomputed figures, and also highly variable from year to year.<sup>2</sup> The conclusion which these experiments suggest is that the two

<sup>1</sup> For example, suppose that an index number includes only wheat and corn, and that their prices are as follows:

	1913	1914
Wheat, per bushel....	\$1.00	\$0.50
Corn, per bushel.....	.40	.40

If 1913 be made the base, the relative prices and index numbers will be:

	1913	1914
Wheat, relative prices	100	50
Corn, relative prices..	100	100
Sums .....	200	150
Index numbers.....	100	75

If now the base be shifted from 1913 to 1914 by the short method, the index number for 1913 will be  $(100 \div 75) 100 = 133\frac{1}{3}$ . But if the figures be recomputed on the basis of prices in 1914, the result is an index number of 150 in 1913:

	1913	1914
Wheat, relative prices	200	100
Corn, relative prices..	100	100
Sums .....	300	200
Index numbers.....	150	100

<sup>2</sup> The discrepancies shown in the table do not result wholly from the mathematical inconsistency of the short method; but partly from the fact that when an index number is shifted to a new base by recomputation in full it is commonly impossible or undesirable to utilize all the original data. Some commodity, for example, may not be quoted for the dates used as the new base, and therefore has either to be dropped or introduced at a later date by means of some doubtful assumption as to what its price would have been had it been quoted for the full period. Of course this observation makes the objection to using the short method stronger rather than weaker. It means that this method often leads the statistician into uses of the original data which he would have avoided had he undertaken the recomputation of the index number.

methods almost always give different results; that the discrepancies are by no means constant from year to year in a given case, and that their magnitude both absolutely and relatively differs much from one case to another. Hence it is well to avoid the short method of shifting bases whenever possible; and when that method must be used, its results should not be treated as showing what the index number would have been had it been made originally on the new base.

TABLE 6.—EXAMPLES OF DISCREPANCIES BETWEEN THE RESULTS OF TWO METHODS OF SHIFTING THE BASES ON WHICH INDEX NUMBERS ARE COMPUTED.

(Arithmetic means.)

Years.	Sauerbeck's index number, 1880-1913.				Bureau of Labor Statistics' index number.				Years.	Sauerbeck's index number, 1880-1901.			
	Original form, 1867-1877=100.	Shifted to 1890=100, by short method.	Computed on basis 1890=100, by long method.	Discrepancies.	Bureau's series on basis 1890=100.	Chain index made by short method.	Chain index made by long method.	Discrepancies.		Original form, 1867-1877=100.	Shifted to 1860=100, by short method.	Computed on basis 1860=100.	Discrepancies.
1860..	72	109	109	.....	112.9	.....	.....	.....	1860.	99	100.0	100.0	.....
1891..	72	109	109	.....	111.7	-1.1	-0.2	0.9	1861.	98	99.0	99.0	0.6
1882..	98	103	103	.....	106.1	-5.0	-4.4	0.6	1862.	101	102.0	103.5	3.5
1883..	68	103	103	.....	106.6	-	-2	3	1863.	103	104.0	109.3	5.3
1894..	63	95	95	.....	96.1	-9.0	-8.7	0.3	1864.	105	106.1	112.3	6.2
1895..	62	94	94	.....	93.6	-2.6	-1.5	1.1	1865.	101	102.0	105.8	3.8
1896..	61	92	92	.....	90.4	-3.4	-2.8	0.6	1866.	102	103.0	106.5	3.5
1897..	62	94	93	1	89.7	-0.8	+2	4	1867.	100	101.0	103.9	2.9
1898..	64	97	97	.....	93.4	+4.1	+4.8	0.7	1868.	99	100.0	103.1	3.1
1899..	68	103	104	1	101.7	+8.9	+10.4	1.5	1869.	98	99.0	101.9	2.9
1900..	75	114	115	1	110.5	+8.7	+9.4	0.7	1870.	96	97.0	100.3	3.3
1901..	70	106	107	1	108.5	-1.8	-1.1	0.7	1871.	100	101.0	102.6	1.6
1902..	69	105	106	1	112.9	+4.1	+4.6	0.5	1872.	109	110.1	112.5	2.4
1903..	69	105	106	1	113.0	+0	+1.2	0.6	1873.	111	112.1	116.6	4.5
1904..	70	106	108	2	113.0	-0.5	-1	0.4	1874.	102	103.0	107.0	4.0
1905..	72	109	111	2	115.9	+2.6	+2.0	0.3	1875.	96	97.0	100.3	3.3
1906..	77	117	119	2	122.5	+5.7	+5.8	0.1	1876.	95	96.0	97.5	1.5
1907..	80	121	123	2	128.5	+5.7	+6.0	0.3	1877.	84	85.0	97.4	2.4
1908..	73	111	112	1	122.8	-5.2	-5.6	0.4	1878.	87	87.9	91.2	3.3
1909..	74	112	114	2	126.5	+3.0	+3.2	0.2	1879.	83	83.8	86.7	2.9
1910..	78	118	120	2	131.0	+4.0	+4.1	0.1	1880.	85	85.9	91.8	2.9
1911..	80	121	123	2	129.2	-1.8	-1.9	0.1	1881.	85	85.9	88.5	2.6
1912..	85	129	130	1	133.6	+3.4	+3.4	.....	1882.	84	84.9	88.0	3.1
1913..	85	129	130	1	135.2	+1.2	+1.2	.....	1883.	82	82.8	86.0	3.2
.....	.....	.....	.....	.....	.....	.....	.....	.....	1884.	76	76.8	79.3	2.5
.....	.....	.....	.....	.....	.....	.....	.....	.....	1885.	72	72.7	75.4	2.7
.....	.....	.....	.....	.....	.....	.....	.....	.....	1886.	69	69.7	72.4	2.7
.....	.....	.....	.....	.....	.....	.....	.....	.....	1887.	68	68.7	70.7	2.0
.....	.....	.....	.....	.....	.....	.....	.....	.....	1888.	70	70.7	73.9	3.2
.....	.....	.....	.....	.....	.....	.....	.....	.....	1889.	72	72.7	76.7	4.0
.....	.....	.....	.....	.....	.....	.....	.....	.....	1890.	72	72.7	76.0	3.3
.....	.....	.....	.....	.....	.....	.....	.....	.....	1891.	72	72.7	75.4	2.7

The second of the preceding examples of discrepancies arising from the two ways of shifting bases merits especial attention because it refers to the new and important chain index number published by the Bureau of Labor Statistics in Bulletin No. 149. All of the "percentages of increase or decrease compared with each preceding year or month" on pages 9 to 16 of Bulletin No. 149 were made by dividing the 1890-1899 index number for each date by the corresponding index number for the preceding date. Consequently these results are not precisely what the captions, under which they appear, suggest.

The fact that the discrepancies between the two sets of results are small, never exceeding 1.5 points in the scale of percentage changes, affords striking confirmation of a conclusion drawn in Section III from the distribution of price variations. Because variations from prices in the preceding year are highly concentrated about a central tendency, while variations from the prices of a remoter period are widely scattered, it was argued that the measurement of price changes is easy in proportion as the time during which these changes have been accumulating is short. So, now, we find that dissimilar methods of manipulating the same data yield nearly the same results when they are applied to the easy problem of making a chain index number.

The use of the short method in making the new chain indexes was the natural result of a practice begun by the bureau in 1908—a practice that illustrates, from another angle, the problem of shifting bases. In that year 11 new commodities were introduced into the bureau's index number.<sup>1</sup> Since quotations were not secured for these commodities prior to 1907, relative prices could not be computed for them on the 1890-1899 base. How, then, could these new articles be included in the index numbers of the groups affected? The bureau solved this problem by (1) computing relative prices for both the new and the old commodities in 1908 on the basis, prices in 1907=100, (2) averaging these relatives, and (3) shifting these new index numbers for 1908 from the 1907 base to the 1890-1899 base. This shift was effected by multiplying the group index numbers for 1908, on the 1907 base, by the group index numbers for 1907, on the 1890-1899 base.

The process may be illustrated from the group of farm products. The index number for this group in 1907, on the base, prices in 1890-1899=100, was 137.1, while in 1908, on the base, prices in 1907=100, the index number was 97.1. The bureau assumed that since prices of farm products in 1908 were, on the average, 97.1 per cent of their prices in 1907, and since their prices in 1907 had been 137.1 per cent of their prices in 1890-1899, therefore prices in 1908 were 97.1 per cent of 137.1 per cent of prices in 1890-1899; that is, 133.1 per cent of prices in 1890-1899. By repeating this process in later years, the bureau forged its successive chain indexes from 1908 to 1913 into a continuous series.

The merits and defects of series made in this fashion have already been canvassed.<sup>2</sup> The one fact important for present purposes is that the results of this method, however excellent in other ways, do not agree with results worked out on a fixed-base system. Hence the

<sup>1</sup> Among farm products, horses, mules, poultry, and leaf tobacco; among food products, canned corn, canned peas, canned tomatoes, fresh beef in Chicago, dressed poultry, and cabbage; among lumber and building materials, yellow-pine flooring.

<sup>2</sup> See pp. 36-38.

bureau's present index numbers of farm products, foods, and lumber and building materials—the three groups into which new commodities were introduced—are not accurately comparable in 1908–1913 either with its figures for these same groups in 1890 to 1907, or with its 1908–1913 figures for the six remaining groups. Even the general index number of all commodities is affected appreciably by the admission of the inconsistent elements into the grand totals from which averages were struck.

The question remains: How much difference did the change in method make? To answer one must find a better way of introducing the 11 new commodities into the old list. To effect this introduction, some assumption is necessary concerning the relation of their prices in 1907, the first year for which quotations were obtained, to their unknown prices in the base period. Perhaps the bureau's implicit assumption that the 1907 index number of the old commodities on the 1890–1899 base should be taken as the starting point for computing relative prices for the new commodities is as defensible as any other guess that can be made. If this guess be accepted, the relative prices for the four new farm products should be computed on the base, actual prices in 1907 = 137.1; for the six new foods on the base, actual prices in 1907 = 117.8, and for the one new kind of lumber on the base, actual prices in 1907 = 146.9. Then the relatives for the new commodities can be added to and averaged with the relatives for the old without more ado. If this method be applied to farm products the result is an index number for 1908 of 133.4,<sup>1</sup> whereas the bureau's method gives 133.1. In the case of foods we get 121.5 instead of the bureau's 120.6, and in the case of lumber and building materials 131.8 instead of 133.1.

Now the discrepancies between these two sets of results for 1908 seem small. But the bureau soon made them large, by building its index for 1909 on the discrepancy for 1908, again building in 1910 on the discrepancy accumulated in 1908 and 1909, and so on. By 1913

<sup>1</sup> The details of this new computation are as follows:

New farm products.	1907	1908	Relative prices in 1908 on base, actual prices in 1907 = 137.1.
Horses.....	\$211.17	\$168.18	127.4
Mules.....	283.80	189.13	127.2
Poultry.....	.1409	.1327	136.1
Leaf tobacco.....	12.4381	15.0625	166.0
Sum of relatives for the 4 new commodities.....			549.7
Sum of relatives for the 16 old commodities.....			2,117.4
Aggregate relative prices of 20 farm products.....			2,667.1
Average relative prices of farm products.....			133.4

the results of the two methods for farm products are far apart; the two figures for food products and for lumber and building materials are seriously at variance, and even the general index numbers for all commodities show a difference of 4.2 points. Table 7 presents the two sets of results side by side.<sup>1</sup>

TABLE 7.—EFFECT OF SHIFTING THE BASE OF INDEX NUMBERS BY SIMPLE MULTIPLICATION.

[Bureau of Labor Statistics' index numbers for farm products, foods, lumber and building materials, and all commodities after the inclusion of 11 new commodities in 1908.]

(Arithmetic means.)

Years.	Farm products.		Food products.		Lumber and building materials.		All commodities.	
	Index numbers on base, prices in preceding year=100, multiplied by index numbers based on 1890-1899 = 100.	Base for old commodities, 1890-1899 = 100. Base for new commodities, prices in 1907= index number of old commodities in that year.	Index numbers on base, prices in preceding year=100, multiplied by index numbers based on 1890-1899 = 100.	Base for old commodities, 1890-1899 = 100. Base for new commodities, prices in 1907= index number of old commodities in that year.	Index numbers on base, prices in preceding year=100, multiplied by index numbers based on 1890-1899 = 100.	Base for old commodities, 1890-1899 = 100. Base for new commodities, prices in 1907= index number of old commodities in that year.	Index numbers on base, prices in preceding year=100, multiplied by index numbers based on 1890-1899 = 100.	Base for old commodities, 1890-1899 = 100. Base for new commodities, prices in 1907= index numbers of their groups in that year.
1908.....	133.1	133.4	120.6	121.5	133.1	131.8	122.8	122.0
1909.....	133.1	130.3	124.7	126.5	138.4	136.4	126.5	125.5
1910.....	164.8	156.8	128.7	129.0	153.2	151.2	131.6	130.5
1911.....	132.0	134.3	131.3	126.4	151.4	152.1	129.2	128.8
1912.....	171.3	162.6	139.5	134.2	148.2	148.2	133.6	130.5
1913.....	165.8	153.8	137.1	131.9	151.8	147.1	135.2	131.0

## 6. THE NUMBERS AND KINDS OF COMMODITIES INCLUDED.

Since the earlier makers of index numbers had to use such price quotations as they could find, the problems how many and what kinds of commodities to include were practically solved for them. As Prof. Edgeworth remarks, "Beggars can not be choosers."

<sup>1</sup> The revised figures should be substituted for the bureau's figures for 1908-1913, or the 11 new commodities should be dropped altogether. The latter course has been followed in other tables in this paper, but it makes little difference which set of results is used, as the following figures show:

*Recomputation of the Bureau of Labor Statistics' index number for all commodities in the years 1908 to 1913.*

	1908	1909	1910	1911	1912	1913
After revising the method of treating the 11 new commodities.....	122.0	125.5	136.5	126.8	136.5	131.0
After dropping the 11 new commodities altogether.....	121.7	124.5	130.0	126.4	130.3	130.4

Paucity of data still hampers contemporary efforts to measure variations of prices in the past; but the compilers of index numbers for current years have a wider range of choice. The scope of their data is limited not by the impossibility but by the expense of collecting quotations. And in the case of governmental bureaus or financial journals the limits set by expense are neither narrow nor rigid. Such organizations can choose many commodities if they will or content themselves with few.

One principle of choice is generally recognized. Those commodities are preferable that are substantially uniform from market to market and from year to year. Often the form of quotation makes all the difference between a substantially uniform and a highly variable commodity. For example, prices of cattle and hogs are more significant than prices of horses and mules, because the prices of cattle and hogs are quoted per pound, while the prices of horses and mules are quoted per head.

It is often argued that the application of this common-sense principle rules out almost all manufactured goods, because such articles are continually being altered in quality to suit the technical exigencies of new industrial processes or the varying tastes of consumers. But minor changes in quality, provided their occurrence is known, do not necessarily unfit a commodity for inclusion. When the brand formerly sold is replaced by a variant it is usually possible to get overlapping quotations for the old and new qualities during the time of transition. Then the new series may be spliced upon the old by means of the ratio borne by the price of the new grade to the price of the old grade in the years when the substitution is made. Statisticians willing to take the extra precautions and trouble involved by such operations can legitimately include not only a large number of staple raw materials and their simplest products, but also an even larger number of manufactured goods.

Some of the modern index numbers, accordingly, have long lists of commodities. Dun's index number seems to be built up from 310 series of quotations, the official Canadian index number includes 272 articles, the Bureau of Labor Statistics' index number for 1913 had 252, and the new weighted index number for 1914 contains 297 quotations of 201 distinct articles. On the other hand, many of the best-known index numbers use less than 50 series of quotations. Forty-five is a favorite number, largely because of the high reputation early established by Sauerbeck's English series. The British Board of Trade's series, the new official French series, the New Zealand series, Von Jankovich's Austrian series, and Atkinson's series for British India



all have just 45 commodities, while the new series of the London Economist and the relative prices published by the Imperial Statistical Office of Germany include 44 articles. Even shorter lists are often used. For example, Schmitz's German series has only 29 commodities, the New York Annalist series 25, and Gibson's series 22. Private investigators working with limited resources sometimes confine themselves to a bare dozen commodities, or even less.<sup>1</sup>

These differences of practice raise important questions of theory. Does it make any substantial difference in the results whether 25 or 50 or 250 commodities be included—provided always that the lists be well chosen in the three cases? If differences do appear in the results, are they merely haphazard, or are they significant differences? If there are significant differences, which set of results is more valuable, that made from the long or from the short lists? And what does the proviso that the lists be well-chosen mean? In short, do the index numbers including hundreds of commodities possess any real advantages over those including 50 or 25 to compensate for the greater trouble and expense of compiling them?

The best way to answer these questions is to experiment with large and small index numbers, made on a strictly uniform plan for the same country and the same years. Table 8 presents six such index numbers which differ only in respect to the number and kind of commodities included. The first column includes all the commodities quoted by the Bureau of Labor Statistics, except the 11 whose prices do not run back of 1908.<sup>2</sup> Many of the commodities in this list are merely different varieties of the same article; for example, there are two kinds of corn meal, four kinds of leather, six kinds of women's dress goods, eleven kinds of steel tools, etc. The second column gives an index number in which all such groups are represented by single averages, so that the number of series which enter

<sup>1</sup> These statements refer to the number of series of relative prices averaged to get the final results as now presented. Often two or more different varieties of an important article are counted as separate commodities, and, on the other hand, the relative prices of slightly different articles are sometimes averaged to make one of the series which enters into the final averages. In view of the diversity of practice in this respect, a perfectly consistent counting of the number of distinct "commodities" included in the general series is impossible. Moreover, the figures are often published with such imperfect explanations as to make the counting of the commodities included doubtful or impossible on any interpretation of that term.

<sup>2</sup> To facilitate comparison, decimals have been dropped and the index for each year rounded off to the nearest whole number. Further, the results for 1908-1913 are changed for the reasons explained on pp. 42-44. Regarding the changes in the number of commodities included, see Bulletin No. 149, p. 11.



made from the prices of 20 pairs, each commodity being given in two forms, raw and manufactured, e. g., barley and malt, cattle and beef, copper ingots and copper wire, etc.<sup>1</sup> The last two columns contain index numbers each made from the prices of 25 important articles selected at random, the two lists having no items in common.<sup>2</sup>

TABLE 5.—SIX INDEX NUMBERS FOR THE UNITED STATES MADE FROM QUOTATIONS FOR DIFFERENT NUMBERS OF COMMODITIES, BY YEARS, 1890 TO 1913.

[Data from the Bulletin of the Bureau of Labor Statistics, No. 140.]

(Arithmetic means. Average prices in 1890-1899=100.)

Year.	242 to 261 commodities.	145 commodities.	50 commodities.	40 commodities.	25 commodities, first list.	25 commodities, second list.
1890.....	113	114	114	113	115	113
1891.....	112	113	114	114	112	118
1892.....	106	106	105	105	103	112
1893.....	106	105	105	101	103	107
1894.....	96	95	94	85	92	96
1895.....	94	93	94	85	85	93
1896.....	90	89	87	88	88	85
1897.....	90	89	89	89	90	84
1898.....	93	93	85	85	96	90
1899.....	102	103	103	108	107	103
1900.....	111	111	112	115	113	109
1901.....	109	110	109	116	111	107
1902.....	113	114	116	122	116	117
1903.....	114	114	115	118	118	117
1904.....	113	114	116	118	122	110
1905.....	118	118	118	122	122	115
1906.....	123	122	123	128	130	122
1907.....	130	130	132	138	132	132
1908.....	122	121	125	129	124	122
1909.....	125	124	132	135	133	128
1910.....	130	131	135	141	133	134
1911.....	126	130	129	135	129	131
1912.....	130	134	138	142	140	138
1913.....	130	131	138	139	142	133
Averages 1890-1899.....	100	100	100	100	100	100
1900-1909.....	118	118	120	124	122	118
1910-1913.....	129	132	135	139	136	134
Number of points by which prices rose (+) or fell (-) in—						
1890-1896.....	-23	-25	-27	-25	-27	-28
1896-1907.....	+40	+41	+45	+50	+44	+47
1907-1908.....	- 8	- 9	- 7	- 9	- 8	-10
1908-1912.....	+ 5	+13	+13	+13	+16	+16
Difference between highest and lowest relative prices.....	40	45	51	54	54	54
Average change from year to year.....	4.0	4.1	4.9	5.5	5.0	4.2

<sup>1</sup> The remaining 17 pairs are corn and corn meal, cotton and cotton textiles, flaxseed and linseed oil, window glass and glassware, hides and leather, hogs and pork, lead (pig) and lead pipe, milk and cheese, petroleum (crude and refined), pig iron and nails, pine boards and pine doors, rye and rye flour, sheep and mutton, spelter and zinc, steel billets and steel tools, wheat and wheat flour, wool and woolen textiles.

<sup>2</sup> The first list includes cotton, corn, wheat, hides, cattle, hogs, coffee, wheat flour, salt, sugar, tea, potatoes, wool, silk, anthracite coal, bituminous coal, crude petroleum, pig iron, steel billets, copper ingots, lead (pig), brick, average of nine kinds of lumber, jute, and rubber.

The second list includes hay, oats, rye, eggs, sheep, lard, beans, corn meal, butter, rice, milk, prunes, cotton yarns, worsted yarns, coke, cement (Rosendale 1890-1909, Portland domestic 1900-1913), tallow, spelter, bar iron, tin (pig), quicksilver, lime, tar, paper, proof spirit.

TABLE 8.—SIX INDEX NUMBERS FOR THE UNITED STATES MADE FROM QUOTATIONS FOR DIFFERENT NUMBERS OF COMMODITIES, BY YEARS, 1890 TO 1913—Concluded.

Number of points by which the selected index numbers were greater (+) or less (-) than the Bureau of Labor Statistics' series.

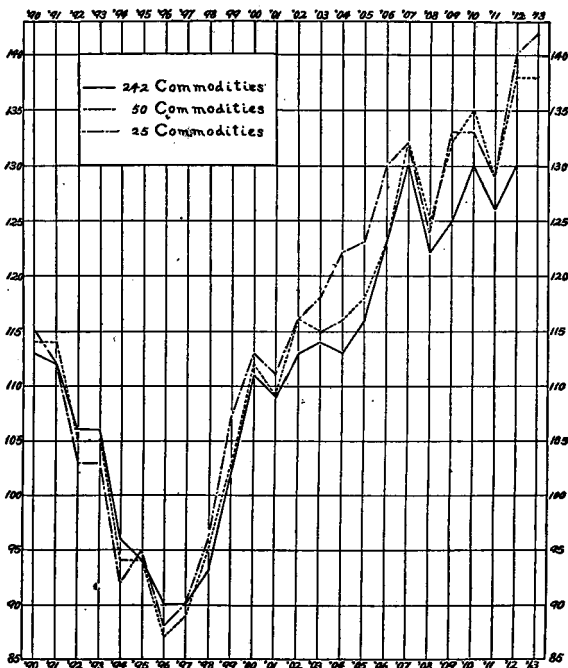
Year.	145 commodities.	50 commodities.	40 commodities.	25 commodities, first list.	25 commodities, second list.
1890.....	+ 1	+ 1	± 0	+ 2	± 0
1891.....	+ 1	+ 2	+ 2	± 0	+ 6
1892.....	± 0	- 1	- 1	- 3	+ 3
1893.....	- 1	- 1	- 5	- 3	+ 1
1894.....	± 0	- 2	- 3	- 4	± 0
1895.....	- 1	± 0	+ 1	+ 1	- 1
1896.....	- 1	- 3	- 2	- 2	- 5
1897.....	- 1	- 3	- 2	± 0	- 6
1898.....	± 0	+ 2	+ 2	± 3	- 3
1899.....	+ 1	+ 1	+ 6	+ 5	+ 1
1900.....	± 0	+ 1	+ 4	+ 2	- 2
1901.....	+ 1	± 0	+ 7	+ 2	- 2
1902.....	+ 1	+ 2	+ 9	+ 3	+ 4
1903.....	± 0	+ 1	+ 4	+ 4	+ 3
1904.....	+ 1	+ 3	+ 5	+ 9	- 3
1905.....	± 0	+ 2	+ 6	+ 7	- 1
1906.....	- 1	± 0	+ 5	+ 7	- 1
1907.....	± 0	+ 3	+ 5	+ 9	+ 2
1908.....	- 1	+ 3	+ 7	+ 2	± 0
1909.....	- 1	+ 7	+ 10	+ 8	+ 3
1910.....	+ 1	+ 5	+ 11	+ 3	+ 4
1911.....	+ 4	+ 2	+ 9	+ 3	+ 5
1912.....	+ 4	+ 4	+ 12	+ 10	+ 8
1913.....	+ 1	+ 8	+ 9	+ 13	+ 3
Arithmetic sums.....	23	60	129	97	70
Algebraic sums.....	+ 9	+ 44	+ 105	+ 73	+ 22
Average differences computed from the—					
Arithmetic sums.....	1.0	2.6	5.4	4.0	2.9
Algebraic sums.....	+ .4	+ 1.8	+ 4.4	+ 3.0	+ .9
Maximum differences.....	+ 4	+ 8	+ 12	+ 12	+ 8
Minimum differences.....	± 0	± 0	± 0	± 0	± 0

Number of points by which each index number rose (+) or fell (-) in each successive year.

Year.	242 to 261 commodities.	145 commodities.	50 commodities.	40 commodities.	25 commodities, first list.	25 commodities, second list.
1891.....	- 1	- 1	± 0	+ 1	- 3	+ 5
1892.....	- 6	- 7	- 9	- 9	- 9	- 6
1893.....	± 0	- 1	± 0	- 4	± 0	- 5
1894.....	- 10	- 9	- 11	- 8	- 11	- 11
1895.....	- 2	- 3	± 0	+ 2	+ 3	- 3
1896.....	- 4	- 4	- 7	- 7	- 7	- 8
1897.....	± 0	± 0	+ 2	+ 1	+ 2	- 1
1898.....	+ 3	+ 4	+ 6	+ 6	+ 6	+ 6
1899.....	+ 9	+ 10	+ 8	+ 13	+ 11	+ 13
1900.....	+ 9	+ 13	+ 9	+ 7	+ 6	+ 6
1901.....	- 2	- 1	- 3	- 3	- 2	- 2
1902.....	+ 4	+ 4	+ 7	+ 6	+ 5	+ 10
1903.....	+ 1	± 0	- 4	- 4	+ 2	± 0
1904.....	- 1	± 0	± 0	± 0	+ 4	- 7
1905.....	+ 3	+ 2	+ 2	+ 4	+ 1	+ 5
1906.....	+ 7	+ 6	+ 5	+ 6	+ 7	+ 7
1907.....	+ 7	+ 8	+ 9	+ 10	+ 2	+ 10
1908.....	- 8	- 9	- 7	- 9	- 8	- 10
1909.....	+ 3	+ 3	+ 7	+ 6	+ 9	+ 6
1910.....	+ 5	+ 7	+ 3	+ 6	± 0	+ 6
1911.....	- 4	- 1	- 6	- 6	- 4	- 3
1912.....	+ 4	+ 4	+ 9	+ 7	+ 11	+ 7
1913.....	± 0	- 3	± 0	- 3	+ 2	- 5

Now, these six index numbers, large and small, certainly have a strong family likeness. The great movements of American prices since 1890 stand out boldly in them all—the heavy fall of prices in 1890–1896, the distinctly greater rise in 1896–1907, the sharp decline in 1908, the recovery in 1909, and the wavering course in 1910–1913.

CHART 5.—GENERAL-PURPOSE INDEX NUMBERS, INCLUDING 25, 50, AND 242 COMMODITIES. (BASED ON TABLE 8.)



If index numbers could pretend to nothing more than to show roughly the trend of price fluctuations, then it would indeed matter little which of these series were used. Either of the sets including only 25 commodities would serve that limited purpose as well as the set containing nearly ten times as many commodities, though doubtless the longer lists would command more confidence.

But the very success with which index numbers, even when made from scanty and dissimilar data, bring out the broader features of price movements encourages one to hope, from this device, for more than an indication of the direction and a rough approximation to the degree of change. Instead of concluding that an easy compilation, based on a few series of quotations "will do," we may hope that careful work covering a wide field will enable us to improve upon our first results and attain measurements that have a narrow margin of error.

When we make these more exacting demands upon our six index numbers we attach importance to the fact that their general similarity does not preclude numerous differences of detail. For example, two series indicate that prices rose in 1891, one indicates that prices did not change, and three indicate a fall; three put the lowest point in 1896, one in 1897, and two make the price level the same in these years; one series shows a rise in 1901, five show a fall; in 1913 again one series indicates a rise of prices, three indicate a fall, and two indicate no change; the general level of prices in the final year is made to vary between an average rise of 30 per cent and one of 42 per cent above the level of 1890-1899; there is also a difference in steadiness, the small series fluctuating through a wider range than the large ones, etc.

To what are these discrepancies due? Are they discreditable to the large series, or to the small ones, or to neither set? Can they be accounted for except as the results of random differences in sampling?

If an index number made from the wholesale prices of 25, or 50, or 250 commodities can measure approximately the changes in all wholesale prices, it must be because the known fluctuations in the prices of these selected commodities are fair samples of the unknown fluctuations in the prices of the vastly larger number of other commodities for which quotations are not collected. Now if (1) the price fluctuations of each commodity that is bought and sold were strictly independent of the price fluctuations of every other commodity, and if (2) each commodity had just the same importance as an element in the general system of prices as every other commodity, then any series of price quotations collected at random would be a fair sample for determining the average changes in the wholesale prices of commodities in general. Of course, the larger the number of commodities included, the more trustworthy would be the index number. In Table 8, for example, the first index number would be adjudged the best, and the divergencies between it and its fellows would be held to result from the scantier material from which the latter are made.

In fact, however, the situation is by no means so simple, because neither of the above-mentioned conditions holds true. Commodities

are far from being all of the same importance as elements in the whole system of prices. With the complications arising from this fact the section on the problems of weighting will deal. Neither are the price fluctuations of different commodities independent of each other. On the contrary, the price changes of practically every commodity in the markets of the whole country are causally related to the changes in the prices of a few or of many, perhaps in the last resort of all, other commodities that are bought and sold. Most of these relations are so slight that they can not be traced by statistical methods. But certain bonds are so close and so strong that they establish definite groups of related prices which fluctuate in harmony with one another and which differ in definable ways from the fluctuations of other such groups. The present task is to show the existence of these groups and the effects which they exercise upon index numbers.

First, the price fluctuations of a raw material are usually reflected in the prices of its manufactured forms. Hence to quote in some cases both the raw material and several of its finished products, and to quote in other cases the raw material alone, assigns certain groups of related prices a larger influence upon the results than is assigned the other groups. When the aim is to secure a set of samples which fairly represent price fluctuations as a whole, the existence of these groups must be taken into account. Neglect on this score may give a misleading twist to the final index numbers. A celebrated case in point is that of the Economist index number in 1863-1865. Out of the 22 commodities included in the Economist's list as then constituted 4 consisted of cotton and its products. Hence when the blockade of Southern ports during the Civil War raised the price of cotton, the Economist index numbers grossly exaggerated the average rise in the price level, as appears from the following comparison between the Economist's results for 1860-1865 and the corresponding English figures compiled by Sauerbeck:<sup>1</sup>

Year.	Economist index number (prices in 1860=100).	Sauerbeck's index number (prices in 1860=100).
1860.....	100	100
1861.....	102	100
1862.....	109	106
1863.....	136	100
1864.....	145	112
1865.....	136	106

<sup>1</sup> To make the comparison as fair as possible, both series are here given, not in their original form, but recomputed on a common basis. See Wholesale Prices, Wages, and Transportation, report by Mr. Aldrich from the Committee on Finance, March 7, 1893, 52d Cong., 2d sess., Senate Report No. 1394, Part I, pp. 226 and 265.

Directly opposing the relations which unite the prices of finished goods with the prices of their raw materials is a second set of influences which make the price fluctuations of manufactured goods considered as a group characteristically different from the price fluctuations of their raw materials considered as a separate group. Table 9 presents several sets of index numbers designed to throw these characteristic differences into high relief. The first two columns compare the relative prices of the 49 raw materials quoted by the Bureau of Labor Statistics and of the 183 to 193 more or less manufactured commodities in its list.<sup>1</sup> The second pair of columns contains index numbers made from the prices of 20 raw materials and of 20 products manufactured from these same materials.<sup>2</sup> Then come three columns giving index numbers made from the prices of five great staples at three successive stages of manufacture: Wheat, flour, and bread; cotton, cotton yarns, and cotton textiles; wool, worsted yarns, and woolen textiles; pig iron, steel billets, and steel tools; hides, leather, and shoes.<sup>3</sup> The later sections of the table give the data for each of these last-mentioned groups separately. These several comparisons establish the conclusion that manufactured goods are steadier in price than raw materials. The manufactured goods fell less in 1890-1896, rose less in 1896-1907, again fell less in 1907-1908, and rose less in 1908-1913. Further, the manufactured goods had the narrower extreme range of fluctuations, the smaller average change from year to year, and the slighter advance in price from one decade to the next.<sup>4</sup> It follows that index numbers made from the prices of raw materials, or of raw materials and slightly manufactured products, must be expected to show wider oscillations than index numbers including a liberal representation of finished commodities.

Third, there are characteristic differences among the price fluctuations of the groups consisting of mineral products, forest products,

<sup>1</sup> See Bulletin No. 146, pp. 13 and 14. The differences between the original figures and those given here are due (1) to the dropping of decimals, (2) to the exclusion of 11 commodities which the Bureau of Labor Statistics quotes in the years 1908-1913 only, (3) to the computation of the arithmetic means in these years by the method applied in 1890-1907 in place of the bureau's roundabout method. See Bulletin No. 146, p. 32 and pp. 42 to 44 of this bulletin. \*

<sup>2</sup> The articles included here are those from which the index number of 40 commodities in Table 8 was made. For the list, see p. 48 and note.

<sup>3</sup> For the lists of textiles and of tools, see Bulletin of the Bureau of Labor, No. 99, March, 1912, pp. 554-556 and 982-983.

<sup>4</sup> Like most generalizations about price changes, these statements are strictly valid only in the case of averages covering several commodities, but the exceptions are not numerous, even in the case of single commodities, as detailed study of the wheat, cotton, wool, iron, and leather groups will show.



TABLE 9.—INDEX NUMBERS MADE FROM THE PRICES OF RAW MATERIALS

[Data from the Bulletin of the Bureau

(Arithmetic means. Average

Year.	49 raw ma- terials.	183 to 193 man- u- factured prod- ucts.	Twenty pairs.		Five triplets.			Wheat group.		
			Raw ma- terials.	Man- u- factured goods.	Raw ma- terials.	Inter- me- di- ate prod- ucts.	Fin- ished goods.	Wheat.	Wheat flour.	Bread.
Number of commodities included..								1	2	3
1890.....	115	112	113	112	125	119	108	119	121	101
1891.....	216	111	114	114	117	116	107	128	128	101
1892.....	108	106	104	105	103	109	106	105	104	101
1893.....	104	106	99	103	95	100	105	90	89	101
1894.....	93	97	91	94	79	86	98	74	78	101
1895.....	92	94	94	95	89	89	95	80	84	98
1896.....	84	92	85	92	87	88	95	85	91	97
1897.....	88	90	88	89	94	90	94	106	110	101
1898.....	94	93	88	92	101	95	95	118	109	101
1899.....	106	101	114	105	111	107	98	95	88	101
1900.....	112	110	118	111	120	110	105	94	88	101
1901.....	111	103	120	113	110	102	102	96	87	101
1902.....	122	111	127	118	123	110	103	99	90	101
1903.....	123	112	122	114	125	114	106	105	97	101
1904.....	120	111	123	113	126	115	110	138	125	106
1905.....	121	115	127	117	129	115	114	135	122	110
1906.....	127	122	135	120	136	119	121	106	97	110
1907.....	133	129	146	131	145	126	125	121	109	110
1908.....	124	121	135	124	130	117	120	132	119	113
1909.....	131	128	148	127	149	128	121	160	139	116
1910.....	135	129	149	132	149	125	124	146	126	118
1911.....	135	124	144	127	135	115	120	131	112	118
1912.....	145	127	151	132	141	119	124	140	122	122
1913.....	139	128	149	128	143	122	127	127	109	123
Averages, 1890-1899.....	100	100	100	100	100	100	100	100	100	100
1900-1909.....	122	116	130	119	130	115	113	119	107	107
1910-1913.....	139	127	148	130	142	120	124	136	117	120
Number of points by which prices rose (+) or fell (-) in—										
1890-1896.....	-31	-20	-28	-20	-38	-31	-13	-34	-30	-4
1896-1907.....	+49	+37	+61	+39	+58	+38	+30	+35	+18	+13
1907-1908.....	-9	-8	-11	-7	-15	-9	-5	+11	+10	+3
1908-1913.....	+15	+7	+14	+4	+13	+5	+7	-5	-10	+10
Difference between highest and lowest relative prices.	61	39	66	43	70	40	33	86	61	26
Average change from year to year...	5.5	4.0	6.4	4.9	8.4	5.5	3.1	13.6	11.6	1.3

AND OF MANUFACTURED GOODS, BY YEARS, 1890 TO 1913.

[of Labor Statistics, No. 149.]

prices in 1890-1899=100.)

Cotton group.			Wool group.			Iron group.			Leather group.			Year.
Raw cotton.	Cotton yarns.	Cotton textiles.	Raw wool.	Worsted yarns.	Woolen textiles.	Pig iron.	Steel billets.	Steel tools.	Hides.	Leather.	Shoes.	
1	2	24	2	2	16	4	1	11	1	4	3	Number of commodities included.
143	112	117	132	122	111	131	142	107	100	101	106	1890.
111	113	112	126	123	112	116	118	106	102	101	104	1891.
90	117	111	113	117	112	105	110	105	93	97	103	1892.
107	111	108	102	110	109	95	95	103	80	97	101	1893.
80	93	98	79	91	86	83	77	99	68	92	99	1894.
94	92	94	70	74	88	91	85	95	110	108	100	1895.
102	93	95	71	73	87	88	88	96	87	95	101	1896.
92	91	90	89	83	90	78	70	95	106	96	96	1897.
77	91	85	106	101	98	77	71	94	123	104	94	1898.
85	89	91	111	107	100	134	145	101	132	109	95	1899.
124	116	103	118	118	111	140	116	112	127	113	98	1900.
111	98	90	97	102	105	112	112	110	132	111	96	1901.
115	94	100	101	112	106	155	142	115	143	113	96	1902.
145	113	105	110	118	111	141	130	118	125	112	96	1903.
156	120	114	116	117	112	104	103	118	124	109	98	1904.
123	106	107	127	125	119	124	112	128	153	112	106	1906.
142	121	117	121	129	125	145	128	134	165	120	119	1906.
153	134	133	122	128	124	175	136	138	156	124	120	1907.
135	109	116	118	118	121	125	122	134	143	119	114	1908.
156	119	117	127	130	123	127	114	129	176	127	121	1909.
195	133	127	116	124	124	124	118	131	165	125	118	1910.
168	125	125	108	116	120	112	100	123	158	121	116	1911.
148	120	122	111	119	123	118	104	124	188	129	127	1912.
165	132	126	105	113	123	122	130	126	196	139	137	1913.
100	100	100	100	100	100	100	100	100	100	100	100	Averages, 1890-1899.
136	113	111	116	120	116	135	122	124	144	116	106	1900-1909.
199	128	125	110	118	123	119	111	126	177	129	125	1910-1913.
												Number of points by which prices rose (+) or fell (-) in—
-41	-19	-22	-61	-49	-24	-43	-54	-11	-13	-6	-5	1890-1896.
+51	+41	+38	+51	+55	+37	+57	+48	+42	+68	+29	+19	1896-1907.
-18	-25	-17	-4	-10	-3	-50	-14	-4	-12	-5	-6	1907-1908.
+30	+23	+10	-13	-5	+2	-3	-2	-8	+53	+20	+23	1908-1913.
118	45	48	62	57	88	98	75	44	128	47	43	Difference between highest and lowest relative prices. Average change from year to year.
18.1	9.8	6.1	9.1	8.1	2.9	17.5	16.0	3.7	14.7	5.0	3.7	

CHART 6.—INDEX NUMBERS OF THE PRICES OF 20 RAW MATERIALS AND OF 20 PRODUCTS MANUFACTURED FROM THEM. (BASED ON TABLE 9.)

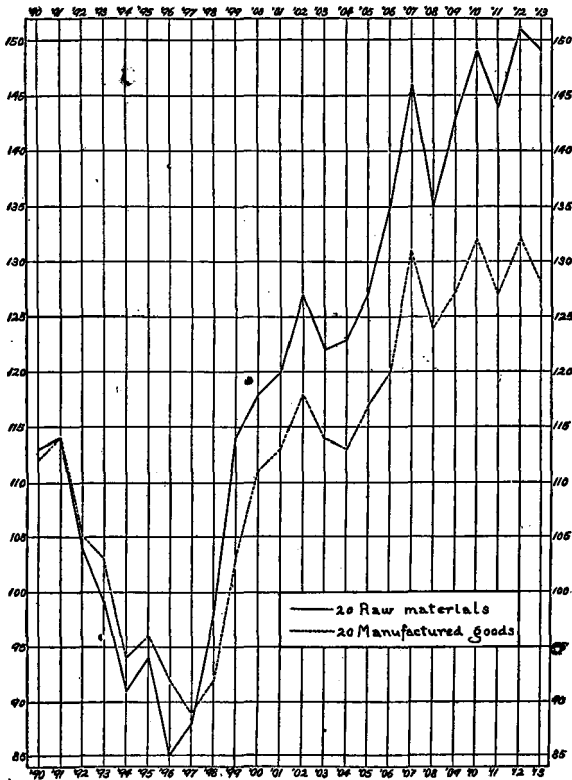
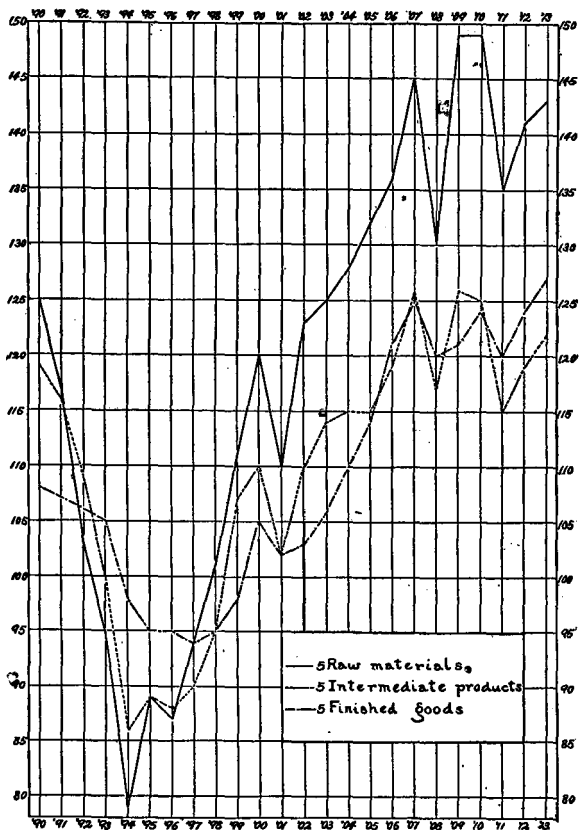


CHART 7.—INDEX NUMBERS OF THE PRICES OF WOOL, COTTON, HIDES, WHEAT, AND FIG IRON IN THEIR RAW, PARTIALLY MANUFACTURED, AND FINISHED FORMS. (BASED ON TABLE 9.)



animal products, and farm crops. Table 10 presents index numbers for these four groups. Fifty-seven commodities are included, all of them raw materials or slightly manufactured products.<sup>1</sup> Here the striking feature is the capricious behavior of the prices of farm crops under the influence of good and bad harvests. The sudden upward jump in their prices in 1891, despite the depressed condition of business, their advance in the dull year 1904, their fall in the year of revival 1905, their failure to advance in the midst of the prosperity of 1906, their trifling decline during the great depression of 1908, and their sharp rise in the face of reaction in 1911 are all opposed to the general trend of other prices. The prices of animal products are distinctly less affected by weather than the prices of vegetable crops, but even they behave queerly at times, for example in 1893. Forest-product prices are notable chiefly for maintaining a much higher level of fluctuation in 1902-1913 than any of the other groups, a level on which their fluctuations, when computed as percentages of the much lower prices of 1890-1899, appear extremely violent. Finally, the prices of minerals accord better with alternations of prosperity, crisis, and depression than any of the other groups. And the anomalies that do appear—the slight rise in three years (1896, 1903, and 1913) when the tide of business was receding—would be removed if the figures were compiled by months. For the trend of mineral prices was downward in these years, but the fall was not so rapid as the rise had been in the preceding years, so that the annual averages were left somewhat higher than before.<sup>2</sup> An index number composed largely of quotations for annual crops, then, would be expected at irregular intervals to contradict capriciously the evidence of index numbers in which most of the articles were mineral, forest, or even animal products.

<sup>1</sup> The lists of commodities are as follows:

*Farm crops:* Cotton, flaxseed, barley, corn, oats, rye, wheat, hay, hops, beans, coffee, rice, pepper, tea, onions, potatoes, cottonseed meal, and lute—18 articles.

*Animal products:* Hides, cattle, hogs, sheep, eggs, lard, milk, tallow, silk, and wool—10 articles.

*Forest products:* Hemlock, maple, oak, white pine, yellow pine, poplar and spruce lumber, together with turpentine, tar, and rubber—10 articles.

*Mineral products:* Salt, anthracite coal, bituminous coal, coke, crude petroleum, copper ingots, lead (pig), pig iron, bar iron, steel billets, quicksilver, silver bars, tin (pig), spelter, zinc, brick, cement, lime, and brimstone—19 articles.

<sup>2</sup> Compare the monthly figures compiled by the Bureau of Labor Statistics for its group of "Metals and Implements," Bulletin No. 149, p. 18. These figures are largely influenced by the relatively stable prices of 11 different kinds of tools. Monthly data for the 19 mineral products of Table 10 would probably show even more of a decline between January and December in these years.

CHARTS.—INDEX NUMBERS OF THE PRICES OF 19 MINERAL PRODUCTS AND OF 18 FARM CROPS. (BASED ON TABLE 10.)

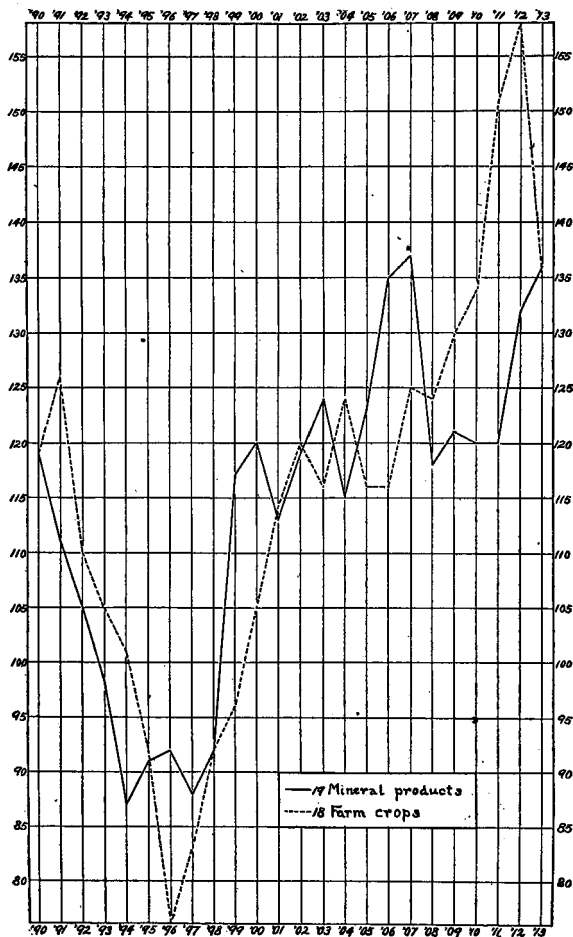


TABLE 10.—INDEX NUMBERS MADE FROM PRICES OF MINERAL, FOREST, ANIMAL,  
AND FARM PRODUCTS, BY YEARS, 1890 TO 1913.

[Data from the Bulletin of the Bureau of Labor Statistics, No. 149.]

(Arithmetic means. Average prices in 1890-1899=100.)

Year.	Mineral products.	Forest products.	Animal products.	Farm crops.
Number of commodities included.....	19	10	10	18
1890.....	119	107	106	119
1891.....	111	105	108	126
1892.....	105	99	100	110
1893.....	98	98	116	105
1894.....	87	95	94	101
1895.....	91	96	95	92
1896.....	92	94	82	76
1897.....	88	96	88	83
1898.....	92	90	97	92
1899.....	117	112	105	96
1900.....	120	121	111	106
1901.....	113	118	112	114
1902.....	119	123	128	120
1903.....	124	127	117	116
1904.....	115	142	113	124
1905.....	123	149	121	116
1906.....	135	163	128	116
1907.....	137	169	135	125
1908.....	118	151	128	124
1909.....	121	164	144	130
1910.....	120	181	152	134
1911.....	120	172	131	151
1912.....	132	168	146	158
1913.....	134	190	150	136
Averages, 1890-1899.....	100	100	100	100
1900-1909.....	123	143	124	119
1910-1913.....	127	178	145	145
Number of points by which prices rose (+) or fell (-) in—				
1890-1896.....	-27	-13	-24	-43
1896-1907.....	+45	+75	+53	+49
1907-1908.....	-19	-18	-9	-1
1908-1913.....	+18	+18	+24	+13
Difference between highest and lowest relative prices.....	50	87	70	82
Average change from year to year.....	7.0	7.4	8.9	8.2

Fourth, there are characteristic differences between the price fluctuations of manufactured commodities bought by consumers for family use and the price fluctuations of manufactured commodities bought by business men for industrial or commercial use. Such at least is the story told by Table 11. The data employed here are quotations for 28 articles from the Bureau of Labor Statistics' list that rank distinctly as consumers' goods and 28 that rank as producers' goods.<sup>1</sup> Though consisting more largely of the erratic-

<sup>1</sup> The consumers' goods are bread, crackers, butter, cheese, salt fish, evaporated apples, prunes, raisins, beef, mutton, pork, molasses, corn starch, sugar, vinegar, shoes, cotton textiles, woolen textiles, candies, matches, quinine, furniture, earthenware, glassware, woodenware, table cutlery, soap, and tobacco. The producers' goods are bags, cotton yarns, leather, linen shoe thread, worsted yarns, refined petroleum, barbed wire, builders' hardware, copper wire, lead pipe, nails, steel rails, tools, wood screws, pine doors, plate glass, window glass, carbonate of lead, oxide of zinc, putty, resin, shingles, muriatic acid, sulphuric acid, malt, paper, proof spirit, and rope.

It will be noticed that a large proportion of the consumers' goods are subject to very slight manufacturing processes, notably the foods. Hence the difference between the two index numbers can scarcely be regarded as merely a fresh contrast between the fluctuations of finished goods and of intermediate products.

ally fluctuating farm products, the consumers' goods are steadier in price than the producers' goods, because the demand for them is less influenced by changes in business conditions.

TABLE II.—INDEX NUMBERS MADE FROM THE PRICES OF CONSUMERS' GOODS AND PRODUCERS' GOODS, BY YEARS, 1890 TO 1913.

(Data from Bulletin of the Bureau of Labor Statistics, No. 149.)

(Arithmetic means. Average prices in 1890-1899=100.)

Year.	Consumers' goods.	Producers' goods.
1890.....	112	115
1891.....	109	111
1892.....	104	107
1893.....	108	102
1894.....	100	92
1895.....	95	91
1896.....	91	93
1897.....	90	89
1898.....	94	93
1899.....	98	107
1900.....	106	117
1901.....	105	113
1902.....	108	114
1903.....	105	114
1904.....	103	114
1905.....	106	117
1906.....	110	124
1907.....	114	133
1908.....	112	119
1909.....	114	118
1910.....	118	126
1911.....	119	125
1912.....	118	125
1913.....	121	123
Averages, 1890-1899.....	100	100
1900-1909.....	108	118
1910-1913.....	119	125
Number of points by which prices rose (+) or fell (-) in—		
1890-1897.....	- 22	- 26
1897-1907.....	+ 24	+ 44
1907-1908.....	- 2	- 14
1908-1913.....	+ 9	+ 4
Difference between highest and lowest relative prices.....	31	44
Average change from year to year.....	3.4	4.7

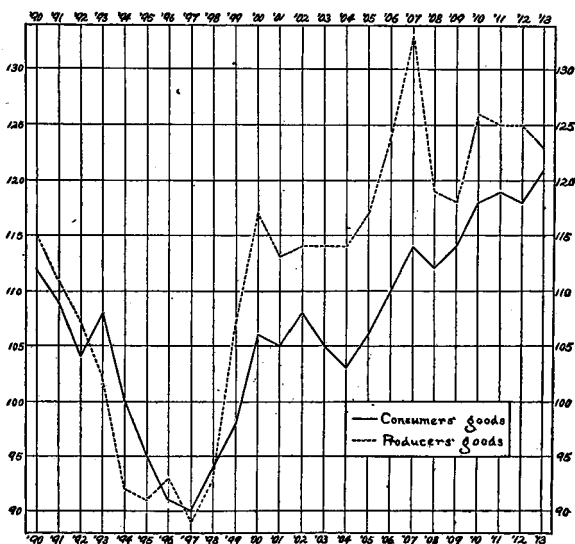
Other groups of related prices having specific peculiarities of fluctuation doubtless exist, but the analysis has been carried far enough for the present purpose. That purpose is to show how the existence of groups of prices which fluctuate in harmony with each other and at variance with other groups affects index numbers in general and in particular the six index numbers for the United States given in Table 8. To apply the knowledge gained from the preceding analysis to the explanation of the differences among these six index numbers is not difficult when once the commodities included in each index number have been classified on the basis of the groups which have been examined.

First, the list of commodities used by the Bureau of Labor Statistics includes 29 quotations for iron and its products, 30 quotations for cotton and its products, and 18 for wool and its products, besides



8 more quotations for fabrics made of wool and cotton together. On the other hand it has but 7 series for wheat and its products, 8 for coal and its products, 3 for copper and its products, etc. The iron, cotton, and wool groups together make up 85 series out of 242, or 35 per cent of the whole number. The same three groups furnish 36 (or 25 per cent) of the 145 series in the second index number in Table 8.

CHART 9.—INDEX NUMBERS OF THE PRICES OF MANUFACTURED GOODS USED FOR FAMILY CONSUMPTION AND FOR INDUSTRIAL PURPOSES. (BASED ON TABLE 11.)



Similarly, cotton, wool, and wheat, or coal, or cattle, with their products, make 20 per cent of the series in the third index number.

Does this large representation of three staples distort these index numbers—particularly the bureau's series where the disproportion is greatest? Perhaps; but if so the distortion does not arise chiefly from the undue influence assigned to the price fluctuations of raw cotton, raw wool, and pig iron. For, contrary to the prevailing impression, the similarity between the price fluctuations of finished products and their raw materials is less than the similarity between

the price fluctuations of finished products made from different materials. Such at least is the testimony of Table 9. As babies from different families are more like one another than they are like their respective parents, so here the relative prices of cotton textiles, woolen textiles, steel tools, bread, and shoes differ far less among themselves than they differ severally from the relative prices of raw cotton, raw wool, pig iron, wheat, and hides.<sup>1</sup> Hence the inclusion of a large number of articles made from iron, cotton, and wool affects an index number mainly by increasing the representation allotted to manufactured goods. What materials those manufactured goods are made from makes less difference in the index number than the fact that they are manufactured. To replace iron, cotton, and woolen products by copper, linen, and rubber products would change the results somewhat, but a much greater change would come from replacing the manufactured forms of iron, cotton, and wool by new varieties of their raw forms.<sup>2</sup>

This similarity among the price fluctuations of manufactured goods arises from the fact demonstrated by Table 9 that such articles are relatively steady in price. Does knowledge of this steadiness assist in explaining the differences among the six American index numbers of Table 8? To answer we must find the proportions of raw and manufactured commodities included in each index number. Classification along this line is rather uncertain in many cases, but the results shown in the following schedule, if not strictly correct, are at least uniform in their errors.

<sup>1</sup> A compilation of the differences among the relative prices in question taken seriatim for each of the 24 years 1890-1913 yields the following results:

Average differences between the relative prices of—	
Raw cotton and cotton textiles.....	20.7 points.
Raw wool and woolen textiles.....	8.9 points.
Pig iron and steel tools.....	14.0 points.
Wheat and bread.....	15.0 points.
Hides and shoes.....	31.6 points.
Average.....	18.0 points.
Cotton textiles and woolen textiles.....	5.3 points.
Cotton textiles and steel tools.....	7.8 points.
Cotton textiles and bread.....	6.9 points.
Cotton textiles and shoes.....	6.7 points.
Woolen textiles and steel tools.....	6.1 points.
Woolen textiles and bread.....	7.3 points.
Woolen textiles and shoes.....	8.1 points.
Steel tools and bread.....	9.4 points.
Steel tools and shoes.....	9.6 points.
Bread and shoes.....	4.7 points.
Average.....	7.2 points.

<sup>2</sup> While the fluctuations in the prices of manufactured goods are generally slighter than those in the prices of raw materials, they are nevertheless violent at times, as in the case of cotton yarns and cotton textiles during the Civil War. (See p. 52.)

TABLE 12.—NUMBER AND PER CENT OF RAW AND MANUFACTURED COMMODITIES INCLUDED IN THE SIX INDEX NUMBERS OF TABLE 8.

Index number.	Total number of commodities.	Number of—		Percentage of—	
		Raw commodities.	Manufactured commodities.	Raw commodities.	Manufactured commodities.
First.....	242	49	193	20	80
Second.....	145	36	109	25	75
Third.....	50	26	24	52	48
Fourth.....	40	17	23	43	57
Fifth.....	25	10	6	76	24
Sixth.....	25	10	15	40	60

On this showing the Bureau of Labor Statistics series ought to be the steadiest, and the second series the next steadiest—and so they are, as the summaries at the bottom of the columns in Table 8 show. With the smaller index numbers, however, the rule does not work well, for the most variable of all—the sixth—has a larger per cent of manufactured goods than the other three. Moreover, number four is more variable than number three, though it has relatively more manufactured goods. But the preceding studies of different groups throw further light upon the matter.

It has been found that among manufactured commodities those bought for family consumption are steadier in price than those bought for business use. To take account of this factor the manufactured goods in the several series are classified as primarily consumers' goods, primarily producers' goods, or as bought in large measure by both classes of purchasers.

TABLE 13.—CLASSIFICATION OF THE MANUFACTURED COMMODITIES INCLUDED IN THE SIX INDEX NUMBERS OF TABLE 8.

Index number.	Number of—				Per cent of—			
	Manufactured articles.	Consumers' commodities.	Producers' commodities.	Both consumers' and producers' commodities.	Manufactured articles.	Consumers' commodities.	Producers' commodities.	Both consumers' and producers' commodities.
First.....	193	108	73	12	80	45	30	5
Second.....	109	51	47	11	75	35	32	8
Third.....	24	11	12	1	48	22	24	2
Fourth.....	23	10	12	1	57	25	30	2
Fifth.....	6	3	3	.....	24	12	12	.....
Sixth.....	15	4	11	.....	60	16	44	.....

Here it does turn out that the two series (numbers four and six) which are highly variable despite the inclusion of many manufactured goods have relatively more of those manufactured goods which as a group are most variable. So far as this factor counts, then, it counts toward clearing up the contradiction pointed out in the preceding paragraph. It also brings out a further reason for the comparative stability of the first two series.

The one remaining form of analysis suggested above seems easy to apply. In the schedule below, raw and slightly manufactured commodities like those used in Table 10 are distributed among four groups according as their constituents come chiefly from mines, forests, animal sources, or cultivated fields. There is little doubt about the classification here, but there is much doubt about the significance of the results as applied to our six index numbers. The figures in the schedule are either such small percentages of the whole number of series that they can not exercise much influence upon the results, or such small numbers that they can not claim to be typical of their groups. Further, the second part of the schedule shows that there is less difference among the six index numbers than appears at first sight in the proportions of the raw and slightly manufactured commodities which consist of mineral, forest, animal, and farm products. Hence it is not surprising that efforts to account for the divergences in Table 8 by appealing to this schedule and to Table 10 accomplish little, especially for the smaller index numbers. This much does appear regarding the first two series: Whenever mineral products and farm crops move sharply in opposite directions the Bureau of Labor Statistics' index diverges from its mate in harmony with mineral products, while the series of 145 commodities bends toward the agricultural products—which is what should happen according to the schedule.

TABLE 14.—FARM, ANIMAL, FOREST, AND MINERAL PRODUCTS IN RAW OR SLIGHTLY MANUFACTURED FORM, INCLUDED IN THE SIX INDEX NUMBERS OF TABLE 8.

Index number.	Total number of commodities.	Number of—					Per cent of the whole number consisting of—				
		Raw and slightly manufactured goods.	Farm crops.	Animal products.	Forest products.	Mineral products.	Raw and slightly manufactured goods.	Farm crops.	Animal products.	Forest products.	Mineral products.
First.....	242	74	18	15	12	29	30	7	6	5	12
Second.....	145	57	18	10	10	19	39	12	7	7	13
Third.....	50	30	10	8	3	9	60	20	16	6	18
Fourth.....	40	19	6	6	1	6	48	15	15	3	15
Fifth.....	25	23	7	5	2	9	92	28	20	8	36
Sixth.....	25	18	5	5	1	7	72	20	20	4	28

Index number.	Per cent of the raw and slightly manufactured commodities consisting of—			
	Farm crops.	Animal products.	Forest products.	Mineral products.
First.....	25	20	16	39
Second.....	31	18	18	33
Third.....	33	27	10	30
Fourth.....	32	32	4	32
Fifth.....	30	22	9	39
Sixth.....	28	28	5	39

Two practical conclusions of moment to both the makers and the users of index numbers are established by this section. (1) To make an index number that measures the changes in wholesale prices at large, samples must be drawn from all the various groups that behave in peculiar ways. (2) In using an index number made by others, one must study the list of commodities included critically with these groups in mind to know what it really does measure.

The first conclusion seems to contradict a rule often practiced and sometimes preached. Most of the middle-sized index numbers are confined to raw materials and slightly manufactured goods. Most of the small index numbers are confined to foods alone. The makers of both sets argue that their series are more "sensitive" and therefore better measures of price changes than the larger series, which are loaded down with a mass of miscellaneous manufactured goods. And many users of index numbers seem to prefer a series like Sauerbeck's with only 45 commodities, or even one like the Annalist's with only 25 commodities, to one like that of the Bureau of Labor Statistics with five or ten times the number.

Critics who take this stand usually assume tacitly that the purpose of an index number is to serve as a "business barometer," or to measure changes in "the cost of living." If these aims were always clearly realized by the critics and clearly stated for their readers the room left for differences of opinion would be narrow. In Table 8 the index number with 145 commodities shows itself a more sensitive and on the whole more faithful barometer of changing business conditions during the 24-year period from 1890 to 1913 than the official series with 242 commodities,<sup>1</sup> and the preceding analysis shows that the sluggishness of the larger index number is due chiefly to its proportion of manufactured goods. For this particular purpose, then, a series modeled after Sauerbeck's has strong claims to preference over one including a larger number of commodities. Indeed, in the light of the preceding discussion one might carry the process of exclusion much further and throw out of the business barometer not only manufactured goods but also all farm crops, on the ground that their prices depend on the eccentricities of the weather, and most forest products, on the ground that their prices are rising so fast as to obscure the effects of bad times, etc. But clearly such exclusions, while they might make the resulting figures more responsive to changes in business conditions, would also make the figures less acceptable as a measure of changes in prices as a whole. The sluggish movements of manufactured goods and of consumers' commodities in particular, the capricious jumping of farm products, the rapidly increasing dearness of lumber, etc., are all part and parcel of the fluctu-

<sup>1</sup> Compare p. 111.

tuations which the price level is actually undergoing. Consequently, an index number which pretends to measure changes in the general level of prices can not logically reject authentic quotations from any of these groups. Every restriction in the scope of the data implies a limitation in the significance of the results.

Probably the most illuminating way of presenting an index number that aspires to cover the whole field of prices at wholesale would be to publish separate results for the groups that have characteristic differences of price fluctuations, and then to publish also a grand total including all the groups. The groups to be recognized and the distribution of commodities among them is a difficult matter to decide. Doubtless intensive research along the lines here followed would suggest the desirability of further subdivisions and perhaps the realignment of the whole classification. But, as matters stand, the most significant arrangement seems to be (1) a division of all commodities into raw and manufactured products; (2) the subdivision of raw commodities into farm crops and animal, forest, and mineral products; (3) the subdivision of manufactured products according as they are bought mainly for personal consumption, mainly for business use, or largely for both purposes. It would also be interesting in a supplementary table to bring together index numbers for the leading raw materials and the products manufactured from them.

This classification is based upon differences among the factors affecting the supply of and the demand for commodities that belong to the several groups—that is, upon differences among the factors which determine prices. If we wish our index numbers to help toward an understanding of changes in the price level, a classification along these causal lines promises the most illuminating results; but it is not the basis of classification usually adopted.

In most large index numbers the commodities are divided among several classes, but these classifications seldom possess logical consistency. Among the nine groups recognized by the Bureau of Labor Statistics, for example, one group, "Farm products," emphasizes the place of production; four groups, "Food, etc.," "Fuel and lighting," "Lumber and building materials," and "House-furnishing goods," emphasize the use to which commodities are put; three groups apply a double criterion, use and physical character of the goods, namely, "Cloths and clothing" (which includes such articles as 2-bushel bags), "Metals and implements," and "Drugs and chemicals"; the remaining group is frankly styled "Miscellaneous." Such a classification is not without usefulness, for there doubtless are readers especially interested in the prices of, say, all things that are raised on farms, and others who care especially about the prices of things used to furnish houses, or things that can be classed together as drugs and chemicals whether they are used chiefly as medicines or to make farm

fertilizers. But if a classification of this empirical character is maintained, it might with advantage be accompanied by a classification that throws more light upon the workings of the complex system of prices.

As for the small series made from the prices of foods alone or from the prices of any single group of commodities, it is clear that, however good for special uses they may be, they are untrustworthy as general-purpose index numbers. Table 15 shows what differences are likely to appear at any time between series confined to foods and series covering a wider field. The general-purpose indexes are taken from Table 8; two of the food indexes include the commodities quoted by the Annalist index number and by the Gibson index number as now constituted; the third food index is the bureau's own series for foods, with decimals dropped and new arithmetic means for 1908-1913.<sup>1</sup>

TABLE 15.—INDEX NUMBERS OF THE PRICES OF FOODS, AND GENERAL-PURPOSE INDEX NUMBERS, BY YEARS, 1890 TO 1913.

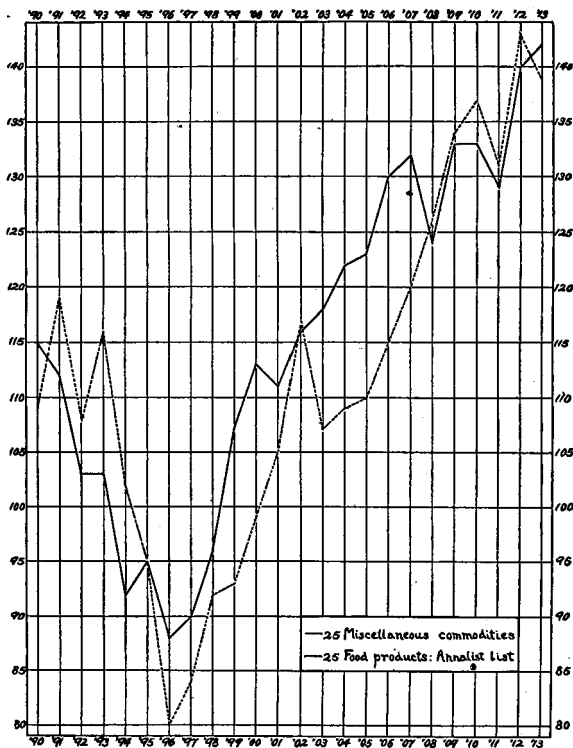
[Data from Bulletin of the Bureau of Labor Statistics, No. 149.]

(Arithmetic means. Average prices in 1890-1899=100.)

Year.	General-purpose index numbers from Table 8.		Index numbers of the prices of foods.		
	242 to 261 commodities.	25 commodities, first list.	25 commodities, Annalist list.	22 commodities, Gibson list.	48 commodities, Bureau of Labor Statistics' list.
1890.....	113	115	109	109	112
1891.....	112	112	119	121	116
1892.....	106	103	108	108	104
1893.....	106	103	116	110	110
1894.....	96	92	102	98	100
1895.....	94	95	95	94	95
1896.....	90	88	80	81	84
1897.....	90	90	84	87	88
1898.....	93	96	92	96	94
1899.....	102	107	93	96	98
1900.....	111	113	96	100	104
1901.....	109	111	105	108	106
1902.....	113	118	117	118	111
1903.....	114	118	107	107	107
1904.....	113	122	100	115	107
1905.....	116	123	110	114	109
1906.....	123	130	115	111	113
1907.....	130	132	120	121	118
1908.....	122	124	126	128	122
1909.....	125	133	134	127	125
1910.....	130	133	137	137	129
1911.....	126	129	131	134	127
1912.....	130	140	143	147	135
1913.....	130	142	139	139	131
Averages, 1890-1899.....	100	100	100	100	100
1900-1909.....	118	122	114	115	112
1910-1913.....	128	136	138	139	131
Number of points by which prices rose (+) or fell (-) in—					
1890-1896.....	- 23	- 27	- 20	- 28	- 28
1896-1907.....	+ 40	+ 44	+ 40	+ 40	+ 34
1907-1908.....	- 8	- 8	+ 6	+ 7	+ 4
1908-1912.....	+ 8	+ 16	+ 17	+ 19	+ 17
1912-1913.....	± 0	+ 2	- 4	- 8	- 4
Difference between highest and lowest relative prices.....	40	54	63	66	51
Average change from year to year.....	4.0	5.0	7.1	7.3	5.0

Compare the explanation given, pp. 42 to 44.

CHART 10.—INDEX NUMBERS OF THE PRICES OF 25 FOOD PRODUCTS AND OF 25 MISCELLANEOUS COMMODITIES. (BASED ON TABLE 13.)





The three index numbers for foods agree better than might have been expected in view of the dissimilarity of the lists of commodities which they quote and the brevity of two of the lists.<sup>1</sup> The bureau series is rather steadier than the others, because of the larger proportion of manufactured products included in it; but this series and that of the *Annalist* invariably agree about the direction in which prices are moving,<sup>2</sup> and the Gibson figures agree with the other two series in 19 years out of the 24. On the other hand, the three food indexes often contradict the evidence of the two general-purpose index numbers in a striking fashion. Such contradictions occur in 1890-1891, 1892-1893, 1900-1901, 1902-1903, 1907-1908, and 1912-1913. These differences are due chiefly to a contrast in the years mentioned between business conditions and harvest conditions. They parallel the differences in Table 10 between the index numbers of mineral products and those of farm crops, or farm crops and animal products taken together; for the food indexes are made up almost wholly from the prices of vegetable crops, food animals, and their derivatives.<sup>3</sup> A food index number, then, is likely at any time to give a wrong impression regarding the shifting of prices in general and is especially treacherous as a business barometer. Nor can such an index when made from wholesale prices be trusted to show changes in the "cost of living"; for living expenses are made up of retail prices, and fluctuations in retail prices do not follow closely those in the wholesale markets.

The second conclusion which this section establishes is that large index numbers are more trustworthy for general purposes than small ones, not only in so far as they include more groups of related prices, but also in so far as they contain more numerous samples from each group. What is characteristic in the behavior of the prices of farm crops, of mineral products, of manufactured wares, of consumers' goods, etc.—what is characteristic in the behavior of any group of prices—is more likely to be brought out and to exercise its due effects upon the final results when the group is represented by 10 or 20 sets of quotations than when it is represented by only one or two sets.

<sup>1</sup> Of the 55 articles included altogether, only 11 are common to all three lists. The Gibson list has 8 commodities and the *Annalist* list has 4 commodities classified by the bureau with farm products instead of with foods, while the bureau has 34 foods not quoted by Gibson and 27 not quoted by the *Annalist*. Even the two short lists have only 15 articles in common, while Gibson has 7 articles not quoted by the *Annalist*, and the *Annalist* has 10 articles not quoted by Gibson.

For the bureau's list see Bulletin No. 148, pp. 90-107.

The *Annalist* list runs—oats, cattle, fresh beef, salt beef, hogs, bacon, salt pork, lard, sheep, mutton, butter (two kinds), cheese, coffee, sugar, wheat flour (two kinds), rye flour, corn meal, rice, beans, potatoes, prunes, evaporated apples, and codfish.

The Gibson list is—barley, corn, oats, rye, wheat, cattle, hogs, sheep, butter, coffee, wheat flour (two kinds), corn meal, bacon, fresh beef, salt beef, hams, mutton, sugar (two kinds), tea, and potatoes.

<sup>2</sup> Even in 1903-4 the bureau's figures record a slight advance of prices in harmony with the *Annalist* figures, though this advance is confined to the decimal columns and disappears when the decimals are rounded off.

<sup>3</sup> The exceptions are salt and soda, and of these articles the *Annalist* and Gibson quote neither.

The basis of this contention is simple: In every group that has been studied there are certain commodities whose prices seldom behave in the typical way, and no commodities whose prices can be trusted always to behave typically. Consequently, no care to include commodities belonging to all the important groups can guarantee accurate results, unless care is also taken to get numerous representatives of each group.

Even here the matter does not end. The different groups that have been discussed, the other groups that might have been discussed, and the commodities that are included within the several groups differ widely in importance as elements in the system of prices. To these differences, and to the methods of making them count in index numbers, we must now turn.

#### 7. PROBLEMS OF WEIGHTING.

It is customary to distinguish sharply between "simple" and "weighted" index numbers. When an effort is made to ascertain the relative importance of the various commodities included, and to apply some plan by which each commodity shall exercise an influence upon the final results proportionate to its relative importance, the index number is said to be weighted. When, on the contrary, no such effort is made, but every commodity is taken just as it comes and supposedly allowed just the same chance to influence the result as every other commodity, the index number is said to be unweighted, or simple.

In unweighted series, however, it is seldom true that every commodity has just the same chance to influence the result as every other commodity. For example, in Bradstreet's index the influence of every article upon the result varies as its price per pound happens to be large or small.<sup>1</sup> Again, the decisive objection to making index numbers by merely adding the ordinary commercial quotations for different articles is that these nominally simple series are in fact viciously weighted series.<sup>2</sup> Nor does the substitution of relative prices for actual prices assure an equal chance to every article. For instance, in its famous report of 1893, the Senate Committee on Finance presented three wholesale-price index numbers—one simple and two weighted; but in the simple series it included relative prices for 25 different kinds of pocketknives, giving this trifling article an influence upon the result more than eight times greater than that given to wheat, corn, and coal put together. Finally, even if one series of relative prices, and only one, be accorded each commodity, it does not follow that equal percentages of change in the price of

<sup>1</sup> For details, see p. 101.

<sup>2</sup> See p. 34.

every article will always exercise equal influence upon the results. For, as shown above, when the relative prices are computed upon a fixed base and averaged by the use of arithmetic means, those commodities that have a long period upward trend in price will presently far outweigh in influence those commodities whose prices are declining.<sup>1</sup>

Lack of attention to weighting, then, does not automatically secure a fair field and no favor to every commodity; on the contrary, it results in what Walsh happily termed haphazard weighting.<sup>2</sup> Indeed, when it is desired to give each commodity an equal chance to influence the results, great care must be taken; practically a scheme of equal weights must be devised. The real problem for the maker of index numbers is whether he shall leave weighting to chance or seek to rationalize it.

There are two excuses for neglect of weighting. First, as has been shown in another connection, to collect satisfactory statistics showing the relative importance of different commodities is extremely laborious and extremely difficult.<sup>3</sup> Second, there are high authorities who hold that the results turn out much the same whether or not formal weights are used.<sup>4</sup> Certainly "the weights are of much less importance in determining an index number of prices than the prices themselves."<sup>5</sup> But whether their importance is negligible is a question best answered by a study of actual cases such as are shown in the next table.<sup>6</sup>

<sup>1</sup> See pp. 37 and 38.

<sup>2</sup> C. M. Walsh, *The Measurement of General Exchange-Value*, pp. 81 and 82. Haphazard weighting is not necessarily the worst weighting; indeed, it often is better than the weighting which results from some systematic calculations. For example, Bradstreet's plan of using actual prices per pound is certainly systematic, but the weighting which this system involves is probably less defensible than the haphazard weighting involved in most averages of the relative prices of commodities selected at random. See p. 101.

<sup>3</sup> See p. 28. When the (then) Department of Labor started its present index number it canvassed the subject of weighting, but decided to use a simple average, because of the "impossibility of securing even approximately accurate figures for annual consumption in the United States of the commodities included." (*Bulletin of the Department of Labor No. 39*, p. 234, March, 1912.) It did, however, allot two or more series to certain commodities, and thus introduced a rough system of weights. Unfortunately the number of series allotted to each commodity seems to have been determined quite as much by the ease of securing quotations as by the importance of the articles. For criticism of the weighting which resulted, see pp. 61, 62, and 101.

<sup>4</sup> Compare A. L. Bowley, *Elements of Statistics*, 2d ed., pp. 113 and 220-224.

<sup>5</sup> Irving Fisher, *The Purchasing Power of Money*, revised edition, p. 406. For further details see the papers by Edgeworth to which Fisher refers in his footnote.

<sup>6</sup> Details concerning the first three sets of simple and weighted averages can be found in the documents referred to in the table. But the fourth set of comparisons is based upon hitherto unpublished data and requires description.

The "unweighted" index numbers in this set are arithmetic means of the relative prices given in the bulletins of the Bureau of Labor Statistics for the commodities listed below. But where two or more series of relative prices are shown in the bulletins for different grades of the same article, as in the case of cattle, hogs, bacon, butter, corn meal, pig iron, etc., they were replaced by a single average series for the article in question, before the arithmetic means of the group were computed.

The "weighted" index numbers were made from these same relative prices in the following way: (1) For each commodity included the Bureau of Labor Statistics made a careful estimate, based upon a critical study of the best available sources of information, of the physical quantity of it entering into exchange in the year 1909. By "quantity entering into exchange" is meant the quantity bought and sold, irrespective of the number of times it changed hands. (See pp. 77 and 78.) (2) These physical quantities were multi-

The discrepancies here revealed between the averages with haphazard and with systematic weights seldom amount to 10 per cent of the results, except under the chaotic price conditions created by the greenback standard in 1862-1873. In many kinds of statistics a 10 per cent margin of error is not accounted large. But in making whole-sale-price index numbers for current years we may reasonably try to get not two, but three, significant figures; and the third figure is usually altered in appreciable degree by the substitution of systematic for haphazard weights. Even the large Canadian series, with its 272 commodities, is shifted 9.5 points, or more than 7 per cent, in 1912 by weighting.

plied by the average prices in 1909 of the respective commodities. (3) The resulting sums of money were used as weights to multiply the relative prices of the respective commodities on the 1890-1899 base. (4) The sums of the products were cast up for each year, and finally these sums were divided by the sums of the weights, i. e., the value in exchange for 1909.

The average prices of the commodities in 1909 may be found in any of the recent wholesale-price bulletins, e. g., No. 149. The commodities included, and the estimated physical quantity of each entering into exchange in 1909, are as follows:

*Farm products:* Barley, 75,300,538 bu.; cattle, 124,346,349 cwt.; corn, 460,778,251 bu.; cotton, 5,406,760,011 lbs.; flaxseed, 20,106,433 bu.; hay, 10,685,804 tons; hides, 922,243,894 lbs.; hogs, 78,438,923 cwt.; hops 48,076,921 lbs.; oats, 267,859,660 bu.; rye, 29,520,508 bu.; sheep, 11,498,000 cwt.; wheat, 683,416,528 bu.

*Food, etc.:* Beans, 8,468,385 cwt.; butter, 1,042,709,709 lbs.; cheese, 353,641,992 lbs.; coffee, 1,038,429,285 lbs.; eggs, 926,660,112 doz.; codfish, 684,692 cwt.; herring, 428,804 bbls.; mackerel, 190,565 bbls.; salmon, 18,431,003 doz. cans; buckwheat flour, 2,009,599 cwt.; rye flour, 1,594,346 bbls.; wheat flour, 107,306,408 bbls.; currants, 32,163,998 lbs.; prunes, 138,795,697 lbs.; raisins, 12,438,944 boxes; glucose, 7,701,223 cwt.; lard, 1,243,872,120 lbs.; corn meal, 83,353,466 cwt.; bacon, 741,354,500 lbs.; beef, fresh, 4,209,196,748 lbs.; beef, salt, 632,388 bbls.; hams, 789,861,744 lbs.; mutton, 495,458,067 lbs.; pork, salt, 4,760,600 bbls.; milk, 7,749,070,256 qts.; molasses, 65,689,983 gals.; rice, 1,042,538,993 lbs.; salt, 22,136,489 bbls.; soda, bicarbonate, 165,600,000 lbs.; pepper, 36,241,462 lbs.; sugar, raw, 6,316,033,669 lbs.; sugar, granulated, 7,366,818,210 lbs.; tallow, 203,209,103 lbs.; vinegar, 98,403,927 gals.; potatoes, 397,491,062 bu.; onions, 4,972,947 cwt.; tea, 113,547,647 lbs.

*Metals and implements:* Bar iron, 2,166,539,067 lbs.; barbed wire, 6,471,300 cwt.; copper, ingot, 1,312,437,910 lbs.; copper wire, 278,964,000 lbs.; lead, pig, 732,152,538 lbs.; lead pipe, 1,068,280 cwt.; nails, wire, 13,916,097 kegs; pig iron, 9,896,248 tons; tin (pig), 94,248,471 lbs.; silver, 151,969,144 ozs.; spelter, 464,903,059 lbs.; steel billets, 4,972,179 tons; steel rails, 3,025,009 tons; tin plate, 12,968,174 cwt.

TABLE 16.—COMPARISONS OF WEIGHTED AND UNWEIGHTED INDEX NUMBERS.

[1. From the report of the Senate Committee on Finance, Mar. 3, 1893. By years, 1860 to 1861.]

(Arithmetic means. Prices in 1860=100.)

Year.	Simple arithmetic means, all articles.	All articles averaged according to importance, certain expenditures being uniform.	All articles averaged according to importance: 68.6 per cent of total expenditure.	Difference between simple and first weighted averages.	Difference between simple and second weighted averages.	Difference between first and second weighted averages.
1860.....	100.0	100.0	100.0	.....	.....	.....
1861.....	100.6	95.9	94.1	4.7	6.5	1.8
1862.....	117.8	102.8	104.1	15.0	13.7	1.3
1863.....	142.8	122.1	131.2	20.5	18.4	10.1
1864.....	190.5	149.4	172.1	41.1	18.4	22.7
1865.....	218.8	190.7	232.2	28.1	15.4	41.5
1866.....	191.0	160.2	187.7	30.8	3.3	27.5
1867.....	172.2	145.2	168.8	27.0	6.4	20.6
1868.....	162.5	150.7	175.0	9.8	13.4	23.2
1869.....	152.5	135.9	152.3	17.6	1.2	18.4
1870.....	142.3	130.4	144.4	11.9	2.1	14.0
1871.....	136.0	124.8	136.1	11.2	1.1	11.3
1872.....	138.8	122.2	132.4	16.6	6.4	10.3
1873.....	137.5	119.9	129.0	17.6	8.5	9.1
1874.....	133.0	120.5	129.9	12.5	3.1	9.4
1875.....	127.6	119.8	128.9	7.8	1.3	9.1
1876.....	118.2	115.5	122.6	2.7	4.4	7.1
1877.....	110.8	109.4	113.6	1.5	2.7	4.2
1878.....	101.3	103.1	104.6	1.8	3.3	1.5
1879.....	96.6	98.6	95.0	.....	1.6	1.6
1880.....	108.9	103.4	104.9	3.5	2.0	1.5
1881.....	105.7	105.8	108.4	1.1	2.7	2.6
1882.....	105.5	103.3	108.1	2.2	6	2.3
1883.....	108.0	104.5	106.6	1.5	6	2.1
1884.....	99.4	101.8	102.6	2.4	3.2	8
1885.....	93.0	96.4	93.3	2.4	3	2.1
1886.....	91.9	96.5	93.4	3.6	1.5	2.1
1887.....	92.6	98.2	94.5	3.6	1.9	1.7
1888.....	94.2	97.4	96.2	3.2	2.0	1.2
1889.....	94.2	99.0	98.5	4.8	4.3	5
1890.....	92.3	96.7	93.7	3.4	1.4	2.0
1891.....	92.2	96.2	94.4	4.0	2.2	1.8

[2. From Bulletin of the Department of Labor, No. 37, March, 1900. January of the years, 1890 to 1899.]

(Arithmetic means. Averages of 9 quarterly quotations, January, 1890 to January, 1892=100.)

Year and month.	All articles simply averaged.	All articles averaged according to importance, certain expenditures being considered uniform.	All articles averaged according to importance, comprising 68.6 per cent of total expenditure.	Difference between simple and first weighted averages.	Difference between simple and second weighted averages.	Difference between first and second weighted averages.
1890, January.....	102.0	100.1	100.2	1.9	1.8	0.1
1891, January.....	100.6	102.2	103.2	1.6	2.6	1.0
1892, January.....	96.5	100.0	100.1	3.5	3.6	1
1893, January.....	97.2	103.4	105.0	6.2	7.8	1.6
1894, January.....	89.6	97.5	96.4	7.9	6.8	1.1
1895, January.....	81.7	93.5	90.5	8.8	6.8	3.0
1896, January.....	85.2	92.8	89.5	7.6	4.3	3.3
1897, January.....	82.0	90.3	85.9	8.3	3.9	4.4
1898, January.....	83.3	91.0	86.8	7.7	3.5	4.2
1899, January.....	86.5	91.0	86.8	4.5	3	4.2

TABLE 16.—COMPARISONS OF WEIGHTED AND UNWEIGHTED INDEX NUMBERS—Cont.

[3. From Wholesale Prices, Canada, 1913. Report by R. H. Coats. By years, 1890 to 1913.]

(Arithmetic means. Average prices, 1890 to 1899=100.)

Year.	Weighted index number.	Un-weighted index number.	Differ-ences.	Year.	Weighted index number.	Un-weighted index number.	Differ-ences.
1890.....	112.0	110.3	1.7	1902.....	109.6	109.0	0.6
1891.....	111.3	108.5	2.8	1903.....	107.7	110.5	-2.8
1892.....	104.9	102.8	2.1	1904.....	110.0	111.4	-1.4
1893.....	103.9	102.5	1.4	1905.....	113.8	113.8	0
1894.....	97.2	97.2	0	1906.....	120.1	120.0	.1
1895.....	95.6	95.6	0	1907.....	129.2	129.2	0
1896.....	90.6	92.5	-1.9	1908.....	125.1	120.8	4.3
1897.....	89.9	92.2	-2.3	1909.....	126.3	121.2	5.1
1898.....	95.5	96.1	-.6	1910.....	128.0	124.2	3.8
1899.....	99.0	100.1	-1.1	1911.....	131.1	127.4	3.7
1900.....	105.8	108.2	-2.4	1912.....	143.9	134.4	9.5
1901.....	106.0	107.0	-1.0	1913.....	139.6	135.5	4.1

[4. From new computations by the Bureau of Labor Statistics. 1]

(Arithmetic means. Average prices in 1890 to 1899=100.)

Year.	13 farm products.			37 food products.			14 metallic products.		
	Un-weighted.	Weighted by estimated expenditures upon each article in 1909.	Differ-ences.	Un-weighted.	Weighted by estimated expenditures upon each article in 1909.	Differ-ences.	Un-weighted.	Weighted by estimated expenditures upon each article in 1909.	Differ-ences.
1890.....	113	109	4	114	114	0	128	131	3
1891.....	124	117	7	116	114	2	118	116	2
1892.....	112	105	7	105	103	2	110	107	3
1893.....	106	107	-1	112	111	1	102	98	4
1894.....	96	94	2	96	97	2	88	84	4
1895.....	93	95	-2	95	94	1	88	88	0
1896.....	78	86	8	83	86	3	80	91	-11
1897.....	84	93	9	87	90	3	82	89	-7
1898.....	97	97	0	93	96	3	83	81	2
1899.....	99	98	1	98	96	2	124	124	0
1900.....	109	109	0	108	100	8	124	123	1
1901.....	117	115	2	110	102	8	114	113	1
1902.....	130	129	1	114	108	6	114	114	0
1903.....	120	120	0	110	104	6	114	113	1
1904.....	130	128	2	113	110	3	105	102	3
1905.....	125	125	2	110	109	1	116	113	3
1906.....	122	124	-2	115	106	9	131	130	1
1907.....	139	136	3	120	112	8	138	140	-2
1908.....	135	135	0	122	119	3	103	108	-5
1909.....	150	154	-4	124	126	2	109	107	2
1910.....	161	165	-4	129	127	2	111	108	3
1911.....	166	169	-3	128	125	3	111	103	8
1912.....	173	164	9	137	137	0	120	114	6
1913.....	152	161	-9	133	127	6	119	116	4

1 See explanations in footnote, p. 72.

If rational weighting is worth striving after, then, by what criterion shall the relative importance of the different commodities be judged? That depends upon the object of the investigation. If, for example, the aim be to measure changes in the cost of living, and the data be retail quotations of consumers' commodities, then the proportionate expenditures upon the different articles as represented by collections of family budgets make appropriate weights. If the aim be to study

changes in the money incomes of farmers, then the data should be "farm prices," the list of commodities should be limited to farm products, and the weights should be proportionate to the monetary receipts from the several products. If the aim be to construct a business barometer, the data should be prices from the most representative wholesale markets, the list should be confined to commodities whose prices are most sensitive to changes in business prospects and least liable to change from other causes, and the weights may logically be adjusted to the relative importance of the commodities as objects of investment. If the aim be merely to find the differences of price fluctuation characteristic of dissimilar groups of commodities, or to study the influence of gold production or the issue of irredeemable paper money upon the way in which prices change, it may be appropriate to give identical weights to all the commodities. If, on the other hand, the aim be to make a general-purpose index number of wholesale prices, the question is less easy to answer.

One proposition, however, is clear. The prevalent practice of weighting wholesale-price index numbers by figures drawn from family budgets is to be deprecated. For family budgets do not show the importance of wheat and cotton, of petroleum and spelter, of tar and lime, of pig iron and hides, of brick and lumber; indeed, to apply budget weights to half or more of the articles in any wholesale list is impossible, or at best nonsensical. And to pretend that wholesale-price index numbers when weighted on the basis of family expenditures show fluctuations in the cost of living is to overtax the credulity of those who know and to abuse the confidence of those who do not.

Allied to the family-budget method of weighting and yet vastly better for wholesale-price index numbers is the "aggregate expenditure" method.<sup>1</sup> Here an attempt is made to ascertain the aggregate sums of money laid out by the people of a whole country upon the articles quoted and to adjust their weights upon this basis. Of course the country as a whole buys raw materials, as single families do not, and of course consumers' commodities can be taken at their aggregate values in wholesale markets. Similar in net effect is the weighting on the basis of consumption practiced by the British Board of Trade. For "consumption is taken to mean any process by which the commodity is substantially changed in character. In other words, consumption in manufacture is recognized as well as consumption by an individual."<sup>2</sup> Somewhat different weights would result if quantities or values produced were taken in place of quantities or values consumed. Mr. Walsh thinks it best to combine these

<sup>1</sup> See G. H. Knibbs, *Prices, Price Indexes, and Cost of Living in Australia*. Commonwealth Bureau of Census and Statistics, Labour and Industrial Branch, Report No. 1, pp. 11-14.

<sup>2</sup> Report on Wholesale and Retail Prices in the United Kingdom in 1902. London, 1903, p. 411. The accuracy of the statistics upon which the Australian and British index numbers are based may be open to question. Not the data, but the method is of interest here.

two criteria—that is, to take “either the total product or the total consumption according as the one or the other is the greater.”<sup>1</sup> Prof. Irving Fisher prefers “an index number in which every article or service is weighted according to the value of it exchanged at base prices in the year whose level of prices it is desired to find.”<sup>2</sup> On this system the weight assigned to each article would be affected by the number of times it changed hands on its way from producer to final consumer. A variation of his plan is therefore represented by the proposal to weight each article according to the quantity of it which enters into the country’s commerce, irrespective of the frequency with which it changes hands.

The practical consequences of adopting these different systems of weighting may be illustrated by considering their application to cotton, corn, and coffee in the United States. Production weights would give cotton much greater importance than consumption or aggregate-expenditure weights, because so large a part of the American crop is exported and consumed abroad. Exchange weights would be practically equivalent to production weights, because practically all the cotton grown is sold by the planters and enters into the commerce of the country, and very little cotton is imported. On Prof. Fisher’s plan, however, the exchange weights would be some multiple of the production weights, depending upon the average number of American hands through which the cotton passed. In the case of corn, production and consumption weights would substantially agree, for we import very little corn and export but a very small percentage of the production. On the other hand, exchange weights would be much less than either production or consumption weights, because a large part of the corn crop is never sold, but is consumed on the farms where it is grown. In the case of coffee, production weights would be practically zero, while consumption and exchange weights would correspond closely.

We are helped toward a choice among these rivals by common agreement upon a slightly different point. In arranging any system of weights except Prof. Fisher’s, double counting is to be avoided so far as possible. For example, if cotton is counted at its full importance as a raw material, then cotton yarns and later cotton fabrics made of the yarn can not be counted at their full importance without assigning triple weight to the raw cotton which is represented at these two successive stages of manufacture. Now, if this sensible observation be applied to cases like those of corn, hay, etc., it casts the die in favor of exchange weights. For if these articles, which are used largely by the original producers in making things quite

<sup>1</sup> C. M. Walsh, *The Measurement of General Exchange-Value*. New York, 1901, p. 95.

<sup>2</sup> Irving Fisher, *The Purchasing Power of Money*, revised edition. New York, 1913, pp. 217 and 218.



different from corn and hay (for instance, pork and beef) are counted at the full amount produced or consumed, and if their products (the pork and beef) are also counted at the full amount produced or consumed, there will be a great deal of double counting. Not all but much of this duplication can be eliminated by counting only the amount of corn and hay sold by the producers and letting the rest of these articles produced and consumed get their proper representation under the captions of pork, beef, etc.<sup>1</sup>

If for this reason exchange appears a rather better criterion of importance than production, consumption, or a combination of the two, it remains only to decide whether the number of times a thing is exchanged should be recognized. Prof. Irving Fisher had good cause to propose multiple counting, for he wanted an index number of prices for constructing the "equation of exchange," a mathematical expression of the necessary equivalence between the total volume of business done in a country and the total volume of payments effected by means of money and credit instruments. Of course the oftener an article is sold and paid for the more important it is as a factor in this equation. But it does not follow that the economic importance of an article is greatly changed by reorganizing the chain of business enterprises that deal in it. "Integration of industry," as expressed in our trusts, does not make pig iron less significant as an item in the country's economic life, except in the sense that it reduces the average number of transfers of ownership. The quantity of the article that enters into exchange, then, irrespective of the number of turnovers, is probably the most satisfactory gauge of importance to apply in making general-purpose index numbers. But anyone experienced in the search for statistical information will need no warning that in the working out of weights along this line many puzzling cases will arise in which consistency will be difficult to maintain, to say nothing of wide gaps and many weak places in the existing data being revealed.

Three interesting questions remain: Should the weights be sums of money or physical quantities? Should the weights be changed from year to year or kept constant? Should the weights be adjusted to the importance of the commodities as such, or should there be taken into account also the importance of the commodities as representing certain types of price fluctuations?

When relative prices are being used the weights should be reduced to a common denominator. As multipliers, of course, weights may be regarded as merely abstract numbers; but in studying the weights

<sup>1</sup> Of course, this same end might be attained without surrendering the production or consumption basis. If the rule against double counting of raw materials and products were made broad enough to include corn, for example, as the raw material of pork; but needless to say there is little likelihood that the common meaning of terms will be stretched to such an extent.

themselves it is necessary to have some common standard by which the relative importance assigned to various commodities can be accurately compared. The only common denominator for all commodities that is significant for economic ends and capable of quantitative expression is money value. But it is ill advised to weight by money values when actual prices are being used, for the common denominator is already present in the quotations themselves. These price quotations are best multiplied by the physical quantities of the goods produced, exchanged, or consumed, as the case may be.

The argument in favor of changing the weights at frequent intervals is that the relative importance of commodities is continually varying. Hence a system of fixed weights applied to prices over a long period of years is certain to be inaccurate for most of these years, however accurately it was adjusted to conditions prevailing when it was devised. The rejoinder is that an index number is primarily a device for measuring changes in prices; if the weights are revised it becomes a measure of two sets of changes, and no one can tell what part of the net results is due to variations in prices and what to variations in weights.<sup>1</sup> Practically, then, the compiler must choose between two evils—inaccurate weights and ambiguous price measures. Sometimes he can minimize the first evil by collecting data showing the average importance of his commodities over a period of years, for these averages are less likely to go awry than figures for a single year. And when he makes chain index numbers he is free to revise his weights as often as he likes, since such series do not profess to yield accurate comparisons except between successive years. In other cases the least objectionable compromise is probably to revise the scheme of weights, say, once a decade, and to show the effect of this change by computing overlapping results for a few years with both the old and new weights.<sup>2</sup> A further practical reason in favor of this compromise is found in the heavy expense of time and labor required for frequent revisions of the weights.

To the third question, whether weights should be adjusted to the importance of the commodities as such, or whether there should also be taken into account the importance of these commodities as representatives of certain types of price fluctuations, little attention has been paid. But the preceding section shows that this neglected problem is both important and difficult. The prices of raw materials behave differently from the prices of manufactured goods; among the raw materials the prices of farm crops, of forest, animal, and mineral products behave differently; there are also differences of behavior between the prices of manufactured goods bought by pro-

<sup>1</sup> See the criticism of index numbers made from import-export values, subsec. 3, p. 31.

<sup>2</sup> Compare G. H. Knibbs, *Prices, Price Indexes, and Cost of Living in Australia*. Commonwealth Bureau of Census and Statistics, Labour and Industrial Branch, Report No. 1, pp. xxiv and xlix.

ducers and by consumers, etc. An accurate measure of changes in the level of all wholesale prices is not obtained unless all of the different types of fluctuation, doubtless including types not yet definitely recognized, are represented in accordance with the relative importance of the commodities belonging to each.

How can such representation be attained? If all the commodities bought and sold could be included in the index number, it would suffice to weight each by the criterion of its own individual importance. Since that is out of the question, it is theoretically necessary to draw from each part of the whole system of prices samples sufficient to determine its characteristic fluctuations, and then to make sure that each part of the whole system counts for the proper amount in determining the final result. On this plan commodities would be weighted simply as commodities in making the subtotals for each recognized group, and these subtotals would be weighted again in making up the grand totals.

Perhaps it is a counsel of perfection to urge such refinements in systems of weighting. Certainly the difficulties to be encountered are very great. Statistical knowledge is not complete enough to supply accurate data for weighting all the different parts of the system of prices that are known to have characteristic peculiarities of fluctuation. Nor have these different types and the commodities exhibiting each been adequately studied. And puzzling difficulties are raised by overlapping among the types—there are commodities that belong in two places at once. But here is certainly a promising lead for future efforts to improve present measurements of changes in the price level. Even now it might be feasible by taking pains to secure rough justice as between raw and manufactured commodities, and as between raw vegetable, animal, forest, and mineral products. One modest step in the right direction can readily be taken by any compiler of index numbers: He can make clear that his results do not measure changes in the general level of wholesale prices accurately when they are obtained without an effort to represent each part of the field according to its due importance.

#### 8. AVERAGES AND AGGREGATES.

Among all the problems involved in the making of index numbers the one that has been discussed most thoroughly is the best form of average to strike. Most of these discussions have come from men interested in the mathematical side of statistics rather than in the problem of ascertaining what changes have actually occurred in prices. The practical makers of index numbers, on the contrary, have seldom troubled themselves greatly about theoretical refinements of method. Indeed, the two problems of finding out how prices have actually changed, and finding the best method of meas-

uring changes, appeal to two types of interest, which are seldom strongly developed in the same mind. The mathematical statistician is likely to know little and care less about the field work of collecting price quotations. To the practical statistician this field work is of overshadowing importance, and the subsequent manipulation of his data is a matter of secondary interest. Hence, a study of index numbers as they are made need not carry one into long mathematical flights.<sup>1</sup>

First, it should be recalled that certain compilers of index numbers do not strike averages at all. The old form of the Economist index and Gibson's present index, for example, are sums of relative prices. More important are the series which dispense with the use of relative prices for each commodity, and give results in the form of sums of actual prices, or such sums thrown back into a series of relative numbers. These cases are still exceptional, however, and most index numbers are made by finding some sort of average from the relative prices of the commodities included.

The sort of average struck is almost always the arithmetic mean—that is, the sum of the relative prices divided by their number. Occasionally medians are used—that is, the midmost relative prices which divide the whole number of cases into two equal groups. In one famous investigation,<sup>2</sup> geometric means were employed—that is, all the relative prices for a given date were multiplied together and the  $n$ th roots of the products were extracted,  $n$  standing for the number of commodities included. But Jevons has had few imitators. The other standard forms of averages—the mode and the harmonic mean—have been discussed frequently, but used seldom, in making index numbers.<sup>3</sup>

For the geometric mean two great merits are claimed. First, unlike the arithmetic mean, it is not in danger of distortion from the asymmetrical distribution of price fluctuations. Chart 2 shows that in a large collection of percentage variations from the prices of the preceding year, the extreme cases of rise run about twice as far up the scale as the extreme cases of fall run down. Such a distribution is characteristic of relative prices in general. Indeed, the case cited is distinctly moderate; most collections of variations covering many

<sup>1</sup> The best systematic discussions of averaging for the purpose in hand are to be found in Prof. Edgeworth's papers referred to in footnote on p. 8; Irving Fisher's *The Purchasing Power of Money*, revised edition, 1913, pp. 385-429; and C. M. Walsh's *The Measurement of General Exchange-Value*, 1901.

<sup>2</sup> W. S. Jevons, "A serious fall in the value of gold ascertained," 1863. Reprinted in his *Investigations in Currency and Finance*, 1884, pp. 13-118.

<sup>3</sup> Concerning the properties of these averages see, for example, F. Žittek, *Statistical Averages* (translated by W. M. Parsons), and G. U. Yule, *Introduction to the Theory of Statistics*, pp. 120-123, 128-129. The "crude mode" is that relative price which occurs most frequently in the data under examination, e. g., in Chart 2 it is "no change." The true mode is "the value of the variable corresponding to the maximum of the ideal frequency-curve which gives the closest possible fit to the actual distribution." "The harmonic mean of a series of quantities is the reciprocal of the arithmetic mean of their reciprocals."

years would show a greater difference. Of course there is no limit to the possible percentage of rise, while the possible percentage of fall can not exceed 100. If the price of one article be doubled and the price of another be halved, their relative prices will be 200 and 50. Then an arithmetic mean will show a net rise of 25 per cent; for  $\frac{200+50}{2} = 125$ . But a geometric mean will show that the price level

has not changed; for  $\sqrt{200 \times 50} = 100$ . Second, geometric means can be shifted from one base period to another easily and without inaccuracy. Suppose, for example, that the price of wheat falls from \$1 per bushel in 1913 to 50 cents in 1914, while the price of corn remains unchanged at 40 cents. Then the relative prices are—

- (1) On the basis, prices in 1913 = 100:

	1913	1914
Wheat.....	100	50
Corn.....	100	100

- (2) On the basis, prices in 1914 = 100:

	1913	1914
Wheat.....	200	100
Corn.....	100	100

The arithmetic and geometric means are

- (1) On the basis of prices in 1913:

	Arithmetic means.	Geometric means.
1913.....	$(100+100) \div 2 = 100$	$\sqrt{100 \times 100} = 100.00$
1914.....	$(50+100) \div 2 = 75$	$\sqrt{50 \times 100} = 70.71+$

- (2) On the basis of prices in 1914:

	Arithmetic means.	Geometric means.
1913.....	$(200+100) \div 2 = 150$	$\sqrt{200 \times 100} = 141.42-$
1914.....	$(100+100) \div 2 = 100$	$\sqrt{100 \times 100} = 100.00$

Here the arithmetic means can not, but the geometric means can, be shifted from the 1913 base to the 1914 base or vice versa by simply dividing the index number for one year by that for the other. That is,  $100 \div 75 = 133\frac{1}{3}$ , not 150; but  $100 \div 70.71 = 141.42$ .<sup>1</sup> By

<sup>1</sup> See the discussion of shifting bases, pp. 39-44.

shifting the base in this simple fashion geometric means can be made to give direct comparisons between the price levels at any two dates covered by the investigation, whereas with arithmetic means comparisons must always be made in terms of prices at the original base period.

The chief objection to geometric means in an index number intended for general use is that this form of average is unfamiliar and therefore more likely to be misinterpreted than arithmetic means. Further, geometric means do not have any direct bearing upon changes in the purchasing power of money as do arithmetic means and weighted aggregates of actual prices.<sup>1</sup> Finally, geometric means are more laborious to compute than arithmetic means or medians. Instead of adding the relative prices just as they stand and dividing the sums by their number, the computer must convert the relative prices of every commodity into their logarithms, add these logarithms, divide the sums by the number of logarithms, and look up the natural numbers corresponding to the quotients.<sup>2</sup> Statisticians are the more loath to incur the extra labor of this process since the special merits of the geometric mean are shared in part by certain other forms of index numbers. Like geometric means, sums of actual prices, or relatives made directly from them, can be shifted to any base desired. Like geometric means, again, medians are not more affected by cases of exceptionally great advances in price than

<sup>1</sup> This point is more fully explained on pp. 88 and 89.

<sup>2</sup> If relative prices are not needed for any other purpose, it is quicker to compute the geometric mean from the logarithms of the successive actual prices and then to find the ratios between the results. But even that is a somewhat longer process than calculating relative prices, casting them up, and dividing by their number.

That geometric means can be computed either with or without the use of relative prices is readily shown.

Let  $\left. \begin{matrix} p_0, p_x \\ p'_0, p'_x \\ p''_0, p''_x \end{matrix} \right\}$  stand for the actual prices of  $n$  commodities in the two years  $o$  and  $x$ .

Then the relative prices of these articles in the year  $x$  on the basis of actual prices in the year  $o$  are

$$\frac{p_x}{p_0}, \frac{p'_x}{p'_0}, \dots, \frac{p''_x}{p''_0}$$

The geometric mean of these relatives is

$$\sqrt[n]{\left(\frac{p_x}{p_0}\right) \left(\frac{p'_x}{p'_0}\right) \dots \left(\frac{p''_x}{p''_0}\right)}$$

But this expression is equal to

$$\frac{\sqrt[n]{(p_x) (p'_x) \dots (p''_x)}}{\sqrt[n]{(p_0) (p'_0) \dots (p''_0)}}$$

And the latter expression, of course, is the ratio between the geometric means of the actual prices in the two years.

by cases of exceptionally great declines. Hence in practice most makers of index numbers who distrust arithmetic means abandon relative prices altogether or use medians instead of taking to geometric means.

Medians, indeed, have several distinguished champions among theoretical writers.<sup>1</sup> Of all averages they are the easiest to compute, for a quick arrangement of the materials followed by simple counting of the items takes the place of casting sums and dividing by the proper number. And Prof. Edgeworth has recently argued that the median is safer than the arithmetic mean when, as in the case of index numbers, the items to be averaged are samples drawn from a larger field. For, according to the theory of probabilities, the probable error of the median can not in any case be much greater than that of the arithmetic mean and in other cases it may be very much less.<sup>2</sup>

But medians have their drawbacks. (1) They are not perfectly reversible; that is, they can not always be shifted from one base to another by simple division. (2) The median may not answer precisely to its definition when several of the items to be averaged have identical values. For example, in Table 2 of this bulletin it often happens that the median falls in a large group of precisely identical figures, so that it ceases to be true that half of the cases are above and half below the median.<sup>3</sup> (3) Medians of different groups can not be combined, averaged, or otherwise manipulated with ease as can arithmetic means. For example, in making up its index number the Bureau of Labor Statistics can add the sums used for making arithmetic means of the relative prices of farm products, foods, cloths and clothing, etc., and from the sum of these sums strike the grand average for all commodities. It could not handle medians in this convenient fashion; instead of combining the sums from the groups it would have to combine the single commodities. Similarly, a reader who finds arithmetic means of two groups in different sources can compute the arithmetic mean of these means, provided the number of items in each group be stated, with no greater error than that arising from the dropping of fractions in the published data; but he can not approximate except in the vaguest way the median of two

<sup>1</sup> Compare, for example, F. Y. Edgeworth, "Index numbers," *Dictionary of Political Economy*, Vol. II, p. 386; Irving Fisher, *The Purchasing Power of Money*, revised edition, p. 425; A. L. Bowley, *Elements of Statistics*, second edition, p. 224. Walsh, however, prefers the geometric mean. See his *Measurement of General Exchange-Value*.

<sup>2</sup> See his paper "On the use of analytical geometry to represent certain kinds of statistics," *Journal of the Royal Statistical Society*, June, 1914, Vol. LXXVII, p. 733.

<sup>3</sup> In 1891, for instance, 232 commodities are represented. One-half the list is 116. But 82 commodities rose in price, while 106 fell. The remaining 44 did not change. Here not only the median but also the 6th decil fall in the group "no change." Of course the median here does not divide the whole number of cases into two equal parts any more than the 6th decil does.

medians.<sup>1</sup> (4) When the number of items to be averaged is small, medians are erratic in their behavior. For in such groups there is often a considerable interval between the midmost relative price and the relative prices standing next above it and next below. No change in any of the items, large or small, can alter the position of the median unless it shifts an item from the upper half of the list to the lower half, or vice versa. But any change of this character, large or small, will make the median jump over the whole interval between its former position and that of the next highest or next lowest relative price, unless the change happens to place a new item within these limits. In large groups such erratic jumps are less likely to occur, because the intervals between the median and its nearest neighbors are usually slight.

Most of the advantages and defects of arithmetic means have been mentioned incidentally, but it is well to list them all together. (1) Arithmetic means, then, stand next to medians in ease of computation, and even ahead of medians when the items are to be averaged first in small and later in large groups. (2) They are perfectly definite in meaning. (3) Their familiarity to all readers is a great advantage in work intended for wide reading. (4) They are more representative averages than medians, being affected by any change in any of the items in the group. (5) They can themselves be averaged and manipulated algebraically in various other ways.<sup>2</sup> On the other side of the score it must be said (6) that arithmetic means are liable to distortion from the occurrence of one or two extremely high relative prices; (7) that arithmetic means of relative prices can not consistently be shifted from one base to another without recomputation in full,<sup>3</sup> and (8) that they may conceivably give contradictory results con-

<sup>1</sup> It is a convenient feature of arithmetic means computed from relatives based on average prices over a period of years that the mean of these means for the base period must be 100—again barring discrepancies caused by dropping fractions. For example, the arithmetic means of the Bureau of Labor Statistics index numbers for the ten-year period 1890-1899 would always add up to 1,000.0, had all the fractions been kept and had all commodities been quoted in every year of the decade. If medians made from these figures add up to 1,000.0 in 1890-1899, it is accidental.

<sup>2</sup> See, for example, G. U. Yule, *Introduction to the Theory of Statistics*, pp. 114-116.

<sup>3</sup> See subsec. 5, "Base Periods."



cerning the direction in which prices are moving, according as relative prices are computed on one base or on another.<sup>1</sup>

Concerning the numerical value of the three averages under discussion, it can be proved that the geometric mean is always less than the arithmetic. On the other hand, the median may be either above or below the arithmetic mean, and likewise either above or below the geometric mean. For example, if the relative prices of the 145 commodities represented in the second index number of Table 8 be averaged in these three ways, the results are as follows for 1913:

Geometric mean, 125.7; median, 126.9; arithmetic mean, 131.3.

A fuller study of the relations between medians and arithmetic means is provided for by the following table.<sup>2</sup> In the chain index the two forms of average never quite coincide; the median is smaller in 20 cases and larger in 3; it is also steadier than the arithmetic mean in the sense that it indicates an average annual change of 2.22 per

<sup>1</sup> Take, for example, the following data:

	1913	1914
Wheat, per bushel.....	\$0.50	\$1.00
Corn, per bushel.....	.48	.24

Then compute index numbers on the basis 1913=100:

	1913	1914
Wheat, relative prices.....	100	200
Corn, relative prices.....	100	50
Index numbers.....	200	250
	100	125

Also, compute index numbers on the basis 1914=100:

	1913	1914
Wheat, relative prices.....	50	100
Corn, relative prices.....	200	100
Index numbers.....	250	200
	125	100

Thus it appears that prices were 25 per cent higher in 1913 than in 1914 and also that they were 25 per cent higher in 1914 than in 1913. Much stress is often laid upon illustrations of this sort; but they are not seriously damaging to the good repute of arithmetic means when properly interpreted. What they really say is: The arithmetic mean variation of prices from 1913 to 1914 may conceivably be upward in percentages of prices in 1913, and at the same time be downward in percentages of prices in 1914. No real inconsistencies involved in that statement to one who can keep the meanings of the two results in mind. It should be added that cases in which such apparent inconsistency occurs, while common in theoretical discussions, seldom if ever occur in the practical computation of wholesale-price index numbers. In retail-price indexes they are not unknown. An example has been pointed out in the British Board of Trade's reports upon cost of living of the working classes. See the reviews by J. M. Keynes in the *Economic Journal*, September and December, 1908.

<sup>2</sup> For numerical examples of geometric and arithmetic means computed from the same data, see F. Y. Edgeworth, "A defense of index numbers," *Economic Journal*, Vol. VI (1896), p. 137, and A. W. Flux, "Modes of constructing index numbers," *Quarterly Journal of Economics*, Vol. XXI (1907), p. 637.

cent from prices in the preceding year, as against 3.64 per cent for the arithmetic mean. In the fixed-base series for 1890-1913, including 145 commodities, the median is likewise steadier than the arithmetic mean, showing a smaller percentage of change except during the middle nineties, when the price level was at its lowest. The second series for these years illustrates the erratic character of the median when used to average a small group of variations. Here the median is greater than the arithmetic mean in 13 years, just the same in one year, and less in 10 years. Moreover, it shows a greater average change from one year to the next than the arithmetic mean. Finally, the figures for prices during the period of irredeemable paper money (1862-1878, inclusive) show how far arithmetic means may depart from the medians when a few commodities attain very high relative prices. The maximum difference occurs in July, 1864, when the arithmetic mean exceeds the median by 42 points, or more than 20 per cent. This excessive difference is due to the high prices of cotton, tar, and other southern products. It is precisely in cases such as this that the median is distinctly safer to trust than the arithmetic mean.

TABLE 17.—COMPARISONS OF MEDIANS AND ARITHMETIC MEANS AS AVERAGES OF RELATIVE PRICES.

[Data from Bulletin of the Bureau of Labor Statistics, No. 149.]

Year.	Chain index number (prices in preceding year=100). <sup>1</sup>		Relative prices of 145 commodities (aver- age prices in 1890- 1899=100). <sup>2</sup>		Relative prices of 25 commodities (aver- age prices in 1890- 1899=100). <sup>3</sup>	
	Medians.	Arithmetic means.	Medians.	Arithmetic means.	Medians.	Arithmetic means.
1890.....			112	114	116	115
1891.....	± 0	- 0.2	111	113	109	112
1892.....	-3.1	- 4.4	107	106	106	103
1893.....	± 0	- 2	104	105	102	103
1894.....	-7.1	- 8.7	96	96	90	92
1895.....	-2.4	- 1.5	94	93	94	95
1896.....	-1.3	- 2.8	90	89	89	88
1897.....	± 0	+ 2	91	89	92	90
1898.....	+1.8	+ 4.8	94	93	99	96
1899.....	+5.5	+10.4	100	103	108	107
1900.....	+7.5	+ 9.4	109	111	117	113
1901.....	-1.5	+ 1.1	107	110	112	111
1902.....	+2.2	+ 4.6	110	114	115	116
1903.....	+1.3	+ 1.2	111	114	112	118
1904.....	± 0	- .1	112	114	124	122
1905.....	+ .7	+ 2.9	114	116	126	123
1906.....	+5.1	+ 5.8	119	122	131	130
1907.....	+3.9	+ 8.0	129	130	133	133
1908.....	-3.8	- 5.6	119	121	125	124
1909.....	± 0	+ 3.2	121	124	130	133
1910.....	+1.5	+ 4.1	124	131	126	133
1911.....	- .9	- 1.9	125	130	131	139
1912.....	+1.0	+ 3.4	127	134	136	140
1913.....	+ .5	+ 1.2	127	131	127	143
Averages, 1890-1899.....			100	100	101	100
1900-1909.....			115	118	123	122
1910-1913.....			126	132	130	136
Average change from one year to the next.....	2.22	3.64	3.61	4.13	5.70	5.00

<sup>1</sup> Compare Tables 2 and 6.<sup>2</sup> Compare Table 8, second series.<sup>3</sup> Compare Table 8, fifth series.

TABLE 17.—COMPARISONS OF MEDIANS AND ARITHMETIC MEANS AS AVERAGES OF RELATIVE PRICES—Concluded.

[From W. C. Mitchell, Gold Prices and Wages under the Greenback Standard, pp. 50, 60.]

92 commodities at wholesale (prices in 1860=100).

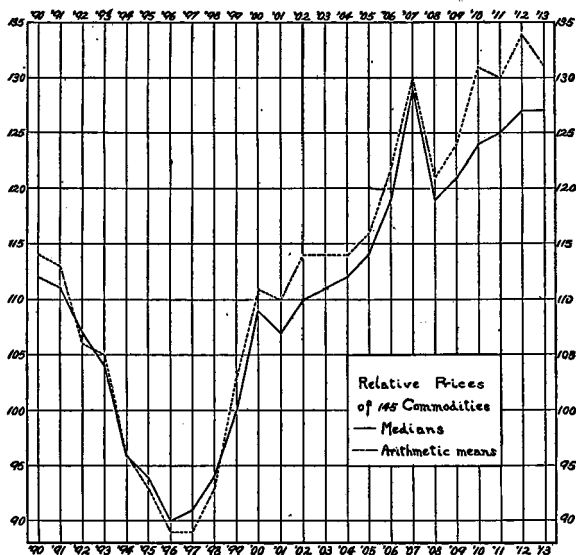
Year.	Me- dians.	Arith- metic means.	Year.	Me- dians.	Arith- metic means.	Year.	Me- dians.	Arith- metic means.
1860, January.....	100	102	1867, January.....	169	179	1874, January.....	130	140
April.....	100	102	April.....	166	175	April.....	129	141
July.....	100	100	July.....	150	170	July.....	130	138
October.....	100	102	October.....	162	172	October.....	130	138
1861, January.....	100	100	1868, January.....	158	171	1875, January.....	127	138
April.....	96	98	April.....	162	176	April.....	125	132
July.....	96	95	July.....	164	165	July.....	121	129
October.....	97	103	October.....	159	166	October.....	120	127
1862, January.....	100	115	1869, January.....	159	165	1876, January.....	117	122
April.....	100	112	April.....	159	165	April.....	115	122
July.....	100	120	July.....	158	158	July.....	110	118
October.....	111	126	October.....	153	157	October.....	108	117
1863, January.....	125	142	1870, January.....	147	152	1877, January.....	114	121
April.....	137	159	April.....	140	146	April.....	108	118
July.....	134	155	July.....	132	145	July.....	100	114
October.....	135	155	October.....	135	143	October.....	102	110
1864, January.....	156	179	1871, January.....	133	142	1878, January.....	99	107
April.....	169	197	April.....	131	140	April.....	95	106
July.....	194	236	July.....	130	137	July.....	96	99
October.....	200	239	October.....	129	139	October.....	94	102
1865, January.....	216	248	1872, January.....	133	141	1879, January.....	88	100
April.....	190	206	April.....	140	145	April.....	84	99
July.....	158	183	July.....	130	139	July.....	85	95
October.....	175	205	October.....	133	143	October.....	95	103
1866, January.....	182	199	1873, January.....	135	142	1880, January.....	108	114
April.....	173	186	April.....	137	144	April.....	107	116
July.....	181	191	July.....	130	140	July.....	102	110
October.....	173	188	October.....	131	140	October.....	101	111

Average change from one quarter to the next: Medians, 5.66 points; arithmetic means, 5.65 points.

Wise choice of the average to use in making an index number, then, involves careful consideration of the materials to be dealt with and of the purpose in view. (1) If that purpose be to measure the *average ratio of change* in prices, the geometric mean is the best, indeed, in strictness, it is the only proper average to employ. For, alone among our averages, the geometric mean always allows equal influence to equal ratios of change in price, quite irrespective of the previous levels of the prices in question, the amounts of money represented by the changes themselves, or any other factor. As has been said already, in a geometric mean the doubling of one price is precisely offset by the halving of another price—though if the two prices were originally the same the rise amounts in money to twice the fall. And further changes of 10 per cent from the two new prices will again be precisely equal in their influence upon a geometric mean, although 10 per cent of the price that has doubled represents a sum of money four times as great as 10 per cent of the price that has been halved. (2) But these same examples show that geometric means are not proper averages for measuring alterations in the amount of money that goods cost. And as a rule our interest does center in the money cost of goods rather than in the average ratio

of changes in price. For example, when we are investigating the increased cost of living, the doubling of one item in the family budget, may well be twice as important as its halving; and when we are studying the "relation of prices to the currency, a large upward variation should count for more than a small downward variation, for it requires more currency."<sup>1</sup> For such purposes the arithmetic

CHART 11.—A COMPARISON OF MEDIANS AND ARITHMETIC MEANS OF 145 COMMODITIES. (BASED ON TABLE 17.)



mean is the logical average to use. (3) Frequently, however, the very fact that an article has advanced greatly in price cuts down its market, so that the increase in money cost represented by the arithmetic mean exists on paper rather than in fact.<sup>2</sup> When such cases of extreme advance are numerous among the relative prices to be averaged, the median may give more significant results than the arithmetic mean. (4) When the number of commodities included

<sup>1</sup> Irving Fisher, *The Purchasing Power of Money*, revised edition, p. 426, note 2.

<sup>2</sup> Such cases might be met by reducing the weight allowed the article in question; but we have seen that revising weights blurs the meaning of the index number, by making it impossible to say how far the final results measure the change in prices and how far they measure the change in weights. See p. 79.

in the index number is small, however, medians are likely to prove highly erratic, representing less the general trend of prices than the peculiarities of the data from which they are made. (5) If the index number is designed for the public at large, the familiarity of arithmetic means is an argument in their favor; but it counts for nothing in the case of figures intended for specialists. (6) Often the usefulness of a new index number may be enhanced without detriment to its special purpose by throwing it into a form directly comparable with that of index numbers already in existence. Then, of course, not only the form of average but also the base period employed in making the existing series has special claims for imitation. (7) Finally, the desirability of making index numbers that can be shifted from one base to another deserves far more consideration than is commonly accorded it. On this count the score is in favor of the geometric mean. If geometric means were invariably used, all index numbers could readily be compared with one another, whatever the bases on which they were originally computed. And that would be a great gain to all students of prices.

No single form of average made from relative prices, then, is without its merits and its defects. Can we not escape the necessity of relying upon any one of them by giving up the use of relative prices and falling back upon aggregates of actual prices?

Index numbers made on this latter plan practically compel the compiler to adopt a systematic scheme of weighting. For the haphazard weighting involved in merely adding up the raw quotations for different commodities in terms of their ordinary commercial units is far more dangerous than the haphazard weighting involved in using the same materials after reduction to relative prices.<sup>1</sup> It is also true that sums in dollars and cents are likely to run in amounts awkward for comparison; but these sums can quickly be turned into a series of relatives on the scale of 100. The same device meets the objection that the introduction of new commodities, necessary at intervals in any large index number that is kept up to date, disturbs a sum of actual prices more than it disturbs an average of relative prices. This statement is valid because the quotations for new commodities, however adjusted, are just so much added to the old sum; while the relative prices of new commodities may be either above or below the old average, and often exercise but a trifling net effect upon its value. But by noting the ratios between the sums of actual money which include and which exclude the new commodities, and by using these ratios to adjust successive aggregates, the compiler

<sup>1</sup> See the example from Hunt's Merchants' Magazine given in subsection 4. However, a very rough system of weights based upon guesswork may give quite as good results as the haphazard weighting of relative prices. Prof. Irving Fisher suggests to the writer a "lazy man's index number," made by adding actual prices for ordinary commercial units, with their decimal points shifted forward or backward, or left unchanged, according to the estimated importance of each article.

meets this difficulty quite as well as if he were averaging relatives from the start.

The technical difficulties attending the construction of index numbers made of actual prices, then, can be surmounted. Offsetting these difficulties are numerous and substantial advantages. Aggregates of money prices weighted according to the importance of the several articles are as easy to understand as arithmetic means of relative prices. They are less laborious to compute than any other form of weighted series, for no relative prices are used; the original quotations are multiplied directly by the physical quantities used as weights, and the products added together. They are not tied to a single base period; but from them relative prices can quickly be made upon the chain system or any fixed base that is desired, and these relative prices themselves can be shifted about at will as readily as geometric means.<sup>1</sup> Hence they are capable of giving direct comparisons between prices on any two dates in which an investigator happens to be interested. Hence, also, they can be compared with any index numbers covering the same years, on whatever base the latter are computed. Their meaning is perfectly definite—which is not always true of medians. They can not be made to give apparently inconsistent results like arithmetic means. When published as sums of money, they can be added, subtracted, multiplied, divided, or averaged in any way that is convenient. When weighted on a sound system, they can not be unduly distorted by a very great advance in the price of a few articles, and yet, unlike medians, they allow every change in the price of every article to influence the result. In fact, they combine most of the merits and few of the defects characteristic of the various methods of averaging relative prices.

<sup>1</sup> The legitimacy of shifting these relatives by the "short" method is best shown by the use of symbols. Let  $p_0, p_x, p_y$  represent the money prices of the two commodities  $p$  and  $p'$  in three years

$p_0, p'_0, p'_y$  in 0,  $x$ , and  $y$ .

Then the sums of these actual prices will be—

$p_0 + p'_0$  in the year 0.

$p_x + p'_x$  in the year  $x$ .

$p_y + p'_y$  in the year  $y$ .

Relative prices in the year  $x$  computed from these sums will be—

$\frac{p_x + p'_x}{p_0 + p'_0}$  on the basis of prices in the year 0, and

$\frac{p_x + p'_x}{p_y + p'_y}$  on the basis of prices in the year  $y$ .

Relative prices in the year  $y$  will be—

$\frac{p_y + p'_y}{p_0 + p'_0}$  on the basis of prices in the year 0.

Now the relative price in the year  $x$ , computed on the basis of prices in the year 0, can be turned into the relative price for the year  $x$  on the basis of prices in the year  $y$ , by dividing the relative for the year  $x$  on the basis of prices in the year 0 by the relative for the year  $y$  on the basis of prices in the year 0. For

$\frac{p_x + p'_x}{p_0 + p'_0} \cdot \frac{p_y + p'_y}{p_0 + p'_0} = \frac{p_x + p'_x}{p_y + p'_y}$

The reason why ordinary arithmetic means of relative prices can not be consistently shifted to another base by this simple method is explained in subsec. 5, p. 32.

But the main issue has still to be faced. Averages of relative prices and aggregates of actual prices are different kinds of things. Which kind do we want in an index number? Do we wish to know how certain sample prices have changed on the average, or do we wish to know how the total cost of a sample bill of goods has changed? This is practically the same question we considered on pages 88 and 89 in discussing how best to average relative prices. And the answer given there is valid here. If our interest really lies in measuring average ratios of change, then geometric means are best. But (1) the unfamiliarity of this average outside technical circles is itself an objection to measuring average changes in an index number designed for wide use, and (2) a measure of change in the money cost of goods probably serves more uses than a measure of average ratios of change in prices. Now, the weighted aggregate of prices is the best measure of change in the money cost of goods; it is better in several ways than the simple arithmetic mean of relative prices, and in addition it has all the merits of the latter form of average. For the relatives which can be computed from these aggregates with little trouble are identical with arithmetic means of relative prices, when the latter are weighted by the money values of the physical quantities used as weights for the corresponding actual prices.

This identity of the variations of a weighted aggregate of actual prices and the arithmetic-mean variations of similarly weighted relative prices can readily be demonstrated. Suppose that we have collected the price quotations and the weights to be used in an index number, and have decided what period to make the base for comparisons. Then if we want an aggregate of actual prices, we merely multiply the quotations of each commodity at each date by the physical quantities used as weights, and add these products. To measure the variations of these aggregates in terms of prices at the base period, we have only to divide the aggregate for each period by the aggregate for the base period. But if we plan to make a weighted arithmetic mean of price variations, we begin by turning the quotations into relative prices. That is, we divide the actual price of each commodity at each date by its price in the base period. Then we weight these relatives, not by physical quantities as in the first case, but by the money values of the physical quantities at the prices of the base year. But in this step the prices of the base year, which were just used as divisors to get relative prices, are used again as factors by which the relative prices are multiplied. Hence our results are the same as if we had neither multiplied nor divided by the prices of the base year; in other words, the same as if we had multiplied the quotations of each commodity in each year by the physical quantities used as weights. But that is just what we did when we set out to make an aggregate of actual prices. So far, then, the two processes

are identical in their outcome. And the remaining steps are also the same. The products must be added, and the sums divided by the physical quantities used as weights times the actual prices of the base year. Therefore, to make relative prices from aggregates of actual prices is a shorter way of getting the same results as are obtained by making similarly weighted arithmetic means of relative prices.<sup>1</sup>

In addition to the advantages peculiar to themselves, then, aggregates of actual prices can readily be given all the advantages claimed for weighted arithmetic means of relative prices. This combination of qualities makes them the most desirable type of general-purpose index numbers.<sup>2</sup>

#### V.—A COMPARISON OF THE LEADING AMERICAN INDEX NUMBERS FOR THE YEARS 1890 TO 1913.

Most of the threads running through the preceding sections can be woven into a comparison of the best-known index numbers currently published in the United States—a comparison having intrinsic interest of its own, as well as making a fitting summary of the introduction to this bulletin. Much repetition of conclusions already stated will be necessary, but repetition makes the essence and the usefulness of summaries.

<sup>1</sup> The explanation given in the text may be put in the form of algebraic formulæ for readers willing to study symbols.

Let  $p_0, p_x$  represent the prices of the commodities from which an index number is to be made in the base year 0 and in some other year designated by the subscript  $x$ .

Let  $q, q',$  and  $q_n$  respectively represent the physical quantities of these commodities to be used as weights.

Then an unweighted arithmetic mean of relative prices is represented by the following formula, in which  $n$  stands for the number of commodities included:

$$\frac{\frac{p_x}{p_0} + \frac{p'_x}{p'_0} + \dots + \frac{p_n}{p_0}}{n}$$

A weighted aggregate of prices reduced to relatives is represented by the following formula:

$$\frac{p_0 q + p'_0 q' + \dots + p_n q_n}{p_0 q + p'_0 q' + \dots + p_n q_n}$$

A weighted arithmetic mean of relative prices is represented by the following formula:

$$\frac{\frac{p_x}{p_0} (q p_0) + \frac{p'_x}{p'_0} (q' p'_0) + \dots + \frac{p_n}{p_0} (q_n p_0)}{p_0 q + p'_0 q' + \dots + p_n q_n}$$

But in the numerator of this fraction,  $p_0, p'_0,$  and  $p_n$  cancel out. Then formula (3) becomes identical with formula (2). That is, the weighted aggregate of prices gives the same results when turned into relatives as the weighted arithmetic mean of relative prices, and gives them with less work.

<sup>2</sup> Because of the disadvantages of calculating index numbers from relatives the Bureau of Labor Statistics has discontinued that method and is now constructing its wage index numbers from weighted averages of money wages, hours of labor index numbers from weighted averages of actual hours worked, and price index numbers from weighted aggregates of money prices. The quantities entering into exchange in the census year 1900 have been taken as the weight for wholesale prices. In making relatives from these aggregates, the fixed base 1890-1899 has been discarded in favor of the last completed year.



## 1. ANALYSIS OF THE SIMILARITIES AND DIFFERENCES.

Seven index numbers are available for the analytical study proposed: Dun's, Bradstreet's, the Annalist's, Gibson's, made from the original list and from the present list of commodities, and two forms of the series compiled by the Bureau of Labor Statistics.

The first step toward comparing index numbers is to throw them into similar form and establish them upon a common base. Both forms of the bureau's series<sup>1</sup> and the Annalist series are arithmetic means of relative prices on the base, average prices in 1890-1899=100. So, likewise, is the first Gibson series, which is made by the writer from the bureau's relative prices for the 50 commodities included in Gibson's original list.<sup>2</sup> These four series accordingly are comparable without more ado.

Not so the remaining three series. Gibson's present index number is a sum (not an average) of relative prices, originally computed on the 1890-1899 basis, but shifted for splicing upon Dun's series as it stood in 1907. This shift was effected by multiplying the sums of relative prices by a number which made the Gibson figures in January, 1907, almost the same as the Dun figures. Hence the Gibson series can be put back on the 1890-1899 basis by dividing the published results by this multiplier.<sup>3</sup> Dun's and Bradstreet's series are sums of actual prices, and accordingly have no base of their own, but may be shifted to any base desired—in this case 1890-1899=100. Dun's figures for this decade average \$84.32. By dividing the published figures by this sum and multiplying the results by 100 we can make a new series strictly comparable with the rest of our material. Shifting Bradstreet's series is less satisfactory, because it does not begin until 1892. The best that can be done is to equate Bradstreet's average for 1892-1899 with the bureau's average for these years—that is, to put \$6.7785=97.1—and then to apply the rule of three.<sup>4</sup>

<sup>1</sup> For the differences between these two forms, see pp. 46 and 47, and footnote.

<sup>2</sup> This list is given in the second footnote on p. 47. The original designer of this series, Dr. J. P. Norton, confined himself to commodities quoted by the bureau, but he changed the form of the bureau's relatives to make them correspond with Dun's figures in 1907. (See the reference in the next footnote.) It is, of course, easy to use his list and the bureau's relatives to make an index number covering the years 1890 to 1913 on the 1890-1899 basis.

<sup>3</sup> This multiplier was obtained from the formula  $\frac{W \times D}{C}$  in which W—the Dun weight for foods, 0.50; D—the average of Dun's results for 1890-1899, namely, \$84.3; and C—the number of foods included in the list, namely, 22. This formula has the value 1.9159. To divide the published results by this multiplier restores the original sums of relative prices. To get arithmetic means instead of sums, we must divide by  $1.9159 \times 22 = 42.14$ . See J. P. Norton, "A revised index number for measuring the rise in prices," *Quarterly Journal of Economics*, August, 1910, vol. 24, pp. 753, 754.

<sup>4</sup> No violence is done by this procedure to Bradstreet's series, but the comparison is not quite satisfactory, because our other series were not worked out on the basis, prices in 1892-1899=97.1, and would probably have shown somewhat different results if they had been. The only way to make a perfect comparison with Bradstreet's figures would be to recompute all the relative prices that enter into the Bureau of Labor Statistics' index number and the other index numbers here derived from it on the basis of 1892-1899=100. In other words, we are here practically applying the short method of shifting a base, which has been shown to involve inaccuracies. See Sec. IV, subsec. 5.

These seven series, then, all in comparable form, are assembled in Table 18.<sup>1</sup> The second and third sections of the table facilitate certain detailed comparisons of greatest interest.

A cursory examination shows that these seven series, made by five independent organizations, have a marked family resemblance—as was found to be the case with the six index numbers made from the Bureau of Labor Statistics data and presented in Table 8. They all say that prices fell heavily in 1890–1896, that prices rose in 1897–1900, that they wavered rather uncertainly in 1901–1904, that they rose sharply again in 1905–1907, and once more in 1908–1913. They all agree that the general level about which these oscillations clustered was distinctly higher in 1910–1913 than in 1900–1910, and higher in 1900–1910 than in 1890–1899. About the major facts of price fluctuations, in short, the testimony from different sources is so unanimous that one can scarcely doubt its validity.

<sup>1</sup> The annual averages, made from the original figures published by Dun, Bradstreet's, and Gibson, run as follows:

Year.	Dun. <sup>a</sup>	Bradstreet's.	Gibson.	Year.	Dun. <sup>a</sup>	Bradstreet's.	Gibson.
1890.....	\$90.9	.....	\$43.4	1905.....	\$100.6	\$8.10	\$47.3
1891.....	92.2	.....	50.8	1906.....	105.3	6.42	49.8
1892.....	90.0	\$7.78	45.3	1907.....	111.8	8.90	50.9
1893.....	92.4	7.53	46.0	1908.....	109.9	8.01	54.2
1894.....	94.7	6.66	43.4	1909.....	117.8	8.53	56.2
1895.....	81.3	6.43	42.0	1910.....	119.2	8.99	59.3
1896.....	76.0	5.91	34.0	1911.....	116.8	8.71	56.9
1897.....	74.0	6.12	34.7	1912.....	124.4	9.19	62.6
1898.....	73.9	6.57	38.7	1913.....	120.9	9.21	58.1
1899.....	82.8	7.21	41.6	1914.....	122.2	.....	.....
1900.....	93.4	7.88	44.2	Averages:			
1901.....	95.9	7.57	44.5	1890-1899.....	84.32	6.78	42.9
1902.....	100.4	7.88	63.5	1900-1909.....	103.43	8.11	61.0
1903.....	99.0	7.94	49.0	1910-1913.....	120.33	9.08	59.2
1904.....	100.2	7.92	48.3				

<sup>a</sup> Mr. Douglas R. Little courteously supplied Dun's figures for 1907–1914 in advance of their publication in Dun's Review.

<sup>b</sup> Average of 1892–1899.

TABLE 18.—A COMPARISON OF THE LEADING AMERICAN INDEX NUMBERS FOR THE YEARS 1890 TO 1913.

Year.	Dun's index number, calculated on base, average prices for 1890-1899 = 100.	Bradstreet's index number, calculated on base, average prices for 1892-1899 = 97.1.	Gibson index number, original list, average prices for 1890-1899 = 100.	Bureau of Labor Statistics' index number, average prices for 1890-1899 = 100.	Revised Bureau of Labor Statistics' index number, <sup>1</sup> average prices for 1890-1899 = 100.	Gibson index number, present form, calculated on base, average prices for 1890-1899 = 100.	Annalist index number, average prices for 1890-1899 = 100.
Number of commodities.....	3107	96	50	242±	145	22	25
1890.....	108	.....	114	113	114	103	* 109
1891.....	109	.....	114	112	113	121	119
1892.....	107	111	105	106	106	108	108
1893.....	110	108	105	100	105	109	110
1894.....	100	96	94	96	96	103	102
1895.....	96	92	94	94	93	100	95
1896.....	90	85	87	90	89	81	* 80
1897.....	88	88	89	90	89	82	84
1898.....	94	94	95	93	93	92	92
1899.....	98	103	103	102	103	99	93
1900.....	111	113	112	111	111	105	* 99
1901.....	114	108	109	109	110	106	105
1902.....	119	113	116	113	114	127	117
1903.....	117	114	115	114	114	116	107
1904.....	119	113	116	112	114	115	109
1905.....	119	116	118	116	116	112	110
1906.....	125	121	123	125	122	118	115
1907.....	133	127	132	130	130	121	120
1908.....	130	115	125	122	121	129	120
1909.....	140	122	132	125	124	141	134
1910.....	141	129	135	130	131	141	* 137
1911.....	139	125	129	128	130	135	* 131
1912.....	148	132	138	130	134	149	* 143
1913.....	143	132	138	130	131	138	* 140
Averages, 1890-1899.....	100	* 97	100	100	100	100	100
1900-1909.....	123	116	120	118	118	119	114
1910-1913.....	143	120	135	129	132	141	138

<sup>1</sup> For explanation of the reasons for and methods of revising the bureau's index number, see pp. 46 and 47.  
<sup>2</sup> As computed by the Annalist. The remaining figures in this column were computed from the Bureau of Labor Statistics' relative prices for the articles on the Annalist list. The results of this computation agree with the Annalist's results except in 1913, when there is a discrepancy—139 as against 140.  
<sup>3</sup> Average of 1892-1899.

THE MAKING AND USING OF INDEX NUMBERS.

TABLE 18.—A COMPARISON OF THE LEADING AMERICAN INDEX NUMBERS FOR THE YEARS 1890 TO 1912—Continued.

Number of points by which the other index numbers were greater (+) or less (-) than the Bureau of Labor Statistics' series, in each year from 1890 to 1913.

Year.	Dun's index number, calculated on base, average prices for 1890-1899 =100.	Bradstreet's index number, calculated on base, average prices for 1892-1899 =97.1.	Gibson index number, original list, average prices for 1890-1899 =100.	Revised Bureau of Labor Statistics' index number, average prices for 1890-1899 =100.	Gibson index number, present form, calculated on base, average prices for 1890-1899 =100.	Annalist index number, average prices for 1890-1899 =100.	Maximum difference between any two index numbers.	Minimum difference between any two index numbers.
1890.....	- 5	.....	+ 1	+ 1	-10	- 4	11	.....
1891.....	- 3	.....	+ 2	+ 1	+ 9	+ 7	12	1
1892.....	+ 1	+ 5	- 1	± 0	+ 2	+ 2	6	.....
1893.....	+ 4	+ 2	- 1	- 1	+ 3	+10	11	.....
1894.....	+ 4	± 0	- 2	± 0	+ 7	+ 6	9	.....
1895.....	+ 2	- 2	± 0	- 1	+ 6	+ 1	8	.....
1896.....	± 0	- 5	- 3	- 1	- 9	-10	10	.....
1897.....	- 2	- 2	- 1	± 1	- 8	- 6	8	.....
1898.....	+ 1	+ 1	+ 2	± 0	- 1	- 1	3	.....
1899.....	- 4	+ 1	+ 1	+ 1	- 3	- 9	10	.....
1900.....	± 0	+ 2	+ 1	± 0	- 6	- 12	14	.....
1901.....	+ 5	- 1	± 0	+ 1	- 3	- 4	9	.....
1902.....	+ 6	± 0	+ 3	+ 1	+14	+ 4	14	.....
1903.....	3	± 0	+ 1	± 0	+ 2	- 7	10	.....
1904.....	+ 6	± 0	+ 3	± 1	+ 2	- 4	10	.....
1905.....	+ 3	± 0	+ 2	± 0	- 4	- 6	9	.....
1906.....	+ 2	- 2	± 0	- 1	- 5	- 8	10	.....
1907.....	+ 3	- 3	+ 2	± 0	- 9	-10	13	.....
1908.....	+ 3	- 7	+ 3	- 1	+ 7	+ 4	15	1
1909.....	+15	- 3	+ 7	- 1	+16	+ 9	19	1
1910.....	+11	- 1	+ 5	+ 1	+11	+ 7	12	.....
1911.....	+13	- 1	+ 3	+ 4	+ 9	+ 5	14	1
1912.....	+18	+ 2	+ 8	+ 4	+19	+13	19	1
1913.....	+13	+ 2	+ 8	+ 1	+ 8	+10	13	.....
Arithmetic sums.....	132	42	60	23	173	159	299	5
Algebraic sums.....	+104	-12	+ 44	+ 9	+ 57	- 3	.....	.....
Average differences computed from the—								
Arithmetic sums.....	5.5	1.9	2.5	1.0	7.2	6.5	11.2	0.2
Algebraic sums.....	+ 4.3	- .5	+ 1.8	+ .4	+ 2.4	- .1	.....	.....
Maximum differences.....	+18	- 7	+ 8	+ 4	+19	+13	19	1
Minimum differences.....	± 0	± 0	± 0	± 0	- 1	+ 1	3	± 0

TABLE 18.—A COMPARISON OF THE LEADING AMERICAN INDEX NUMBERS FOR THE YEARS 1890 TO 1912—Concluded.

Number of points by which each index number rose (+) or fell (-) in each successive year.

Year.	Dun's index number calculated on base, average prices for 1890-1899 = 100.	Bradstreet's index number calculated on base, average prices for 1892-1899 = 97.1.	Gibson index number, original list, average prices for 1890-1899 = 100.	Bureau of Labor Statistics' index number, average prices for 1890-1899 = 100.	Revised Bureau of Labor Statistics' index number, average prices for 1890-1899 = 100.	Gibson index number, present form, calculated on base, average prices for 1890-1899 = 100.	Annalist index number, average prices for 1890-1899 = 100.	Maximum difference between any two index numbers.	Minimum difference between any two index numbers.
Number of commodities.....	310*	96	50	242±	145	22	25		
1890-1891.....	+ 1		± 0	- 1	- 1	+18	+10	19	
1891-1892.....	- 2		- 9	- 6	- 7	-13	-11	11	1
1892-1893.....	+ 2	- 3	± 0	± 0	- 1	+ 1	+ 8	11	
1893-1894.....	-10	-12	-11	-10	- 9	- 6	-14	8	
1894-1895.....	- 4	- 4	± 0	- 2	- 2	- 3	- 7	7	
1895-1896.....	- 6	- 7	- 7	- 4	- 4	- 3	-15	7	
1896-1897.....	- 2	+ 3	+ 2	± 0	± 0	+ 1	+ 4	6	
1897-1898.....	+ 6	+ 6	+ 6	+ 3	+ 4	+10	+ 8	7	
1898-1899.....	+ 4	+ 9	+ 8	+ 9	+10	+ 7	+ 1	9	
1899-1900.....	+13	+10	+ 9	+ 9	+ 8	+ 6	+ 6	7	
1900-1901.....	+ 3	- 5	- 3	- 9	- 1	+ 1	+ 6	11	1
1901-1902.....	+ 5	+ 5	+ 7	+ 4	+ 4	+21	+12	17	
1902-1903.....	- 2	+ 1	- 1	+ 1	± 0	-11	-10	12	
1903-1904.....	+ 2	- 1	+ 1	- 1	± 0	- 1	+ 2	4	
1904-1905.....	± 0	+ 3	- 2	+ 3	+ 2	- 3	+ 1	6	
1905-1906.....	+ 6	+ 5	+ 5	+ 9	+ 6	+ 6	+ 5	2	
1906-1907.....	+ 8	+ 6	+ 9	+ 7	+ 8	+ 3	+ 5	6	
1907-1908.....	- 3	-12	- 7	- 8	- 9	+ 8	+ 6	20	1
1908-1909.....	+10	+ 7	+ 7	+ 3	+ 3	+12	+ 8	9	
1909-1910.....	+ 1	+ 7	+ 3	+ 5	+ 7	± 0	+ 3	7	
1910-1911.....	- 2	- 4	- 6	- 4	- 1	- 6	- 8	5	
1911-1912.....	+ 9	+ 7	+ 9	+ 4	+ 4	+14	+12	10	
1912-1913.....	- 5	± 0	± 0	± 0	- 3	-11	- 3	11	
Net rise (+) or fall (-):									
1890-1896.....	-18	1-26	-27	-23	-25	-22	-20		
1896-1907.....	+43	+42	+45	+40	+41	+40	+40		
1907-1908.....	- 3	-12	- 7	- 8	- 9	+ 8	+ 6		
1908-1912.....	+18	+17	+18	+ 8	+13	+20	+17		
1912-1913.....	- 5	± 0	± 0	± 0	- 3	-11	- 3		
Difference between highest and lowest points.....	60	*47	51	40	45	68	68		
Average change from year to year.....	4.7	*5.6	4.9	4.0	4.1	7.9	7.1		
Net rise in 1890-1913.....	35	*21	24	17	17	35	31		

\* 1892-1896.

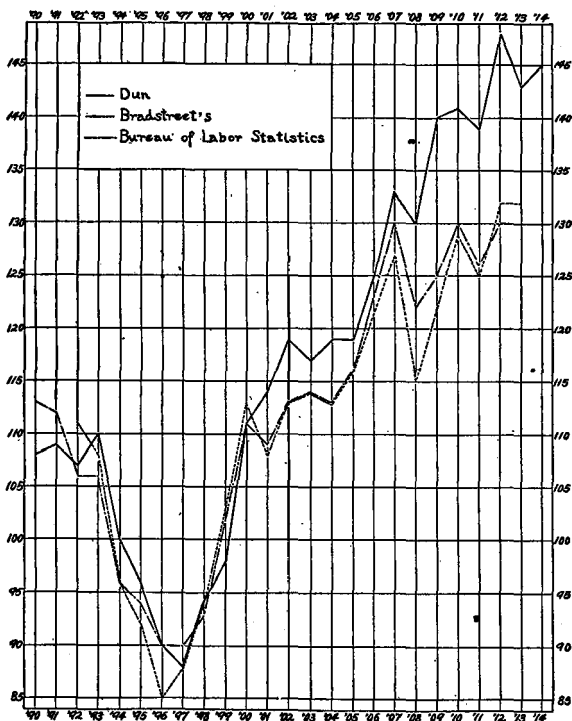
\* 1892-1913.

The man who thinks that index numbers do well if they get within 10 per cent of the truth might be satisfied with this showing. But the man who hopes for three significant digits<sup>1</sup> would be disappointed if he had to accept these seven series as similar in meaning and equal in authority. For the detailed differences among them are neither few nor trifling. Indeed these differences are distinctly greater than those found among the six index numbers made from the bureau's data and presented in Table 8. For example, (1) the net change in the price level between 1890 and 1913 is made twice as great by two series as it is made by two others; (2) the maximum

<sup>1</sup> Or for two significant digits when the index number is less than 100.

difference between any two series for a given year averages over 11 points and varies irregularly between the wide limits of 3 and 19 points; (3) in a year of such decided business character as 1908 two of the series show a rise of 6 to 8 points, while four indicate a fall of

CHART 12.—DUN'S, BRADSTREET'S, AND THE BUREAU OF LABOR STATISTICS' INDEX NUMBERS REDUCED TO A COMMON BASIS. (BASED ON TABLE 18.)



7 to 12 points; (4) indeed the seven series all agree about the direction of price changes in only 12 cases out of 23; (5) regarding the degree of these changes from one year to the next they show discrepancies ranging all the way from 2 to 20 points and averaging nearly

10 points for the whole period; (6) the seven series also differ strikingly in respect to steadiness, the least steady making the average change in prices from one year to the next almost twice as great as the steadiest series makes it; (7) certain of the series reflect changes in business conditions with marked regularity, others are quite unreliable business barometers, etc.

To show that these series differ in many details, however, means little. The significant problem is whether these differences are due to the inherent difficulty of measuring changes in the price level, to the crudity of the general method of measurement in vogue, or to technical differences in the construction of the particular index numbers in question.

The way to attack this problem is shown by the preceding sections. The seven series may be analyzed with respect to the ultimate sources of information drawn upon, the adequacy of the original quotations of each commodity, the numbers and kinds of commodities included, the weights employed, the use made of relative prices, and the kinds of average struck. At each step the question is whether the observed differences among the index numbers accord with the differences found to be characteristic of the various methods considered. If most of the differences can be accounted for in this way, considerable confidence may be felt in the possibility of measuring approximately the variations in prices by index numbers.

The sources of information, the frequency of the quotations, and the forms of average used, are in part so little known and in part so similar that they give us no help in explaining the discrepancies among the results.<sup>1</sup> On the contrary, a marked influence can be

<sup>1</sup> Concerning the sources of information drawn upon by the compilers of Dun's, Bradstreet's, Gibson's, and the *Annalist's* index numbers, the published information is slight. Despite the meager information, however, there seems little reason to doubt that all these authorities use market prices at wholesale. The Bureau of Labor Statistics alone states in full the source of every set of quotations, except those obtained from private houses. The differences among the results therefore can not be ascribed to differences in the nature of the ultimate data.

Dun's Review uses quotations for Jan. 1 and July 1 in the years 1890 to 1900; from 1901 forward it uses quotations on the 1st day of every month. Bradstreet's uses quarterly quotations from 1862 to 1896, and monthly quotations thereafter. The Bureau of Labor Statistics in 1913 secured weekly quotations for 44 commodities and monthly quotations for 208. In 1890-1901, however, it was obliged to content itself with only one quotation a year for 18 commodities and with quarterly quotations for 4 more. (See *Bulletin* No. 39, p. 215, and No. 149, p. 28.) The Gibson index number for 1890-1908 is made from quotations collected by the Bureau of Labor Statistics; from January, 1909, onward it is based upon an independent collection of monthly figures. (See J. P. Norton, "A revised index number for measuring the rise in prices," *Quarterly Journal of Economics*, Aug., 1910, vol. 24, p. 758, note.) As explained above, the index number made from the list of 80 articles originally included by Gibson is compiled throughout from the bureau's data. Finally, the *Annalist* also takes its data from the Bureau of Labor Statistics for earlier years (1890, 1896, 1910, 1911), but seemingly makes an independent compilation by months for 1912, and by weeks for 1913 and 1914. (The *Annalist* figures for 1891-1895, 1897-1899, and 1901-1909 have been filled in by the present writer from computations based upon the bureau's relative prices.) All these authorities, then, have more frequent and therefore more representative quotations for later years. For the earlier years the Bureau of Labor Statistics' collection seems rather the fullest on the whole. But it is not easy to show just how the results are affected by differences in the frequency of quotations.

Also, the form of average used may be set aside as of no moment in explaining the discrepancies among the results. Five of the series are arithmetic means of relative prices. The other two are relative figures based upon sums of actual prices, and of course these sums bear the same ratios to each other as arithmetic means made from them would bear, provided the weights were adjusted to that end. (See pp. 92 and 93.)

traced with confidence to differences in methods of weighting and in the numbers and kinds of commodities included.

Dun's index number is said to be weighted by per capita consumption, and the weights for the separate commodities are so arranged that foods count for 50 per cent of the total, textiles for 18 per cent, minerals for 16 per cent, and other commodities for 16 per cent.<sup>1</sup> Gibson's index number in its present form is also said by the publisher to be weighted according to Dun's method.<sup>2</sup> Bradstreet's series has a curious combination of rational and irrational weights. The rational element consists in the inclusion of several quotations for important articles like pig iron, coal, lumber, and hog products, and only one quotation for articles like lemons, tea, and flax. The irrational element results from the reduction of all the original quotations to prices per pound. On April 1, 1897, these prices per pound ranged from \$0.0008 for soft coal and coke to \$0.52 for quicksilver and \$0.83 for rubber. Recognition of the excessive influence upon the results accorded to these high-priced articles presently led the computers to drop them from the index number; but they seem to have retained articles like alcohol and Australian wool which in 1897 cost \$0.33 and \$0.49 per pound—400 and 600 times as much as soft coal and coke. Haphazard weighting preponderates also in the two series from the Bureau of Labor Statistics, for the representation accorded to different commodities has not been thoroughly worked out on any logical plan. It is true that in the original figures certain highly important articles are represented by two or more series—for instance, coal, iron, cattle, and leather; but so also are certain articles of slight moment, such as window glass, glassware, saws, sheetings, etc.<sup>3</sup> In the two remaining index numbers, the Annalist series and the original form of Gibson's index number, no formal weights are applied; but the lists of commodities have been carefully studied and the most important articles allotted two or three sets of quotations.

The constitution of the seven series with respect to the numbers and kinds of commodities included can best be represented in tabular form. The analysis, given in the next table, can not be applied to Dun's index number for lack of information about the commodities and weights used, and it can not be strictly applied to Gibson's present series because we know the commodities but not the weights allotted each. In the case of Bradstreet's index number the percentages of the total are computed on the basis of the prices per pound of 96 commodities published for April 1, 1897. This basis is not wholly

<sup>1</sup> See J. P. Norton's article in the *Quarterly Journal of Economics*, Aug., 1910, vol. 24, p. 754.

<sup>2</sup> It must be these weights that make Gibson's figures as recomputed from the published index number for Table 18 differ from the series made from Gibson's present list and presented in Table 15. The latter figures are unweighted arithmetic means of the relative prices prepared by the Bureau of Labor Statistics for the 22 articles which Gibson now includes.

<sup>3</sup> Compare pp. 61, 63, and 72, note 3.



satisfactory, because the relative price per pound of different commodities, and therefore their relative influence upon the result, has doubtless changed considerably from year to year. But the error arising from using these figures for a single date is less than the error that would arise if we merely counted the number of Bradstreet's commodities in the several classes.<sup>1</sup> In dealing with the remaining series counting the number of commodities in each class is satisfactory, since there are no weights to be considered aside from the number of forms or products by which each article is represented.

TABLE 19.—ANALYSIS OF THE COMMODITIES INCLUDED IN THE LEADING AMERICAN INDEX NUMBERS.

1. Division into raw, slightly manufactured, and manufactured products.

Index number.	Total number of commodities.	Number of commodities classified as—			Percentage of the total.		
		Raw.	Slightly manufactured.	Manufactured.	Raw.	Slightly manufactured.	Manufactured.
1. Bureau of Labor Statistics, original.....	242	49	26	168	20	10	70
2. Bureau of Labor Statistics, revised.....	145	38	21	88	25	14	61
3. Bradstreet's.....	96	40	22	34	38	29	35
4. Gibson, original.....	59	28	4	26	32	8	40
5. Annalist.....	25	8	5	12	32	20	48
6. Gibson, present.....	22	11	2	9	50	9	41

2. Subdivision of the manufactured and slightly manufactured goods.

Index number.	Number of commodities.	Number of these commodities classified as—			Percentage of the total.		
		Consumers' goods.	Producers' goods.	Both consumers' and producers' goods.	Consumers' goods.	Producers' goods.	Both consumers' and producers' goods.
1. Bureau of Labor Statistics, original.....	198	108	73	12	45	30	6
2. Bureau of Labor Statistics, revised.....	109	51	47	11	35	32	8
3. Bradstreet's.....	54	21	20	5	26	26	12
4. Gibson, original.....	24	11	12	1	22	24	2
5. Annalist.....	17	17	.....	.....	68	.....	.....
6. Gibson, present.....	11	11	.....	.....	50	.....	.....

<sup>1</sup> Bradstreet's now publishes quotations of 106 commodities, bases its index number on quotations of 96, and does not tell which 10 are omitted. Its prices per pound, published for only a short while in 1897, include 98 articles, among them rubber and quicksilver, which are known to have been dropped from the index number at a later date. Accordingly the quotations for the remaining 96 articles have been accepted as the basis of this analysis. Their prices per pound sum up to \$5,9154, whereas Bradstreet's revised index number for this date is \$6.0460—a difference of about 2 per cent.

<sup>2</sup> Percentage of the total weights on Apr. 1, 1897, not of the number of commodities included.

TABLE 19.—ANALYSIS OF THE COMMODITIES INCLUDED IN THE LEADING AMERICAN INDEX NUMBERS—Concluded.

## 3. Subdivision of the raw materials and slightly manufactured goods.

Index number.	Number of commodities.	Number of these commodities classified as—				Percentage of the total.			
		Farm crops.	Animal products.	Forest products.	Mineral products.	Farm crops.	Animal products.	Forest products.	Mineral products.
1. Bureau of Labor Statistics, original.....	74	18	15	12	29	7	6	5	13
2. Bureau of Labor Statistics, revised.....	57	18	10	10	19	12	7	7	13
3. Bradstreet's.....	62	24	15	6	17	14	125	11	15
4. Gibson, original.....	30	10	8	3	9	23	16	6	18
5. Annalist.....	13	6	7			24	22		
6. Gibson, present.....	13	8	5			36	23		

<sup>1</sup> Percentage of the total weights on Apr. 1, 1897, not of the number of commodities included.

What light do these facts about weights and the numbers and kinds of commodities included shed upon the differences among the seven index numbers?

To begin with, the present Gibson and the Annalist index numbers are confined to one kind of commodities—foods, or rather foods and the staples from which foods are prepared. The other index numbers include besides foods an equal or greater number of textile materials and fabrics, minerals, building materials, fuels, drugs, etc. The constitution of the seven series in this respect is as follows:<sup>1</sup>

Index number.	Whole number of commodities.	Number of foods.	Per cent of foods.
1. Bureau of Labor Statistics, original.....	242	58	24
2. Bureau of Labor Statistics, revised.....	145	40	28
3. Bradstreet's.....	96	37	39
4. Gibson, original.....	50	21	42
5. Dun's.....	310 <sup>1</sup>	7	2.3
6. Gibson, present.....	22	22	100
7. Annalist.....	25	25	100

<sup>1</sup> Weights allotted foods. Bradstreet's weights as of Apr. 1, 1897.

Now it has been shown above that food index numbers differ widely and capriciously from miscellaneous-list index numbers,<sup>2</sup> because the prices of agricultural products are largely dependent upon the yield of each season's harvests, while the prices of most other articles are less dependent upon weather conditions than upon the activity or depression of business.<sup>3</sup> Hence, if index numbers are sufficiently accu-

<sup>1</sup> Foods are here taken in the rather liberal sense implied by the present Gibson and the Annalist index numbers. Hence the number of foods credited to the Bureau of Labor Statistics is greater than the number of articles which it so classifies in its own index number.

<sup>2</sup> See pp. 68-70.

rate to charge their very differences with meaning, the seven series under analysis should fall into three groups. (1) The two index numbers composed exclusively of foods should resemble each other rather closely and should differ rather widely from the three series in which foods count for less than a third of the total. (2) These three series, in turn, should resemble each other closely and differ, not only from the food indexes pure and simple, but also, though in less measure, from the two series in which foods count for approximately half of the total. (3) The latter, Dun's index number and the index number made from Gibson's original list, should be hybrids, standing intermediate between the two pure stocks, Dun's inclining rather toward the food index numbers and Gibson's toward the miscellaneous-list group.

These expectations are put to the test in the next table and handsomely realized. The best simple criterion of relationships among the index numbers is the average number of points by which their results differ for each of the 24 years for which data are available. On this basis it appears that the two forms of the Bureau of Labor Statistics' series and Bradstreet's index number come very close together—the greatest average difference is only 2 points. On the other hand, the two food index numbers agree much better with each other than they agree with any of the other series—though the average difference between them is 3.9 points—distinctly larger than the differences among the miscellaneous-list series. Presumably, this greater difference arises from the relatively small number of articles included by both the Annalist and Gibson's present list, 25 and 22, respectively. Finally, it also turns out not only that Dun's index number and the series made from Gibson's original list stand between the two extreme groups, but also that of the two the Gibson series bears a distinctly greater resemblance to the miscellaneous-list group and Dun's index number a rather closer resemblance to the food group.<sup>1</sup>

<sup>1</sup> The influence of the food factor can be traced in the detailed differences among the series as well as in the average differences. For instance, it is the peculiar harvest conditions of 1891, 1893, 1901, and 1908 that force the food index numbers up when the miscellaneous-list series fall because of business depression; and it is harvest conditions of an opposite sort that check the rise of the food index numbers in 1905 and 1910 when the miscellaneous-list series respond buoyantly to the increasing activity of trade. In all of these cases Dun's index number, and in less measure that made from Gibson's original list, move in partial sympathy with the food series. Again, the food index numbers change more from one year to the next than the other series, because raw materials in general and farm crops and animal products in particular are more variable in their prices than manufactured goods and raw mineral and forest products. In addition, their high percentages of raw materials and especially of agricultural products account also for the relatively high levels upon which the food index numbers fluctuate in the later years covered by the tables; for it has been found that these classes of commodities have risen more in price since 1890-1899 than those with which they are contrasted. (See Tables 9 and 10.)

TABLE 20.—DEGREES OF KINSHIP AMONG THE SEVEN AMERICAN INDEX NUMBERS OF TABLE 18 AS SHOWN BY THE AVERAGE NUMBER OF POINTS BY WHICH THEY DIFFER IN THE YEARS 1890 TO 1918.

## 1. Average differences between the original form of the Bureau of Labor Statistics index number and—

	Points.		Points.		Points.
Bureau of Labor Statistics, original.....	1.0	Gibson, original.....	2.5	Annalist.....	6.6
Bradstreet's.....	1.9	Dun's.....	5.5	Gibson, present form....	7.2

## 2. Average differences between the revised form of the Bureau of Labor Statistics index number and—

	Points.		Points.		Points.
Bureau of Labor Statistics, original.....	1.0	Gibson, original.....	2.0	Annalist.....	6.3
Bradstreet's.....	2.0	Dun's.....	5.3	Gibson, present form....	6.8

## 3. Average differences between Bradstreet's index number and—

	Points.		Points.		Points.
Bureau of Labor Statistics, original.....	1.9	Gibson, original.....	3.5	Annalist.....	6.7
Bureau of Labor Statistics, revised.....	2.0	Dun's.....	6.0	Gibson, present form....	7.0

## 4. Average differences between the index number made from Gibson's original list and—

	Points.		Points.		Points.
Bureau of Labor Statistics, original.....	2.5	Dun's.....	4.1	Annalist.....	5.5
Bureau of Labor Statistics, revised.....	2.0			Gibson, present form....	5.9
Bradstreet's.....	3.5				

## 5. Average differences between Dun's index number and—

	Points.		Points.		Points.
Bureau of Labor Statistics, original.....	6.5	Gibson, original.....	4.1	Annalist.....	6.1
Bureau of Labor Statistics, revised.....	5.2			Gibson, present form....	4.5
Bradstreet's.....	6.5				

## 6. Average differences between the Annalist index number and—

	Points.		Points.		Points.
Bureau of Labor Statistics, original.....	6.8	Dun's.....	6.1	Gibson, present form....	3.9
Bureau of Labor Statistics, revised.....	6.3	Gibson, original.....	5.5		
Bradstreet's.....	6.7				

## 7. Average differences between the present form of Gibson's index number and—

	Points.		Points.		Points.
Bureau of Labor Statistics, original.....	7.2	Dun's.....	4.5	Annalist.....	3.9
Bureau of Labor Statistics, revised.....	6.8	Gibson, original.....	5.9		
Bradstreet's.....	7.0				

Gibson's present series, then, and the *Annalist* index number may be set aside as different in kind from the miscellaneous-list series. They do not aim to measure the same thing as the latter, and therefore the wide and frequent discrepancies between the two groups are not disquieting. Quite the contrary, the series differ from the miscellaneous-list series in precisely the ways that the previous sections would lead one to expect. This fact is highly reassuring; for it means that in different parts of the business field there really are general trends among the apparently random variations of prices, and that existing index numbers have measured these divergent trends with approximate accuracy. Otherwise such close consistency would hardly exist among the results.

It is equally reassuring to find that most of the small discrepancies among the three miscellaneous-list series are also consistent with what has already been learned about the price fluctuations of different kinds of commodities. Indeed it is curious that two such dissimilar kinds of weighting as are used in Bradstreet's index and in the two series drawn from the Bureau of Labor Statistics should not have produced wide discrepancies. These three series never contradict one another flatly about the direction in which prices are moving. The nearest approach to disagreement occurs in the five years (1893, 1897, 1903, 1904, and 1913) when one or two fail to change while another moves up or down a trifle. In no year are the two bureau series more than 4 points apart, and their average difference is only 1 point. Similarly, Bradstreet's is never more than 7 points out with the original bureau index, and never more than 6 points out with the revised series. Its average differences from them are 1.9 and 2 points, respectively. Bradstreet's is sometimes above and sometimes below the two bureau series, so that its average differences from them computed from algebraic sums of the plus and minus quantities are only five-tenths and nine-tenths of 1 point, respectively. The corresponding average difference between the two bureau series is four-tenths of 1 point.<sup>1</sup>

<sup>1</sup> It is interesting to compare these differences with those which separate the index numbers worked out above for different parts of the system of prices.

Index number.	Difference.		
	Average.	Maxi- mum.	Mini- mum.
Bureau of Labor Statistics, original, and Bureau of Labor Statistics, revised.....	1.0	4	.....
Bureau of Labor Statistics, original, and Bradstreet's.....	1.9	7	.....
Bureau of Labor Statistics, revised, and Bradstreet's.....	2.0	6	.....
49 raw materials and 193 to 193 manufactured articles.....	5.9	18	1
20 raw materials and 20 of their products.....	9.1	21	.....
5 raw materials and 5 groups of their products.....	14.0	26	.....
Mineral and farm products.....	10.1	31	.....
Mineral and animal products.....	9.0	32	.....
Mineral and forest products.....	16.6	33	.....
Farm and animal products.....	8.9	20	1
Farm and forest products.....	19.6	47	1
Animal and forest products.....	15.8	41	1
Producers' and consumers' goods.....	6.7	19	1

NOTE.—For the figures from which these differences are computed see Tables 18, 9, 10, and 11.

The discrepancies that do occur arise chiefly from the fact that while a given change in business conditions affects all three series in the same way it usually causes a wider fluctuation in Bradstreet's index than in the revised bureau series, and a wider fluctuation in the latter than in the bureau's original series. This difference in steadiness is just what should follow from the constitution of these three index numbers with reference to their proportions of raw materials and manufactured products. To the reader who remembers that raw materials fluctuate much more widely in price than goods manufactured from them, the following schedule tells its own story:

Index number.	Average change from year to year.	Percentage of raw materials.
	<i>Points.</i>	
Bureau of Labor Statistics, original.....	4.0	20
Bureau of Labor Statistics, revised.....	4.1	26
Bradstreet's.....	5.6	36

The only thing that is difficult to explain, indeed, is the general level on which the three index numbers fluctuate in 1900-1913. We should expect Bradstreet's to stand a little higher than the two bureau indexes because of its larger proportion of raw materials and smaller proportion of minerals. In fact it stands a shade lower, and the slight weight it assigns to the rapidly rising prices of forest products seems hardly sufficient to account for this result, since these products count for only 5 and 7 per cent of the totals in the two bureau series.

The preceding comparison of index numbers on the 1890-1899 basis may be supplemented by a similar comparison on the chain basis, that is, prices in the preceding year equal 100. Table 21 supplies chain index numbers for this purpose. Only three of the seven series can be included; for among the relative-price index numbers yearly percentages of rise or fall in price have been computed and averaged only for the official list of the Bureau of Labor Statistics. Of course chain figures can easily be made from the aggregate actual prices given by Bradstreet's and Dun.

In part the results merely show in a slightly different form the differences among the three series brought out by Table 18 and explained in the preceding commentary. It may be noted, however, that the use of a finer scale, including one place in the decimal column, makes the agreement between the bureau's series and Bradstreet's even closer than it has hitherto appeared. In Table 21 these two series invariably agree about the direction in which prices changed from one year to the next, though Bradstreet's index number, maintaining its greater sensitiveness, makes the degree of change rather larger on the average. On the other hand, Dun's series contradicts the other two about the direction of change in 7 years out of 23.

TABLE 21.—CHAIN INDEX NUMBERS.

(Percentage of rise (+) or fall (-) from prices in the preceding year.)

Year.	Chain index numbers made from data supplied by—			Year.	Chain index numbers made from data supplied by—		
	Bureau of Labor Statistics.	Bradstreet's.	Dun.		Bureau of Labor Statistics.	Bradstreet's.	Dun.
1891.....	- 0.2	.....	+ 6.9	1903.....	+ 1.2	+ .8	- 1.4
1892.....	- 4.4	.....	- 7.4	1904.....	- .1	- .2	+ 1.1
1893.....	- 2	- 3.1	+ 2.7	1905.....	+ 2.9	+ 2.3	+ 4
1894.....	- 8.7	-11.2	- 8.4	1906.....	+ 5.8	+ 3.9	+ 4.7
1895.....	- 1.5	- 3.7	- 4.0	1907.....	+ 6.0	+ 5.8	+ 6.1
1896.....	- 2.8	- 3.1	- 6.4	1908.....	- 5.6	-10.1	- 1.8
1897.....	+ .2	+ 3.4	- 2.7	1909.....	+ 3.2	+ 6.3	+ 7.2
1898.....	+ 4.8	+ 7.4	+ 5.6	1910.....	+ 4.1	+ 5.5	+ 1.2
1899.....	+10.4	+ 9.7	+ 5.9	1911.....	- 1.9	- 3.1	- 2.0
1900.....	+ 9.4	+ 9.3	+12.7	1912.....	+ 3.4	+ 5.4	+ 6.5
1901.....	- 1.1	- 3.9	+ 2.7	1913.....	+ 1.2	+ .2	- 2.8
1902.....	+ 4.6	+ 4.0	+ 4.7				

The new point of chief interest in this table is that the chain index numbers differ less than the corresponding series computed on a fixed base. A comparison covering the years 1892-1913 works out as follows:

Index number.	Difference.					
	Average.		Maximum.		Minimum.	
	Fixed-base series.	Chain index number.	Fixed-base series.	Chain index number.	Fixed-base series.	Chain index number.
Bureau of Labor Statistics and Bradstreet's.....	1.9	1.8	7	5	.....	.....
Bureau of Labor Statistics and Dun's.....	5.4	2.5	18	5	.....	.....
Bradstreet's and Dun's.....	6.6	2.8	18	8	.....	.....

For the closer agreement among the chain-index form of these figures there are two reasons, one of them arising from the trend of price fluctuations in the particular period covered, and the other of more general significance. In a majority of the years 1890 to 1913 the price level was higher than its average in 1890-1899. Hence the majority of the year-to-year changes are percentages of a larger number than that upon which the fixed-base relatives are computed. Therefore the percentages are themselves smaller numbers. And of course the differences between smaller numbers are themselves smaller, other things being equal. The second reason has been brought out before. Variations of prices over an interval of only one year are more highly concentrated about a central tendency than variations over an interval of several years.<sup>1</sup> Hence averages made

<sup>1</sup> See pp. 21-23.

from the yearly variations are less likely to be distorted by differences in the samples used than averages made from variations computed on a fixed base.

## 2. CRITICAL VALUATION.

A just evaluation of our seven American index numbers is not easy to make. For a comparison has little meaning unless it deals with all the important points at which the series differ. And since no one series is superior to the others at all points a verdict can not be rendered in a single sentence.

In the publication of actual prices, the Bureau of Labor Statistics and Bradstreet's stand foremost. The contribution they have thus made to the knowledge of prices possesses great and permanent value over and above the value attaching to their index numbers. For, it is well to repeat, all efforts to improve index numbers, all investigations into the causes and consequences of price fluctuations, and all possibility of making our pecuniary institutions better instruments of public welfare depend for their realization in large measure upon the possession of systematic and long-sustained records of actual prices. And much of this invaluable material would be lost if it were not recorded month by month and year by year.

Critical users of statistics justly feel greater confidence in figures which they can test than in figures which they must accept upon faith. Hence the compilers of index numbers who do not publish their original quotations inevitably compromise somewhat the reputation of their series. They compromise this reputation still further when they fail to explain in full just what commodities they include, and just what methods of compilation they adopt.<sup>1</sup> In the latter respect the Annalist index number shares first honors with the Bureau of Labor Statistics' series. Anyone who chooses to take the trouble can find what commodities are used, and how the final results are worked up from the raw material. Bradstreet's index number suffers a bit in comparison because readers are not told which 96 commodities out of the 106 of which prices are published are included in the index number, and because the method of reducing prices by the yard, the dozen, the bushel, the gallon, etc., to prices per pound is not fully explained. Dun's index number is more mysterious still, because neither the list of commodities nor the weights applied to each commodity are disclosed. And Gibson's present series also stands partly in the shadow because, while the list of commodities is known, the publishers state merely that these articles are weighted by Dun's system.

With reference to weighting, Bradstreet's index number takes low rank, for the plan of reducing all quotations to prices per pound grossly misrepresents the relative importance of many articles. That figures

<sup>1</sup> Compare p. 29.



made thus should give results in close agreement with the Bureau of Labor Statistics' series is a remarkable demonstration of the ability of index numbers to extract substantial truth even from unpromising materials. The agreement is all the more remarkable since the bureau's series is also badly weighted, though in a different way and in less degree.<sup>1</sup> The revised bureau series is scarcely better than the original in this respect. It is better in substituting a single set of relatives for the articles of minor importance to which the original accorded several sets (for example, shirtings, sheetings, tools, window glass, etc.), but worse in cutting down the representation accorded to great staples (for example, pork, coal, pig iron, and leather).<sup>2</sup> The Annalist index number follows the sensible, though rudimentary, plan of including two or three varieties of the most important articles, and only one of the less important. The like can be said in favor of Gibson's index number, both in its original and its present form, and in addition Gibson uses the Dun system of weights. The latter system is, in theory, the nearest approach to a satisfactory plan of weighting made by any American index number at present. Whether the practice is as good as the theory is doubtful, to say the least, for anyone familiar with the deficiencies of American statistics of consumption must wonder whence the compilers derived their estimates of the quantities of 310 commodities "annually consumed by each inhabitant." Moreover, what little is known concerning the actual weights is not unobjectionable. Fifty per cent of the total is too large a weight to allow to foods in a wholesale-price series. Even in the great collection of budgets of workmen's families made by the Commissioner of Labor in 1901 the average expenditure for food was less than 45 per cent of total family expenditure;<sup>3</sup> and in wholesale markets, of course, many commodities that are never directly consumed by families have great importance.

Dun's index number is supposed to stand first in number of commodities included, but lack of definite information makes it impossible to judge whether its list is well balanced. The bureau's list also is long and contains samples of many different kinds of goods, manufactured as well as raw, consumed for all sorts of purposes and produced under all sorts of conditions; but the representation accorded to different parts of the whole system of prices is certainly far from equitable. Bradstreet's list, while less than half as long as the bureau's, seems better chosen. It is particularly strong in raw materials and rather weak in manufactured goods. The same remarks apply to Gibson's original list, though it suffers in comparison by

<sup>1</sup> Compare p. 72, note.

<sup>2</sup> See the list of commodities used in this index number, p. 47, footnote.

<sup>3</sup> Eighteenth Annual Report of the Commissioner of Labor, 1903, p. 68. The data represented 25,440 families and 124,106 persons, both natives and immigrants.

being only about half the length of Bradstreet's. Finally, the present Gibson index number and the Annalist series are confined to foodstuffs, and make no pretense of representing prices at large.

In the form of presenting results, Bradstreet's set an admirable example, which was wisely followed by Dun's. Their sums of actual prices can readily be turned into relatives on any base desired, and hence can be made to yield direct comparisons between any two dates. The other series, as averages of relative prices on the 1890-1899 basis, can not be properly shifted without a detailed recomputation of the relative prices of each commodity, and force readers to make all their comparisons in terms of what prices were in the decade used as base.

It is interesting, finally, to test the reliability of the several index numbers as "business barometers." Monthly figures would be much better than our yearly averages for this purpose; but, since they are not to be had for most of the series during most of the period covered, we must do the best we can with the rougher gauge. In 11 of the 23 cases of changes from one year to the next the seven index numbers disagree as to whether prices rose, fell, or remained constant. In the following schedule these 11 years are represented by columns in which each index number is credited with plus one when its change accords with the character of the alteration in business conditions, debited with minus one in cases of disagreement, and marked zero when it recognizes no change in the price level.<sup>1</sup> The net scores made by casting up the plus and minus entries indicate roughly the relative faithfulness with which these series have reflected changes in business conditions in the past. Of the index numbers regularly published, Bradstreet's makes much the best showing. Even the scores against it in 1895 and 1903, and its failure to show the reaction in business conditions in 1913, would be wiped out were the data by quarters and months used in place of the annual averages.

Index number.	1891	1893	1895	1897	1901	1903	1904	1905	1908	1910	1913	Net score.
1. Bradstreet's.....	+1	+1	-1	+1	+1	-1	+1	+1	+1	+1	0	+6
2. Bureau of Labor Statistics, revised.....	+1	+1	-1	0	+1	0	0	+1	+1	+1	+1	+6
3. Gibson, original.....	0	0	0	+1	+1	0	-1	+1	+1	+1	0	+5
4. Bureau of Labor Statistics, original.....	+1	0	-1	0	+1	-1	+1	+1	+1	+1	0	+4
5. Annalist.....	-1	-1	-1	+1	-1	+1	-1	+1	-1	+1	+1	-1
6. Dun's.....	-1	-1	-1	-1	-1	+1	-1	0	+1	+1	+1	-2
7. Gibson, present.....	-1	-1	-1	+1	-1	+1	+1	-1	-1	0	+1	-2

<sup>1</sup> For a description of American business conditions in this period, see W. C. Mitchell, *Business Cycles*, Chapter III (Summary, p. 88).

<sup>2</sup> Based on Bradstreet's original figures for 1890 and 1891, figures which are not used in the index number as currently published.

Each of these seven series, then, has its special uses, its merits, and its defects. Choice among them should be made in accordance with the particular purpose for which an index number happens to be wanted. But it seems feasible to construct an American series which would present a stronger combination of good qualities as a general-purpose index number than any now existing. The original quotations might be collected from the records of the Bureau of Labor Statistics and Bradstreet's, a list of commodities more complete than Bradstreet's and better balanced than the bureau's might be drawn up, the use of actual prices might be adopted from Bradstreet's and Dun's, the several commodities might be weighted by physical quantities after Dun's fashion, but with the use of a criterion more appropriate to wholesale prices, and the whole process of construction might be set forth with the frankness characteristic of the *Annalist* and the bureau. Such a series might differ little from the figures now available; but, however it might turn out, its results would merit greater confidence than can properly be felt in any of the present index numbers as a measure of changes in the general level of wholesale prices.

#### VI.—CONCLUSIONS.

1. Variations in the level of wholesale prices from one year to the next are capable of being measured with a close approximation to accuracy, for these variations are highly concentrated about a central tendency. There are two American chain index numbers which never differ by more than 5.3 per cent, and differ on the average by less than 2 per cent, although they were compiled from start to finish quite independently of each other, based upon dissimilar sets of price variations, constructed by unlike methods, and extended over 22 years of violent fluctuations. Moreover, these moderate differences are not inscrutable results of dependence upon chance for the samples used for analysis, but for the most part arise from known causes, and harmonize with the outcome of investigations into the dissimilarities of variation characteristic of different parts of the system of prices.

2. Variations in prices that have been cumulating through several or many years show much less concentration about a central tendency than variations from one year to the next. Hence, index numbers on a fixed base become less trustworthy the greater the time elapsing between the base period and the year under consideration. Hence, also, most of the entries in a fixed-base series are less trustworthy than chain index numbers with a one-year interval made from the same data. Nevertheless, the discrepancies observed between the two series just referred to (Bradstreet's and the Bureau of Labor Statistics' index numbers) never exceed 7 points in the scale of relative

prices, and average less than 2 points, even when compared in the fixed-base form. And, to repeat, the discrepancies themselves are of the character which an investigator would predict, if he were familiar both with the data used in these two series and with the fluctuations characteristic of various groups of commodities.

3. The choice of methods to be employed in making an index number should be guided by the purpose for which the results are to be used. These purposes are so numerous and so diverse that it is impossible to make a single series well adapted to them all. Probably the time is near when certain uses will be so standardized that several divergent types of index numbers will be regularly compiled to serve the needs of various groups of users. Even now we have special index numbers of the prices of foods, of farm products, of metals, etc. To this list there might well be added a series especially designed to throw changes in business conditions into high relief, and assist in the bettering of business forecasts. Most of the currently published index numbers, however, are what may be called general-purpose series, which undertake to measure changes in the wholesale price level at large.

4. The best form for these general-purpose series is a weighted aggregate of actual prices

5. The more commodities that can be included in such an index number the better, provided that the system of weighting is sound. Certainly, each of the following classes of commodities should be represented, and represented as fully as is feasible: Raw mineral, forest, animal, and farm products; and manufactured products in various stages of elaboration, bought for family consumption and for business use.

6. Probably the best weights to apply are the average physical quantities of the commodities bought and sold over a period of years without reference to the number of times their ownership is changed. These weights should be applied directly to the actual prices of each commodity in making up the totals for the several groups that have been mentioned, and then, if the necessary data can be secured, the totals for the several groups should be weighted again in making up the grand totals for "all commodities."

7. In presenting such an index number, it is well to publish the aggregate actual prices, both for the several groups and for the grand totals. But it is highly desirable to publish also relatives made from these actual prices on a percentage scale, since comparisons can be made more easily from such figures than from the aggregates of actual prices, which are likely to run in awkward quantities. Indeed, several sets of these relatives, computed on the basis of actual prices at different times, can readily be provided for readers interested in

knowing how prices have changed with reference to recent or to past years. Among the relatives of greatest significance is the set which shows the annual percentage of rise or fall as compared with prices in the preceding year. In such chain index numbers it is usually possible to include some commodities for which quotations are lacking in certain of the years covered by the whole investigation.

8. While index numbers are a most convenient concentrated extract of price variations, they are far from being a competent representation of all the facts which they summarize. Most "consumers of statistics" lack the time to go back of the finished products to the data from which they are made. But the increase of knowledge concerning the causes and consequences of price variations depends much more upon intensive study of the ultimate data than upon the manipulation of averages or aggregates. Upon the extension of knowledge in this field depend in turn large issues of public welfare. Hence it is highly important to collect and to publish in full the actual prices of as many commodities as possible, even though some of the quotations may not now be available for use in making an index number.

## PART II.—INDEX NUMBERS OF WHOLESALE PRICES IN THE UNITED STATES AND FOREIGN COUN- TRIES.

### UNITED STATES.

#### INDEX NUMBERS OF THE UNITED STATES BUREAU OF LABOR STA- TISTICS.

##### PUBLICATION.

An index number is published in connection with the reports on wholesale prices issued by the Bureau of Labor Statistics of the United States Department of Labor at Washington. These reports are issued in bulletin form and appear annually.

##### HISTORY.

The publication of this index number was begun in 1902. Prior to that time the Department of Labor, now the Bureau of Labor Statistics, had conducted an inquiry into the course of wholesale prices from 1890 to 1899, the results of which were published in March, 1900.<sup>1</sup> The purpose of this inquiry was to continue, so far as practicable, the investigation made for the Senate Committee on Finance for the years 1840 to 1891 under the direction of Roland P. Falkner, statistician to the committee.<sup>2</sup> In the report of the Department of Labor alluded to, the index numbers appearing in the Senate Finance Committee's report were brought down to 1899, important changes with respect to the base period and the method of weighting being adopted. In 1902, however, when the material for the new report on wholesale prices was being assembled, it was found that many articles included in the report of the Senate Committee on Finance were either no longer manufactured or had ceased to be important factors in the market. On the other hand, a number of articles not shown in that report had become of such importance as to render necessary their inclusion in the new report. These facts necessitated the computation of a new series of index numbers based on the revised list of commodities. It was found, however, that prices of such commodities could be obtained for a period dating back to 1890, so that the new series of index numbers, as published in the 1902 report,<sup>3</sup> covered the 12 years from 1890 to 1901, inclusive. This series has been continued in subsequent wholesale-price reports.

<sup>1</sup> Bulletin of the Department of Labor, No. 27.

<sup>2</sup> Report from the Committee on Finance of the United States Senate on Wholesale Prices, Wages, and Transportation. Mar. 3, 1883. 52d Congress, 2d session, Report No. 1304.

<sup>3</sup> Bulletin of the Department of Labor, No. 39, March, 1902.

## SOURCE OF QUOTATIONS.

The commodities included in the reports have been selected, not only with regard to their representative character, but also with regard to their availability in the future in the continuation of the price record. Standard trade journals, reports of boards of trade, chambers of commerce, produce exchanges, and leading manufacturers or their selling agents are the usual sources from which the price quotations are obtained. It has been the aim to secure the quotations for the various commodities from their primary markets. At present about one-half of the quoted prices are those in the New York market. For grains, live stock, etc., Chicago prices are quoted; for fish, New York and Boston prices; for pig iron, Pittsburgh prices; for tar, Wilmington, N. C., prices; etc. The prices for textiles are those prevailing in the general distributing markets, such as New York, Boston, and Philadelphia; and where no market is mentioned it should be understood that the prices are for the general market.<sup>1</sup>

## BASE PERIOD.

In the compilation of the bureau's index numbers it was recognized that in reducing a series of actual prices to relative prices a base must first be chosen that represents, approximately at least, prices when business conditions are normal. This may be either a single quotation, the average price for one year, or the average for two or more years. If the price for a single year is chosen, it is essential that the year be a normal one, for if prices are high in the year chosen for the base any subsequent fall will be unduly magnified, while on the other hand, if prices are low any subsequent rise will be unduly magnified. For the reason that all commodities probably never present a normal condition as regards prices in any one year, it was decided that an average price for a number of years would better reflect average conditions and form a broader and more satisfactory base than would the price for any single year. The period chosen as this base was that from 1890 to 1899—a period of 10 years. In the cases of a few articles for which prices for the entire 10-year period could not be obtained, the average for such years prior to 1899 as were available was chosen as the base.\*

The relative prices included in the series have been calculated in the usual manner and represent the percentage which each monthly or yearly price is of the average price for the base period 1890-1899. The average price of every article for the base period is represented by 100, and the relative prices for each month or year show the percentage of rise and fall, from month to month or from year to year, of the prices of each single commodity, of each group of commodities, and of all commodities in terms of the average prices in 1890-1899.

<sup>1</sup> Bulletin of the United States Bureau of Labor Statistics, No 146, p. 27.

## PRICES: HOW SHOWN AND COMPUTED.

Weekly prices have been secured in the case of all articles which are subject to frequent fluctuations in price, such as butter, cheese, eggs, grain, live stock, meats, etc. In the case of articles whose prices are more stable, monthly prices have been taken. The majority of the weekly quotations show the price on Tuesday, but if for any reason the price was not obtainable on the particular day stated, the first available price thereafter has been taken. The quotations from trade and other journals, when credited to the first of each month, are not in all instances the price for the exact day stated. The prices are, however, the earliest prices quoted for the month in the journal to which the article is credited.

In many localities the price of bread per loaf is not affected by changes in the price of flour, but the weight of the loaf is changed from time to time. For this reason the relative prices of bread are computed on the price per pound and not per loaf.

The average price for the year is obtained by dividing the sum of the quotations for a given commodity by the number of quotations shown. For example, the sum of the 52 Tuesday prices of cotton for 1913 was \$6.6520. This total divided by 52 gives \$0.12792 as the average price for the year. When a range is shown the mean price for each date is found, and this is used in computing the yearly average as above described. It should be understood that, in order to secure for any commodity a strictly scientific average price for the year, one must know the quantity marketed and the price for which each unit of quantity was sold. It is manifestly impossible to secure such detail, and even if it were possible the labor and cost involved in such a compilation would be prohibitive. It is believed that the method adopted here, which is also that used in the construction of other index numbers, secures results which are quite satisfactory for all practical purposes.<sup>1</sup>

Net cash prices are shown for textiles and all articles whose list prices are subject to large and varying discounts. In the case of a few articles, however, the prices of which are subject to a small discount for cash, no deduction has been made. All rebates have been deducted.

## NUMBER AND CLASS OF COMMODITIES.

In the record of prices from 1890 to 1913, 234 series of quotations have been presented for the entire period and an additional 38 for some portion of the period. The number of commodities included in the report for 1913 was 252, classified as follows: Farm products, 20 articles; food, etc., 54 articles; cloths and clothing, 63 articles; fuel and lighting, 13 articles; metals and implements, 38 articles; lumber and building materials, 28 articles; drugs and chemicals, 9

<sup>1</sup> Bulletin of the United States Bureau of Labor Statistics, No. 149, p. 20.



articles; house-furnishing goods, 14 articles; and miscellaneous, 13 articles. It was recognized by the bureau that, in the computation of an index number of this character, it is important that the greatest care be exercised in the choice of commodities, in order that a simple average of their relative prices shall show a general price level, and it has been the aim to select only important and representative articles in each group. The use of a large number of articles, carefully selected, minimizes the effect on the general price level of an unusual change in the price of any one article or of a few articles.

#### DESCRIPTION AND GROUPING OF COMMODITIES.

The following list, compiled from the 1913 report (pp. 33 to 82), shows the grouping and description of the articles:

##### *Farm products (20 articles).*

Barley: Choice to fancy malting, by samples.

Cattle:

Steers, choice to prime, corn fed.

Steers, good to choice, corn fed.

Corn: Contract grades, cash.

Cotton: Upland, middling.

Flaxseed: No. 1, cash.

Hay: Timothy, No. 1.

Hides: Green, salted, packers', heavy native steers.

Hogs:

Heavy (range of quotations for selected 260 to 300 pounds packing and fair to fancy heavy shipping).

Light (range of quotations for common to choice, light bacon, and fair to fancy selected butcher's).

Hops: New York State, prime to choice.

Horses: Draft, choice to extra.

Mules: Medium to extra (16 hands from January to second week in February, 16 to 16½ hands from third week in February to December).

Oats: Contract grades, cash.

Poultry: Live fowls (by freight), choice.

Rye: No. 2, cash.

Sheep:

Native wethers, poor to prime.

Western wethers, plain to prime.

Tobacco: Burley, dark red, good leaf.

Wheat:

No. 1, northern spring, cash.

No. 2, red winter, cash.

} Prices combined to form 1 series of quotations.

##### *Foods, etc. (54 articles).*

Beans: Medium, choice.

Bread:

Crackers, oyster, puff, in boxes.

Crackers, soda, in boxes, containing 3 dozen each.

Loaf (weight before baking, 16 ounces).

Loaf (weight before baking, 15 to 15½ ounces).

**Butter:**

- Creamery, Elgin.
- Creamery, extra.
- Dairy, New York State, tubs, finest.

**Canned goods:**

- Corn, Republic No. 2, fancy.
- Peas, Republic No. 2, sifted.
- Tomatoes, Arlington, standard, New Jersey, No. 3.
- Cheese: New York State, full cream, large, colored, fancy.
- Coffee: Rio No. 7, Brazil grades.

Eggs: New laid, State, Pennsylvania and near-by, range of hennery and fresh-gathered white.

**Fish:**

- Cod, whole fish, dry, bank, large.
- Herring, pickled, Newfoundland split, large No. 1.
- Mackerel, salt, large No. 3.
- Salmon, canned, Columbia River, 1-pound talls (Chinook fancy).

**Flour:**

- Buckwheat.
- Rye (range, in jute and in wood).
- Wheat, spring patents (range, in sacks and barrels).
- Wheat, winter straights (range, in sacks and barrels).

**Fruit:**

- Apples, evaporated, choice.
- Currants, uncleaned, in barrels.
- Prunes, California, 60s to 70s, in 50-pound boxes.
- Raisins, California, London layer.

Glucose: 42 degrees mixing.

Lard: Prime contract.

**Meal:**

- Corn, fine white.
- Corn, fine yellow.

**Meat:**

- Bacon, rough sides (short rib), smoked, loose.
- Bacon, short clear sides, smoked, loose.
- Beef, fresh, carcass, good native sides.
- Beef, fresh, native sides.
- Beef, salt, extra, mess.
- Hams, smoked, loose.
- Mutton, dressed.
- Pork, salt, mess, old to new.

Milk: Fresh.

Molasses: New Orleans, open kettle.

Poultry: Fresh-killed dressed fowls, western, dry packed, dry picked, fancy, 48 to 55 pounds to the dozen.

Rice: Domestic, choice, head.

Salt: American, medium.

Soda: Bicarbonate of, American.

Spices: Pepper, black, Singapore.

Starch: Corn, for culinary purposes, Sunbeam, 48 1-pound packages in box.

**Sugar:**

- 96 degrees centrifugal.
- Granulated, in barrels.

Tallow.

Tea: Formosa, fine.

Vegetables, fresh:

Cabbage, white (range of domestic-grown cabbage from native and Danish seed).

Onions.

Potatoes, white, ordinary to fancy.

Vinegar: Cider, Monarch, 40-grain, in 45-gallon barrels.

*Cloths and clothing (68 articles).*

Bags: 2-bushel, Amoskeag.

Blankets:

All wool, 11-4, 5 pounds to the pair.

Cotton, 2 pounds to the pair, 54 by 74 inches.

Boots and shoes:

Men's seamless Creedmores (split ties), first quality standard screw or pegged.

Men's vici calf shoes, blucher bal., vici calf top, single sole.

Men's vici kid shoes, Goodyear welt.

Women's solid grain shoes, leather, poliah or polka.

Broadcloths: First quality black, 54-inch, made from XXX wool.

Calico: American standard prints, 64 by 64, 7 yards to the pound.

Carpets:

Brussels, 5-frame, Bigelow.

Wilton, 5-frame, Bigelow.

Cotton flannels:

2½ yards to the pound.

3½ yards to the pound.

Cotton thread: 6-cord, 200-yard spools, J. & P. Coats.

Cotton yarns:

Carded, white, mule-spun, northern, cones, 10/1.

Carded, white, mule-spun, northern, cones, 22/1.

Denims: Amoskeag.

Drillings:

Brown, Pepperell.

30-inch, Massachusetts D standard, 2.85 yards per pound.

Flannels: White, 4-4 Ballard Vale, No. 3.

Ginghams:

Amoskeag.

Lancaster.

Horse blankets: All wool, 6 pounds each.

Hosiery:

Men's cotton half hose, seamless, fast black, 20 to 22 ounce, 160 needles, single thread, carded yarn.

Women's cotton hose, high-spliced heel, double sole, full fashioned, combed peeler yarn.

Women's cotton hose, seamless, 26-ounce, 17½ needles, single thread, carded yarn.

Leather:

Chrome calf, dull or bright finish, B grade (range of prices).

Harness, oak, 17 pounds and up, No. 1.

Sole, hemlock, Buenos Aires and Montevideo, middles, No. 1.

Sole, oak, scoured backs, heavy No. 1.

Linen shoe thread: 10s, Barbour.

Overcoatings:

Covert cloth, all wool, double and twist, 14-ounce.

Soft-faced, black, plain twill, 24-ounce.

Print cloths: 28-inch, 64 by 64.

Sheetings:

- Bleached, 10-4 Pepperell.
- Bleached, 10-4, Wamsutta S. T.
- Brown, 4-4 Indian Head.
- Brown, 4-4, Pepperell R.
- Brown, 4-4 Ware Shoals L. L., 4 yards to the pound.

Shirtings:

- Bleached, 4-4, Fruit of the Loom.
- Bleached, 4-4, Rough Rider.
- Bleached, 36-inch, Lonsdale.
- Bleached, 4-4, Wamsutta  $\frac{X^O}{XX}$ .

Silk:

- Raw, Italian, classical.
- Raw, Japan, Kansai, No. 1.

Suitings:

- Clay worsted, diagonal, 12-ounce, Washington mills.
- Clay worsted, diagonal, 16-ounce, Washington mills.
- Serge, 11-ounce, Fulton mills, 3192.
- Wool dyed blue, 55-56 inch, 15-ounce.

Tickings: Amoskeag, A.C.A.

Trouserings: Fancy worsted, worsted warp and filling, worsted back, 16½ to 17½ ounce.

Underwear.

- Shirts and drawers, merino, natural color, full-fashioned, 50 per cent wool, 24-gauge.
- Union suits, merino, natural color, 40 per cent wool, circular, 24-gauge, light weight.

Women's dress goods:

- Cashmere, all wool, 8-9 twill, 35-inch, Atlantic Mills, 3602.
- Cashmere, cotton warp, 9-twill, 4-4, Atlantic Mills, F.
- Cashmere, cotton warp, 4-4, Hamilton.
- Panama cloth, all wool, 54-inch.
- Poplar cloth, cotton warp and worsted filling, 4-4.
- Sicilian cloth, cotton warp, 50-inch.

Wool:

- Ohio, fine fleece (X and XX grade), scoured.
- Ohio, medium fleece (one-fourth and three-eighths grade), scoured.

Worsted yarns:

- 2-40s, Australian fine.
- 2-32s, crossbred stock, white, in skeins.

*Fuel and lighting (13 articles).*

Candles: Adamantine, 6s, 14-ounce.

Coal:

- Anthracite, broken.
- Anthracite, chestnut.
- Anthracite, egg.
- Anthracite, stove.
- Bituminous, Georges Creek, at the mine.
- Bituminous, Georges Creek, f. o. b. New York harbor.
- Bituminous, Pittsburgh (Youghiogheny), lump.

Coke: Connellsville, furnace.

Matches: Globe, No. 1, in cases.

## Petroleum:

Crude.

Refined, for export, in barrels, cargo lots, S. W., 110 degrees fire test.

Refined 150 degrees fire test, water-white, in barrels (jobbing lots).

*Metals and implements (38 articles).*

Augers: Extra, 1-inch.

Axes: Essex, pattern handled.

Bar iron:

Best refined.

Common to best refined, from mill.

Barb wire: Galvanized.

Butts: Loose pin, wrought steel, 3½ by 3½ inches.

Chisels: Extra, socket firmer, 1-inch.

Copper:

Ingot, electrolytic.

Sheet, hot-rolled (base sizes).

Wire, bare, No. 8, B. &amp; S. gauge and heavier (base sizes).

Door knobs: Steel, bronze-plated.

Files: 8-inch mill bastard, Nicholson.

Hammers: Maydole, No. 1½.

Lead: Pig, desilverized.

Lead pipe.

Locks: Common mortise, knob lock, 3½-inch.

Nails:

Cut, 8-penny, fence and common.

Wire, 8-penny, fence and common.

Pig iron:

Bessemer.

Foundry No. 1.

Foundry No. 2, northern.

Gray forge, southern, coke.

Planes: Sargent 414, jack plane.

Quicksilver: Jobbing lots.

Saws:

Cross-cut, Disston No. 2, 6-foot, Champion tooth.

Hand, Disston No. 7, 26-inch.

Shovels: Ames, No. 2, cast-steel, long-handle, round-point, back-strap, black.

Silver: Bar, fine.

Spelter (pig zinc): Western.

Steel billets.

Steel rails.

Steel sheets: Black, No. 27, box annealed, cold-rolled, United States standard.

Tin: Pig.

Tin plate, coke.

Trowels: Johnson's, brick, 10½-inch.

Vises: Solid box, 50-pound.

Wood screws: 1-inch, No. 10, flathead.

Zinc: Sheet, ordinary numbers and sizes, packed in 600-pound casks.

*Lumber and building materials (28 articles).*

Brick: Common red, domestic building.

Carbonate of lead: American, in oil.

## Cement:

Portland, domestic.  
Rosendale.

Doors: Western white-pine, 2 feet 8 inches by 6 feet 8 inches, 1 $\frac{3}{4}$  inches thick, 4-panel No. 2 O. G.

Hemlock: Base price, Pennsylvania and West Virginia stock.

Lime: Rockport, common.

Linseed oil: Raw, in barrels.

Maple: Hard and soft, 1-inch (4-4), firsts and seconds.

## Oak:

White, plain, mixed, rock, mountain or West Virginia stock, 1-inch (4-4) firsts and seconds.

White, quartered, Indiana, firsts and seconds, 6 inches and up wide, 10 to 16 feet long.

Oxide of zinc: American, extra dry.

## Pine:

White, boards, No. 2 barn, 10 inches wide, rough.

White, boards, upper, 1-inch (4-4), rough or dressed.

Yellow, flooring, long-leaf, B, heart-face, rift sawn, 1 $\frac{1}{4}$  by 2 $\frac{1}{2}$ -face (counted 1 by 3), D. & M.

Yellow, siding, long-leaf, boards, heart-face, 1-inch and 1 $\frac{1}{4}$ -inch.

## Plate glass:

Polished, glazing, area 5 to 10 square feet.

Polished, glazing, area 3 to 5 square feet.

Poplar: Yellow, 1-inch, firsts and seconds, 7 to 17 inches and up wide, rough.

Putty: Commercial (bulk).

Rosin: Common to good, strained.

## Shingles:

Cypress, best all heart, 5 inches wide, 16 inches long.

Red cedar, clear, random width, 16 inches long.

Spruce: 6 to 9 inch, cargoes, eastern.

Tar: Pine.

Turpentine: Spirits of, southern, barrels.

## Window glass:

American, single, AA, 25-inch.

American, single, B, 25-inch.

*Drugs and chemicals (9 articles).*

## Alcohol:

Grain, 190 proof, U. S. P.

Wood, refined, 95 per cent.

## Alum: Lump.

Brimstone: Crude, domestic.

Glycerin: Refined, chemically pure, in bulk.

Muriatic acid: 20 degrees.

Opium: Natural, in cases.

Quinine: American, in 100-ounce tins.

Sulphuric acid: 66 degrees.

*House-furnishing goods (14 articles).*

## Earthenware:

Plates, cream-colored, 7-inch.

Plates, white granite, 7-inch.

Teacups and saucers, white granite, with handles.

## Furniture:

- Bedroom sets, 3 pieces, iron bedstead, hardwood dresser and washstand.
- Chairs, bedroom, maple, cane seat.
- Chairs, kitchen, common spindle.
- Tables, kitchen, 3 $\frac{1}{2}$ -foot.

## Glassware:

- Nappies, 4-inch, common.
- Pitchers, one-half gallon, common.
- Tumblers, table, one-third pint, common.

## Table cutlery:

- Carvers, stag handles, No. 016, 8-inch.
- Knives and forks, cocobolo handles, metal bolsters, No. 210.

## Woodenware:

- Pails, oak-grained, 3-hoop, wire ears.
- Tubs, oak-grained, 3 in nest, C, 19, 21, and 23 inches in diameter.

*Miscellaneous (13 articles).*

- Cottonseed meal.
- Cottonseed oil: Prime, summer, yellow.
- Jute: Raw M-double triangle, shipment, medium grades.
- Malt: Western grade, standard.
- Paper:
  - News, wood, roll, contract.
  - Manila, wrapping, No. 1 jute.
- Proof spirit: Finished goods basis (whisky).
- Rope: Pure manila (base sizes,  $\frac{1}{8}$ -inch and larger to Mar. 10; thereafter  $\frac{1}{4}$ -inch and larger, three-strand).
- Rubber: Para Island, fine.
- Soap: Castile, mottled, pure.
- Starch: Laundry, 50-pound boxes, in bulk.
- Tobacco:
  - Plug, Climax, 12 pieces to the pound.
  - Smoking, granulated, Seal of North Carolina, 1-ounce bags.

## SUBSTITUTIONS AND ADDITIONS.

Since the issuance of the first wholesale price report covering the years 1890 to 1901 a number of changes have been made necessary in the character of the articles included. Certain articles no longer commercially important or for which satisfactory price quotations could no longer be obtained have had to be discontinued and other articles substituted therefor. Thus material changes in the description of 3 articles became necessary in 1902, of 2 articles in 1903, of 1 article in 1904, of 4 articles in 1905, of 6 articles in 1906, of 3 articles in 1907, of 19 articles in 1908, of 1 article in 1909, of 2 articles in 1910, of 4 articles in 1911, of 4 articles in 1912, and of 16 articles in 1913. For 7 of these articles the trade journals no longer supply satisfactory quotations; the manufacture of the particular grade of 15 previously quoted has been discontinued by the establishments heretofore furnishing quotations, and for 43 articles the substituted descriptions more nearly represent the present demands of the trade. In making these substitutions articles were supplied corresponding as closely as possible to those which were previously used.

In explanation of the method adopted for computing the relative prices of articles substituted for others the statement is made in the report for 1913 (p. 31) that in any year where it was found necessary to introduce an article to replace another the relative price assigned to the new article for that year was identical with the relative price already ascertained for its predecessor in the same year. In other words, it is assumed that if the price of a commodity in any year, as represented by the price of a particular grade of the commodity in question, be correctly expressed by the relative number assigned it, then its price in the same year may continue to be expressed by assigning this same relative number to a new grade of the commodity when substituted for the former grade.

In 1908 a number of articles (11) were added to the list of those previously included. For such articles no relative price based on the 1890-1899 period could be computed, owing to the impossibility of obtaining satisfactory prices for those years. However, it was deemed necessary to include these new commodities in the several group relatives for 1908. This was accomplished by dividing the 1908 price of each article in the group, both old and new, by its 1907 price and then computing the simple average of the percentages thus obtained. This last result, which represents the group index for 1908 expressed as a percentage of the 1907 group index, was then multiplied by the relative price of the group in 1907 to produce the group relative for 1908. Similarly, in succeeding years, the relative prices for individual articles in the current year, computed on the prices of the preceding year as a base, have been averaged and the result multiplied by the group relative for the preceding year to give the corresponding group relative for the current year. The general index number for all commodities in 1908 and in subsequent years has been computed in the same manner as explained above.

#### INTERPOLATION.

Prices have not been interpolated for periods when price quotations were lacking for any of the commodities for which index numbers have been computed, although whenever new commodities have been introduced or substituted for other commodities, the assumption is tacitly made that the price of the newly introduced article has changed by the same percentage as the group as a whole and that the price of every substituted commodity has varied exactly as the price of the old article varied up to the time when the substitution was made.

#### WEIGHTING.

In compiling the present series of index numbers weighting in its technical sense has not been attempted. Instead, it has been thought best to use simply a large number of representative staple articles, selecting them in such a manner as to make them, to a large



extent, weight themselves. Upon a casual examination it may seem that by this method a comparatively unimportant commodity—such, for instance, as tea—is given the same weight or importance as one of the more important commodities, such as wheat. A closer examination, however, will disclose the fact that tea enters into no other commodity under consideration, while wheat is quoted in the raw state and enters into the two descriptions of wheat flour, the two descriptions of crackers, and the two descriptions of loaf bread. This method is the one employed by Mr. Sauerbeck in his compilation of English prices.

## TESTING.

No formal comparison of the index number compiled by the Bureau of Labor Statistics with other index numbers has been made in any of the wholesale-price reports. Great care is exercised in the selection and compilation of the data on which the index is based and the percentage changes in prices recorded are therefore quite accurate.

## TABLES OF RESULTS.

The following table, which has been reproduced from the 1913 report,<sup>1</sup> shows the movement in wholesale prices for the period from 1890 to 1913 in each of the nine principal groups of commodities and the monthly variations from January to December, 1913:

RELATIVE PRICES OF COMMODITIES, BY GROUPS, 1890 TO 1913, AND JANUARY TO DECEMBER, 1913.

(Base period, 1890-1899=100.)

Year.	Farm products.	Food, etc.	Cloths and clothing.	Fuel and lighting.	Metals and implements.	Lumber and building materials.	Drugs and chemicals.	Household goods.	Miscellaneous.	All commodities.
1890.....	110.0	112.4	113.5	104.7	119.2	111.0	110.2	111.1	110.3	112.9
1891.....	121.5	115.7	111.3	102.7	111.7	108.4	103.6	110.2	109.4	111.7
1892.....	111.7	103.6	108.0	101.1	106.0	102.8	102.9	108.5	106.2	106.1
1893.....	107.0	110.2	107.2	100.0	100.7	101.9	100.5	104.9	106.9	105.6
1894.....	95.9	99.8	95.1	92.4	90.7	96.3	89.8	100.1	98.8	96.1
1895.....	93.3	94.6	92.7	98.1	92.0	94.1	87.9	96.5	94.5	93.6
1896.....	78.3	83.8	91.3	104.3	93.7	93.4	92.6	94.0	91.4	90.4
1897.....	85.2	87.7	91.1	96.4	86.5	90.4	94.4	89.8	92.1	89.7
1898.....	95.1	94.4	93.4	95.4	86.4	86.8	100.6	92.0	92.4	93.4
1899.....	100.0	98.3	96.7	105.0	114.7	108.8	111.3	95.1	97.7	101.7
1900.....	109.5	104.2	106.8	120.9	120.5	115.7	115.7	106.1	109.8	110.5
1901.....	116.0	105.9	101.0	119.5	111.9	115.7	115.2	110.9	107.4	108.5
1902.....	130.5	111.8	102.0	134.3	117.2	118.8	114.2	112.2	114.1	112.9
1903.....	118.8	107.1	106.6	149.3	117.6	121.4	112.6	113.0	113.6	113.6
1904.....	120.2	107.2	109.8	132.6	109.6	122.7	110.0	111.7	111.7	113.0
1905.....	124.2	108.7	112.0	128.8	122.5	127.7	100.1	109.1	112.8	115.9
1906.....	123.6	112.0	120.0	131.9	135.2	140.1	101.2	111.0	121.1	122.5
1907.....	137.1	117.8	126.7	135.0	143.4	146.9	109.6	118.5	127.1	129.5
1908.....	133.1	120.6	116.9	130.8	126.4	133.1	110.4	114.0	119.9	122.8
1909.....	153.1	124.7	119.6	129.3	124.8	138.4	112.4	111.7	126.0	126.5
1910.....	164.6	128.7	123.7	126.4	128.5	153.2	117.0	111.6	133.1	131.6
1911.....	162.0	131.3	119.6	122.4	119.4	151.4	120.3	111.1	131.2	129.2
1912.....	171.8	139.5	120.7	135.9	126.1	148.2	122.9	113.7	135.2	133.6
1913.....	165.8	137.1	123.7	143.2	127.5	151.8	124.1	118.1	137.1	136.2

<sup>1</sup> Bulletin of the United States Bureau of Labor Statistics, No. 149, p. 11.

RELATIVE PRICES OF COMMODITIES, BY GROUPS, 1890 TO 1913, AND JANUARY TO DECEMBER, 1913—Concluded.

Year.	Farm products.	Food, etc.	Cloths and clothing.	Fuel and lighting.	Metals and imple-ments.	Lumber and building materials.	Drugs and chemi-cals.	House-furnish-ing goods.	Miscel-laneous.	All com-mo-dities.
<b>1913.</b>										
January ..	160.4	132.7	124.2	144.3	132.8	153.1	123.0	117.5	134.9	134.9
February ..	162.3	133.1	124.7	144.3	132.1	154.1	124.1	117.5	134.5	135.3
March .....	166.3	132.4	124.7	142.8	130.4	154.8	125.5	118.3	134.3	135.1
April .....	157.8	132.9	124.6	138.9	129.4	154.7	124.5	118.3	135.5	135.0
May .....	163.1	132.5	124.1	138.5	129.1	153.2	124.9	118.3	135.6	134.3
June .....	162.7	133.4	123.6	139.9	127.7	152.3	124.7	118.3	136.4	134.1
July .....	162.7	135.4	123.7	141.0	126.1	151.2	123.5	118.3	138.6	134.3
August .....	154.6	136.4	122.9	142.7	126.2	150.3	123.1	118.3	138.7	134.4
September ..	168.6	141.2	123.5	143.9	126.7	150.7	123.7	118.3	140.3	136.1
October .....	168.9	144.1	123.5	143.2	125.5	148.9	124.7	118.3	139.6	136.3
November .....	166.7	143.3	123.7	142.7	123.3	148.0	124.6	118.3	138.8	135.8
December .....	171.8	144.6	123.2	143.6	120.5	149.7	124.8	118.3	137.6	135.7

In order to follow the movement in the two great classes of commodities—raw and manufactured—the following table, which shows the relative prices by years, 1890 to 1913, and by months, January to December, 1913, has been prepared:<sup>1</sup>

RELATIVE PRICES OF RAW AND MANUFACTURED COMMODITIES, BY YEARS, 1890 TO 1913, AND BY MONTHS, JANUARY TO DECEMBER, 1913.

(Base period, 1890-1899=100.)

Year or month.	Raw com-mo-dities.	Manufac-tured com-mo-dities.	All com-mo-dities.
1890.....	115.0	112.3	112.9
1891.....	116.3	110.6	111.7
1892.....	107.9	105.6	106.1
1893.....	104.4	105.9	105.6
1894.....	93.2	96.8	96.1
1895.....	91.7	94.0	93.6
1896.....	84.0	91.9	90.4
1897.....	87.6	90.1	89.7
1898.....	94.0	93.3	93.4
1899.....	105.9	100.7	101.7
1900.....	111.9	110.2	110.5
1901.....	111.4	107.8	108.5
1902.....	122.4	110.6	112.9
1903.....	122.7	111.5	113.6
1904.....	119.7	111.3	113.0
1905.....	121.2	114.6	115.9
1906.....	126.5	121.6	122.5
1907.....	133.4	126.6	129.5
1908.....	126.5	122.2	122.8
1909.....	136.8	123.9	136.5
1910.....	139.7	126.6	131.6
1911.....	139.9	126.6	136.2
1912.....	149.5	129.7	133.6
1913.....	147.8	132.0	135.2
<b>1913.</b>			
January.....	145.2	132.4	134.9
February.....	145.6	132.7	135.3
March.....	145.4	132.0	135.1
April.....	143.7	132.8	135.0
May.....	143.6	131.9	134.3
June.....	143.0	131.8	134.1
July.....	144.2	131.8	134.3
August.....	146.5	131.5	134.4
September.....	153.2	131.9	136.1
October.....	155.2	131.7	136.3
November.....	154.1	131.3	135.8
December.....	154.4	131.1	135.7

<sup>1</sup> Bulletin of the United States Bureau of Labor Statistics, No. 149, pp. 13 and 14.

INDEX NUMBERS OF THE UNITED STATES SENATE COMMITTEE ON FINANCE.<sup>1</sup>

## PUBLICATION.

The Committee on Finance of the United States Senate published in 1893 an exhaustive report in which the course of wholesale prices in the United States was shown by means of index numbers for the 52-year period from 1840 to 1891. The report was of a special character, involving an extensive research, and the price data contained therein have not been continued except in a modified form for subsequent years.

## HISTORY.

A Senate resolution of March 3, 1891, authorized the Committee on Finance "to ascertain in every practicable way, and to report from time to time to the Senate, the effect of the tariff laws upon the imports and exports, the growth, development, production, and prices of agricultural and manufactured articles at home and abroad." Pursuant to this resolution the committee undertook to ascertain through accurate and adequate statistics of prices and wages the changes which had taken place in the condition, as shown by the relative purchasing power of their earnings, of the great mass of people in the country for the preceding 50 years. The report of the committee submitted on March 3, 1893, contained a mass of statistics relating to wholesale prices compiled by the statistician of the committee, Roland P. Falkner. (See Report on Wholesale Prices, Wages, and Transportation, Part 1, Appendix A.)

A continuation of this series of prices has been published in Bulletin No. 27 issued by the United States Department of Labor (now the Bureau of Labor Statistics) bringing the data down to 1899. In this latter series, however, two important changes of method were introduced. The first was in adopting as a basis the average price for the nine quarters—January, 1890, to January, 1892, inclusive—in place of the single-date basis, and the second in departing from the simple average method of allowing to each article equal weight, and instead combining the index numbers of similar articles to form one index number, to be used as one article only in calculating the index numbers for groups and for all commodities.

Another presentation of the data for the years 1860–1880 in somewhat different form (by quarters) is contained in "Gold Prices and Wages under the Greenback Standard," by Wesley C. Mitchell.<sup>2</sup>

## SOURCE OF QUOTATIONS.

The wholesale price quotations included in the report were collected mainly by the United States Department of Labor through its corps of agents and experts. In some cases experts employed

<sup>1</sup> Report from the Committee on Finance of the United States Senate on Wholesale Prices, Wages and Transportation. Mar. 3, 1893. 52d Congress, 2d session, Report No. 1394.

<sup>2</sup> University of California Publications in Economics, vol. 1, Mar. 27, 1908.

directly by the committee furnished the data for the tabulation. As a rule, the prices were obtained first hand; that is, from records of actual sales. In the selection of articles for quotations the committee frequently consulted the representatives of leading industries.

"The greatest care was exercised to secure absolutely accurate statements, and the books of merchants and manufacturers were ransacked in order to obtain figures worthy of every confidence."<sup>1</sup>

#### BASE PERIOD.

It is explained that the year 1840 was not used as a base because a statement based on that year "would have rendered comparatively useless for purposes of comparison all the articles the quotations for which begin later than 1840."<sup>2</sup> For this reason the year 1860, which would include most of the figures presented, was considered preferable. Moreover, it was believed that "the year 1860 represents a period in our industrial development midway between the older methods of production that prevailed before the war and those which have come into use since that period. It is also a period of comparatively normal prices. The markets of the country had recovered from the crisis of 1857 and the disturbances of trade caused by the war had not yet taken place."<sup>3</sup>

Also, a single year, 1860, rather than the average for a period of years, was taken because "it was not always practicable to secure for the articles in question the average prices that would have covered the period immediately prior to 1860, while in the following year some prices already manifested the disturbances due to the unsettled state of national affairs"; 1860 possessed all the aspects of a normal year. "Its price varies little from that of 1859 or of 1858 on the one hand and of 1861 on the other. It is therefore quite as proper a basis of comparison as would be an average of these four years."<sup>4</sup>

#### PRICES: HOW SHOWN AND COMPUTED.

As a rule the prices used were actual prices obtained at certain dates. In a few cases average prices for the year were used, when such prices were considered representative. The index numbers were calculated on the basis of the January prices in each year where the prices were quoted by quarters. An exception was made to this rule in the cases of those articles for which the January price was not the representative price for the year, as for fresh vegetables, in which cases the most appropriate month was selected.

#### NUMBER AND CLASS OF COMMODITIES.

In all there were 230 series of quotations presented, covering the prices not only of food products and raw materials but also of a very

<sup>1</sup> Report from the Committee on Finance of the United States Senate on Wholesale Prices, Wages, and Transportation, Pt. I, p. 29.

<sup>2</sup> *Idem*, p. 28.

large number of manufactured articles. While all series of quotations did not cover the entire period, owing to the difficulty of obtaining for the earlier years prices of articles in use during the later years, prices for 85 articles quoted in 1891 were secured as far back as 1840, and for 223 articles as far back as 1860. Those articles which are articles of luxury only and whose price had increased so immoderately that they could not be said to enter into consumption in the same degree as formerly were omitted.

DESCRIPTION AND GROUPING OF COMMODITIES.

The 223 articles were grouped as follows:

- Food (53).
- Cloths and clothing (28).
- Fuel and lighting (10).
- Metals and implements (54).
- Lumber and building materials (35).
- Drugs and chemicals (18).
- House-furnishing goods (15).
- Miscellaneous (10).

Following is an enumeration of the articles appearing on pages 30 to 52 of Part I of the report:

*Food.*

Beans.

Bread:

- A ship bread.
- B ship bread.
- Boston crackers (two quotations).
- Navy ship bread.
- Oyster crackers.
- Ship biscuits.
- Soda crackers.

Butter.

Cheese.

Coffee, Rio, fair.

Eggs.

Fish:

- Cod.
- Mackerel, salt, shore, No. 1.
- Mackerel, salt, shore, No. 2.
- Mackerel, salt, shore, No. 3.

Flour, wheat.

Flour, rye.

Fruit:

- Apples, dried.
- Currants, Zante.
- Raisins.

Lard.

Lard, pure leaf.

Meal, corn, yellow, kiln-dried.

## Meat:

Bacon, clear.  
 Beef, loins.  
 Beef, salt, mess.  
 Beef, ribs.  
 Ham, sugar-cured.  
 Lamb.  
 Mutton.  
 Pork, salt, mess.

## Milk, fresh.

## Molasses:

New Orleans, prime.  
 Porto Rico, best.

## Rice, Carolina, prime.

## Salt:

Ashton's.  
 Ashton's Liverpool, fine.  
 Coarse, solar.  
 Fine, boiled.  
 Turk's Island.

## Spices:

Nutmegs.  
 Pepper, whole, Sumatra.

## Starch, corn (two quotations).

## Sugar:

Brown.  
 Cut.  
 Fair refining.  
 Refined, crushed, and granulated.

## Tallow, prime, city, in hogheads.

## Vegetables:

Fresh, potatoes, white (two quotations).

*Cloths and clothing.*

## Blankets, 11-4, 5 pounds to the pair:

Cotton warp, cotton and wool filling.  
 Cotton warp, all-wool filling.

## Broadcloths:

First quality, black, 54-inch, made from XXX wool.  
 Second quality, black, 54-inch, made from XX wool.

## Calico, Cocheco prints.

## Carpets:

Brussels, 5-frame, Bigelow.  
 Ingrain, 2-ply, Lowell.  
 Wilton, 5-frame, Bigelow.

## Cassimeres, all-wool:

3-4, 7-ounce, Harris double and twist.  
 3-4, 12-ounce, Harris double and twist.  
 3-4, 12-ounce, Harris silk mixed.  
 Fancy, 3-4, light weight.

## Checks, black and white, all-wool, 3-4, 7-ounce, Harris.

## Cotton, upland, middling.

Denims, Amoskeag.  
 Drilling, 30-inch, Pepperell.  
 Hides, dry, Buenos Aires.  
 Horse blankets, 6 pounds, all-wool.  
 Leather, harness.  
 Print cloths:  
     28-inch, 64 by 64, Metacomet.  
     28-inch, 7 yards to the pound, standard.  
 Shawls, standard, 72 by 144 inches, weighing 42 ounces, made of XX Ohio fleece wool.  
 Sheetings, brown, 4-4, Atlantic A.  
 Shirtings, bleaches, 4-4, New York mills.  
 Sole leather, first quality, medium weight, Buenos Aires.  
 Tickings, Amoskeag, A. C. A.  
 Wool, Ohio, medium fleece, scoured.  
 Wool, Ohio, fine fleece, scoured.

*Fuel and lighting.*

Candles, best adamantine.

Coal, anthracite:

    Chestnut.  
     Egg.  
     F. lump.  
     Grate.  
     Pea.  
     S. lump.  
     Stove.

Coal, bituminous.

Matches, 8-card.

*Metals and implements.*

Anvils, domestic.

Bar iron, best refined, rolled.

Butts, loose, joint, cast, 3 by 3 inch.

Copper, ingot.

Copper, sheet.

Door knobs, mineral.

Iron rods, for making common wood screws.

Iron wire, market, No. 10.

Lead, drop shot.

Lead:

    Fig (two quotations).

    Pipe.

Locks:

    Common mortise.

    Common rim.

Meat cutters, Hale's, No. 12.

Nails, cut.

Pig iron, No. 1, anthracite, foundry.

Pocket knives:

    Redwood, iron-lined handle, 2½-inch, 1 blade.

    Standard, black horn, brass G. S. handle, 3¼-inch, pen, 2 blades.

    Standard—

        Cocoa, brass G. S. handle, 3½-inch, 2 blades.

        Cocoa, brass G. S. handle, 3½-inch, 2 blades.

        Cocoa, iron-lined handle, 2½-inch, 1 blade.

        Cocoa, iron-lined handle, 3½-inch, 1 blade (two quotations).

## Pocket knives—Continued.

## Standard—Continued.

- Cocoa, iron-lined handle, 3½-inch, 2 blades.
- Cocoa, iron-lined handle, 3½-inch, 2 blades.
- Cocoa, iron-lined handle, 4-inch, 1 blade.
- Ebony, brass G. S. handle, 3½-inch, 2 blades.
- Ivory, brass G. S. handle, 3-inch, pen, 2 blades.
- Ivory, brass G. S. handle, 3½-inch, pen, 2 blades.
- Ivory, brass G. S. handle, 3½-inch, pen, 4 blades.
- Ivory, brass G. S. handle, 3½-inch, pen, 3 blades.
- Pearl, brass-lined handle, 3½-inch, pen, 3 blades.
- Pearl, silver-lined handle, 3½-inch, pen, 3 blades.
- Pearl, silver-lined handle, 3½-inch, pen, 4 blades.
- Redwood, iron-lined handle, 4-inch pruner, 1 blade.
- Redwood, iron-lined handle, 5-inch pruner, 1 blade.
- Stag, brass G. S. handle, 4½-inch, 3 blades.
- Stag, brass-lined handle, 3½-inch, pen, 3 blades.
- Stag, brass-lined handle, 3½-inch, pen, 3 blades.
- Stag, brass-lined handle, 3½-inch, 4 blades.
- Stag, brass-lined handle, 4-inch, 4 blades.

## Quicksilver.

## Rope:

- Manila.
- Tarred, American.
- Tarred, Russian.

## Saws:

- Circular, 52-inch, Disston's.
- Crosscut, 6-foot, Disston's.
- Hand, common, Disston's.
- Hand, standard, Disston's.

## Scythes.

- Shovels, Ames No. 2, cast-steel D handle, square-point, back-strap.
- Spelter, imported.
- Wood screws, 1-inch, No. 10, flat head, iron.

*Lumber and building materials.*

- Brick, common domestic building.
- Carbonate of lead, in oil.
- Cement, Rosendale.
- Chestnut, lumber, in the log, not sawed.
- Doors, pine, unmolded, 2 feet 4 inches by 6 feet 8 inches, 1½ inches thick.
- Hemlock, boards, first quality, 1-inch, not planed.
- Hemlock, lumber, in the log, not sawed.
- Lime, Rockland.
- Maple, boards, first quality, 1-inch, rough.
- Oak, boards, white, plain, first quality, 1-inch, rough.
- Oxide of zinc, American, dry.
- Pine, boards, white, clear, 1-inch, not planed.
- Pine:
  - Boards, white, clear, extra, 1-inch, not planed (2 quotations).
  - Boards, white, common, 1-inch, not planed (2 quotations).
  - Boards, white, culls, 1-inch, not planed.
  - Flooring, white, extra, 1-inch, not planed.
  - Lumber, in the log, not sawed.



## Plate glass, polished:

- Unsilvered, area 1 to 3 square feet.
- Unsilvered, area 3 to 5 square feet.
- Unsilvered, area 5 to 10 square feet.
- Unsilvered, area 10 to 40 square feet.
- Unsilvered, area 40 to 80 square feet.
- Unsilvered, area 80 to 100 square feet.

## Putty.

## Shingles, pine:

- 16 inches, XXX.
- 16 inches, extra XXX cut.
- 16 inches, extra XXX sawed.

## Spruce boards, 1-inch.

## Tar, Wilmington.

## Turpentine.

## Window glass:

- American, 10 by 14.
- French, 10 by 14, firsts, single.
- French, 10 by 14, thirds, single.

*Drugs and chemicals.*

- Alcohol.
- Alum, lump, crystal.
- Bichromate of potash.
- Blue vitriol.
- Brimstone, crude.
- Calomel.
- Copperas.
- Flaxseed.
- Glycerin, refined.
- Linseed oil.
- Mercury.
- Muriatic acid.
- Opium.
- Quinine.
- Soda ash.
- Sugar of lead:
  - Brown.
  - White.
- Sulphuric acid.

*House-furnishing goods.*

## Furniture:

- Chairs, bedroom, maple, cane seat.
- Chairs, kitchen, common, spindle.
- Tables, kitchen, pine, 3 $\frac{1}{2}$ -foot.

## Glassware:

- Bowls, 8-inch.
- Goblets, common.
- Pitchers,  $\frac{1}{2}$ -gallon.
- Sets, finished.
- Tumblers,  $\frac{1}{2}$ -pint.

## Pails, wooden:

- 2-hoop (2 quotations).
- 3-hoop.

## Tubs, wooden (4 quotations).

*Miscellaneous.*

Powder, rifle (2 quotations).  
 Rubber, Para.  
 Soap, castile, mottled, imported.  
 Starch:  
   Ontario.  
   Ordinary laundry.  
   Pearl.  
   Pure.  
   Refined.  
   Silver gloss.

## SUBSTITUTIONS AND ADDITIONS.

In the compilation of the index numbers no substitution of one grade or quality of an article for another grade or quality of the same article or for a different article previously included was made. In cases where quotations on a particular article could no longer be had, or where the article had ceased to be representative, it was discontinued and the index number was computed on the remaining articles. Additions to the list of articles were made from time to time as occasion demanded, such additions being carried into the index number for the year.

## INTERPOLATION.

Interpolation of prices was not resorted to in the preparation of the index numbers. In cases where prices for particular periods were lacking, the article in question was temporarily discontinued.

## WEIGHTING.

The committee calculated three distinct index numbers. The first was unweighted, while the second and third were weighted by assigning to each article an importance in the result equal to its importance in family consumption. The basis selected by the committee for determining this consumption was the Seventh Annual Report of the Commissioner of Labor, showing the values of various articles consumed by a large number of families which were considered typical of the expenditures of the mass of the people. This information is summarized in the following table showing the distribution of expenditure for 2,561 normal families.

DISTRIBUTION OF EXPENDITURE FOR 2,561 FAMILIES.

Group.	Per cent of expenditure for each purpose.	Proportions of 10,000.
Rent.....	15.06	1,506
Food.....	41.03	4,103
Fuel.....	5.00	500
Clothing.....	15.31	1,531
Lighting.....	.90	90
All other purposes....	22.70	2,270
	100.00	10,000

This table shows the main groups of family expenditures only, and these were not sufficiently specific for the purpose. In order to secure accurate and specific data as to the composition of these groups themselves, therefore, 232 special budgets of family expenses were collected. The table based on 2,561 families was then used to secure the proportion of the groups entering into consumption, while a table based on 232 families was used to secure the distribution of expenditure within the groups themselves. The figures thus secured, showing the relative weight in consumption of each article contained in the family budgets, were then applied to the various articles in the index numbers. Few articles were found, however, with identical descriptions, hence a method of grouping was resorted to. For example, two or more articles contained in the index numbers were often grouped to represent one article of the family budget, thus, "ham," "bacon," and "pork" were considered equivalent to the "hog products" of the family budgets, and an arithmetical average was made of the index numbers of these three articles, which was made the index number of hog products and given its appropriate weight. Briefly described, the method as applied to the food group was as follows: The figure denoting the importance of each article in the group in a given year was multiplied by its simple index number (or the average where two or more articles were grouped), and the sum of these products was divided by the total of the figures denoting importance for the weighted index number for the general group of food. This method was used in securing similar weighted index numbers for the other years of the period. It is seen that according to this method the same weights were used for each year of the period, although they were based on the consumption of families in 1891.

The following table shows the weighted relative prices or index numbers in 1891 for each of the groups considered, together with the total weighted relative price or index number:

RELATIVE PRICES OF ALL ARTICLES IN 1891, MEASURED BY CONSUMPTION.

(Base period, 1860-100.)

Group.	Importance.	Weighted index number.	Result.
Rent.....	1,506	100.0	1,506,000
Food.....	4,103	103.7	4,254,811
Fuel.....	500	98.1	490,500
Lighting.....	90	43.1	43,290
Clothing.....	1,531	75.1	1,162,029
All other purposes.....	2,270	95.3	2,164,096
Total.....	10,000	96.2	9,620,726

In the above table the weighted index numbers for the various groups were found in practically the same manner as has previously been described for food, except that rent and certain items entering

into the group "All other purposes" were considered to have remained unchanged. These were then multiplied by the figures denoting importance, and the sum of the products divided by the total of the figures denoting importance (10,000) to secure the weighted total of 96.2. The remaining years were treated in a similar manner.

The items of budget expenditure considered as remaining unchanged (rent, taxes, insurance, etc.), constituted 31.40 per cent of the total expenditure, leaving 68.60 per cent as affected by changes in prices. Another set of index numbers for such articles was made by the committee by assigning a total numerical weight of 6,860 to such articles and working out the index numbers on that basis. This resulted in a slightly different total index number.

## TESTING.

The accuracy of the results secured was tested by comparison of the index numbers with those of the London Economist and of Sauerbeck for England.<sup>1</sup>

## TABLES OF RESULTS.

The index numbers computed by the three methods, i. e., simple average, average of all articles weighted according to consumption, and average of fluctuating articles only, weighted according to consumption, are shown in the following table. The prices are in currency.<sup>2</sup>

RELATIVE PRICES IN EACH YEAR, 1840 TO 1891, FOR ALL ARTICLES GROUPED BY DIFFERENT METHODS.

Year.	All articles simply averaged.	All articles averaged according to importance, certain expenditures being considered uniform.	All articles averaged according to importance, comprising 68.60 per cent of total expenditure.	Year.	All articles simply averaged.	All articles averaged according to importance, certain expenditures being considered uniform.	All articles averaged according to importance, comprising 68.60 per cent of total expenditure.
1840	116.8	98.5	97.7	1866	191.0	160.2	187.7
1841	115.8	98.7	98.1	1867	172.2	145.2	155.8
1842	107.8	93.2	90.1	1868	160.5	150.7	173.9
1843	101.5	89.3	84.3	1869	153.5	135.9	152.3
1844	101.9	89.8	85.0	1870	142.3	130.4	144.4
1845	102.8	92.1	88.2	1871	136.0	124.8	136.1
1846	106.4	95.7	95.2	1872	138.8	122.2	132.4
1847	106.5	96.7	95.2	1873	137.5	119.9	128.0
1848	101.4	92.0	88.3	1874	133.0	120.5	129.9
1849	98.7	88.9	83.5	1875	127.6	119.8	128.0
1850	102.8	92.6	89.2	1876	118.2	115.5	122.6
1851	105.9	92.1	88.6	1877	110.9	109.4	113.6
1852	102.7	98.5	97.9	1878	101.3	103.1	104.6
1853	109.1	103.4	105.0	1879	96.6	96.0	95.0
1854	112.9	100.4	105.0	1880	106.9	103.4	104.9
1855	113.1	106.8	109.2	1881	105.7	105.8	105.4
1856	113.2	103.5	112.3	1882	108.5	106.3	108.1
1857	112.5	109.6	114.0	1883	106.0	104.5	106.6
1858	101.8	109.1	113.2	1884	99.4	101.8	102.6
1859	100.2	102.0	102.9	1885	93.0	95.4	93.8
1860	100.0	100.0	100.0	1886	91.9	95.5	93.4
1861	100.0	95.9	94.1	1887	92.0	96.2	94.5
1862	117.8	102.8	104.1	1888	94.2	97.4	96.2
1863	148.6	122.1	132.2	1889	94.2	99.0	98.5
1864	190.5	149.4	172.1	1890	92.3	95.7	93.7
1865	216.8	160.7	232.2	1891	92.3	96.2	94.4

<sup>1</sup> Report from the Committee on Finance of the United States Senate on Wholesale Prices, Wages, and Transportation, Pt. I, pp. 226, 227, and 256.

<sup>2</sup> Idem, Pt. I, p. 9.

A convenient summary of the foregoing table, by periods of five years, is found in the table following:<sup>1</sup>

RELATIVE PRICES, BY 5-YEAR PERIODS, 1840 TO 1891, FOR ALL ARTICLES GROUPED BY DIFFERENT METHODS.

Period.	All articles simply averaged.	All articles averaged according to importance, certain expenditures being considered uniform.	All articles averaged according to importance comprising 68.60 per cent of total expenditure.
1840-1844.....	108.8	93.9	91.0
1845-1849.....	103.2	93.3	90.1
1850-1854.....	106.6	99.4	99.1
1855-1859.....	108.2	107.1	110.3
1860-1864.....	131.5	114.0	120.5
1865-1869.....	178.8	156.5	182.4
1870-1874.....	137.5	123.6	134.4
1875-1879.....	110.9	108.9	112.9
1880-1884.....	105.3	104.4	106.3
1885-1889.....	93.2	96.7	95.2
1890-1891.....	92.3	96.0	94.1

#### INDEX NUMBERS OF THE ANNALIST.

##### PUBLICATION.

The *Annalist*, a magazine of finance, commerce, and economics, published weekly in New York City, has compiled an index number based on the wholesale prices of 25 food commodities in the United States. These articles are so selected as to represent a theoretical family food budget.

##### HISTORY.

The publication of this index number began with the first issue of the *Annalist* on January 20, 1913, and has been continued weekly since that date in connection with the exhibit of various other items of business activity appearing under the caption of "Barometrics."

##### SOURCE OF QUOTATIONS.

The prices used in the computation of the index number are those prevailing in the New York and Chicago markets.

##### BASE PERIOD.

The 10 years 1890-1899 constitute the base period used in computing the index number.

##### PRICES: HOW SHOWN AND COMPUTED.

During the period from May 19 to September 1, 1913, the *Annalist* published in each week's issue the mean price of each selected commodity during the preceding week, together with the relation

<sup>1</sup> Report from the Committee on Finance of the United States Senate on Wholesale Prices, Wages, and Transportation, Pt. I, p. 10.

of such price to the price for the base period 1890-1899. The sum of these relative prices, divided by 25 (the number of commodities), constitutes the index number for the week. In all other issues of the *Annalist* up to date no exhibit of wholesale prices is made in connection with the presentation of the index number.

#### NUMBER AND CLASS OF COMMODITIES.

As previously stated, 25 articles of food are included in the index. These are listed in the *Annalist* of May 19, 1913, and in subsequent numbers to September 1 of the same year, as follows:

Steers.	Flour, wheat, spring.
Hogs.	Flour, wheat, winter.
Sheep.	Corn meal.
Beef, fresh.	Rice.
Mutton, dressed.	Oats.
Beef, salt.	Apples, evaporated.
Pork, salt.	Prunes.
Bacon.	Butter, creamery.
Codfish, salt.	Butter, dairy.
Lard.	Cheese.
Potatoes.	Coffee.
Beans.	Sugar, granulated.
Flour, rye.	

#### DESCRIPTION AND GROUPING OF COMMODITIES.

The following description of the commodities included in the index number has been supplied by the publishers of the *Annalist*:

##### New York markets.

Codfish (Georges), corn meal, rice, beans, evaporated apples, California prunes, extra creamery butter, New York State dairy butter, cheese (New York State, whole milk, held), No. 7 Rio coffee, fine granulated sugar, fresh beef, dressed mutton, salt beef, salt pork, wheat flour (winter straights and spring patents), Middle West lard, and rye flour.

##### Chicago markets.

Good to choice steers, hogs (250-300 pound packers and fair to select butcher's), sheep (good to choice wethers), bacon (short, clear sides), white potatoes, and cash oats (2 white, 3 white, and standards).

#### SUBSTITUTIONS AND ADDITIONS.

The statement is made in the *Annalist* of October 13, 1913, that "a substitution has been made which affects the current numbers seven-tenths of 1 per cent." This was occasioned by the substitution of "good to choice steers" for "prime to fancy steers," as quotations on the latter grade had become nominal in the Chicago market. The entire index number was recast so as to conform to the change made in this respect. No additions to the list of commodities have been made.

## INTERPOLATION.

No prices have been interpolated, as far as the published information discloses.

## WEIGHTING.

The index number is unweighted and is obtained by computing the simple arithmetic mean of the relative prices of the different commodities.

## TESTING.

No test of the index number by means of comparison with other indexes or by other means is shown in any issue of the Annalist.

## TABLE OF RESULTS.

The course of the index number by years from 1890 to 1914 and by months during 1912, 1913, and 1914 is shown in the following statement furnished by the publishers of the Annalist:

## INDEX NUMBERS, BY YEARS, 1890 TO 1914, AND BY MONTHS, 1912, 1913, AND 1914.

(Base period, 1890-1899=100.)

## Yearly.

Year.	Index number.	Year.	Index number.	Year.	Index number.
1890.....	106.252	1899.....	93.348	1908.....	125.756
1891.....	119.488	1900.....	99.388	1909.....	133.962
1892.....	108.624	1901.....	104.656	1910.....	137.172
1893.....	116.100	1902.....	116.264	1911.....	131.068
1894.....	102.076	1903.....	107.516	1912.....	143.254
1895.....	94.504	1904.....	108.664	1913.....	139.980
1896.....	80.096	1905.....	110.652	1914.....	146.069
1897.....	84.092	1906.....	114.364		
1898.....	92.208	1907.....	117.940		

## Monthly.

1912		1913		1914	
Month.	Index number.	Month.	Index number.	Month.	Index number.
January.....	139.681	January.....	137.197	January.....	142.452
February.....	138.012	February.....	137.868	February.....	141.278
March.....	143.515	March.....	139.926	March.....	143.079
April.....	152.326	April.....	141.971	April.....	141.120
May.....	152.958	May.....	137.927	May.....	139.231
June.....	148.193	June.....	137.750	June.....	141.653
July.....	143.285	July.....	139.839	July.....	144.879
August.....	140.871	August.....	139.927	August.....	152.106
September.....	140.794	September.....	142.290	September.....	160.776
October.....	141.861	October.....	141.664	October.....	150.245
November.....	139.543	November.....	141.538	November.....	139.008
December.....	138.013	December.....	141.847	December.....	146.779

## INDEX NUMBERS OF BRADSTREET'S.

## PUBLICATION.

This "index"<sup>1</sup> represents the record of wholesale prices of staple articles in the primary markets of the United States and is now published every month. Formerly it was issued only every quarter.

## HISTORY.

Bradstreet's index had its beginning in the issue of September 21, 1895, of the periodical of that name, which presented a table of comparative prices of 110 staple articles for each quarter from October 1, 1890, to July 1, 1895, under the heading, "Five years' prices for 110 staple products."

The compiler evidently had in mind a record of price movements in the United States similar to that furnished by Sauerbeck's index of English prices, as he refers to it in the introductory paragraph as follows:

"In Sauerbeck's latest record of prices of staple products in the United Kingdom during the past 30 years it is shown that quotations for 50 selected articles by groups averaged lower in 1894 than in any of the 16 next preceding years, as well as lower than in the 11-year period from 1867 to 1877, which the eminent statistician selected as representing the normal and called 100."<sup>2</sup>

In explanation of the data presented in Bradstreet's the compiler says: "In the accompanying exhibit of comparative prices of staple articles at primary markets in the United States at quarterly intervals, beginning with the autumn of 1890, prior to the Baring crash, and ending with July 1, 1895, is furnished what should prove an opportunity for tracing the relative effects of panic and trade depression on the prices in different lines of business."<sup>2</sup>

In the issue of October 26, 1895, the report was extended to include prices for October 1 of that year and the statement made that "it will be recalled this work was first made public by Bradstreet's late in the summer with a comparison of quotations for more than 100 articles of merchandise and produce at quarterly intervals during the past five years."

Again in the issue of January 11, 1896, the author has this to say in discussing the compilation: "Perhaps the most elaborate exhibit which has been compiled of comparative prices of staple products, breadstuffs, live stock, provisions, fresh and dried fruits, hides and leather, raw and manufactured textiles, coal and coke, mineral and vegetable oils, building materials, chemicals and drugs, and others

<sup>1</sup> Not an index in the true sense of the word, being rather a number representing the aggregate of per pound prices of certain selected commodities.

<sup>2</sup> Bradstreet's, Saturday, Sept. 21, 1895, p. 504.



is presented in connection with this article. The quotations are given for quarterly periods during the past five calendar years, and probably few, if any, better outlines of the movement of quotations have thus far been presented."

The comparative prices continued to be presented on the first of each quarter until May 8, 1897, when in connection with "A study of prices" an index number was published for the first time.

The index as constructed was simply the sum obtained by adding the per pound prices of the different articles included. At first it was not expressed in dollars and cents, but as an abstract number. No attempt was made at weighting, nor was consumption taken into account, so that the result was "not an absolute indication of the price movement based on the proportions in which each of the products and articles are used, but a fair indication of the tendency." The author stated that only 97 articles were included in the index, but as actual prices were shown for 108 articles and only 10 articles were stated to be excluded it would appear that the index comprised 98 articles.

In the issue of June 11, 1898, actual prices were shown for 107 articles, quotations for onions being dropped, and the index number was revised to exclude the price of quicksilver. The only explanation given for this was: "It might be stated in passing that the lowering of the index number is accounted for by the deduction of the price of quicksilver." The index for the period October, 1890, to June, 1898, was thus recomputed by deducting the price of quicksilver; for instance, the old index for January, 1898, was 80,149 and the new one was 75,084; that is, the price of quicksilver on January 1, 1898 (\$0.5065 per pound), was deducted from 80,149, leaving 75,084 as the new index. There were still 10 articles, excluding quicksilver, not included in the index, but for which comparative prices were given.

Again on September 10, 1898, the index appeared with revised figures. This revision was due to the quotation of a different grade of hides. Previous to this time prices had been quoted for dry Buenos Aires hides, but for some reason not stated the new quotations were for No. 1 native steer hides. The difference between the prices of these two grades of hides in August, 1898, was \$0.0925, and this deduction from the former index for August (77,481) leaves 76,556 as the new index. This amount was deducted from every index figure already established as far back as October, 1890.

In the issue of October 12, 1901, the first group indexes were shown and consisted of the sum of the per pound prices for all of the articles included in the group. The sum of the 13 groups was the index shown for all commodities. The general index was expressed in dollars and cents and continued to be stated this way until April 9,

1904, when it was restated in dollars, cents, and fractions thereof. This was not a revision of the index, but simply a change in the method of pointing off. The index numbers for the groups had been expressed in this way for some time before this date. The index now began with January 1, 1892, instead of October 1, 1890, as formerly, and was computed upon the basis of the revision of September, 1898, until December 16, 1905, when a general index "revised to exclude some staples showing wide fluctuations" in price was published. It is not stated in connection with these figures what articles were excluded or on how many commodities the revised index number was based. The exhibit as published contained the index number by quarters from January 1, 1892, to October 1, 1898, and by months from January 1, 1899, to December 1, 1905, inclusive. No further revision of the index number appears to have been made.

#### SOURCE OF QUOTATIONS.

The source of these quotations is not disclosed, but it is stated that they are from primary markets.

#### BASE PERIOD.

No base period was selected in the compilation of the index number, the need of such being obviated by the method employed, which consists simply in adding together the prices per pound of the various selected articles at the date named.

#### PRICES: HOW SHOWN AND COMPUTED.

Prices are published each month for a selected list of representative commodities. These prices are shown for the first day of the current month and, for purpose of comparison, the first day of several preceding months and the first day of the corresponding month in the preceding year. No range of quotations is shown in any case, and it is evident that a single price has been used, but whether either extreme or the mean was taken it is impossible to determine with the source of quotations unknown. No yearly average actual prices are published.

In the issue of May 8, 1897, the price per pound of each article was shown as quoted on the first of April, the articles being grouped under the amount paid per pound. The list was prefaced by the following statement: "Bradstreet's exhibit of 98 staple, raw and manufactured articles, products, produce and live stock classified according to the cost of 1 pound of each on April 1, 1897." This exhibit was continued at intervals for about a year and then dropped. In many cases the figures appear to have been approximations. The list as published in Bradstreet's of July 10, 1897, follows. The prices are for July 1.

Cost per pound.

- \$.0007 Connellsville coke, southern coke.
- .001 Bituminous coal, brick, iron ore.
- .002 Anthracite coal.
- .003 Salt, southern pig iron, crude petroleum, rosin, lime, phosphate rock.
- .004 Bessemer pig iron, pine lumber, cotton seed.
- .005 Corn, eastern pig iron, tar, spruce, hemlock.
- .006 Steel billets.
- .007 Oats, barley, rye, potatoes, hay, sulphuric acid.
- .009 Steel rails, steel beams, refined petroleum.
- .015 Wheat, milk, peas, nails, alum, bicarbonate of soda.
- .02 Flour, molasses, beans, paper, caustic soda.
- .03 Hogs, lemons, hemp, jute, tin plates, cottonseed oil, turpentine, glass, flax.
- .04 Bees, sheep, bread, barreled beef, pork, lard, codfish, rice, linseed oil, raisins, lead, nitric acid.
- .05 Pigs, sugar, currants, borax, bacon.
- .06 Eggs.
- .07 Beef carcasses, mutton, coffee, olive oil, hops.
- .08 Horses, mackerel, cheese, cotton.
- .10 Hams.
- .11 Copper.
- .12 Castor oil.
- .14 Standard sheetings, cotton sheetings, tin, tobacco.
- .15 Butter.
- .175 Print cloths.
- .18 Tea, Buenos Aires hides, carbolic acid.
- .20 Hemlock hides, wool.
- .27 Union leather.
- .29 Oak leather.
- .31 Ginghams.
- .34 Alcohol.
- .50 Australian wool.
- .52 Quicksilver.
- .84 Rubber.

## NUMBER AND CLASS OF COMMODITIES.

In the beginning 110 articles were shown in the comparative table of actual prices, but now only 106 are included, and of these only 96 are included in the index. Oranges, naphtha, onions, and aluminum were the articles dropped from the table of comparative prices, but the reason for their discontinuance is not given. Two of these, onions and aluminum, were never included in the compilation of the index. Two articles that at first were included in the index are no longer included—namely, quicksilver and rubber—but these are still shown in the table of actual prices. When these articles were dropped the index was recomputed from that date to the beginning, necessitating a new index figure for every previous date. The list of articles includes both raw and manufactured commodities that are of general consumption in the United States.

## DESCRIPTION AND GROUPING OF COMMODITIES.

The articles on which the index is based are divided into 13 general groups, as follows: Breadstuffs, live stock, provisions and groceries, fresh and dried fruits, hides and leather, raw and manufactured textiles, metals, coal and coke, mineral and vegetable oils, naval stores, building materials, chemicals and drugs, and miscellaneous. Since October 12, 1901, an index has been computed usually for each of the different groups separately. The sum of the indexes for the 13 groups is the index for the whole number of articles. Index numbers for years are computed by averaging the 12 monthly totals.

The following list is an enumeration of the articles, under the various groups, for which actual prices are shown in the comparative price table. As before stated, only 96 of these 106 articles are included in the index as now compiled. This is the list and description of articles as printed in Bradstreet's of December 12, 1914:

*Breadstuffs (6 articles).*

Wheat, No. 2, red winter, in elevator.	Barley, No. 2 (Milwaukee).
Corn, No. 2, mixed, in elevator.	Rye, western.
Oats, No. 2, mixed, in elevator.	Flour, straight winter.

*Live stock (4 articles).*

Beeves, best, native steers (Chicago).	Hogs, prime (Chicago).
Sheep, prime (Chicago).	Horses, average, common to best (Chicago).

*Provisions and groceries (24 articles).*

Beef, carcasses (Chicago).	Cheese, choice, east factory.
Hogs, market pigs, carcasses (Chicago).	Mackerel, No. 1, bays (Boston).
Mutton, carcasses (Chicago).	Godfish, large dried.
Milk (New York).	Coffee, Rio, No. 7.
Eggs, State, fresh (New York).	Sugar, granulated.
Bread (New York).	Tea, Formosa Oolong, superior.
Beef, family.	Molasses, New Orleans, prime.
Pork, new mess.	Salt, fine domestic, sacks.
Bacon, short ribs, smoked (Chicago).	Rice, domestic, good.
Hams, smoked.	Beans (New York), choice marrow.
Lard, western steam.	Peas, choice (New York).
Butter, creamery, State, best.	Potatoes, eastern.

*Fresh and dried fruits (6 articles).*

Apples (State).	Lemons, choice.
Cranberries, Cape Cod, fancy.	Raisins, layer.
Peanuts, best Virginia, in hull.	Currants, new, dried.

*Hides and leather (4 articles).*

Native steer hides, No. 1.	Union, middlebacks, tannery run.
Hemlock, packer, middleweights, No. 1.	Oak, scoured backs, No. 1.

*Raw and manufactured textiles (11 articles).*

Wotton, middling uplands.	Silk, best No. 1, filature.
Wool, Ohio, and Pennsylvania X, washed (Boston).	Flax, New Zealand, spot.
Wool, Australian super combing, scoured.	Print cloths, 64s (Boston).
Hemp, manila.	Standard sheetings (Boston).
Jute, average of grades.	Ginghams, Amoskeag staple (Boston).
	Cotton, sheetings, southern, 3 yards.

*Metals (13 articles).*

Iron ore, old range, Bessemer, hematite.	Tin plates, American (Pittsburgh).
Pig iron, No. 1 foundry, eastern (New York).	Steel beams (Pittsburgh).
Pig iron, No. 2 foundry, southern (Birmingham).	Silver, commercial bars (New York).
Pig iron, Bessemer (Pittsburgh).	Copper, electrolytic (New York).
Steel billets, Bessemer (Pittsburgh).	Lead, pig, western (New York).
Steel rails, standard (Pittsburgh).	Tin, pig, spot (New York).
	Quicksilver (San Francisco).

*Coal and coke (4 articles).*

Anthracite, stove sizes (New York).	Connellsville coke, short ton, f. o. b.
Bituminous (Pittsburgh), f. o. b. Chicago.	Southern coke (Chattanooga).

*Mineral and vegetable oils (6 articles).*

Petroleum, crude, in barrels (New York).	Cottonseed, crude, prime (New York).
Petroleum, refined, in cases.	Castor, No. 1.
Linseed.	Olive, Italian, in barrels.

*Naval stores (3 articles).*

Rosin, good, strained (Savannah).	Tar, regular (Wilmington, N. C.).
Turpentine, machine, regular (Savannah).	

*Building materials (7 articles).*

Brick, Hudson River, hard.	Pine, yellow, 12-inch and under.
Lime, eastern common.	Timber, eastern spruce, wide random.
Nails, wire, from store, base prices.	Timber, hemlock, Pennsylvania, random.
Glass, window, 10 by 15.	

*Chemicals and drugs (11 articles).*

Alum.	Sulphuric acid, 66 degrees.
Bicarbonate of soda, American.	Phosphate rock, South Carolina, ground.
Borax, crystals.	Alcohol, 94 per cent.
Carbolic acid, in bulk.	Opium.
Caustic soda, 60 per cent.	Quinine, domestic, in bulk.
Nitric acid, 36 degrees.	

*Miscellaneous (7 articles).*

Hops, New York State, choice.	Paper, news, roll.
Rubber, upriver, Para, fine new.	Ground bone, fine, steamed.
Tobacco, medium leaf, Burley (Louisville).	Hay prime (New York).
	Cotton seed (Houston).

## SUBSTITUTIONS AND ADDITIONS.

Numerous changes in description of the articles have occurred from time to time, but only once, apparently, has a substitution been considered of enough importance to justify any change in the index. This was in the case of dry Buenos Aires hides, for which were substituted No. 1 native steer hides, when the index was recomputed back to the beginning.

## INTERPOLATION.

No method of supplying missing data is disclosed, if such has been found necessary.

## WEIGHTING.

Apart from the basic plan of expressing in terms of dollars and cents the value of 1 pound avoirdupois of each commodity, there is no attempt at assigning varying degrees of importance to the different articles included in the index.

## TESTING.

No test has been made of the index so far as known, other than a comparison in parallel columns of the numbers with those published by the London Economist, the Statist (Sauerbeck's), the Canadian Department of Labor, and La Réforme Économique for the same dates.

## TABLES OF RESULTS.

The following table, appearing in Bradstreet's issue of December 12, 1914, illustrates the manner in which the group index numbers for different dates are shown:

BRADSTREET'S INDEX NUMBERS FOR SPECIFIED DATES.

Commodity.	Dec. 1, 1913.	Aug. 15, 1914.	Nov. 1, 1914.	Dec. 1, 1914.
Breadstuffs.....	\$0.0947	\$0.1001	\$0.1116	\$0.1139
Live stock.....	.4480	.4860	.4415	.4220
Provisions.....	2.4513	2.5006	2.3753	2.3689
Fruits.....	.1380	.2305	.1736	.1648
Hides and leather.....	1.3500	1.4300	1.4175	1.4250
Textiles.....	2.5625	2.3704	2.1354	2.1392
Metals.....	.6720	.8707	.6279	.5830
Coal and coke.....	.0070	.0067	.0067	.0066
Oils.....	.3539	.3755	.3434	.3503
Naval stores.....	.0771	.0784	.0794	.0770
Building materials.....	.0821	.0822	.0816	.0821
Chemicals and drugs.....	.5867	1.0096	.8520	.9979
Miscellaneous.....	.3477	.3088	.2652	.2547
Total.....	9.2290	9.8495	8.8630	9.0354

For some years past a yearly index has been computed by averaging the 12 monthly indexes. The manner of presenting this information is shown by the following table, which is reproduced from Bradstreet's of December 12, 1914.

1914.....	\$8. 9035	1902.....	\$7. 8759
1913.....	9. 2076	1901.....	7. 5746
1912.....	9. 1867	1900.....	7. 8839
1911.....	8. 7132	1899.....	7. 2100
1910.....	8. 9881	1898.....	6. 5713
1909.....	8. 5153	1897.....	6. 1159
1908.....	8. 0094	1896.....	5. 9124
1907.....	8. 9045	1895.....	6. 4346
1906.....	8. 4176	1894.....	6. 6846
1905.....	8. 0987	1893.....	7. 5324
1904.....	7. 9187	1892.....	7. 7769
1903.....	7. 9364		

Ten-year average, 1902 to 1911, inclusive, \$8.3377.

Ten-year average, 1892 to 1901, inclusive, \$6.9696.

The index numbers computed from the wholesale prices of 96 articles on the first day of each month from January, 1903, to December, 1914, inclusive, are shown in the subjoined table, also reproduced from Bradstreet's issue of December 12, 1914.

BRADSTREET'S INDEX NUMBERS, JANUARY, 1903, TO DECEMBER, 1914, INCLUSIVE.

Year	Index number: First of each month.											
	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.	\$8. 0789	\$8. 0824	\$8. 1300	\$8. 1247	\$7. 9667	\$7. 8751	\$7. 8706	\$7. 7473	\$7. 7583	\$7. 9083	\$7. 8871	\$7. 8383
1904.	7. 9885	8. 0973	8. 0882	7. 9690	7. 9852	7. 9677	7. 6318	7. 7623	7. 7846	7. 9213	8. 0015	8. 0579
1905.	8. 0827	8. 0805	8. 0979	7. 9996	7. 9700	7. 9073	7. 9160	8. 1111	8. 2785	8. 2298	8. 2097	8. 3014
1906.	8. 3289	8. 2415	8. 2321	8. 2987	8. 3054	8. 3203	8. 2856	8. 3376	8. 4528	8. 5589	8. 7509	8. 9023
1907.	8. 9172	8. 9353	8. 1293	8. 9040	8. 9356	8. 9801	9. 0409	8. 9304	8. 8297	8. 8563	8. 7468	8. 5246
1908.	8. 2049	8. 1289	7. 9802	8. 0650	7. 9629	7. 7227	7. 8224	7. 8028	7. 9051	8. 0139	8. 0674	8. 2133
1909.	8. 2031	8. 3022	8. 2167	8. 3157	8. 3016	8. 3960	8. 4573	8. 5039	8. 5906	8. 7478	8. 9635	9. 1262
1910.	9. 2310	9. 0730	9. 1113	9. 1990	9. 0385	8. 9105	8. 9246	8. 8222	8. 9519	8. 9267	8. 8841	8. 7844
1911.	8. 8301	8. 7602	8. 6929	8. 5223	8. 4585	8. 5294	8. 5935	8. 6568	8. 8191	8. 8905	8. 8922	8. 9824
1912.	8. 9433	8. 8578	8. 9019	9. 0978	9. 2695	9. 1017	9. 1119	9. 1595	9. 2157	9. 4515	9. 4731	9. 5462
1913.	9. 4935	9. 4592	9. 4052	9. 2976	9. 1394	9. 0721	8. 9521	9. 0115	9. 1006	9. 1526	9. 2252	9. 2290
1914.	8. 8857	8. 8619	8. 8320	8. 7562	8. 6224	8. 6220	8. 6566	8. 7087	9. 7572	9. 2416	8. 8620	9. 0354

### INDEX NUMBERS OF DUN.

#### PUBLICATION.

An "index" <sup>1</sup> number based on the wholesale prices of a large number of representative commodities in general use in the United States is published by the mercantile agency of R. G. Dun & Co., of New York City. The information appears monthly in Dun's Review, the weekly journal of finance and trade issued by the above-named company.

<sup>1</sup> Not an index in the true sense of the word, but a statement in dollars and cents of the per capita cost of a year's supply of certain commodities at each date named.

**HISTORY.**

The publication of this index number was begun in 1901 and covered a period of time extending back to 1860. From 1901 to 1907 periodical presentation of the index in Dun's Review appears to have been made. With the issue of May 11, 1907, however, its publication was discontinued and apparently was not resumed until May 9, 1914. The issue of the latter date contained data for the first five months of the years 1912, 1913, and 1914, respectively; but no attempt was made in this number to supply figures for all of the period intervening since 1907. Data for other months of 1912, 1913, and 1914 are shown in subsequent issues; and in Dun's Review of January 9, 1915, a presentation is made of the index number on the first of each month for the entire period from 1907 to 1914, inclusive, thus furnishing a continuous series since the inception of the undertaking.

**SOURCE OF QUOTATIONS.**

The price quotations on which the index number is based are those gathered by Dun & Co. in the principal markets of the country, New York and Chicago prices predominating.

**BASE PERIOD.**

Under the method followed in the computation of the index number no base period is employed, the index in the case of each article and group being the actual amount in dollars and cents required to purchase a year's supply for a single individual at the date named.

**PRICES: HOW SHOWN AND COMPUTED.**

With regard to the method of calculation, the following statement is reproduced from Dun's Review of May 9, 1914:

Quotations of all the necessaries of life are taken and in each case the price is multiplied by the annual per capita consumption, which precludes any one commodity having more than its proper weight in the aggregate. Thus, wide fluctuations in the price of an article little used do not materially affect the "index," but changes in the great staples have a large influence in advancing or depressing the total. \* \* \* The per capita consumption used to multiply each of many hundreds of commodities does not change. There appears to be much confusion on this point, but it should be seen at a glance that there would be no accurate record of the course of prices if the ratio of consumption changed. It was possible, however, to obtain figures sufficiently accurate to give each commodity its proper importance in the compilation. This was done by taking averages for a period of years when business conditions were normal and every available trade record was utilized, in addition to official statistics of agriculture, foreign commerce, and census returns of manufactures.



## NUMBER AND CLASS OF COMMODITIES.

The following excerpt from the same source shows what commodities are included:

For convenience of comparison and economy of space the prices are grouped into seven classes: Breadstuffs include quotations of wheat, corn, oats, rye, barley, beans, and peas; meats include live hogs, beef, sheep, and many provisions, lard, tallow, etc.; dairy and garden products embrace eggs, vegetables, fruits, milk, butter, cheese, etc.; other foods include fish, liquors, condiments, sugar, rice, also tobacco, etc.; clothing covers the raw material of each industry, as well as quotations for woolen, cotton, silk, and rubber goods, also hides, leather and boots and shoes; metals include various quotations for pig iron and partially manufactured and finished products, as well as the minor metals, tin, lead, copper, etc., and coal and petroleum; miscellaneous includes many grades of hard and soft lumber, lath, brick, lime, glass, turpentine, hemp, linseed oil, paints, fertilizers, and drugs.

The precise number of articles included in the index is not stated; but in Dun's Review of January 9, 1915, it is said that "about 200 products are taken."

## DESCRIPTION AND GROUPING OF COMMODITIES.

As previously stated, the commodities are divided into seven groups: viz, breadstuffs, meats, dairy and garden products, other foods, clothing, metals, and miscellaneous articles. No further description of the articles entering into the index is given.

## SUBSTITUTIONS AND ADDITIONS.

Additions to the list of commodities for which index numbers have been computed, or substitutions of a particular grade or quality of an article for another grade or quality of the same article, if any, are not shown in connection with any of the published data.

## INTERPOLATION.

So far as can be determined from the information at hand concerning the long period covered, no interpolation of prices has been made.

## WEIGHTING.

As stated in a preceding paragraph, weighting is accomplished by multiplying the price of each commodity, at the date named, by its annual per capita consumption "for a period of years when business conditions were normal,"<sup>1</sup> as nearly as could be ascertained by reference to reliable statistical records. It is stated in Dun's Review of January 9, 1915, that "while it is obvious that the consumption of some commodities has increased during recent years, it would defeat the purpose of the index to change the multiplier in any instance,

because there would no longer be a comparative record of the cost of the same quantities of the same articles back to 1860, as is now the case." The issue of September 7, 1901, states that "while the figures can not be considered exact, the approximation is sufficiently close to attain the desired result, and the ratio being constant the comparison with different dates shows to a cent the rise or fall in the cost of living."<sup>1</sup>

TESTING.

No comparison of the index number with those compiled by others has been made, nor have other means of testing been employed so far as can be determined.

TABLE OF RESULTS.

The following statistics, showing the trend of wholesale prices from January 1, 1860, to December 1, 1914, have been compiled from Dun's Review of May 11, 1907, and January 9, 1915:

WHOLESALE PRICES OF SPECIFIED COMMODITIES, JAN. 1, 1860, TO DEC. 1, 1914.

Date.	Bread-stuffs.	Meats.	Dairy and garden products.	Other foods.	Clothing.	Metals.	Miscellaneous.	Total.
1860, Jan. 1.....	\$23.652	\$10.064	\$14.189	\$8.978	\$22.094	\$26.082	\$15.572	\$121.621
1864, Sept. 1.....	46.138	17.790	29.426	29.562	91.667	61.964	38.191	\$12.737
1870, Jan. 1.....	29.076	15.255	21.178	16.240	32.986	27.682	23.056	165.473
1875, Jan. 1.....	28.048	11.932	17.832	14.548	25.718	22.833	18.669	137.578
1880, Jan. 1.....	22.955	8.206	14.007	11.573	22.673	25.002	16.983	122.679
1885, Jan. 1.....	15.342	9.432	14.304	8.996	18.081	15.065	14.245	98.465
1888, Jan. 1.....	18.565	8.920	15.030	10.340	15.140	17.330	14.577	99.902
1889, Jan. 1.....	18.185	8.705	14.670	10.480	15.170	17.350	14.496	99.076
1890, Jan. 1.....	18.765	7.630	12.675	9.935	14.945	19.240	15.111	90.191
1891, Jan. 1.....	19.725	7.810	15.270	10.215	14.135	15.875	14.217	98.247
1892, Jan. 1.....	17.700	7.895	13.180	9.185	13.430	14.665	23.767	88.822
1893, Jan. 1.....	15.750	9.315	15.290	9.595	13.900	15.985	14.320	94.155
1894, Jan. 1.....	13.530	8.655	13.945	8.945	12.880	14.565	13.512	86.032
1895, Jan. 1.....	14.311	8.359	12.190	8.907	11.896	12.026	13.007	80.992
1896, Jan. 1.....	11.380	7.549	10.989	8.898	12.787	12.803	13.403	77.780
1897, Jan. 1.....	11.729	7.327	10.456	8.170	12.407	13.014	12.389	75.502
1897, July 1 (low).....	10.587	7.529	8.714	7.887	13.838	11.642	12.288	72.455
1898, Jan. 1.....	13.511	7.336	12.371	8.312	14.654	11.572	12.184	79.940
1899, Jan. 1.....	13.816	7.520	11.458	9.066	14.150	11.843	12.540	80.423
1900, Jan. 1.....	13.254	7.258	13.702	9.290	17.484	18.085	16.312	98.298
1901, Jan. 1.....	14.486	8.407	15.556	9.504	16.024	15.810	15.851	98.668
1902, Jan. 1.....	20.002	9.670	15.248	8.652	15.547	15.375	16.793	101.587
1903, Jan. 1.....	17.104	9.522	14.613	9.418	15.938	17.185	16.576	100.356
1904, Jan. 1.....	17.102	8.138	15.287	8.653	17.316	15.887	16.759	100.142
1905, Jan. 1.....	18.278	7.950	13.948	10.699	16.319	18.188	16.936	100.318
1906, Jan. 1.....	16.554	8.426	14.399	9.822	19.313	17.141	18.809	104.464
1907, Jan. 1.....	16.079	9.350	14.965	9.790	19.637	18.087	19.385	107.264
Feb. 1.....	16.389	9.693	14.411	9.804	19.798	18.162	19.109	107.366
Mar. 1.....	17.478	9.673	15.727	9.767	20.000	18.133	19.133	109.913
Apr. 1.....	16.982	9.629	14.792	9.817	19.997	17.372	19.305	107.885
May 1.....	18.165	9.641	14.461	9.824	20.098	17.524	19.242	108.955
June 1.....	20.089	9.982	16.417	10.190	20.252	17.680	20.125	113.654
July 1.....	20.396	10.196	14.767	10.013	20.355	17.688	20.335	113.660
Aug. 1.....	19.872	10.090	15.438	10.041	20.281	17.667	20.319	113.728
Sept. 1.....	22.483	10.150	15.019	10.180	20.529	17.656	20.088	116.073
Oct. 1.....	22.940	9.667	15.646	10.446	20.109	17.206	19.976	116.140
Nov. 1.....	21.987	9.229	15.840	9.629	19.953	17.179	19.636	113.533
Dec. 1.....	21.290	8.329	17.169	10.152	19.389	16.937	19.498	113.272
1908, Jan. 1.....	22.254	8.146	17.380	10.236	18.819	17.592	19.185	113.292
Feb. 1.....	21.120	8.246	15.643	10.384	18.313	16.944	19.264	109.910
Mar. 1.....	21.480	8.546	15.904	10.354	17.731	17.122	19.252	110.389
Apr. 1.....	22.032	9.221	14.369	10.501	17.290	17.176	18.229	108.728
May 1.....	22.882	9.777	14.303	10.397	16.894	16.873	19.150	110.185
June 1.....	23.163	9.620	13.114	10.314	16.919	16.656	18.198	107.987

<sup>1</sup> The issue of May 9, 1914, contains the statement that "Dun's index number does not propose to show the cost of living, because wholesale prices are taken and all luxuries omitted. Its economic value lies in showing the percentage of advance or decline from month to month."

WHOLESALE PRICES OF SPECIFIED COMMODITIES, JAN. 1, 1880, TO DEC. 1, 1914—  
Concluded.

Date.	Bread- stuffs.	Meats.	Dairy and garden products.	Other foods.	Clothing.	Metals.	Miscella- neous.	Total.
1908, July 1	\$22.826	\$10.197	\$12.552	\$10.465	\$17.223	\$18.542	\$18.359	\$108.174
Aug. 1	24.161	9.992	13.357	10.319	17.348	18.537	17.751	109.495
Sept. 1	24.178	9.488	13.924	10.060	17.225	18.720	17.908	106.331
Oct. 1	23.990	9.534	14.620	10.090	17.226	18.521	17.710	106.991
Nov. 1	23.579	9.175	15.016	10.314	17.308	18.788	17.734	109.914
Dec. 1	21.879	9.185	17.019	10.428	17.828	18.920	17.781	111.008
1909, Jan. 1	21.480	9.142	18.104	10.396	18.024	18.919	17.783	111.848
Feb. 1	22.900	10.277	15.645	10.506	18.377	18.935	18.914	113.454
Mar. 1	23.967	8.890	15.212	10.417	18.863	18.852	21.419	115.420
Apr. 1	24.129	9.247	16.142	10.680	18.633	18.388	21.635	116.864
May 1	25.695	9.022	15.705	10.620	19.078	18.353	21.780	118.263
June 1	26.781	9.498	16.053	10.850	19.587	18.453	22.003	121.025
July 1	25.854	9.955	15.268	10.628	20.062	18.428	20.828	119.021
Aug. 1	23.957	10.517	15.248	10.810	20.194	18.515	22.832	115.449
Sept. 1	22.002	9.540	16.014	10.740	21.061	18.948	20.655	116.961
Oct. 1	21.530	9.459	16.265	10.975	21.528	17.200	21.362	118.301
Nov. 1	21.838	9.351	17.508	11.078	22.145	17.304	21.751	120.770
Dec. 1	22.315	9.546	19.194	11.052	22.130	17.437	21.770	122.414
1910, Jan. 1	23.830	9.642	18.906	10.833	22.174	18.515	22.123	123.434
Feb. 1	23.500	9.683	17.564	10.810	21.671	17.419	21.743	122.390
Mar. 1	23.423	10.786	16.927	10.906	21.785	17.265	21.743	122.840
Apr. 1	22.172	12.359	15.237	10.778	22.061	17.132	21.810	121.565
May 1	20.992	11.542	14.321	10.515	22.194	18.337	21.806	118.307
June 1	21.598	11.692	14.325	10.649	21.281	18.804	21.910	119.518
July 1	21.690	11.406	14.663	10.656	21.173	18.744	22.626	119.168
Aug. 1	21.883	11.080	15.457	10.830	20.508	18.587	22.171	118.524
Sept. 1	20.263	11.029	15.738	11.037	20.536	18.622	22.150	117.431
Oct. 1	19.120	10.370	16.264	11.038	19.832	18.574	22.181	115.449
Nov. 1	18.830	9.897	18.810	10.890	19.806	18.144	22.180	111.623
Dec. 1	18.567	9.788	18.013	10.509	20.042	18.092	22.633	114.664
1911, Jan. 1	18.010	9.483	18.073	11.196	19.444	18.919	22.177	115.102
Feb. 1	18.175	9.963	18.468	11.258	19.596	18.591	22.201	116.252
Mar. 1	17.732	10.146	14.586	11.018	19.780	18.742	22.243	114.978
Apr. 1	18.176	9.742	13.634	11.078	19.355	18.718	22.225	110.928
May 1	19.973	9.363	14.759	11.283	20.021	18.694	22.166	114.259
June 1	20.508	9.638	14.701	10.981	18.945	18.617	22.093	113.373
July 1	21.283	9.414	17.473	11.584	18.324	18.583	22.669	118.180
Aug. 1	21.085	9.903	16.648	11.404	18.778	18.526	22.842	119.735
Sept. 1	22.145	10.080	18.001	12.055	18.506	18.502	22.040	119.332
Oct. 1	23.828	9.612	16.501	12.339	18.638	18.307	22.067	119.292
Nov. 1	24.864	9.218	19.190	12.597	18.191	18.594	21.616	121.970
Dec. 1	23.125	8.324	22.177	12.610	18.191	18.361	21.534	122.922
1912, Jan. 1	23.523	8.920	21.286	12.261	18.630	18.371	22.437	123.438
Feb. 1	24.278	9.173	21.898	12.237	19.048	18.356	22.435	125.425
Mar. 1	24.718	9.514	19.364	12.222	19.480	18.961	22.255	123.577
Apr. 1	25.590	10.590	21.774	12.323	19.868	18.560	22.354	126.049
May 1	27.637	11.283	20.776	11.753	19.979	18.918	21.940	128.886
June 1	27.391	11.016	18.087	11.976	20.003	18.104	21.411	125.988
July 1	25.964	10.715	15.501	11.828	20.449	18.349	21.471	122.277
Aug. 1	25.760	10.848	16.752	11.705	20.588	18.664	21.875	123.892
Sept. 1	24.088	11.186	16.491	11.590	20.703	17.022	21.065	122.545
Oct. 1	21.785	10.923	18.627	11.757	20.705	17.633	21.865	121.106
Nov. 1	22.371	10.457	19.416	11.103	20.780	18.029	21.390	123.525
Dec. 1	20.665	10.629	19.223	11.112	21.066	18.046	21.313	122.054
1913, Jan. 1	19.883	10.912	17.925	11.073	21.015	17.942	22.082	120.832
Feb. 1	19.565	11.522	16.651	10.977	20.835	17.550	22.428	119.728
Mar. 1	19.596	13.047	16.143	10.732	21.143	17.379	22.432	120.461
Apr. 1	19.906	13.478	15.319	10.185	20.938	18.924	22.427	119.217
May 1	20.673	13.183	15.112	10.120	20.807	18.753	21.678	118.324
June 1	21.277	12.963	16.535	10.250	20.765	18.760	21.570	120.050
July 1	21.192	13.000	15.099	10.218	20.534	18.512	21.730	119.319
Aug. 1	21.032	13.080	14.916	10.267	20.250	18.528	21.842	118.515
Sept. 1	22.975	12.786	16.004	10.571	20.507	18.742	21.808	122.053
Oct. 1	22.538	13.053	17.934	10.700	20.947	18.760	21.922	123.002
Nov. 1	22.610	12.211	19.976	11.068	21.074	18.758	21.904	123.503
Dec. 1	23.004	12.059	20.454	11.010	20.815	18.596	21.794	125.734
1914, Jan. 1	21.961	12.150	20.087	10.950	20.664	18.170	22.546	124.528
Feb. 1	20.062	12.625	18.056	11.002	20.241	18.185	22.570	121.641
Mar. 1	22.146	13.168	18.009	11.381	20.434	18.881	22.772	121.771
Apr. 1	21.402	12.868	18.879	10.848	20.641	18.794	22.540	119.791
May 1	21.544	12.813	18.437	10.467	19.969	18.559	21.441	118.230
June 1	23.162	13.068	16.114	10.610	20.686	18.086	21.781	121.096
July 1	21.088	12.979	17.344	10.449	20.804	18.601	21.425	119.708
Aug. 1	22.567	13.427	16.201	10.284	20.975	18.754	21.522	122.740
Sept. 1	26.283	12.839	17.432	11.228	20.898	18.128	22.188	128.975
Oct. 1	24.441	13.063	17.326	11.423	20.259	18.974	22.015	123.531
Nov. 1	25.300	11.907	18.586	10.880	19.970	18.849	21.848	124.340
Dec. 1	24.426	11.324	19.825	10.548	19.883	18.124	22.043	124.183

## INDEX NUMBERS OF GIBSON.

## PUBLICATION.

This index of wholesale prices in the United States is published by Thomas Gibson, New York, every Saturday, in his weekly market letter.

## HISTORY.

In March, 1910, Prof. J. Pease Norton published a "report on a new method of compiling index numbers on the Sauerbeck selection of commodities modified with the Dun system of weighting," which was prepared for use in the weekly market report of Thomas Gibson.<sup>1</sup> The work was undertaken as a continuation of the Dun index, which had been suspended in May, 1907.

In this compilation 50 articles, divided into four general groups, were used instead of the much larger number included in Dun's index. The general food group was in turn divided into vegetable foods and animal foods. The descriptions of the 50 articles whose prices formed the index were the same as those used for these 50 articles in Bulletin of the United States Bureau of Labor, No. 75. The actual and relative prices for 1907 of these 50 articles appear to have been taken from the latter source. The plan followed in the compilation of this index was intended to be that used by Sauerbeck. It is claimed that no manufactured or derivative products are included, but that only primary commodities have been used.

Since November, 1912, only 22 articles, all of which belong to the food group alone, have been included in the index number.

## SOURCE OF QUOTATIONS.

As previously stated, the quotations used to join this index number with the one compiled by Dun were those published for January, 1907, in Bulletin of the United States Bureau of Labor, No. 75. The source of later quotations is not given.<sup>2</sup>

## BASE PERIOD.

The years 1890 to 1899 are used as the base period in the computation of the index number.

## PRICES: HOW SHOWN AND COMPUTED.

The actual prices of the articles are not shown for any period, the only data published in Gibson's weekly market report being the index for all commodities.

<sup>1</sup> See also article by Prof. Norton in Quarterly Journal of Economics, August, 1910, pp. 750-759. Published by Harvard University, Cambridge, Mass.

<sup>2</sup> It is stated, however, in the Quarterly Journal of Economics, August, 1910, p. 758 (footnote) that "Statistics collected from trade journals were used from January, 1900, to compute relative prices."

## NUMBER AND CLASS OF COMMODITIES.

As has been stated, when this index was first published it covered 50 articles from the farm, mines, and other sources, and included such as had been subjected only to an initial manufacturing process. Since November, 1912, it has been calculated on the food group alone, including 22 articles. It is stated that the articles covered are those essentially primary in their nature.

## DESCRIPTION AND GROUPING OF COMMODITIES.

The present list of articles is divided into two groups, as follows:

*Vegetable foods (13 articles).*

Wheat, contract price.  
 Wheat flour, spring patents.  
 Wheat flour, winter patents.  
 Barley, by sample.  
 Oats, cash.  
 Corn, No. 2, cash.  
 Corn meal, fine yellow.  
 Potatoes, white.  
 Rye, No. 2.  
 Sugar, 89°, fair refining.  
 Sugar, 96°, centrifugal.  
 Coffee, Rio, No. 7.  
 Tea, Formosa, fine.

*Animal foods (9 articles).*

Beef, steers (average of quotations for two grades).  
 Beef, fresh native sides.  
 Beef, salt.  
 Mutton, sheep (average of quotations for two grades).  
 Mutton, dressed.  
 Pork, hogs (average of quotations for two grades).  
 Bacon, short rib sides.  
 Hams.  
 Butter (average of quotations for three grades).

## SUBSTITUTIONS AND ADDITIONS.

Since the adoption of the present list there have been no additions of new articles nor substitutions in the place of those carried, so far as can be ascertained from the material published.

## INTERPOLATION.

Methods of supplying lacking statistical data, if resorted to, are not disclosed.

## WEIGHTING.

The weights assigned to the four groups formerly included in the index number were 50 for foods, 18 for textiles, 16 for minerals, and 16 for other commodities.

The weighting was accomplished by using a combination of figures from Dun's report and the material published by the

United States Bureau of Labor. The first operation was to secure an average of Dun's general index numbers for the years 1890 to 1899, which was found to be 0.843. The sum of the relative prices for all the articles in a group as published for January, 1907, in Bulletin No. 75 of the Bureau of Labor was then found. These relative prices were based upon the average for 1890 to 1899 as 100. The sum of these relatives was then divided by the average of the Dun number, 0.843. The quotient thus obtained was termed a multiplier. The total of the relatives of a group was then multiplied by this multiplier. The result divided by 100 was the index for that group, and the sum of the indexes for the four groups was the general index number.

The following statement explains the process of calculating the index by the above method:

## ILLUSTRATIVE EXAMPLE OF CALCULATING GIBSON'S INDEX NUMBERS.

Commodity.	Total relatives of the groups.	Multi- pliers.	Weighted product.
Foods.....	2422.1	1.9159	46.4950
Textiles.....	1264.9	1.6880	21.3010
Minerals.....	1324.8	1.4987	19.8548
Other.....	1408.7	1.8488	19.0065
Index number.....			106.5613

Since the reduction of the number of articles on which the index number is calculated from 50 articles of all classes to 22 food commodities, no explanation has been given concerning the method of weighting employed, so far as can be ascertained. It is stated, however, in Gibson's weekly market letter of January 11, 1913, and in subsequent issues that the index number is weighted according to Dun's method.

## TESTING.

The compiler of Gibson's index compares the result obtained under his method, 106.5613, with 107.2640, Dun's number for the same period. As a further test to show that figures compiled by this method would take the course of Dun's index number, the following figures are shown:

Date.	Gibson numbers.	Dun numbers.
January, 1907.....	106.56	107.26
February, 1907.....	108.01	107.37
March, 1907.....	109.58	109.91
April, 1907.....	110.55	(107.90)
May, 1907.....	113.41	(109.00)
1896.....	72.22	74.32

The compiler expresses the opinion that in April and May of 1907 the comparison of the two index numbers can not justly be made, inasmuch as it appears probable the Dun calculator changed his system of weighting for those months.

TABLES OF RESULTS.

The average yearly index numbers for the cost of foodstuffs, the only part of the original series now published, as computed by this process from 1890 down to the present time, are shown in the following table appearing in Gibson's weekly market letter of December 31, 1914:

AVERAGE YEARLY INDEX NUMBERS, 1890 TO 1914.

Year.	Average yearly index number.	Year.	Average yearly index number.	Year.	Average yearly index number.
1890.....	43.4	1900.....	44.2	1910.....	59.3
1891.....	50.8	1901.....	41.5	1911.....	56.9
1892.....	45.3	1902.....	53.5	1912.....	62.6
1893.....	46.0	1903.....	49.0	1913.....	58.1
1894.....	43.4	1904.....	48.3	1914.....	60.8
1895.....	42.0	1905.....	47.3		
1896.....	34.0	1906.....	49.8		
1897.....	34.7	1907.....	50.9		
1898.....	38.7	1908.....	54.2		
1899.....	41.6	1909.....	59.2		

Monthly averages for 1913 and 1914, also shown in the publication referred to above, are as follows:

MONTHLY AVERAGES, 1913 AND 1914.

1913				1914			
Month.	Monthly average.	Month.	Monthly average.	Month.	Monthly average.	Month.	Monthly average.
January.....	55.5	July.....	58.6	January.....	58.2	July.....	58.9
February.....	57.0	August.....	59.3	February.....	58.2	August.....	64.9
March.....	57.8	September.....	60.0	March.....	57.8	September.....	68.6
April.....	59.0	October.....	58.4	April.....	57.7	October.....	62.9
May.....	57.8	November.....	53.4	May.....	57.9	November.....	63.1
June.....	57.3	December.....	55.2	June.....	59.4	December.....	62.3

## AUSTRALIA.

## INDEX NUMBERS OF THE COMMONWEALTH BUREAU OF CENSUS AND STATISTICS.

## PUBLICATION.

In December, 1912, a report entitled "Prices, Price Indexes, and Cost of Living in Australia," compiled by G. H. Knibbs, Commonwealth statistician, was published by the recently organized Labor and Industrial Branch of the Commonwealth Bureau of Census and Statistics at Melbourne as its Report No. 1. Both wholesale and retail prices, together with import and export index numbers for Australia, are among the subjects considered in the report.

This publication is the first of a proposed series designed to include topics covering general industrial conditions as well as prices. Its main object, as stated in the preface, is "to furnish information as to prices in past years in such a form as to be fully comparable with that which it is proposed to publish periodically in the future."

The continuation of these index numbers is to be found in Report No. 2, entitled "Trade Unionism, Unemployment, Wages, Prices, and Cost of Living in Australia, 1891 to 1912," under date of April, 1913.

## HISTORY.

The author of these reports, having studied the various systems of index numbers published in other countries, became convinced that the methods ordinarily followed were so defective as to be misleading. He believed that an accurate system of inquiry should be determined upon to secure reliable and satisfactory data on which to base index numbers, and further that a uniform method for the international study of prices as a basis for world index numbers should likewise be worked out by those economists interested in the subject. These conditions he undertook to meet.

## SOURCE OF QUOTATIONS.

At first an attempt was made to secure from market reports wholesale prices of a representative list of commodities for the capital towns of each State. This plan was abandoned when it was found to be impracticable owing to the lack of complete records and to the difficulty in obtaining comparable returns. Moreover, the compilation of figures for Melbourne alone involved so much labor that no attempt was made to complete any other city.

The figures for Melbourne were obtained mainly from market prices published in the ordinary press and in special trade reviews. Where there was any question as to the reliability of the quotations the figures were verified by "reference to well-known and important business firms dealing in the articles in question."



The prices quoted are taken from the following sources: Journal of Commerce, 1861, 1866, 1871, 1872, and 1883 to 1912; Australasian Trade Review, 1871 to 1882 and occasionally to 1892; Melbourne papers, 1873 to 1912; for meats, Gippsland Mercury, 1890 to 1892; for coal, Federated Steamship Owners, 1901 to 1912.

#### BASE PERIOD.

The basic period for the computations of the wholesale price indexes was the year 1911, the aggregate expenditure on all articles and on each group of articles in this year being taken as 1,000. To quote: "The index numbers show the amount which would have had to be expended in each of the years specified in order to purchase what would have cost £1,000 in 1911, distributed in purchasing the relative quantities (indicated by the mass units) of the several commodities included in each group and in all groups respectively."

#### PRICES: HOW SHOWN AND COMPUTED.

A table in the appendix to the first report shows the average annual wholesale prices in Melbourne of all commodities included in the investigation except meats from 1871 to 1912 (first 9 months only), inclusive. Complete 1912 data for all of the 80 commodities, except silk; and for 13 additional commodities, are contained in the appendix to the second report.

Prices for meat were not obtained for the years prior to 1884 and 1885 nor for the years 1886 to 1889, inclusive. The unit of measurement is given for each article and the price stated in shillings and pence. The articles for which prices are quoted are divided into eight groups. In most cases monthly prices were obtained, and from these the yearly averages were computed. For tea, coal, cotton, wool, and silk, however, monthly prices were not available, so that yearly averages based in each case on expert opinion<sup>1</sup> were secured.

The monthly quotations, from which the yearly average is computed, are not shown.

The group and general index figures for 1861 and 1866 are shown elsewhere in the report, but no actual prices are given for these years.

#### NUMBER AND CLASS OF COMMODITIES.

In the computation of index numbers for the years prior to 1911 (the base year) the aggregate expenditure on 80 commodities was used, while for 1912 the number of commodities included was increased to 92. The author states that the commodities included are generally in the nature of raw materials—that is, materials in which the labor cost is relatively low.

<sup>1</sup> Source of this expert opinion not stated.

There are no articles of clothing, boots or shoes, or furniture included. The reason assigned for their omission was the impracticability of obtaining periodic prices for predominant grades and qualities and of satisfactorily determining the relative importance in consumption of the various items, the author contending that the character of clothing and of furniture includes the element of change due to the influence of fashion, and that where incomes are limited economy strikes first at these articles.

#### DESCRIPTION AND GROUPING OF COMMODITIES.

The 80 commodities used in computing the index numbers for years prior to 1911 are divided into 8 groups as follows:

- I. Metals and coal, 12 commodities.
- II. Jute, leather, etc., 9 commodities.
- III. Agricultural produce, 13 commodities.
- IV. Dairy produce, 7 commodities.
- V. Groceries, 21 commodities.
- VI. Meat, 5 commodities.
- VII. Building materials, 9 commodities.
- VIII. Chemicals, 4 commodities.

The list of articles, with their description or brand, the source of information, the unit upon which quoted, the quantities consumed, and the "mass unit"—i. e., the extent to which a commodity is used—are shown in detail on pages 162 to 164 of this bulletin.

In both reports index numbers are given for all groups taken as a whole and for each group. Under each group in the first report is shown the index number for a few individual articles of importance computed on the price in 1911 as the base, but no table is given showing an index for each of the 80 articles separately.

#### SUBSTITUTIONS AND ADDITIONS.

Cases of substitution of a particular grade or quality of an article for another grade or quality of the same article, if any, are not apparent in the tables, owing to the manner in which the information is presented. The author states, however, that "every care was taken to insure that the prices quoted for each article refer to a uniform quality" and that "special precautions were taken to insure substantial continuity of quality or grade."

In the computation of the index numbers for 1912 in the second report, as previously stated, the author added 13 articles and dropped raw silk, so that the index for 1912 covers 92 articles instead of 80, as formerly. The aggregate expenditure on these 92 articles in 1911 formed the base for the 1912 index. In group 3 the mass unit for hay was changed from 270 to 135, and oat chaff, a new article in this

group, was assigned a mass unit of 135, thus making the sum of the mass units used for hay and oaten chaff in 1912 equal the mass unit for hay in the earlier years. The 13 articles added are as follows:

GROUPS OF ARTICLES ADDED IN THE COMPUTATION OF THE INDEX NUMBERS FOR 1912.

Commodity.	Unit.	Mass unit.
Group I:		
Tinned plates, I. C. coka.....	Hundredweight.	60
Quicksilver.....	Pound.....	12
Group II:		
Twine, reaper and binder.....	Pound.....	150
Tallow, prime mutton.....	Ton.....	14
Group III:		
Chaff, good oaten.....	Ton.....	135
Malt, Victorian.....	Bushel.....	140
Onions.....	Ton.....	3
Group IV:		
Beeswax.....	Pound.....	40
Condensed milk, Baccus Marsh.....	Dozen pounds.....	160
Group VII:		
Slates, Welsh, 20 by 10.....	1,000.....	4
Group VIII:		
Caustic soda.....	Hundredweight.	7
Alum, lump.....	Hundredweight.	4
Cyanide potassium.....	Pound.....	570

NOTE.—Groups V and VI have no additions.

INTERPOLATION.

As already stated, prices for meats were not secured prior to 1890 except for 1884 and 1885. For the full period since 1871 the index numbers were accordingly worked out for the seven groups, excluding meats, and also for the period since 1890 for the eight groups, including meats. The figures for the general index for 1871 to 1889 (except 1884 and 1885) were then adjusted, on the basis of the results of succeeding years, so as to include meats. The exact procedure has not been disclosed.

WEIGHTING.

The system of weighting used differs materially from the system generally employed by compilers of index numbers. The author bases his index numbers on what he terms the aggregate expenditure method. By this method the cost of an unvarying bill of goods is calculated at the varying prices prevailing during different years. The extent to which a commodity is used is expressed by a number termed the "mass unit." The mass unit is developed from the figures which denote the quantity used or consumed, which latter amount has in general been obtained by adding to the production of each commodity in Australia the amount of imports and from this sum subtracting the amount of exports. The figures have, in general, been based on the average production and the average export and import returns for the five years 1906 to 1910, inclusive. No further explanation as to the source of his con-

sumption figures has been given by the author. Reference to the table on pages 162-164 of this Bulletin will indicate the manner in which the mass units were obtained. In this table the quantities consumed of the various commodities are expressed in thousands only. The mass unit is obtained in each case by dividing the figure denoting the quantity consumed by 10 and approximating the quotient. For instance, the average annual consumption of pig iron is stated to be 64 thousand tons, which is restated as a mass unit of 6½.

The mass unit having been established and the average yearly price for the year determined, the process then was to multiply the mass unit by the price. Thus, the price of pig iron was 81s. 2d. (\$19.48) for a ton in 1911. This price, 81s. 2d. (\$19.48), multiplied by the mass unit (6½) gives the aggregate expenditure on pig iron in 1911. This process was applied to each article of the metals group in 1911 and each of the years during the entire period (1890-1912), the sum of such products producing the yearly aggregate group expenditure. The same mass unit was used for all the years of the period. The index for a single group and for all groups was obtained by dividing the total expenditures of a given year by the total expenditures of the basic year, i. e., 1911, and the result multiplied by 1,000.

The following table illustrates the system of weighted index numbers used:

COMPUTATION OF INDEX NUMBERS—ILLUSTRATIVE EXAMPLE OF AGGREGATE EXPENDITURES METHOD.

Articles.	Unit.	Quantities consumed (in millions).	Prices.		Total expenditures (in millions).	
			1901	1911	1901	1911
Butter.....	Pounds.....	90	d. 15	d. 18	d. 1,350	d. 1,620
Bread.....	2-pound loaf.....	470	3	4	1,410	1,880
Mutton.....	Pounds.....	330	3	5	990	1,650
Milk.....	Quarts.....	300	4	5	1,200	1,500
Total.....					4,950	6,650

Thus 6,650 millions is the total expenditure for this group in 1911, which is the base or 1,000. To secure the index figure for 1901, the total aggregate number 4,950 millions for 1901 is divided by 6,650 millions, the base, which quotient multiplied by 1,000 equals 744 as the index for 1901. A similar process was used for each of the groups represented in the report. The author lays particular emphasis on the fact that his index numbers are reversible, by which he means that they may be recomputed with any other year than 1911 as the base and the results be as accurate as if that year had been taken as the base originally.

## TESTING.

The author tests his system of weighting by mass units instead of actual quantities consumed by a comparison of results obtained under the two methods by taking a list of prices from 1871 to 1911 for 73 articles, the year 1911 being used as a base. In the first instance the actual figures were used and in the second the mass units. The result in the first case was 1,194, and in the second 1,193, the slight difference thus shown appearing not to warrant the extra arithmetical labor required by the use of the actual figures instead of the rounded numbers or mass units.

He further tests his index numbers by a comparison with index numbers obtained by other methods. The following table illustrates this comparison:

PRICE INDEXES: EXAMINATION AS TO RELIABILITY OF VARIOUS METHODS.

	Aggregate expenditure method.	Weighted price-ratio method (geometric mean).	Weighted price-ratio method (arithmetic mean).	Un-weighted price-ratio method.
Index number for 1871, with 1911 (equaling 1,000) as base year.....	1,194	1,195	1,289	1,310

He considers the first two as valid but the last two as invalid for his use.

## TABLES OF RESULTS.

The following table shows the list of 80 commodities divided into 8 groups, with the brand, source of information, unit, quantities consumed, and mass unit in each case:

MELBOURNE WHOLESALE PRICES, COMMODITIES INCLUDED, SOURCES OF INFORMATION, QUANTITIES CONSUMED, AND MASS UNITS.

## Group I.—Metals and coal (12 commodities).

Commodity.	Brand.	Sources of Information.	Unit.	Quantities consumed (in thousands).	Mass unit.
Iron:					
Pig.....	Mixed numbers...	Trade Journals <sup>1</sup> ...	Ton.....	64	64
Rod and bar.....	Stafford.....	do.....	do.....	34	34
Angle and T.....	do.....	do.....	do.....	34	34
Plate.....	do.....	do.....	do.....	31	31
Hoop.....	do.....	do.....	do.....	6	6
Galvanized.....	26-gauge.....	do.....	do.....	52	52
Fencing wire.....	No. 8.....	do.....	do.....	60	60
Zinc sheet.....	do.....	do.....	do.....	8	8
Lead sheet.....	do.....	do.....	do.....	7	7
Lead pipes.....	do.....	do.....	do.....	6	6
Copper sheet.....	do.....	do.....	do.....	20,000	2,000
Coal.....	Newcastle, on wharf.	Journal of Commerce, 1871 and 1872, quoted in Bay, Melbourne papers, 1873 to 1910, Federated Steamship Owners, 1901 to 1912.	Found. Ton.....	6,004	600
Total.....					2,630½

<sup>1</sup> When "trade journals" is mentioned it signifies the Journal of Commerce, 1861, 1866, 1871, 1872, and 1883 to 1912, and the Australasian Trade Review, 1871 to 1882, and occasionally to 1892.

MELBOURNE WHOLESALE PRICES, COMMODITIES INCLUDED, SOURCES OF INFORMATION, QUANTITIES CONSUMED, AND "MASS UNITS"—Continued.

Group II.—Jute, leather, wool, etc. (9 commodities).

Commodity.	Brand.	Sources of information.	Unit.	Quantities consumed (in thousands).	Mass unit.
Bran, bags.....		Trade journals <sup>1</sup>	Dozen.....	1,090	110
Corn, sacks.....		do.....	do.....	2,500	250
Woolpacks.....		do.....	Each.....	2,000	200
Leather, kip (small beasts, as calf, sheep).		do.....	Pound.....	10,710	1,070
Leather, calf.....		do.....	do.....	6,946	700
Leather, harness (leather tanned in bark as distinguished from "roan," tanned in sumach).		do.....	Dozen.....	257	25
Cotton.....	Raw	London prices.....	Pound.....	243,200	24,000
Silk.....	do.	do.....	do.....	2,435	250
Wool.....	do.	London prices (Australasian wool).	do.....	122,000	12,200
Total.....					38,805

Group III.—Grains, etc. (13 commodities).

Wheat.....		Trade journals <sup>1</sup> and Melbourne papers.	Bushel.....	4,853	500
Flour.....		do.....	Ton.....	477	48
Bran.....		do.....	Bushel.....	14,350	1,400
Follard.....		do.....	do.....	14,350	1,400
Oats.....	Feed.	do.....	do.....	12,365	1,200
Oatmeal.....	Colonial.	Trade journals <sup>1</sup> and Melbourne papers, 1891 to date.	Ton.....	16	1½
Barley.....	Malting	do.....	Bushel.....	1,500	150
Do.....	Feed	do.....	do.....	1,000	100
Maize.....	do.....	do.....	do.....	8,624	1,000
Hay.....	Best mangle.	Melbourne papers	Ton.....	2,985	270
Straw.....	Victorian	do.....	do.....	265	25
Poss.....	do.....	Trade journals <sup>1</sup>	Bushel.....	554	55
Potatoes.....	do.....	Melbourne papers.	Ton.....	402	40
Total.....					6,189½

Group IV.—Dairy produce (7 commodities).

Ham.....		Melbourne papers.	Pound.....	8,000	800
Bacon.....		do.....	do.....	32,500	3,200
Cheese.....		do.....	do.....	15,000	1,500
Butter.....	Best fresh	do.....	do.....	605,000	9,500
Lard.....	In bladders	do.....	do.....	2,000	200
Eggs.....	Ordinary	do.....	Dozen	18,000	1,800
Honey.....	do.....	do.....	Pound.....	5,847	600
Total.....					17,600

Group V.—Groceries (21 commodities).

Currants.....		Trade journals <sup>1</sup>	Pound.....	14,000	1,400
Raisins.....	Sultanas	do.....	do.....	14,000	1,400
Herrings.....	1-pound tins	do.....	Dozen 1-pound tins.	500	50
Salmon.....	do.....	do.....	do.....	500	50
Sardines.....	Halves	do.....	Dozen halves.....	1,000	100

<sup>1</sup> When "trade journals" is mentioned it signifies the Journal of Commerce, 1861, 1866, 1871, 1872, and 1883 to 1912, and the Australasian Trade Review, 1871 to 1882, and occasionally to 1892.

## MELBOURNE WHOLESALE PRICES, COMMODITIES INCLUDED, SOURCES OF INFORMATION, QUANTITIES CONSUMED, AND "MASS UNITS"—Concluded.

## Group V.—Groceries (21 commodities)—Concluded.

Commodity.	Brand.	Sources of information.	Unit.	Quantities consumed (in thousands).	Mass unit.
Coffee.....	Plantation.....	Trade journals <sup>1</sup> ...	Pound.....	2,100	200
Cocoa.....	Taylor's.....	do.....	do.....	1,000	100
Sugar.....	No. A1 or its equivalent in former years.	do.....	Ton.....	220	22
Macaroni.....	.....	do.....	Pound.....	2,000	200
Sago.....	.....	do.....	do.....	7,750	800
Rice.....	Patna.....	do.....	Ton.....	22	2
Salt.....	Liverpool, fine.....	do.....	do.....	70	7
Do.....	Rock.....	do.....	do.....	10	1
Mustard.....	1871-1883 D. S. F.; in 1884-1911, 1-pound tins, Coleman's.	do.....	Dozen 1-pound tins.	64	6
Starch.....	Coleman's white.....	do.....	Pound.....	1,000	100
Blue.....	Kean's.....	do.....	do.....	500	50
Matches.....	Wooden safety.....	do.....	Gross.....	800	90
Candles.....	Gouda.....	do.....	Pound.....	15,000	1,600
Tobacco.....	Two Seas, in pocket pieces.	do.....	do.....	13,000	1,300
Tea.....	.....	London prices.....	do.....	20,000	2,000
Kerosene.....	.....	Trade journals <sup>1</sup> ...	Gallon.....	17,500	1,700
Total.....					12,178

## Group VI.—Meat (5 commodities).

Beef.....	Average quality...	Metropolitan meat market reports. <sup>2</sup>	100 pounds.....	3,875	300
Mutton.....	do.....	do.....	Pound.....	332,000	33,000
Veal.....	do.....	do.....	do.....	20,000	2,000
Lamb.....	do.....	do.....	Each.....	2,047	200
Pork.....	do.....	do.....	Pound.....	37,000	3,700
Total.....					39,200

## Group VII.—Building materials (9 commodities).

Timber.....	Flooring:	Trade journals <sup>1</sup> ...	100 feet, linear.....				
	6 by 1½.....					300	30
	8 by 1.....					300	30
	6 by 1.....					300	30
	6 by 1.....					300	30
	6 by 1.....					2,000	200
	Weatherboards.....	do.....	do.....	200	20		
	Oregon.....	do.....	1,000 feet, superficial.	200	20		
Cement.....	Shelving.....	do.....	do.....	100	10		
	Portland.....	do.....	Cask.....	312	30		
White lead.....	Portland.....	do.....	Ton.....	8	½		
Total.....					280½		

## Group VIII.—Chemicals (4 commodities).

Cream of tartar.....	In kegs.....	Trade journals <sup>1</sup> ...	Pound.....	4,030	400
Carbonate of soda.....	.....	do.....	Ton.....	8	½
Saltpeter.....	Refined.....	do.....	do.....	½	½
Sulphur.....	.....	do.....	do.....	2	½
Total.....					400½

<sup>1</sup> When "trade journals" is mentioned it signifies the Journal of Commerce, 1861, 1866, 1871, 1872, and 1883 to 1912, and the Australasian Trade Review, 1871 to 1882, and occasionally to 1892.<sup>2</sup> Gippsland Mercury, 1890 to 1892; Melbourne papers, 1893 to 1912.

The next table contains the index numbers for each group and for all the groups as a whole from 1871 to 1912, inclusive. It will be noticed that no index numbers for meats are given before 1884 or for the years 1886 to 1889.

MELBOURNE WHOLESALE-PRICE INDEX NUMBERS, 1871 TO 1912, COMPUTED TO YEAR 1911 AS BASE.

Year.	I. Metals and coal.	II. Furs, leather, etc.	III. Agricultural produce, etc.	IV. Dairy produce.	V. Groceries.	VI. Meat.	VII. Building materials.	VIII. Chemicals.	All commodities together.
1871.....	1096	1257	1236	864	1586	.....	1044	1409	1229
1872.....	1456	1394	1246	1019	1608	.....	1097	1537	1335
1873.....	1816	1362	1422	1032	1581	.....	1446	1661	1451
1874.....	1635	1240	1456	1160	1476	.....	1138	1663	1387
1875.....	1487	1230	1361	1345	1435	.....	1009	1654	1337
1876.....	1406	1146	1445	1415	1462	.....	1054	1532	1350
1877.....	1400	1149	1347	1303	1502	.....	1047	1569	1311
1878.....	1329	1084	1269	1112	1378	.....	886	1411	1216
1879.....	1266	1060	1298	1146	1371	.....	852	1444	1210
1880.....	1347	1101	954	900	1421	.....	943	1628	1109
1881.....	1178	1115	1012	935	1412	.....	1091	1587	1121
1882.....	1297	1032	1444	1347	1414	.....	1005	1493	1289
1883.....	1231	1021	1237	1114	1408	.....	910	1484	1183
1884.....	1208	997	1124	1156	1326	.....	876	1471	1132
1885.....	1216	921	1156	1316	1158	1042	880	1432	1105
1886.....	1164	835	1222	1286	1139	.....	730	1398	1089
1887.....	1033	883	1184	1091	1128	.....	790	1401	1065
1888.....	1216	870	1123	1210	1122	.....	837	1378	1074
1889.....	1061	886	1505	1082	1152	.....	940	1228	1171
1890.....	1402	911	1022	1099	1074	1007	880	1257	1053
1891.....	895	847	1024	965	1032	888	780	1194	945
1892.....	889	800	971	1066	967	901	704	1149	918
1893.....	856	783	834	842	1033	816	739	1018	850
1894.....	752	721	644	708	1057	665	731	934	749
1895.....	720	684	734	712	1016	682	789	1003	780
1896.....	808	749	1116	875	1021	808	780	1065	922
1897.....	813	706	1083	937	1009	1072	786	971	925
1898.....	842	683	920	1034	1000	1091	838	953	885
1899.....	933	717	670	814	1003	960	805	892	809
1900.....	1042	861	703	838	1039	1163	911	908	894
1901.....	1061	774	928	1029	1048	1345	841	917	974
1902.....	1007	756	1192	1215	945	1447	837	881	1051
1903.....	923	834	1209	1059	936	1443	875	921	1049
1904.....	821	885	754	876	916	1427	845	875	890
1905.....	772	850	894	980	942	1209	801	859	910
1906.....	882	978	916	972	923	1110	886	864	948
1907.....	1037	1017	973	1020	948	1294	968	961	1021
1908.....	1033	901	1312	1198	968	1335	935	891	1115
1909.....	1014	907	1000	1119	978	1088	911	815	983
1910.....	1004	1052	969	1100	999	1008	966	896	1003
1911.....	1000	1000	1000	1000	1000	1000	1000	1000	1000
1912.....	1021	991	1370	1206	1052	1367	1057	978	1170

The author presents the following table of index numbers by quinquennial periods to show the average level of prices over periods of several years. The average for each 5-year period is 1000 and that for 1911 and 1912 is compared with this base. For instance, taking the average price level of 1871-1875 as 1000, that for 1911-1912 has fallen to 806, and taking that of 1876-1880 as 1000 that for 1911-1912 in comparison is 877. The other figures are to be read in the same manner.



INDEX NUMBERS FOR 1911-1912, WITH AVERAGE EXPENDITURE IN EACH SUCCESSIVE QUINQUENNIAL PERIOD AS BASE.

Base period (prices=1000).	I. Metals and coal.	II. Wool, leather, etc.	III. Agricul- tural produce.	IV. Dairy produce.	V. Groceries.	VI. Meat.	VII. Building materials.	VIII. Chemicals.	All groups together.
1871-1875..	672	792	841	1,087	678	.....	899	621	806
1876-1880..	746	926	896	957	731	.....	1,067	641	877
1881-1885..	821	1,012	946	857	775	.....	1,071	651	932
1886-1890..	854	1,172	934	974	925	.....	1,183	730	939
1891-1895..	1,225	1,340	1,345	1,299	1,015	1,438	1,362	917	1,288
1896-1900..	1,134	1,383	1,265	1,240	1,028	1,122	1,244	1,019	1,222
1901-1905..	1,098	1,224	1,137	1,089	1,089	833	1,214	1,091	1,115
1906-1910..	1,013	1,059	1,094	1,039	1,082	981	1,084	1,067	1,070

A table contained in the first of the two reports compares index numbers of wholesale prices in Australia with those of the United Kingdom, Belgium, Germany, Italy, France, Canada, the United States, and New Zealand. Complete data for all countries are shown for the years 1890 to 1911, inclusive. In the cases of the United Kingdom and the United States the comparison is extended back to 1840. This comparative table does not show, of course, the relative prices as published in the different countries, but as recomputed for each country on the base 1911 equals 1,000. The last column of the table contains figures computed by weighting the index number for each country by its relative population, thus supplying what the author says may be termed the world's index number.

#### AUSTRIA-HUNGARY.

##### INDEX NUMBERS OF DR. BÉLA VON JANKOVICH<sup>1</sup>

###### PUBLICATION AND HISTORY.

This index for the years 1867-1897 appeared under the title "Die Fluktuation der Waarenpreise im Grosshandel und die Schwankungen der Wechselkurse der oesterreich-ungarischen Papierwäuta in den Jahren 1867-1897" (The fluctuation of wholesale prices and the variation in the rate of exchange of the Austro-Hungarian paper values). It was printed in the Hungarian economic review entitled "Kozgazdasagi Szemle 1899."

It was continued to 1909 and reprinted in the Bulletin of the International Institute of Statistics, volume 19, Part III, page 136 et seq., in 1912 (*Bulletin de L'Institut International de Statistique*), under the title "Index Nummer von 45 Waaren in der oesterreich-ungarischen Monarchie, 1867-1909; System Sauerbeck, zum Teil vom Verfasser korrigiert" (Index number of forty-five articles in the

<sup>1</sup> Dr. von Jankovich was in 1911 professor of the theory of finance and credit in the University of Budapest (according to the *Minerva Yearbook of the Learned World*) and vice president of the Hungarian Chamber of Deputies.

Austro-Hungarian monarchy, 1867-1909, according to the system of Sauerbeck, with some corrections by the author).

Sauerbeck's method of computation was followed as closely as possible in order that the Austrian index might be comparable with Sauerbeck's index, since England throughout the period had a gold standard. Articles were also selected to correspond as closely as practicable with those entering into Sauerbeck's index.

## SOURCE OF QUOTATIONS.

The sources of the actual prices vary, being mostly official and semi-official publications of Austro-Hungarian cities and Provinces.

## BASE PERIOD.

The years 1867-1877 were used as a base for all articles except petroleum, for which 1873-1877 constitutes the base, and flax, for which 1874-1877 constitutes the base.

## NUMBER AND CLASS OF COMMODITIES.

The index includes 45 articles. Actual as well as relative prices are shown for all articles except tea, but in a few cases the actual prices are not complete. Relatives are also shown for each of six groups into which the 45 articles are separated, and for the entire 45 taken together. The six groups are: Grains (1-8), animal products (9-15), colonial goods (16-19), minerals (20-26), textiles, raw materials (27-34), and miscellaneous (35-45).

## TABLE OF RESULTS.

The following table summarizes the results of Dr. von Jankovich's compilations:

SUMMARY TABLE SHOWING INDEX NUMBERS FOR THE PRICES OF 45 ARTICLES IN THE WHOLESALE MARKETS OF AUSTRIA-HUNGARY.<sup>1</sup>

[Source: Bulletin de L'Institut International de Statistique, vol. 19, Pt. III, p. 156.]

Year.	Grains (1-8).	Animal products (9-15).	Colonial goods (16-19).	All foods (1-19).	Mineral products (20-26).	Textiles (raw materials) (27-34).	Miscella- neous raw materials (35-45).	All raw materials (20-45).	Index number, Austria- Hungary for 45 articles.
1867.....	110	90	101	101	101	117	104	107	104
1868.....	95	96	99	96	93	104	99	99	98
1869.....	88	98	104	95	99	109	103	103	100
1870.....	95	101	103	99	104	106	106	106	102
1871.....	101	102	104	102	116	105	106	109	106
1872.....	101	108	102	104	106	110	103	106	105
1873.....	108	111	99	107	107	95	100	101	104
1874.....	114	103	98	106	98	87	95	94	99
1875.....	91	97	95	94	86	87	92	89	91
1876.....	96	97	94	96	97	86	96	93	95
1877.....	103	97	103	101	93	94	96	95	96
1878.....	91	94	86	91	89	85	89	88	89
1879.....	89	90	82	88	81	82	82	82	89
1880.....	103	96	82	82	86	87	82	84	85

<sup>1</sup> Numbers appearing in the boxes refer to the column numbers of the articles making up the six groups as they appear in the detailed table.

SUMMARY TABLE SHOWING INDEX NUMBERS FOR THE PRICES OF 45 ARTICLES IN THE WHOLESALE MARKETS OF AUSTRIA-HUNGARY<sup>1</sup>—Concluded.

Year.	Grains (1-3).	Animal products (9-15).	Colonial goods (16-19).	All foods (1-19).	Mineral products (20-26).	Textiles (raw materials) (27-34).	Miscellaneous raw materials (35-45).	All raw materials (20-45).	Index number, Austria-Hungary, for 45 articles.
1881.....	99	97	79	94	86	82	79	82	87
1882.....	99	101	77	95	89	81	78	80	86
1883.....	93	103	72	92	83	78	83	82	85
1884.....	93	101	64	90	77	78	85	81	85
1885.....	84	97	82	84	74	74	80	77	80
1886.....	82	83	61	82	74	73	74	74	77
1887.....	79	92	66	81	76	74	73	74	77
1888.....	79	94	67	82	80	71	71	74	77
1889.....	78	90	70	81	78	72	73	74	77
1890.....	83	92	84	82	81	70	70	73	77
1891.....	89	96	94	86	82	67	70	72	78
1892.....	80	90	94	80	79	65	67	70	74
1893.....	75	91	68	79	78	60	71	72	75
1894.....	74	91	62	78	73	65	66	68	72
1895.....	76	97	68	80	72	64	66	67	73
1896.....	71	94	54	76	74	63	65	66	71
1897.....	81	94	47	78	76	62	66	68	72
1898.....	89	99	45	83	81	59	68	68	76
1899.....	79	97	46	78	90	67	68	75	78
1900.....	76	98	47	78	109	76	74	84	82
1901.....	81	97	41	78	106	71	73	81	80
1902.....	83	103	37	81	92	71	69	76	78
1903.....	83	112	39	84	93	76	67	77	80
1904.....	91	109	45	88	90	78	68	77	82
1905.....	96	121	40	96	96	70	69	79	85
1906.....	89	129	44	94	112	85	74	82	91
1907.....	95	131	46	98	117	88	79	92	95
1908.....	109	125	46	100	105	79	76	84	91
1909.....	115	130	48	107	103	79	79	86	94

<sup>1</sup> Numbers appearing in the boxes refer to the column numbers of the articles making up the six groups as they appear in the detailed table.

## INDEX NUMBERS OF MARIO ALBERTI

## PUBLICATION.

A volume entitled "Il costo della vita i salari e le paghe a Trieste nell' ultimo quarto di secolo" (The Cost of Living, Salaries, and Wages in Trieste During the Last Quarter of the Century), by Mario Alberti, was published in Trieste in April, 1911, under the direction of the Museo Commerciale, a nonofficial organization of that city.

A second volume, *Il movimento dei prezzi e dei salari a Trieste, 1911* (The Movement of Prices and Wages in Trieste, 1911), was published by the same author in 1912.

## HISTORY.

Mario Alberti in his two works has made a study of prices and has computed index numbers for certain commodities purchased by contract in Trieste.

In his cost of living study the author traces from the time of ancient Rome to the present the interest manifested in the question of the cost of living and the means adopted to study the movement of prices in various epochs and countries. Chapter IV of this work deals exclusively with conditions in Trieste. The volume on the movement of prices and wages also relates exclusively to Trieste.

## SOURCE OF QUOTATIONS.

The prices used in the tables of index numbers are contract or semi-wholesale prices quoted by the Istituto dei Poveri (Institution for the Poor) and by the Austrian Lloyd Steamship Co. Those for the Istituto dei Poveri extend from 1885 to 1911, inclusive, and for the Austrian Lloyd Steamship Co. from 1892 to 1911, inclusive.

## BASE PERIOD.

For the index numbers relating to the Istituto dei Poveri the year 1885, taken as 100, is used as a base. For those of the Austrian Lloyd Steamship Co. the years 1892-1896, taken as 100, are used as a base.

## PRICES: HOW SHOWN AND COMPUTED.

Tables are presented showing by years the average annual price of each commodity purchased by the Istituto dei Poveri and by the Austrian Lloyd Steamship Co. In addition, the simple index, the coefficient or weight attributed to the commodity, and the weighted index for the commodity are given. The totals for each year show the figures on which the simple index and the weighted index for all commodities taken as a whole are computed.

## NUMBER AND CLASS OF COMMODITIES.

The commodities included are:

(a) For the Istituto dei Poveri:

Bread.	Cheese.
Flour.	Meat.
Paste (macaroni, etc.).	Sugar.
Rice.	Wine.
Kidney beans.	Vinegar.
Potatoes.	Coal.
Oil.	Soap.

(b) For the Austrian Lloyd Steamship Co.:

Bread. <sup>(1)</sup>	Sugar.
Flour N. O. (national).	Wine, Dalmatian, in transit.
Paste (macaroni, etc.), national, fine.	Vinegar. <sup>1</sup>
Rice, fine, in transit.	Soap. <sup>1</sup>
Kidney beans.	Fresh butter.
Potatoes.	Coffee, Santos, in transit.
Oil, fine, in transit.	Milk.
Cheese, Parma, in transit.	Lard.
Beef (cow).	Eggs.
	Meal, yellow.

<sup>1</sup> Prices are average prices paid by the Istituto dei Poveri.

## SUBSTITUTIONS AND ADDITIONS.

For 1910 two sets of prices were used in the computation of the indexes. The report on the cost of living contained prices based on estimates, while the volume devoted to the movement of prices and wages contained prices based on actual expenditures. On page 21 of the latter the author states that for this reason "The index number for 1910 was newly calculated on the base of prices furnished by the Istituto dei Poveri."

## WEIGHTING.

The prices of the different articles are weighted by the use of coefficients which represent the relative amounts of the commodities consumed. These coefficients are shown for the tables relating to the Istituto dei Poveri in the following list:

Bread.....	26	Cheese.....	1-5
Flour, wheat.....	1	Meat.....	20
Paste (macaroni, etc.).....	4	Sugar.....	4
Rice.....	2.5	Wine.....	20
Kidney beans.....	2	Vinegar.....	3-5
Potatoes.....	10	Coal.....	50
Oil.....	2	Soap.....	1

The coefficients used in the tables for the Austrian Lloyd Steamship Co. are as follows:

Bread.....	26	Wine.....	20
Flour, wheat.....	1	Vinegar.....	3-5
Paste (macaroni, etc.).....	4	Soap.....	1
Rice.....	2.5	Fresh butter.....	2
Kidney beans.....	2	Coffee.....	1
Potatoes.....	10	Milk.....	30
Oil.....	2	Lard.....	2
Cheese.....	1-5	Eggs.....	50
Beef.....	20	Meal, yellow.....	1
Sugar.....	4		

## TESTING.

No comparison with other index numbers or other means of testing the accuracy of the results obtained has been attempted so far as the published information discloses.

## TABLES OF RESULTS.

The first of the three following tables shows the average price of each of 14 articles for the base year 1885; the coefficients used in computing the weighted index; the average price, the simple index and the weighted index for each of the 14 articles for the years 1910 and 1911, and the totals of the simple and the weighted indexes for those two years. The prices in the table are based on reports from the Istituto dei Poveri.

The second table shows the indexes, both simple and weighted, for the 14 articles taken as a whole, in yearly periods from 1885 to 1911, inclusive.

The third table shows the average prices for 1892-1896 of 19 articles (18 food articles and soap); the coefficients; the average price, the simple index and the weighted index for each article in the years 1910 and 1911; and the totals of the indexes for 1910 and 1911, respectively. The prices are based on the period 1892-1896, taken as 100, and were obtained from the Austrian Lloyd Steamship Co.

INDEX NUMBERS BASED ON PRICES OF ISTITUTO DEI POVERI.<sup>1</sup>

Name of article.	Price in base period, 1885.	Coeffi- cient.	1910			1911		
			Price.	Simple index.	Weighted index.	Price.	Simple index.	Weighted index.
Bread .....	32.00	25	38.17	119.28	3,101.28	37.54	117.31	3,050.06
Flour, wheat .....	25.52	1	35.60	139.85	139.85	84.19	133.97	133.97
Paste (macaroni, etc.) .....	30.00	4	48.47	134.64	538.56	49.97	138.81	555.94
Rice .....	30.50	2.5	31.82	104.33	260.82	33.91	111.18	277.95
Kidney beans .....	15.52	2	29.69	191.26	382.52	35.05	225.84	451.68
Potatoes .....	8.00	10	8.06	100.75	1,007.50	11.04	138.00	1,380.00
Oil .....	120.00	2	102.43	85.36	170.72	106.70	88.22	177.64
Cheese .....	137.60	2	213.57	155.22	31.04	219.98	159.87	31.97
Meat .....	92.00	20	105.00	114.13	2,282.60	138.00	150.00	3,000.00
Sugar .....	43.36	4	79.14	182.52	730.08	82.13	189.42	757.68
Wine .....	66.00	20	70.45	70.45	1,409.00	78.00	118.18	2,363.60
Vinegar .....	17.00	6	6.00	35.29	21.18	6.03	35.47	21.28
Coal .....	2.00	50	2.14	107.00	5,350.00	2.04	102.00	5,100.00
Soup .....	52.00	1	56.90	109.42	109.42	59.33	114.10	114.10
				1,650	15,536		1,823	17,416

INDEX NUMBERS BASED ON PRICES OF ISTITUTO DEI POVERI, FOR EACH YEAR, 1885 to 1911, INCLUSIVE.<sup>1</sup>

Year.	Simple index.	Weighted index.
1885.....	100.00	100.00
1886.....	97.21	95.74
1887.....	95.57	93.52
1888.....	94.14	90.54
1889.....	90.21	85.96
1890.....	92.43	94.11
1891.....	93.80	97.55
1892.....	97.86	92.77
1893.....	96.86	92.46
1894.....	95.43	89.69
1895.....	90.28	86.32
1896.....	91.86	90.70
1897.....	96.93	97.40
1898.....	99.57	99.99
1899.....	99.87	102.43
1900.....	101.21	114.95
1901.....	101.78	116.11
1902.....	103.00	108.09
1903.....	102.43	103.31
1904.....	100.86	100.36
1905.....	108.00	104.97
1906.....	105.00	104.36
1907.....	111.43	111.72
1908.....	116.79	117.53
1909.....	117.14	112.33
1910.....	117.86	108.41
1911.....	130.21	121.63

<sup>1</sup> Mario Alberti, *Il Movimento dei prezzi e dei salari nell' anno 1911 a Trieste*, pp. 24 and 26.

INDEX NUMBERS BASED ON PRICES OBTAINED FROM THE AUSTRIAN LLOYD STEAMSHIP CO.<sup>1</sup>

Name of article.	Price in base period, 1892-1896.	Coeff. cent.	1910			1911		
			Price.	Simple index.	Weighted index.	Price.	Simple index.	Weighted index.
Bread <sup>2</sup> .....	27.916	26.00	38.17	136.73	3,554.98	37.54	134.48	3,496.48
Flour, N. O., national.....	25.962	1.00	40.61	156.48	156.48	35.22	136.71	135.71
Paste(macaroni, etc.) national, fine	35.920	4.00	45.46	126.56	598.24	47.96	133.24	532.96
Rice, fine, in transit.....	36.880	2.50	43.95	119.17	297.94	45.11	122.32	306.79
Kidney beans.....	22.740	2.00	30.55	134.35	268.69	31.72	139.49	278.98
Potatoes.....	6.392	10.00	7.57	118.43	1,184.30	9.88	154.26	1,542.50
Oil, fine, in transit.....	97.908	2.00	135.40	138.29	276.58	145.60	148.71	297.42
Cheese, Parma, in transit.....	181.752	20	252.68	138.70	27.74	240.52	132.54	26.47
Beef (cow) <sup>1</sup> .....	94.300	20.00	105.00	111.24	2,226.80	128.00	146.35	2,977.00
Sugar.....	64.906	4.00	80.99	124.61	498.44	83.66	128.72	514.86
Wine, Dalmatian, in transit.....	23.322	20.00	22.53	96.61	1,932.20	44.06	188.92	3,778.40
Vinegar <sup>2</sup> .....	12.896	1.00	6.00	48.62	27.91	6.03	46.76	28.06
Soap <sup>2</sup> .....	50.062	1.00	55.90	113.59	113.59	59.33	118.44	118.44
Fresh butter.....	224.922	2.00	231.58	102.98	236.96	259.96	115.55	231.10
Coffee, Santos, in transit.....	193.300	1.00	108.87	56.37	66.37	161.38	79.87	79.87
Milk.....	20.000	30.00	22.00	110.00	3,300.00	23.80	119.00	3,570.00
Lard.....	102.612	2.00	187.67	182.90	366.80	100.66	156.56	313.12
Eggs.....	6.222	50.00	8.60	105.90	5,295.00	7.18	115.06	5,752.50
Meal, yellow.....	17.364	1.00	23.68	126.37	126.37	22.68	130.62	130.62
				2,266	20,431		2,446	24,060

<sup>1</sup> Mario Alberti, Il movimento dei prezzi e dei salari nell' anno 1911 a Trieste.<sup>2</sup> Index numbers based on prices paid by the Istituto dei Poveri.

## BELGIUM.

## INDEX NUMBERS OF HECTOR DENIS.

## HISTORY.

Hector Denis, professor at the University of Brussels, is believed to be the author of the only series of index numbers of prices in Belgium that has been presented with any measure of continuity and completeness. This series has not, however, been published in uniform manner, but has appeared as a gradual development in various publications credited to its author. Even at the present time it does not seem to have reached its final form, since every succeeding presentation either alters or omits former tables or includes additional ones. The only exception seems to be a table of index numbers computed for 28 articles of export, which is given in 1911 in practically the same form in which it first appeared in 1895.

## PUBLICATION.

Among the publications of Prof. Denis in which his various tables of indexes appear are the Economic and Social Depression and the History of Prices (*La dépression économique et sociale et l'histoire des prix*), 1895,<sup>1</sup> and the Index Numbers of Moral Phenomena (*Les index numbers—nombres indices—des phénomènes moraux*), 1911.<sup>2</sup>

The most nearly complete examples of his indexes, however, are published in the Bulletin of the International Institute of Statistics, volume 19, Part III, pages 157-195, and are computed to include the years 1909, 1910, or 1911, as the case may be. Only two of the earlier tables appear in the bulletin. Of these the index numbers based on the 28 exports are continued to include the year 1910, as is likewise a comparative table that had appeared in his Index Numbers of Moral Phenomena. This comparative table is used by Prof. Denis to test his own general index for the 28 articles of export of Belgium. He reduced the general index numbers of France (Palgrave), Germany (Soetbeer), England (Sauerbeck), and the United States (Falkner-Hardy) to the common base 1867-1877, and presented them in parallel columns with his own for each year and for five-year periods from 1860 to 1893.<sup>3</sup> In the same publication the table appears a second time, but with data for each year from 1850 to 1910,<sup>4</sup> and without the reduction of the indexes to a common base. A second table of index numbers of exports, similar to but not identical with the one published in 1895 on the base period 1865, also appears in the bulletin. Separate tables of index numbers are also given for vegetable products, meats and butter, cereals, and other groups of articles.

## SOURCE OF QUOTATIONS.

Prof. Denis bases his computations for the index numbers appearing in his study of the economic and social depression on the quotations given in the tables of foreign commerce of Belgium (*tableaux du commerce extérieur de la Belgique*), i. e., on the prices used for fixing

<sup>1</sup> In this appear four tables of indexes. The first is an index for 28 exports yearly from 1850 to 1890, computed on the base period 1867-1877. The second index covers the same period of years and almost the same articles, except that some are grouped and one or two are added, the base period being the single year 1865. The third index is similar to the first, but is based on 22 imports. The fourth table presents the general index number for imports and also for exports for every year from 1865 to 1890, the period 1867-1877 again being used as the base.

<sup>2</sup> Published by the Royal Academy of Belgium in its *Mémoires*, second series, 4, Brussels, 1908-1911. Separate tables of price index numbers are given for cereals, beef, wheat, coal, and metals, all computed on the base period 1867-1877. A comparative table shows index numbers for the United States, Belgium, Germany, and England.

<sup>3</sup> This table is given on p. 176 of this bulletin.

<sup>4</sup> The general index computed for Belgium by Prof. Denis, which appears in this table, is printed on p. 176 of this bulletin for the years 1894-1910.



the customs values. Of these Mr. Armand Julin<sup>1</sup> remarks that he finds that the averages adopted by the commission for the official values correspond but remotely with the real fluctuations in prices. Therefore the accuracy of Prof. Denis's index numbers may appear rather doubtful. However, this criticism can apply only to the single original table of 28 exports that is continued to include 1910, since in the additional tables published in the bulletin of the International Institute of Statistics referred to above he states in a footnote that prices up to 1852 were taken from the secular almanac of the observatory (*l'Almanach séculaire de l'Observatoire*) and those for later years from the statistical yearbooks (*Annuaire statistiques*).

#### BASE PERIOD

For the base period Prof. Denis selected the years 1867-1877, as did Sauerbeck for England. His reason for such a choice appears to be the fact that during those years there were periods of both rise and depression in prices, while a later period would not include the economic depression that followed 1873 and an earlier one would cover a time of rising prices only.

#### DESCRIPTION OF COMMODITIES

The articles for which index numbers have been computed are not described specifically in the publications mentioned above, but it is stated in the one dealing with the economic and social depression that the 28 exports (whose indexes are continued to 1910) and the 22 imports (not computed after 1890) were selected with a view to including those most prominent, and that the total of 50 articles so selected comprises two-thirds of the total exports and imports of Belgium.

#### WEIGHTING.

The indexes are not weighted, and in his *Economic and Social Depression and the History of Prices* Prof. Denis justifies himself by stating that in spite of the use of weighted averages the variation in the curve of prices as shown in the diagrams accompanying that publication remain essentially the same and that therefore he has not abandoned the simpler method, but presents his indexes with the caution that the results are to be taken only as an approximation of the truth.

#### TABLES OF RESULTS.

Below follows the comparative table of general index numbers for several countries as it appears in his treatise on the Index Numbers of Moral Phenomena mentioned above:

<sup>1</sup> "The economic progress of Belgium from 1880 to 1908," in the *Journal of the Royal Statistical Society*, 1911, p. 208.

COMPARISON OF GENERAL INDEX NUMBERS FOR FRANCE (PALGRAVE), GERMANY (SOETBEER), ENGLAND (SAUERBECK), UNITED STATES (FALKNER-HARDY), AND BELGIUM (DENIS), REDUCED TO A COMMON BASE.

(Base period, 1867-1877=100.)

Year.	France (Palgrave).	Germany (Soetbeer).	England (Sauerbeck).	United States (Falkner- Hardy).	Belgium (Denis).
1860.....		94.6	99	72	103.6
1861.....		92	98	72	98.8
1862.....		95.3	101	84	99.9
1863.....		97.8	103	106.8	104.2
1864.....		100.8	105	137	116.6
1865.....		96.3	101	156	106.9
1866.....	97.6	98.5	102	138	106.9
1867.....	97.6	97	102	123	93.1
1868.....	97.6 97	95.5 96.7	99 99	115	117.6 95.8
1869.....	97.6	96.3	98	110	91.0
1870.....	94.6	96.3	96	102	91.8
1871.....	101.5	100	100	97.8	98.8
1872.....	108.3	106.4	109	90.8	109
1873.....	107.3 103	107.9 104.5	111 103.6	98.8 96.7	108.6 107.6
1874.....	98.5	106.4	102	95.6	108.3
1875.....	99.5	101.7	96	91.8	113.4
1876.....	97.6	100.1	85	85	108.3
1877.....	99.5	100.1	94	79.7	103
1878.....	86.8 90.7	94.6 96.3	87 89.2	72.8 76.7	98.4 101.1
1879.....	83.9	91.5	83	69.5	85.8
1880.....	85.8	95.6	89	76.9	100.1
1881.....	82.9	94.6	85	76	97.8
1882.....	81.9	85.5	84	78	85
1883.....	80 79.7	95.5 92.1	82 79.8	76.2 73.7	85.7 86.1
1884.....	74.1	90	76	71.5	82.8
1885.....		85.2	72	66.9	79.1
1886.....		81.0	69	66.1	77.8
1887.....		80.6	68	66.6	76.2
1888.....		80.6 82.2	70 70.2	67.7 66.9	75.6 74.2
1889.....		83.7	72	67.7	71.6
1890.....		85.1	72	66.4	70
1891.....			72	66.3	69.9
1892.....			68		66.5
1893.....			68		64.4

A continuation of the general index numbers for Belgium as computed by Prof. Denis in the above table appears on page 158 of volume 19, Part III, of the Bulletin of the International Institute of Statistics, as follows:

Year.	Index numbers.	Year.	Index numbers.
1894.....	59.0	1903.....	60.6
1895.....	61.5	1904.....	61.8
1896.....	61.0	1905.....	60.9
1897.....	56.0	1906.....	64.8
1898.....	58.5	1907.....	69.2
1899.....	61.8	1908.....	67.7
1900.....	63.4	1909.....	65.9
1901.....	63.1	1910.....	64.7
1902.....	64.0		

## CANADA.

## INDEX NUMBERS OF THE DEPARTMENT OF LABOR.

## PUBLICATION.

This compilation of wholesale prices for the Dominion of Canada is published yearly by the Department of Labor of Canada at Ottawa. Index numbers for each group of commodities and for its main subdivisions are also published monthly in the Labor Gazette, the official organ of the department of labor.

## HISTORY.

The first report on wholesale prices made by the Canadian Department of Labor was published in 1910 and covered the years 1890 to 1909, inclusive. The object in undertaking this work was to determine as accurately as possible the nature and extent of the general rise in wholesale prices which had occurred in Canada during recent years. Prior to the beginning of this work the Labor Gazette, the official organ of the department, had for some time published each month certain data regarding prices in connection with its review of industrial and labor conditions. The importance of the subject and the unsatisfactoriness of general statements in a matter of this kind led the department in 1910 to adopt a more comprehensive and systematic method of treating the subject of prices in the monthly summary and also to extend the inquiry into the wholesale prices of a selected list of representative staple commodities back over the preceding 20 years.<sup>1</sup> In subsequent annual and monthly reports the price data have been brought down to the present time.

## SOURCE OF QUOTATIONS.

It is stated that the practice followed throughout the investigation was "to collect and collate the best available published information and to submit the result for verification to long-established firms at the wholesale center in question." The daily press and weekly trade journals of Canada and the printed reports of exchanges, boards of trade, etc., are mentioned as the principal sources of data. When reliable printed matter failed, information was obtained from books of manufacturers and wholesalers.

A source used for verification purposes in the case of a few important raw materials imported by manufacturers direct from the primary markets of the world, and in which there is no wholesale trade in Canada, was the declared import values, which were divided by total quantities to show the average prices. Toronto and Montreal markets furnish the great mass of the quotations published in the reports.<sup>2</sup>

<sup>1</sup> Wholesale prices in Canada, 1890-1909, p. 2.

<sup>2</sup> *Idem*, p. 8.

## BASE PERIOD.

The base period selected for the computation of index numbers for practically all commodities is the decade 1890-1899. Two reasons are given for this selection: (1) The period was considered as representative of normal conditions as any available, containing a time of falling and a time of rising prices, and (2) direct comparison with the similar study of the United States Department of Labor was considered very desirable, and this was made possible by choosing the same base period.<sup>1</sup> In a few instances, owing to special reasons, a period other than the decade 1890-1899 has been chosen as the base.

## PRICES: HOW COMPUTED AND SHOWN.

In the first report the prices quoted are stated to be "for the most part those prevailing on the opening day of each month, though if, in particular cases, these were found to be abnormal, an average of the week was taken."<sup>2</sup> In the report for 1912 it is stated that the manner of quoting prices is the same as in the earlier reports except that for certain articles subject to rapid fluctuations (grains, live animals, certain meats, butter, eggs, potatoes, and fresh fruits—40 in all) weekly instead of monthly quotations were obtained.<sup>3</sup> This plan was continued in the preparation of the wholesale-price data for 1913.

Difficulty was encountered in obtaining quotations of a uniform quality of certain articles, particularly of manufactured articles, through a series of years. It is stated in the reports that wherever such articles are quoted, care has been taken to see that changes in quality are accounted for in the prices given.<sup>4</sup> In a few cases—as, for example, in the case of cotton goods—the prices published are not simple quotations on a single variety, but averages of a large number of varieties.

In the annual reports the actual prices are published for each commodity by months, or, in some cases, by weeks, and the average of these quotations is given as the price for the year. Index numbers are published in the annual reports for each commodity by years and in the *Labor Gazette* for each group and subgroup (56 items in all) by months currently. Index numbers do not seem to be published for single commodities by months. Many of the actual prices are stated in the form of a range of price, and apparently the mean is used for computations based on these figures.

Some commodities whose price is largely governed by seasonal conditions are quoted for only those months of the year when they are in season—as, for example, blue grapes, for which quotations are given only for September and October.

<sup>1</sup> Wholesale prices in Canada, 1890-1909, p. 440.

<sup>2</sup> *Idem*, p. 439.

<sup>3</sup> *Idem*, 1912, p. 2.

<sup>4</sup> *Idem*, 1890-1909, p. 439.

## NUMBER AND CLASS OF COMMODITIES.

The index number for the 20-year period 1890-1909 is based on 230 commodities so-called, some of these quotations being, however, as in the case of cotton fabrics, the average of a large number of varieties of the articles. In the first annual report (covering the year 1910) one quotation was dropped and six new quotations were added, thus making the number of commodities 235. In the second annual report (covering the year 1911) one quotation was dropped, but the entire number covered by the index was increased to 261. In the latter report the statement is made that it is hoped ultimately to include about 280 commodities. The total was increased to 272 in 1912 by the addition of nine new articles and additional series of quotations in the case of two articles previously included. No change in the list was made in 1913. The new articles have been included in the index numbers since 1910, so as to assist immediate comparisons, but no recalculation of the entire series of index numbers back to 1890 is to be made on the enlarged basis until the number of commodities is completed.<sup>1</sup>

In recent reports, prices for a number of articles which it is hoped ultimately to include in the index number are published in connection with prices for the 272 commodities included at present. Both raw materials and manufactured articles are included in the commodities used in computing the index number. Difficulties attending the employment of manufactured articles were recognized, but their inclusion on a conservative basis seemed imperative in selecting a sufficiently large number of representative commodities. With respect to the original number, 230, it was said that "the effect of tendencies incidental to the manufacturing process are present in about 40 per cent of the quotations."<sup>2</sup>

## DESCRIPTION AND GROUPING OF COMMODITIES.

The commodities for which index numbers have been computed are shown in the following list, which is taken from the report for 1913 (pp. 218-240).

## I. Grains and fodder.

Barley, Western.	Oats, No. 2, white, Ontario.
Barley, No. 2, Ontario.	Peas, No. 2, Ontario.
Bran.	Rye, No. 2, Ontario.
Corn, No. 3, yellow.	Shorts.
Flaxseed, No. 1, Northwestern.	Straw.
Hay, Montreal.	Wheat, No. 1, Northern.
Hay, Toronto.	Wheat, No. 2, white, Ontario.
Oats, No. 2, white, Western.	

<sup>1</sup> Wholesale Prices in Canada, 1912, p. 2.<sup>2</sup> Idem, 1890-1909, p. 438.

## II. Animals and meats.

Bacon, English boneless breakfast.	Hogs, dressed.
Beef, plate.	Lard, pure.
Beef, dressed, hind quarters.	Mutton, dressed.
Beef, dressed, forequarters.	Lamb.
Cattle, Western prime.	Pork, Canada, heavy short-cut mess.
Cattle, choice steers, Toronto.	Sheep, export ewes.
Fowls.	Turkeys.
Hams, city cured, medium.	Veal, dressed.
Hogs, select.	

## III. Dairy products.

Butter, creamery, Montreal.	Eggs, storage, Toronto.
Butter, creamery solids, Toronto.	Milk, at Montreal.
Butter, dairy, prints, Toronto.	Milk, at Toronto.
Cheese, western colored.	Milk, at Victoria, B. C.
Eggs, fresh, Montreal.	

## IV. Fish.

Godfish, dry, f. o. b.	Lobster, canned.
Haddock, dry, f. o. b.	Mackerel, salted.
Halibut.	Salmon, B. C., canned.
Herring, salted.	Salmon trout, fresh.
Lobster, fresh.	Whitefish, fresh.

## V. Other foods.

## (a) Fruits and vegetables.

1. Fresh fruits.	2. Dried fruits.
Native—	Apples, evaporated.
Apples, good seasonable.	Currants, Patras.
Cherries.	Prunes, Bosnia.
Grapes, Blue.	Raisins, Sultanas.
Peaches, Leno covers, No. 1 fruit.	3. Fresh vegetables.
Pears, early, Bartlett's and winter.	Beans, hand-picked.
Plums, early, Lombards, green-gages.	Onions, Canadian Red.
Raspberries, red.	Potatoes, Montreal.
Strawberries.	Potatoes, Toronto.
Foreign—	Turnips.
Bananas, yellow.	Tomatoes.
Lemons, Messina and Verdelia.	4. Canned vegetables.
Oranges, navels and Valencia.	Corn, standards, 2's.
	Peas, standards, 2's,
	Tomatoes, 3's.

## (b) Miscellaneous groceries and provisions.

1. Breadstuffs.	1. Breadstuffs—Concluded.
Flour, straight rollers.	Bread, Victoria, B. C.
Flour, strong bakers.	Biscuits, soda.
Flour, winter wheat patents.	Oatmeal, standard.
Flour, Manitoba 1st patents.	Rice, Patna.
Bread, Toronto.	Tapioca, medium pearl.

## V. Other foods—Concluded.

## (b) Miscellaneous groceries and provisions—Concluded.

- |   |   |
|---|---|
| <p>2. Tea, coffee, and chocolate.<br/>         Chocolate, Diamond.<br/>         Coffee, Rio, No. 7.<br/>         Coffee, Santos.<br/>         Tea, good common Japan.</p> <p>3. Sugar, etc.<br/>         Glucose.<br/>         Honey, strained.<br/>         Maple sugar.<br/>         Molasses, New Orleans.</p> | <p>3. Sugar, etc.—Concluded.<br/>         Sugar, Montreal granulated.<br/>         Sugar, Montreal yellow.</p> <p>4. Condiments, etc.<br/>         Pepper, black, pure.<br/>         Cream of tartar.<br/>         Salt, fine, dairy, cheese, and table.<br/>         Soda, bicarbonate of.<br/>         Vinegar, white wine, proof strength.</p> |
|---|---|

## VI. Textiles.

- |   |   |
|---|---|
| <p>(a) Woolens:<br/>         Wool (Ontario), washed.<br/>         Wool (Ontario), unwashed.<br/>         Yarn.<br/>         Woolen underwear.<br/>         Beaver cloth.</p> <p>(b) Cotton:<br/>         Cotton, upland middling.<br/>         Gray cottons.<br/>         Woven colored fabrics.<br/>         Prints.</p> <p>(c) Silk:<br/>         Silk, raw, Italian, classical.<br/>         Belding's, 50 yards spool silk (A).<br/>         Belding's prize medal (16-ounce, machine).</p> | <p>(d) Flax products:<br/>         Flax sewing twine.<br/>         Linen rope, white.<br/>         Flax fiber.<br/>         Tow, fine.</p> <p>(e) Jute:<br/>         Jute, first marks.<br/>         Hessian, 10½-ounce, 40-inch.</p> <p>(f) Oil cloths:<br/>         Floor oil cloth, No. 3 quality.<br/>         Table oil cloth, assorted patterns (5-4 wide).</p> |
|---|---|

## VII. Hides and tallow, leathers, and boots and shoes.

- |   |  |
|---|--|
| <p>Hides and tallow:<br/>         No. 1 inspected steers and cows.<br/>         No. 1 green calfskins.<br/>         Horsehides.<br/>         Tallow rendered, No. 1 stock, in barrel.</p> <p>Leather:<br/>         No. 1 Spanish sole, for jobbing.<br/>         No. 1 slaughter sole, heavy.</p> | <p>Leather—Concluded.<br/>         Harness, No. 1, U. O.<br/>         Heavy upper.</p> <p>Boots and shoes:<br/>         Men's split blucher bal., pegged.<br/>         Men's box calf blucher bal., G. W.<br/>         Women's Dongola blucher bal., F. S.</p> |
|---|--|

## VIII. Metals and implements.

- |  |   |
|--|---|
| <p>(a) Metals:<br/>         Antimony.<br/>         Brass.<br/>         Copper.<br/>         Iron, pig, Summerlee.<br/>         Iron, pig, No. 1 foundry, N. S.<br/>         Iron, common bar.<br/>         Iron, black sheets.<br/>         Iron, galvanized sheets.</p> | <p>(a) Metals—Continued.<br/>         Iron, tin-plate, charcoal.<br/>         Iron, tin-plate, Bessemer.<br/>         Iron, boiler-plate.<br/>         Wrought iron, No. 1.<br/>         Lead, imported.<br/>         Lead, domestic, Trail.<br/>         Nickel.<br/>         Quicksilver.</p> |
|--|---|

## VIII. Metals and implements—Concluded.

- |   |  |
|---|--|
| <p>(a) Metals—Concluded.</p> <ul style="list-style-type: none"> <li>Silver.</li> <li>Solder.</li> <li>Spelter.</li> <li>Steel billets.</li> <li>Steel, cast.</li> <li>Tin, ingots.</li> <li>Zinc, sheets.</li> </ul> <p>(b) Implements:</p> <ul style="list-style-type: none"> <li>Anvils, Wrights', 80 pounds and over.</li> </ul> | <p>(b) Implements—Concluded.</p> <ul style="list-style-type: none"> <li>Axes, standard.</li> <li>Chains, coil.</li> <li>Crowbars.</li> <li>Grindstones, 40-200 pounds.</li> <li>Horseshoes.</li> <li>Mallets, carpenters' hickory.</li> <li>Screws, bench wood.</li> <li>Soldering irons.</li> <li>Vises, Wrights'.</li> </ul> |
|---|--|

## IX. Fuel and lighting.

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>Coal, N. S., run of mines.</li> <li>Coal, Crow's Nest Pass.</li> <li>Coal, Pennsylvania anthracite.</li> <li>Coke, Connellsville furnace.</li> <li>Coke, Crow's Nest Pass.</li> </ul> | <ul style="list-style-type: none"> <li>Gasoline.</li> <li>Coal oil, Canadian standard.</li> <li>Coal oil, United States standard.</li> <li>Calcium carbide.</li> <li>Matches.</li> </ul> |
|--|--|

## X. Building materials.

## (a) Lumber.

- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li>Pine, all grades, Ottawa.</li> <li>Pine, good sidings, Ottawa.</li> <li>Pine, No. 1 cuts, Toronto.</li> <li>Laths, pine, Ottawa.</li> <li>Pine, shipping, culls, Ottawa.</li> <li>Pine, box boards, Ottawa.</li> <li>Hemlock, Ottawa.</li> </ul> | <ul style="list-style-type: none"> <li>Spruce, New Brunswick.</li> <li>Shingles, New Brunswick.</li> <li>Birch, Toronto.</li> <li>Maple, Toronto.</li> <li>Oak, Toronto.</li> <li>British Columbia fir.</li> <li>British Columbia shingles.</li> </ul> |
|---|--|

## (b) Miscellaneous building materials.

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>Brick, fire.</li> <li>Brick, common building.</li> <li>Cement, Canadian Portland.</li> <li>Hinges.</li> <li>Iron pipe.</li> <li>Lead pipe.</li> <li>Lime.</li> <li>Nails, cut.</li> <li>Nails, wire.</li> <li>Pitch.</li> </ul> | <ul style="list-style-type: none"> <li>Plaster of Paris.</li> <li>Red lead, dry.</li> <li>Sash cord.</li> <li>Sash weights.</li> <li>Soil pipe, medium.</li> <li>Tar.</li> <li>Wire, copper.</li> <li>Wire, iron.</li> <li>Wire cloth.</li> <li>Wire fencing.</li> </ul> |
|--|--|

## (c) Paints, oil, and glass.

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>Benzine.</li> <li>Glue.</li> <li>Linseed oil (raw).</li> <li>Linseed oil (boiled).</li> <li>Paris green.</li> <li>Prepared paints.</li> <li>Putty.</li> </ul> | <ul style="list-style-type: none"> <li>Rosin, white.</li> <li>Shellac.</li> <li>Turpentine.</li> <li>Varnish.</li> <li>Venetian red (dry color).</li> <li>White lead.</li> <li>Window glass.</li> </ul> |
|--|---|



## XI. House furnishings.

- |   |   |
|---|---|
| <p>(a) Furniture:</p> <p>Kitchen chairs (common spindle).</p> <p>Kitchen tables (4-foot, with drawer).</p> <p>Dining tables (hardwood, extension, 8-foot).</p> <p>Sideboards (hardwood, with mirror 16 by 28).</p> <p>Bedroom sets (dresser and stand, hardwood).</p> <p>Iron beds, continuous pillars, 4-foot.</p> | <p>(b) Crockery and glassware—Concluded.</p> <p>Earthenware: 10-piece printed toilet sets.</p> <p>Earthenware: 97-piece printed dinner sets.</p>  |
| <p>(b) Crockery and glassware:</p> <p>Tumblers, tank glass, <math>\frac{1}{2}</math>-pint.</p> <p>Earthenware: White cups and saucers.</p>  | <p>(c) Table cutlery:</p> <p>Knives, celluloid handle, medium size.</p> <p>Silver-plated knives and forks, 6 pennyweight, medium.</p> <p>(d) Kitchen furnishings:</p> <p>Pails.</p> <p>Tubs.</p> <p>Brooms.</p> <p>Sadiron, Mrs. Potts.</p> |

## XII. Drugs and chemicals.

- |   |  |
|---|--|
| <p>Alcohol, 65 O. P.</p> <p>Alcohol, wood.</p> <p>Alum.</p> <p>Bleaching powder.</p> <p>Borax.</p> <p>Brimstone.</p> <p>Carbolic acid.</p> <p>Caustic soda.</p> | <p>Copperas.</p> <p>Glycerine.</p> <p>Muriatic acid.</p> <p>Opium.</p> <p>Quinine.</p> <p>Soda ash.</p> <p>Sulphuric acid.</p> |
|---|--|

## XIII. Miscellaneous.

(a) *Furs.*

- |  |   |
|--|---|
| <p>Mink, dark.</p> <p>Muskrat, best fall and winter.</p> | <p>Raccoon.</p> <p>Skunk, black Canadian.</p> |
|--|---|

(b) *Liquors and tobacco.*

- |  |   |
|--|---|
| <p>Hops.</p> <p>Malt.</p> <p>Whisky (Can. Club 20-8 up).</p> | <p>Ale and porter (draft).</p> <p>Tobacco, smoking.</p> <p>Tobacco, raw leaf.</p> |
|--|---|

(c) *Sundries.*

- |   |   |
|---|---|
| <p>Binder twine.</p> <p>Gunpowder.</p> <p>Paper, news print.</p> <p>Rope.</p> | <p>Rubber, Para Island.</p> <p>Soap.</p> <p>Starch.</p> |
|---|---|

## SUBSTITUTIONS AND ADDITIONS.

In cases where new articles have been included in the index number an effort was made to secure a series of quotations back to 1890. In some cases this was not found possible, owing to "poverty of records, changes in industrial methods or consumption standards, etc." It is stated that no satisfactory solution of this problem has been found, but that "the method followed was to assign to the new commodity the index number of the commodity displaced or most nearly represented in the year in question. Thus the index number of the lowest

grade of pine lumber was assigned to hemlock in the year in which that article first makes its appearance in the quotations. In this way the new commodity creates a minimum of disturbance in the index number of the year in which it first occurs, whilst subsequent variations make themselves duly felt."<sup>1</sup> In the case of calcium carbide, an entirely new commodity introduced into the index in 1894, and the case of Crow's Nest Pass coal and Crow's Nest Pass coke, both introduced in 1899, the price first quoted was taken as 100, or the base, while in the case of cotton prints, introduced in 1893, the average price for the years 1893-1899 was taken as the base.

#### INTERPOLATION.

So far as can be determined, no price quotations have been interpolated. In the case of a few commodities, however, the statement is made that, owing to incomplete records, associated data have been drawn upon in calculating the base prices. Thus the price of flaxseed for the base period 1890-1899 was estimated from the price at Chicago from 1890-1910, as published in the reports of the United States Bureau of Labor Statistics, and the price at Winnipeg from 1906-1910. The base price of plate beef was in like manner "calculated from the percentages of cattle and beef prices from 1906 to 1911," while the base price of dressed veal is "based on the average prices of other meat products, 1890-1899."<sup>2</sup>

#### WEIGHTING.

The general index number is the simple average or arithmetic mean of the index numbers of the several commodities; i. e., the sum of the relative prices of the different commodities, divided by the number of commodities. Certain commodities are represented by more than one quotation and, as would happen in any extensive list including both raw materials and manufactured products, some commodities are represented indirectly more than once, as, for example, lumber, which is also represented by furniture. In the opinion of the compiler "an extended list of articles tends to weight itself."

#### TESTING.

With the object of testing the results obtained by the use of the simple arithmetical average of the index numbers representing the several commodities, a weighted index has been computed. This is based on the table prepared by the British Association for the Advancement of Science, a committee of which dealt exhaustively with the whole subject of index numbers in 1887-1890. The table follows.<sup>3</sup>

<sup>1</sup> Wholesale Prices in Canada, 1890-1909, p. 447.

<sup>2</sup> Idem, 1890-1909, p. 442.

<sup>3</sup> Idem, 1913, pp. 120, 130.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE TABLE OF WEIGHTS  
FOR THE CONSTRUCTION OF AN INDEX NUMBER.

[The following explanation of the table is given in the Canadian report:  
The second column gives in round numbers (000,000's being omitted) the average national expenditure (in pounds) on each class of article at present and for the last few years, and presumably also for the immediate future the proportion at least, if not the absolute amounts, of expenditure. In the estimated amount of consumption allowance is made for the addition to the value made before the articles are in the form in which they are finally consumed.

In the third column these amounts (or proportions) are reduced to percentages (of the total amount expended on such articles).

In the last column the relative importance proposed to be assigned to each article in the index number is stated, mainly on the basis of the percentages in the third column, but with modifications so as to substitute even figures for the convenience of handling.]

Articles consumed or used up.	Estimated expenditure per annum on each article.	Percentage of each amount to total.	Relative importance proposed for each article in index number reduced to percentage.
<b>Breadstuffs:</b>			
Wheat.....	60	6.5	5
Barley.....	30	3.3	5
Oats.....	50	5.4	5
Potatoes, rice, etc.....	50	5.4	5
			20
<b>Meat and dairy food:</b>			
Meat.....	100	10.9	10
Fish.....	20	2.2	2½
Cheese.....			
Butter.....			
Milk.....	60	6.5	7½
			20
<b>Mass luxuries:</b>			
Sugar.....	30	3.3	2½
Tea.....	20	2.2	2½
Beer.....	100	10.9	9
Spirits.....	40	4.3	2½
Wine.....	10	1.1	1
Tobacco.....	10	1.1	2½
			20
<b>Clothing:</b>			
Cotton.....	20	2.2	2½
Wool.....	30	3.3	2½
Silk.....	20	2.2	2½
Leather.....	10	1.1	2½
			10
<b>Metals and minerals:</b>			
Coal.....	100	10.9	10
Iron.....	30	3.3	5
Copper.....	25	2.7	2½
Lead, tin, zinc, etc.....	25	2.7	2½
			20
<b>Miscellaneous:</b>			
Timber.....	30	3.3	3
Petroleum.....	5	0.5	1
Indigo.....	5	0.5	1
Flax and linsed.....	10	1.1	3
Palm oil.....	5	0.5	1
Ceoutchouc.....	5	0.5	1
			10
<b>Total.....</b>	<b>920</b>	<b>100.0</b>	<b>100</b>

1 This percentage does not agree with that found in the Canadian report, but is correct according to the expenditure given in the preceding column.

Slight modifications were made in the above table to meet the groupings adopted in the Canadian investigation and the different standards of consumption in that country. In the absence of statistics directly bearing on consumption standards in Canada, apart from statistics of import and export trade and of production, use was made of the special studies of family expenditures of the British, United States, and Massachusetts labor departments.

The following figures show the weighting used in the Canadian study:<sup>1</sup>

Group.	Weight.
Grains and fodder.....	18
Animals and meats.....	10
Fish.....	2½
Dairy produce.....	7½
Other foods.....	15
Textiles.....	8
Hides, leather, boots and shoes.....	2
Metals and implements:	
(a) Metals.....	8
(b) Implements.....	1
Fuel and lighting.....	10
Building materials:	
(c) Lumber.....	6
(b) Miscellaneous building materials.....	2
(c) Paints, etc.....	1
House furnishings.....	2
Drugs and chemicals.....	2
Miscellaneous:	
(c) Furs.....	1
(b) Liquors and tobacco.....	2
(c) Sundry.....	2
Total.....	100

The results of the testing may be seen in the following table, which gives both the weighted and unweighted index numbers for each year from 1890 to 1913, inclusive.<sup>2</sup>

Year.	Weighted number.	Unweighted number.
1890.....	112.0	110.3
1891.....	111.3	108.6
1892.....	104.9	102.8
1893.....	103.9	102.6
1894.....	97.2	97.2
1895.....	95.6	95.0
1896.....	90.6	92.5
1897.....	89.9	92.2
1898.....	86.5	96.1
1899.....	99.0	100.1
1900.....	105.8	108.2
1901.....	106.0	107.0
1902.....	109.6	109.0
1903.....	109.7	110.5
1904.....	110.6	111.4
1905.....	113.8	113.8
1906.....	120.1	120.0
1907.....	129.2	126.2
1908.....	125.1	120.8
1909.....	126.3	121.2
1910.....	128.0	124.2
1911.....	131.1	127.4
1912.....	143.9	134.4
1913.....	139.6	135.5

<sup>1</sup> Wholesale Prices in Canada, 1890-1909, p. 12.

<sup>2</sup> Idem, 1913, p. 11.

## TABLE OF RESULTS.

The following table, reproduced from the 1913 report (p. 3), shows by groups of commodities the index numbers for the 24 years 1890-1913, inclusive:

## INDEX NUMBERS OF COMMODITIES, BY GROUPS, 1890-1913.

(Base period, 1890-1899=100.0.)

Group.	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901
1. Grains and fodder.....	116.7	123.0	106.7	99.1	94.2	98.8	85.2	80.6	98.8	96.7	99.9	107.3
2. Animals and meats.....	111.2	104.7	108.5	117.7	98.7	92.2	82.4	90.4	97.9	95.1	103.4	111.3
3. Dairy products.....	103.0	106.2	105.8	110.4	104.6	94.8	90.1	90.1	92.9	101.4	109.0	102.5
4. Fish.....	103.3	97.8	90.6	99.7	98.4	101.4	102.3	98.6	99.0	110.0	106.4	113.2
5. Other foods.....	120.3	121.3	104.7	102.1	95.0	95.2	87.1	86.0	94.3	93.0	96.4	98.6
6. Textiles.....	111.4	104.2	102.2	101.2	97.3	93.0	96.9	98.0	95.2	99.8	100.0	103.6
7. Hides, leather, boots.....	100.6	102.6	99.8	101.8	89.9	98.6	92.9	100.1	105.0	109.4	113.8	112.8
8. Metals and implements:												
Metals.....	125.4	114.4	107.6	102.1	91.1	87.0	87.5	85.7	82.6	111.9	121.2	110.4
Implements.....	103.8	103.2	102.9	102.6	102.2	101.0	98.5	93.1	94.3	98.0	100.1	102.2
9. Fuel and lighting.....	107.4	108.7	106.6	102.0	97.5	97.0	98.9	96.4	93.5	96.9	100.8	98.1
10. Building materials:												
Lumber.....	108.5	102.7	104.4	103.7	104.6	102.8	97.1	93.9	90.6	95.8	114.0	114.6
Miscellaneous.....	117.6	110.4	106.8	103.7	98.7	95.2	93.0	87.7	87.4	97.2	111.8	105.0
Paints, oils, glass.....	109.5	103.8	98.2	98.0	95.5	96.1	96.2	95.5	100.0	107.6	125.9	121.9
11. House furnishings.....	100.2	100.5	100.9	101.1	101.3	97.9	97.5	99.8	99.0	100.2	110.2	107.9
12. Drugs and chemicals.....	110.5	110.3	104.4	104.4	103.1	100.3	99.8	96.5	96.8	93.3	101.6	99.8
13. Miscellaneous:												
Furs.....	86.5	99.7	108.7	123.0	118.5	80.5	80.7	88.0	111.1	111.8	147.3	140.9
Liquors and tobacco.....	94.9	99.0	99.7	99.4	98.7	96.4	98.0	103.9	102.3	103.3	108.3	103.3
Sundries.....	112.0	106.7	98.8	100.3	93.7	91.3	92.6	91.2	103.3	109.5	113.0	110.9
Total.....	110.3	108.5	102.8	102.5	97.2	95.6	92.8	92.2	96.1	100.1	108.2	107.0

Group.	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913
1. Grains and fodder.....	116.1	106.6	115.5	116.4	118.5	140.2	148.3	149.9	140.7	148.4	167.3	136.8
2. Animals and meats.....	122.2	117.9	111.3	120.7	130.1	133.8	126.0	148.6	163.6	146.6	160.8	180.8
3. Dairy products.....	106.9	108.9	107.2	115.1	120.2	131.6	136.3	133.6	133.7	136.2	159.0	154.7
4. Fish.....	110.2	116.2	119.5	116.7	121.8	129.6	120.5	134.0	145.3	143.6	156.7	158.0
5. Other foods.....	98.4	98.1	101.8	100.7	103.1	112.5	110.3	107.6	111.3	118.7	126.0	117.4
6. Textiles.....	101.0	105.9	110.4	114.6	123.4	128.1	111.0	108.3	114.6	119.2	120.7	130.8
7. Hides, leather, boots.....	118.2	115.7	113.6	119.6	128.1	125.5	120.0	135.4	135.4	139.6	152.4	158.9
8. Metals and implements:												
Metals.....	102.8	105.5	99.7	108.4	128.6	134.8	106.3	101.9	97.6	108.3	117.4	119.1
Implements.....	104.7	105.7	106.2	106.1	106.0	107.1	104.2	102.4	104.5	104.5	104.7	106.6
9. Fuel and lighting.....	104.9	111.0	108.0	104.1	106.4	108.8	102.2	103.8	103.0	100.5	113.3	118.2
10. Building materials:												
Lumber.....	122.0	128.8	131.3	134.1	152.7	165.2	162.6	154.6	158.5	165.4	160.6	181.3
Miscellaneous.....	104.6	107.7	107.2	106.8	104.7	108.7	107.5	105.7	109.2	102.6	105.4	112.7
Paints, oils, glass.....	128.1	126.3	122.4	125.3	135.3	141.2	134.8	135.2	145.5	154.5	148.6	144.8
11. House furnishings.....	109.2	108.6	112.7	107.3	113.0	112.7	112.8	110.4	110.6	110.4	114.5	126.2
12. Drugs and chemicals.....	102.2	103.5	108.6	108.4	108.3	108.6	107.1	103.9	108.5	112.1	115.5	113.3
13. Miscellaneous:												
Furs.....	145.2	108.1	171.3	217.4	220.2	239.4	231.8	227.2	234.5	252.9	297.2	307.9
Liquors and tobacco.....	103.7	107.6	107.8	108.1	108.1	125.3	118.0	117.5	132.9	151.2	155.2	134.7
Sundries.....	116.8	115.9	119.1	121.1	120.9	123.6	117.6	121.6	118.0	100.8	104.3	113.1
Total.....	108.0	110.6	111.4	113.8	120.0	126.2	120.8	121.2	124.2	127.4	134.4	125.5

## DENMARK.

## INDEX NUMBERS OF THE STATE STATISTICAL BUREAU.

## HISTORY AND PUBLICATION.

This series of index numbers is based on the values of Danish imports and exports. It was first compiled in 1907 by Michael Koefoed, chief statistician of the State Statistical Bureau of Denmark,

and since then has been published annually in the trade statistics of that country,<sup>1</sup> with a brief advance statement of it appearing in the journal of the statistical office.<sup>2</sup> It covers a period extending from 1876 down to the present time.

## SOURCE OF QUOTATIONS.

The index numbers are computed from average annual prices reported by various corporations, public authorities, and a considerable number of private business houses, upon the basis of which the customs officials determine the value of imported and exported commodities. For the four varieties of grains included in the index, the figures taken are the official Government prices.

## BASE PERIOD

The decade 1891–1900 constitutes the base period used in the computation of the annual index numbers.

## NUMBER AND GROUPING OF COMMODITIES.

From a list of about 100 commodities entering into the import and export trade of Denmark, there were selected for inclusion in the index 38 of the more important ones classified into three groups, as follows:

*Group I.*—Fats, oleomargarine, wheat flour, flaxseed, copra and palm kernel, rice, coffee (green), cacao bean, tobacco (raw), cotton, cotton yarn (undyed), tallow, copper (including brass, copper plates, and tin), and petroleum—in all, 14 commodities.

*Group II.*—Horses, eggs, salt herring, wheat, potatoes, wool, wool yarn (undyed), hides (raw), boots and shoes (not including those with silk tops), paper (writing and print), firewood bricks—in all, 12 commodities.

*Group III.*—Salt pork, meat (other than pork), butter, rye, barley, oats, maize, oil-meal cakes, sugar (3 articles or more—granulated, whiter than Dutch standard No. 18; rock sugar, etc.; also granulated, whiter than No. 9), lumber (rough, for ships, etc.), coal, bar and hoop iron—in all 12 commodities.

It is not possible to ascertain with any certainty the number and variety of articles included. The classification used in the administration of the customs laws determines the nature of the commodities which enter into this index number. A somewhat arbitrary method of combining articles has, therefore, been adopted. Thus, the articles coming under the single designation of "boots and shoes" apparently include all boots and shoes except those with silk tops; "sugar" includes two separate items in the tariff schedule and forms in reality three or more articles, while "paper" includes two kinds (writing and print) made up of various qualities combined for the purposes of collecting the customs duty.

<sup>1</sup> Danmarks værditabel og udførelsesstatistik 1906–1912. Udgivet af det Statistiske departementet. Copenhagen, 1907–1912. (Danmarks Statistisk Tabelværk. 5. række, Litra D.)

<sup>2</sup> Statistiske offentligninger, udgivet af det Statistiske departementet. Copenhagen, 1909–1914.

## WEIGHTING.

The system of weighting is unique. The commodities have been placed in three distinct groups, as already noted, and these three groups in their numerical order have been given the relative importance in the total index of 1, 2, and 3, respectively. No statement is made as to the reason why certain commodities were thrown into any particular group. An examination of the grouping of the commodities, however, leads to the inference that they were thrown into one group or the other on the basis of their relative importance in consumption.

## TABLE OF RESULTS.

No group index numbers are given, only a general index for all 38 commodities being published. This table follows:

## INDEX NUMBER OF WHOLESALE PRICES OF 38 IMPORTANT ARTICLES ENTERING INTO THE IMPORT AND EXPORT TRADE OF DENMARK, 1876 TO 1913.

[Source: Danmarks vareindførsel og-udførsel i aaret 1912. Udgivet af det Statistiske departementet. Copenhagen, 1913: Pt. 2, p. 7\*.]

(Base period, 1891-1900=100.)

Year.	Index number.	Year.	Index number.	Year.	Index number.	Year.	Index number.
1876.....	145	1886.....	101	1896.....	93	1906.....	114
1877.....	135	1887.....	99	1897.....	95	1907.....	118
1878.....	122	1888.....	105	1898.....	99	1908.....	113
1879.....	120	1889.....	109	1899.....	105	1909.....	115
1880.....	128	1890.....	109	1900.....	110	1910.....	120
1881.....	129	1891.....	112	1901.....	106	1911.....	123
1882.....	127	1892.....	101	1902.....	108	1912.....	130
1883.....	126	1893.....	100	1903.....	105	1913.....	120
1884.....	120	1894.....	94	1904.....	107		
1885.....	109	1895.....	93	1905.....	110		

<sup>1</sup> Statistiske efterretninger, 6te aargang, 1914. Udgivet af det Statistiske departementet. Copenhagen, 1914, p. 53.

## FRANCE.

## INDEX NUMBERS OF ANNUAIRE STATISTIQUE DE LA FRANCE.

## PUBLICATION.

The statistical annual (*annuaire statistique de la France*) published by the general statistical office of France (*statistique générale de la France*) in Paris, under the direction of the Ministry of Labor and Social Welfare, contains index numbers for a group composed of certain food commodities and for a second group comprising other commodities, such as mineral products, textiles, hides, oils, etc., for the years from 1857 to the present time.

In addition to these there are now shown in the report, for purpose of comparison, Sauerbeck's index number for the United Kingdom, as published in the Journal of the Royal Statistical Society, the index number for Hamburg, Germany, based on import values, the index numbers for the United States, published by the Senate Committee on Finance and by the Bureau of Labor Statistics, and

the one compiled by Jules Domergue for France and published in *La Réforme Économique*.

#### HISTORY.

Index numbers were first published in the *Annuaire Statistique* of 1904 (page 151\*). Previous to this date average wholesale prices for certain food commodities, for fodder, and for fuels had been shown, but no totals were made for these average prices, each of which represented data for one year. The prefatory note to the table appearing in the 1904 report states that the index numbers for France are based on the import values of 43 articles, the period 1867 to 1877 being taken as the base. In this table all commodities are divided into two classes—foodstuffs and miscellaneous materials. An index number is also given for all articles combined.

In the preparation of the 1907 report the period 1891–1900 was adopted as the base instead of the years 1867–1877 and, in accordance with this change, new index numbers were computed for all preceding years.<sup>1</sup> In 1912 a further change was made by the substitution for the years since 1905 of index numbers based on the average annual prices of 45 articles in interior markets of the country instead of the import values of 43 articles, as in former reports.<sup>2</sup>

#### SOURCE OF QUOTATIONS.

The index numbers for years prior to 1906 are based on data published by the customs administration showing the values of imports. These values were fixed by the board of appraisers (*commission des valeurs en douane*). Beginning with 1906, as has been stated, the index numbers are computed from the average yearly prices of the different articles in interior markets of France. These average prices are compiled mainly from records of transactions on the Paris Bourse and from periodicals.<sup>3</sup>

#### BASE PERIOD

Prior to the 1907 report the base period used was that of 1867–1877. In the 1907 report, as already stated, the base period was changed to 1891–1900 and recomputations of the index number for previous years were made.

#### PRICES: HOW SHOWN AND COMPUTED.

The prices shown in the reports are in all cases averages of those prevailing during the year. For years prior to 1906 these averages are based on values assigned to imported articles by officials of the customs service. The figures for years beginning with 1906 represent in each case the average of 12 monthly quotations in selected interior markets.

\* *Annuaire Statistique de la France*, 1907, p. vii.

<sup>2</sup> *Idem*, 1912, p. 223<sup>a</sup>.

<sup>3</sup> *Idem*, pp. 88<sup>a</sup>, 89<sup>a</sup>.



## NUMBER AND CLASS OF COMMODITIES.

The index numbers for the years from 1857 to 1905, inclusive, are computed on the import values of 43 articles, while those for years since 1905 are based on the market prices of 45 articles. Both raw and manufactured commodities are included, the former predominating.

## DESCRIPTION AND GROUPING OF COMMODITIES.

The commodities for which average yearly prices are published in the *Annuaire Statistique* are shown in the following list appearing in the report for 1912 (pages 88\* and 89\*):

- |                                    |                            |
|------------------------------------|----------------------------|
| 1. Wheat.                          | 27. Cast iron (columns).   |
| 2. Wheat flour                     | 28. Cast iron (plates).    |
| 3. Rye.                            | 29. Copper (bars).         |
| 4. Barley.                         | 30. Tin.                   |
| 5. Oats.                           | 31. Lead.                  |
| 6. Maize (corn).                   | 32. Zinc.                  |
| 7. Potatoes.                       | 33. Coal.                  |
| 8. Rice.                           | 34. Cotton.                |
| 9. Beef (Villette).                | 35. Flax (raw).            |
| 10. Veal (Villette).               | 36. Hemp.                  |
| 11. Mutton (Villette).             | 37. Jute.                  |
| 12. Pork (Villette).               | 38. Wool.                  |
| 13. Beef (Halles Centrales).       | 39. Silk (raw).            |
| 14. Veal (Halles Centrales).       | 40. Hides (cattle).        |
| 15. Mutton (Halles Centrales).     | 41. Hides (horses).        |
| 16. Pork (Halles Centrales).       | 42. Tallow.                |
| 17. Salt meats.                    | 43. Rapeseed oil.          |
| 18. Butter.                        | 44. Linseed oil.           |
| 19. Cheese (soft).                 | 45. Alcohol.               |
| 20. Cheese (dry).                  | 46. Petroleum (refined)    |
| 21. Sugar (white, No. 3).          | 47. Soda (carbonate).      |
| 22. Sugar (refined, good quality). | 48. Soda (nitrate).        |
| 23. Coffee.                        | 49. Indigo.                |
| 24. Cocoa.                         | 50. Timber (Russian fir).  |
| 25. Bar iron (No. 2).              | 51. Timber (Austrian oak). |
| 26. Cast iron (pipes).             | 52. Rubber (Para, fine).   |

It is stated on page 223\* of the 1912 report that since 1905 the index numbers are computed on 45 of the above-named articles. It is not shown which articles are not included.<sup>1</sup> As previously stated, the commodities are arranged in three groups: Foodstuffs, miscellaneous articles other than food, and all commodities combined. No description of the articles appears in direct connection with the index numbers as published in the *Annuaire Statistique*.

## SUBSTITUTIONS AND ADDITIONS.

Except for the changes made in the preparation of the 1912 report, no additions to the list of articles or substitutions of one grade or

<sup>1</sup> See, however, page 191 of this bulletin for list of articles published in the *Bulletin de la Statistique Générale de la France*, October, 1912.

quality of an article for another have been made, so far as the printed information discloses.

## INTERPOLATION.

No prices have been interpolated, as far as can be ascertained from the reports.

## WEIGHTING.

The index numbers are unweighted.

## TESTING.

Other than the arrangement by which the index numbers are exhibited in comparison with other index numbers, by years, no testing as to accuracy of results is apparent from the information at hand.

## TABLES OF RESULTS.

The following table, showing the variation in the index number by years, from 1857 to 1913, inclusive, is reproduced from the *Annuaire Statistique* for 1912 (XXXII<sup>e</sup> volume, page 224\*):

FLUCTUATION IN WHOLESALE PRICES, 1857 TO 1913, BY YEARS.

Year.	Food.	Miscellaneous commodities.	Total.	Year.	Food.	Miscellaneous commodities.	Total.	Year.	Food.	Miscellaneous commodities.	Total.
1857....	136	105	169	1876....	135	151	144	1895....	97	93	94
1858....	117	180	152	1877....	144	146	145	1896....	90	91	91
1859....	121	176	152	1878....	135	132	133	1897....	94	90	92
1860....	130	183	100	1879....	137	125	130	1898....	98	93	95
1861....	141	170	157	1880....	136	130	133	1899....	95	110	103
1862....	131	179	158	1881....	133	128	130	1900....	95	121	110
1863....	125	185	159	1882....	130	125	127	1901....	97	111	105
1864....	122	184	157	1883....	122	122	122	1902....	95	109	103
1865....	118	179	147	1884....	109	114	112	1903....	95	110	104
1866....	127	167	149	1885....	110	110	110	1904....	95	110	103
1867....	131	157	146	1886....	103	106	106	1905....	102	115	109
1868....	137	155	147	1887....	100	104	102	1906....	100	123	115
1869....	133	153	144	1888....	104	109	107	1907....	107	132	121
1870....	137	167	148	1889....	107	113	111	1908....	106	115	112
1871....	148	157	153	1890....	105	115	111	1909....	106	117	112
1872....	138	170	159	1891....	109	110	109	1910....	111	127	120
1873....	141	173	159	1892....	109	103	106	1911....	122	128	126
1874....	136	185	147	1893....	110	90	104	1912....	127	134	131
1876....	130	153	143	1894....	104	90	96	1913....	119	136	128

An index number apparently based on the same 45 articles that are included in the *Annuaire Statistique* index is published in the quarterly bulletin which is also issued by the General Statistical Office of France (*Bulletin de la statistique générale de la France*). The list of articles as published in the bulletin for October, 1912, pages 22 to 25, is as follows: Wheat, wheat flour, rye, barley, oats, maize, potatoes, rice, beef (2 kinds), mutton (2 kinds), pork, salt meats, butter, cheese, raw sugar, refined sugar, coffee, cocoa, cast iron, bar iron, copper, tin, lead, zinc, coal, cotton, flax, hemp, jute, wool, silk, salted hides, skins, rapeseed oil, linseed oil, alcohol (90°), petroleum, soda carbonate, soda nitrate, indigo, lumber, and rubber.

The publication of this index number began with the April, 1912, issue of the bulletin and has been continued in each subsequent issue. For purpose of comparison the index numbers of the *Réforme Économique*, those of Sauerbeck, and those published in the *Economist* are shown in connection with it, all four being reduced to the common base period 1901-1910. The following table showing the manner in which the information is presented has been reproduced from the bulletin of January, 1914:

TABLE SHOWING FOUR INDEX NUMBERS FOR PURPOSES OF COMPARISON.

Year and month or quarter.	France.		England.	
	Statistique Générale.	Réforme Économique.	Sauerbeck.	The Economist.
<b>1913</b>				
December.....	112.9	114.0	114.2	111.8
November.....	114.7	115.0	113.4	113.5
October.....	114.4	116.0	115.1	114.5
Fourth quarter.....	114.3	115.0	114.2	113.8
Third quarter.....	115.1	114.5	115.7	115.0
Second quarter.....	116.7	115.7	116.2	115.0
First quarter.....	116.2	117.2	117.6	116.1
Entire year.....	115.6	115.6	115.9	114.8
<b>1912</b>				
Fourth quarter.....	116.7	116.6	116.8	116.7
Third quarter.....	118.3	117.2	117.6	116.9
Second quarter.....	119.7	119.5	116.1	114.9
First quarter.....	116.6	116.1	113.0	114.5
Entire year.....	117.8	117.4	115.9	115.8

## INDEX NUMBERS OF THE STATISTIQUE GÉNÉRALE DE LA FRANCE.

## PUBLICATION AND HISTORY.

In 1911 the general statistical office (*statistique générale*) of the French Ministry of Labor and Social Welfare published a volume devoted exclusively to the subject of wages and the cost of living in France at different epochs. Under the cost of living topic is included a study of wholesale prices, contract prices, and retail prices, with index numbers for each class. Index numbers are also given for wages and for family budgets.

## SOURCE OF QUOTATIONS.

The prices published in connection with the data on the cost of living relate to the city of Paris. They were obtained from various sources and may be classified as follows:

1. Wholesale prices (current prices published by the Bourse de Commerce; import prices, as fixed by the board of appraisers of customs; prices of various articles in the municipal markets of Halles Centrales; and meat prices in the market of Villette).

2. Contract prices (prices paid for large quantities of supplies furnished on the basis of awards on competitive bids to the Department of Public Aid and to the Lycée Louis-le-Grand).

3. Retail prices (prices charged by the company stores of two railroad companies, by cooperative stores, and by a few large groceries).

**BASE PERIOD.**

In the computation of the index numbers the average of the prices for the years 1891–1900 was taken as the base, or 100.

**PRICES: HOW SHOWN AND COMPUTED.**

Only annual prices are shown in the various tables included in the report.

**NUMBER AND CLASS OF COMMODITIES.**

Table 2, on pages 44 and 45 of the report, contains 10 commodities for which index numbers are given for the years 1880 to 1909, inclusive. The articles are as follows:

Bread.	Oil (edible).
Butter.	Wine (ordinary).
Cheese.	Sugar, refined.
Potatoes.	Coal.
Rice.	Oil (illuminating).

For each of these articles separate index numbers are given for wholesale or import prices, for the prices paid by the Department of Public Aid, and for retail prices.

A continuation of this table on page 46 covers the period from 1867 to 1910, inclusive, and contains index numbers for the following articles:

Beef (steer). <sup>1</sup>	Beef (cow). <sup>2</sup>
Veal. <sup>1</sup>	Fresh meats of all qualities. <sup>3</sup>
Mutton. <sup>1</sup>	Bacon. <sup>4</sup>
Pork. <sup>1</sup>	Lard. <sup>4</sup>

On page 47 of the report is found a table of index numbers for the years 1875 to 1910, inclusive, in which the following articles are included:

Milk.	Vinegar.
Eggs.	Candles.
Coffee.	Petroleum (refined).
Salt.	

<sup>1</sup> Based on prices in the markets of Villette and Halles Centrales, respectively.

<sup>2</sup> Based on prices in market of Villette.

<sup>3</sup> Based on import prices and those paid by the Department of Public Aid, and by the Lycée Louis-le-Grand, respectively.

<sup>4</sup> Based on prices paid by the Department of Public Aid and on retail prices, respectively.

For all of these articles except eggs index numbers, based on import prices, are given in addition to those based on retail prices or prices paid by the Department of Public Aid, or both. In the case of eggs, the index numbers are computed from retail prices and from those paid by the Department of Public Aid and by the Lycée Louis-le-Grand, respectively. Prices paid by the last-named institution also furnish the basis for index numbers shown for vinegar and salt.

## TABLES OF RESULTS.

In the following table, which has been compiled from data published on pages 44 and 45 of the report, are shown index numbers covering the period from 1880 to 1909, inclusive, computed from the wholesale or import prices of 10 commodities in common use. The figures for refined sugar and illuminating oil are based on wholesale prices of the Bourse de Commerce of Paris. Those for wine are computed from prices published annually by the minister of finance in the Bulletin de Statistique et de Législation. The index numbers for the remaining articles are based on import prices. As stated in a preceding paragraph, the average of the prices for 1891-1900, taken as 100, constitutes the base.

RELATIVE PRICES OF COMMODITIES, 1880 TO 1909.

Year.	Bread.	Butter.	Cheese.	Pota- toes.	Rice.	Oil, edible.	Wine, ordi- nary.	Sugar, refined.	Coal.	Oil, illumi- nating.
1880.....	137	100	117	150	132	169	148	123	98	132
1881.....	135	100	117	142	129	169	156	114	100	133
1882.....	134	98	121	150	118	150	157	106	100	130
1883.....	114	98	121	145	122	166	144	101	82	156
1884.....	105	95	121	133	122	184	155	100	82	121
1885.....	101	91	110	150	125	183	155	100	77	109
1886.....	107	89	102	100	125	183	156	92	71	94
1887.....	99	82	99	92	125	175	140	94	71	97
1888.....	112	82	102	125	107	161	118	102	82	107
1889.....	109	82	110	92	125	149	122	111	120	120
1890.....	100	82	113	118	125	146	138	102	122	122
1891.....	106	82	110	117	111	134	116	103	95	123
1892.....	101	100	100	83	125	138	111	101	95	97
1893.....	84	107	104	100	129	124	90	109	88	98
1894.....	78	98	97	100	118	115	89	101	90	88
1895.....	78	96	98	87	100	105	122	95	88	91
1896.....	100	107	98	83	82	88	98	96	90	103
1897.....	120	96	98	117	98	78	92	92	95	100
1898.....	121	102	99	100	90	78	112	99	105	93
1899.....	105	104	99	117	79	73	99	101	113	89
1900.....	105	107	104	117	82	73	70	100	147	117
1901.....	105	111	110	167	82	101	56	96	131	110
1902.....	106	107	118	150	82	121	78	91	111	104
1903.....	107	100	104	167	75	128	109	78	101	90
1904.....	119	102	106	150	80	128	65	50	95	83
1905.....	120	104	110	167	84	131	62	63	93	88
1906.....	120	111	88	183	86	142	71	56	112	115
1907.....	129	107	120	167	89	149	66	55	128	141
1908.....	129	107	120	199	104	181	62	58	117	109
1909.....	130	106	128	199	100	192	70	60	128	106

The following table, reproduced from page 45 of the report, contains three series of index numbers representing in each case the average of index numbers computed for the 10 articles included in the pre-

ceding table. In addition to index numbers based on wholesale or import prices, similar data for contract prices paid by the Department of Public Aid and for retail prices are given in this table.

THREE SERIES OF INDEX NUMBERS COMPUTED FOR 10 ARTICLES, 1880 TO 1909.

Year.	Wholesale or import prices.	Contract prices paid by the Department of Public Aid.	Retail prices.	Year.	Wholesale or import prices.	Contract prices paid by the Department of Public Aid.	Retail prices.
1880.....	132	126	121	1885.....	94	96	96
1881.....	129	121	121	1886.....	94	96	93
1882.....	126	125	111	1887.....	98	99	93
1883.....	125	120	117	1888.....	99	98	99
1884.....	122	116	105	1889.....	98	99	100
1885.....	120	109	106	1900.....	102	99	97
1886.....	112	110	101	1901.....	107	99	99
1887.....	108	104	94	1902.....	107	95	95
1888.....	110	106	104	1903.....	106	96	93
1889.....	114	104	105	1904.....	99	90	94
1890.....	117	105	103	1905.....	102	85	94
1891.....	110	108	104	1906.....	109	89	95
1892.....	105	106	108	1907.....	115	85	95
1893.....	102	101	103	1908.....	122	96	99
1894.....	98	100	105	1909.....	122	93	101

## INDEX NUMBERS OF LA RÉFORME ÉCONOMIQUE.

## PUBLICATION.

This series of index numbers is based on wholesale prices in France and is published weekly in *La Réforme Économique*, a journal of social and political economy, of which Jules Domergue is the editor.

## HISTORY.

For a number of years prior to 1900 comparative prices for a varying number of commodities were published in this journal. In the earlier numbers the increase or decrease in prices of seven commodities as compared with the primary period (1890) was shown by means of a chart. In 1894 prices for corresponding dates in 1892, 1893, and 1894 were given, and for some articles an average monthly price was computed. In 1896 a weekly table of prices was presented for the first time, and on May 9, 1897, a series of tables was begun showing the average monthly prices of all the commodities used in the computation. Beginning with January, 1899, an annual average price was computed and published for the years 1890 to 1898, inclusive, and in addition current prices were compared with these by means of annual average prices. No comparison was made by means of index numbers, however, until 1900, when the method of presenting the variation in prices for stated periods was changed by showing in addition to the average price of each commodity the simple percentages of increase or decrease in the various commodities.

## SOURCE OF QUOTATIONS.

Actual commercial transactions are sought for in the collection of price data. The prices quoted are said to be those obtained from the records of licensed brokers (*courtiers assermentés*) and private brokers (*courtiers libres*) in different parts of Paris and in the departments; official quotations of the Department of Agriculture; prices obtained in the municipal markets of La Villette and Halles Centrales; quotations on importations as stated in the records of the Government warehouses in Paris and elsewhere; and official quotations of the price of bread furnished by the prefecture of the Seine.

## BASE PERIOD.

The year 1890 is used as the base period. Nothing is stated in connection with the figures, so far as can be ascertained, as to why this year was chosen in preference to any other year or period of years.

## PRICES: HOW SHOWN AND COMPUTED.

As has been stated, no comparison of prices was made by means of percentages until 1900. In that year, after noting the principal objections to an index number representative of the combined prices of all commodities for which prices are quoted, it was decided to construct an index for each article and an index for each group of articles, in addition to the index for the entire list. The prices used in the calculations were the average annual prices already published in *La Réforme Économique* for the period 1890-1895, the quarterly average prices for the years 1896-1898, and the average monthly quotations for the year 1899.

A special presentation of the price of cotton is made in the issue of September 23, 1900, showing for five grades the range of prices of this commodity from 1875 to September, 1900, with an index based on the price in 1875 (equal to 100). In the supplement to the issue of November 24, 1901, the average prices of wheat, sugar, wine, and alcohol for the periods 1884-1891 and 1893-1900 have been computed and the divergence in price between the two periods is shown. The prices for the year 1892 are not a factor in either period.

## NUMBER AND CLASS OF COMMODITIES.

In tracing this index number through the period elapsing since its inception, there is great difficulty in determining the number and class of commodities which have been included in the compilation. Between 1890 and 1899 prices and index numbers were shown for from 40 to 56 or even more articles, according to the system of counting and classification adopted. Thus the compiler evidently combined four kinds of meat (beef, pork, mutton, and veal) into one commodity, while from two to four kinds of wool, silk, or cotton were

each sometimes given a separate index number. From 1900 to date it would appear that approximately 48 articles make up the series of index percentages, although average annual wholesale prices are given for several additional articles.<sup>1</sup> After 1904 a statement printed on the cover page and called "La Thermomètre des Affaires en France" shows a separate index number for only 21 leading commodities, although the general percentage index number includes additional articles, as may be verified by actual arithmetical test.

#### DESCRIPTION AND GROUPING OF COMMODITIES.

The classification of the various commodities has differed from time to time. The first summary table, presented in the issue of January 14, 1900, page 67, shows index percentages for 56 commodities (43 if certain grades of textiles and bar and structural iron are not considered separate commodities), classified in five main groups as follows:

*Food products.*—Wheat, flour, rye, barley, meats, wine, sugar, alcohol, coffee, butter, sirup, edible starches (fecula),<sup>2</sup> oleomargarine, tallow, lard, cocoa, rice, and bread.

*Textiles.*—Silk (2 grades), wool (raw and yarn), linen (raw and thread), cotton (raw and spun), hemp, jute.

*Agricultural products.*—Hides (raw), leather, oats, maize, fodder, fatty acids (3), rapeseed oil, linseed oil.

*Minerals and metals.*—Coal, petroleum, copper, tin, zinc, lead, steel, iron (2 grades), sheet iron.

*Miscellaneous.*—Rubber, sulphuric acid, hydrochloric acid, chloride of lime, carbonate of soda, sal soda, sulphate of ammonia, superphosphates.

In the issue of April 14, 1901, average annual wholesale prices are presented for all of these 56 commodities, while relative prices are shown for only 43 of them, divided into five groups as above, except that the fifth group is termed "Chemicals and fertilizers" but contains the same commodities as the group which is designated above as "Miscellaneous" commodities. Certain interchanges were also made as between "Food products" and "Agricultural products." This classification was continued until January, 1902, so as to include indexes for the year 1901.

In 1904 the list of commodities for which separate relative prices were presented was reduced to 21 commodities as follows: Wheat, meat, wine, sugar, alcohol, coffee, coal, petroleum, copper, tin, zinc, lead, steel, iron, silk, wool, flax, cotton, nitrate of soda, superphosphates, and sulphuric acid.

Beginning with the issue of December 10, 1905, a change was made in the form of classification, the articles being grouped as (1) agricul-

<sup>1</sup> Annuaire Statistique de la France, 1912, p. 223\*.

<sup>2</sup> The French term "fécule" includes such articles as potato flour, tapioca, sago, arrowroot flour, etc.



tural products and (2) industrial products. Under this classification average annual wholesale prices are presented for 21 articles in the first group, if forage is counted as one commodity and not as two, and wines as one instead of three, meats as one instead of four (beef, pork, veal, and mutton), and fatty acids as a single commodity instead of three; whereas if all these subdivisions are counted as separate commodities, the number would appear as 29. In the second group, that of industrial products, there are 28 or 40 commodities, according to the system of counting adopted.

For the above commodities general index percentages are given only for both groups combined, and not for each group separately or for each commodity. This plan of presentation has continued since 1905, although the commodities differ a trifle from year to year. As already stated a separate index number for 21 commodities is shown in "Le Thermomètre," which forms part of the cover page.

#### SUBSTITUTIONS AND ADDITIONS.

In the issue of *La Réforme Économique* for January 15, 1899, the average prices of raw and spun silk of several grades was included for the period of 1890-1898, and on February 12 of the same year average prices of iron (two grades), steel rails, sheet iron, bar copper, and tin (Banka) were added for the years 1890 to that date.

Two further groups were added on April 2, 1899. The first of these included wine, coffee (Santos, good average), hops (Burgundy), nitrate of soda, sulphate of ammonia, and superphosphates; the second, sulphuric acid 66°, hydrochloric acid 20-21°, chloride of lime 105-110°, carbonate of soda 90-92°, and caustic soda 80°, for manufacturing and laundry purposes. Quotations for hides, raw (three quotations), and tanned (four quotations) were added on April 23, 1899. The index for tanned leather does not appear after 1900, nor do those for cocoa, rice, rubber, oleomargarine, bread, lard, and fatty acids.

During the year 1902 percentage relatives for two articles were dropped from the list, and in the first issue of 1903 two more indexes were dropped. After 1905 no quotations appear for the following classes of wine: Alicante, Huelva, Aragon, Valence, and Haw. Apparently no adjustment of previous percentages have been made. No further change in the list of articles or method of presenting the variation of prices appears to have been made since 1905.

Oleomargarine did not figure in the index series until 1896, and it was dropped in 1900. Up to 1900 separate relative prices were calculated for two kinds of sugar, raw and refined; after that date only

one index is shown, although wholesale prices are quoted for both kinds. Apparently, however, the index percentage is based on the average of the prices shown for each kind. Similar changes have taken place in the coal index. Thus, four index percentages were presented up to 1900, but after that date only one is shown, which is based on the average wholesale prices of all four kinds.

In general, when any changes were made in the number or classes of commodities the index percentages were recomputed back to the base year, 1890.

#### INTERPOLATION.

No method of price interpolation has been resorted to, so far as can be determined from the information published in *La Réforme Économique*.

#### WEIGHTING.

No scientific method of weighting has been used, the arithmetic average alone being employed in the construction of the index numbers. The method of calculating the yearly general index for groups of commodities and for all commodities seems to be as follows: For the years already covered by the reports on wholesale prices, the sum of the average prices for the year of the different articles was divided by that of the basic year (1890). Thereafter, average monthly prices were obtained by getting the average of the weekly quotations made during the month as published in *La Réforme Économique*, and from these average monthly prices the yearly average price was computed, the yearly general index then being computed as before. The relatives for each article (when given), the index for each group, and the general index are in all cases simple percentages based on the prices of corresponding items for the corresponding period in 1890.

#### TESTING.

In the earlier years Sauerbeck's table of index numbers for England was occasionally given for comparison, and in the later issues it has appeared quite regularly. No other comparisons are made.

#### TABLE OF RESULTS.

The following table has been compiled from the numbers of *La Réforme Économique* published during the years 1892-1913. The items extending throughout the entire series of years are identical with those contained in the summary table showing index percentages for 21 commodities published regularly as a part of "*La Thermomètre des Affaires en France*," which forms the cover page of current numbers.

## INDEX NUMBERS COMPUTED FROM

[Source: La R4,

(Base period,

Mar- gin- al num- ber.	Commodity.	1891	1892	1893	1894	1895	1896	1897	1898
1	Wheat.....	100	92	83	76	75	75	100	101
2	Flour.....	109	95	84	78	79	77	97	102
3	Bread.....	107	97	89	84	85	82	97	103
4	Rye.....	117	101	84	77	66	71	96	101
5	Oats.....	83	79	101	102	81	79	86	101
6	Barley.....	92	73	90	81	71	74	81	89
7	Beef.....	103	94	94	100	96	76	78	70
8	Veal.....	98	98	103	105	103	89	90	85
9	Mutton.....	105	101	94	103	104	97	94	90
10	Pork.....	101	100	99	118	117	78	80	96
11	Average, meats.....	102	98	97	100	106	85	87	86
12	Raw hides.....	99	81	82	77	107	97	96	110
13	Leather.....	104	99	98	98	111	105	101	102
	Wines:								
14	Filtered.....	97	91	97	82	77	88	87	87
15	French.....	103	93	87	76	67	79	65	85
16	Algurian.....	84	78	68	62	74	88	85	85
17	Foreign.....	92	97	85	81	85	89	91	95
18	Average, wines.....	91	94	88	80	76	85	81	89
	Sugar:								
19	Beet root, raw.....	107	113	123	94	82	88	78	90
20	Beet root, refined.....	101	99	107	90	94	95	91	98
21	Average, sugar.....	104	106	115	96	88	91	84	94
22	Alcohol.....	110	132	123	94	87	86	106	128
23	Syrups.....	102	101	86	85	84	91	91	94
24	Starches (edible).....	101	96	82	75	71	74	81	93
25	Butter.....	102	124	133	103	89	85	87	97
26	Oleomargarine.....	101	89	81	72	74	85	99	104
27	Rapessed oil.....	96	93	97	91	88	77	64	70
28	Linseed oil.....	94	83	89	87	86	82	68	72
29	Tallow.....	103	99	116	96	86	76	73	81
30	Lard.....	99	108	139	121	101	70	63	87
31	Stearic acid.....	104	100	119	97	90	81	77	85
32	Oleic acid.....	96	93	97	91	88	77	64	70
33	Glycerin.....	76	62	73	62	68	130	85	84
34	Straw.....	101	102	156	117	99	76	81	91
35	Hay.....	104	134	178	151	108	107	115	97
36	Coffee.....	86	85	92	90	90	67	44	35
37	Cocoa.....	104	102	133	120	133	160	200	275
38	Rice.....	112	98	85	76	73	71	80	90
39	Maize.....	143	124	112	117	112	80	76	90
40	Rubber.....	100	104	104	104	114	119	140	157
41	Petroleum.....	94	81	72	71	107	100	93	108
	Coal:								
42	France.....	87	77	71	71	63	64	66	77
43	Cardiff.....	112	86	77	82	73	70	71	119
44	Mons.....	95	79	74	72	71	71	72	73
45	Charleval.....	98	78	72	73	75	76	77	77
46	Saarbrücken.....	104	97	93	91	90	89	90	92
47	Average, coal.....	99	83	77	80	76	74	75	88
48	Copper.....	90	81	76	71	76	83	86	91
49	Tin.....	97	99	92	74	68	64	66	75
50	Zinc.....	90	90	75	67	63	71	75	84
51	Lead.....	93	80	74	72	79	84	93	108
52	Iron (structural and merchant bar).....	106	94	61	68	87	83	97	97
53	Steel.....	100	100	100	99	96	96	99	95
54	Sheet iron.....	84	83	81	77	76	78	80	78

<sup>1</sup> The French term "fécula" includes such articles as potato flour, tapioca, sago, arrowroot flour, etc.



## INDEX NUMBERS COMPUTED FROM AVERAGE

Marginal number.	Commodity.	1891	1892	1893	1894	1895	1896	1897	1898
	<b>Silk:</b>								
55	Organzine, French, first grade.....	86	87	111	74	78	76	72	75
56	Organzine, French, second grade.....	85	89	112	73	78	76	72	75
57	Tram, Japan.....	86	88	105	70	77	75	74	78
58	Raw, first grade, Oryzines.....	86	85	105	72	78	74	72	75
59	Raw, second grade, Italy.....	85	84	101	71	78	72	71	74
60	Raw, China.....	87	76	81	65	67	65	70	77
61	Canton.....	89	84	92	65	71	67	65	72
62	Average, silk.....	86	85	101	70	75	72	71	75
63	Flax, raw.....	95	101	127	128	103	111	103	95
64	Linon thread, No. 20.....	100	101	119	100	101	105	105	101
65	Linon cloth.....	99	100	104	106	106	101	101	99
66	Average, flax.....	98	101	117	111	101	106	103	98
67	Wool, carded.....	88	77	77	67	63	70	66	75
68	Woolen yarn, warp (frame 40).....	82	74	74	70	76	78	72	75
69	Woolen yarn, wool (frame 60).....	86	73	75	73	74	79	70	76
70	Woolen yarn of 710 meters to the skein.....	85	78	78	85	110	105	75	75
71	Merino cloth.....	87	75	75	71	74	77	71	70
72	Average, wool.....	85	75	76	70	71	76	69	75
	<b>Cotton:</b>								
73	Raw.....	80	71	77	63	63	71	65	56
74	Warp (frame 25).....	91	82	90	89	79	82	78	67
75	Wool (frame 37).....	91	83	93	84	83	85	89	71
76	Cloth.....	94	89	101	93	78	80	74	71
77	Average, cotton.....	89	82	90	80	76	79	75	66
78	Hemp.....	82	72	68	54	55.7	45	41	64
79	Jute.....	97	113	97	98	6	83	91	80
80	Sulphuric acid.....	99	96	95	95	94	93	91	94
81	Chloride of lime.....	98	98	107	104	1.3	92	85	83
82	Carbonate of soda.....	114	110	103	107	76	74	74	75
83	Sul soda.....	107	107	103	107	86	86	85	83
84	Nitrate of soda.....	97	97	103	94	90	87	85	83
85	Sulphate of ammonia.....	98	93	112	117	89	74	73	85
86	Superphosphates.....	109	81	81	82	74	70	70	74
87	Hydrochloric acid.....	101	100	100	101	99	98	98	97
*	General percentages.....	90.60	94.20	97.60	86.40	84.40	82.20	83.40	87.60

INDEX NUMBERS—FRANCE.

ANNUAL PRICES: 1891 TO 1913—Concluded.

1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	Marginal number.
91															55
91															56
95															57
98	87	74	83												58
94	87	73	82												59
91															60
85															61
93	87	74	82	93	83	85	94	114	83	84	82	83	81	85	62
98	160	175	145												63
97	130	135	123												64
91															65
95	137	147	130	143	152	131	147	164	128	129	153	167	155	162	66
98	80	70	79												67
101	93	79	88												68
100															69
101															70
88															71
100	88	79	86	89	94	98	107	112	93	105	112	105	97	103	72
61	90	79	80												73
72	96	95	87												74
75															75
83															76
73	98	91	87	100	102	90	100	117	115	104	118	109	105	113	77
88	109	91	111												78
90	105	107													79
93	92	92	92	86	80	80	97	106	106	106	109	109	108	100	80
82	91	99													81
76	86	82													82
84	88	80													83
85	93	100	102	105	114	117	125	125	111	107	102	110	124	124	84
101	101	95	104												85
80	78	75	79	81	72	59	74	85	81	72	70	72	72	69	86
94	96	96													87
95.00	102.40	95.80	94.20	95.80	95.20	95.80	105.40	112.20	101.20	101.80	108.20	113.80	117.80	116.00	

## INDEX NUMBERS OF ÉMILE LEVASSEUR.

## PUBLICATION.

This "Inquiry into the price of food commodities for a period of 25 years in 70 high schools of France" was published in the *Revue Économique Internationale*, Brussels, in May, 1909. Later in the same year, under the title of "Le coût de la vie," it appeared as a separate pamphlet, which also was published by the *Revue*.<sup>1</sup>

## HISTORY.

Toward the close of 1908 the minister of public instruction, at the request of Mr. É. Levasseur, addressed to the principals of 70 high schools of Paris and the Departments an inquiry concerning the prices of certain food products and of coal as paid by the schools since 1880.

The inquiry covered the years 1880, 1885, 1890, 1895, and each year from 1900 to 1908, inclusive.

The schools selected, exclusive of those of Paris and its suburbs, included some of the large and some of the small institutions in each of the nine agricultural sections of France.

Mr. Lucien March, chief of the general statistical office (*statistique générale*) of France, assisted in the work by assuming the responsibility for the calculation of the index numbers from the figures secured.

The author states that from the data received it was possible to secure a sufficiently exact report of the variation which the prices of commodities had undergone for a period of about 25 years.

## SOURCE OF QUOTATIONS.

The prices considered are contract or semiwholesale prices (*prix d'adjudication*) obtained from 70 high schools. The articles are 21 in number—20 food commodities and coal.

## BASE PERIOD.

The average price for the two years 1895 and 1900, taken as 100, is used as the base. The index numbers for the period 1880 to 1908 derived from the use of this base are shown in the following table, appearing on page 7 of the pamphlet:

Years.	Index numbers.	Years.	Index numbers.
1880.....	111.9	1903.....	99.9
1885.....	104.2	1904.....	99.9
1890.....	101.4	1905.....	98.0
1895.....	100.2	1906.....	98.8
1900.....	99.3	1907.....	103.1
1901.....	99.8	1908.....	106.5
1902.....	98.8		

<sup>1</sup> *Le coût de la vie. Enquête sur le prix des denrées alimentaires depuis un quart de siècle dans 70 lycées*, par É. Levasseur, membre de l'Institut, administrateur du Collège de France.

## DESCRIPTION OF COMMODITIES.

The articles selected for which É. Levasseur computed index numbers are the following:

Bread.	Oil (table).
Fresh meats (other than pork).	Eggs.
Fresh pork.	Milk.
Smoked pork (charcuterie).	Cheese.
Poultry and game.	Sugar.
Red wine.	Fresh fish.
White wine.	Salted fish and canned fish.
Bear. <sup>1</sup>	Codfish.
Cider. <sup>2</sup>	Potatoes.
Butter.	Coal.
Drippings and lard.	

## TESTING.

Mr. Levasseur verified his index numbers by comparison with index numbers for France, England, Germany, and the United States.

The variations as shown by the index numbers of prices in 70 high schools were verified by comparisons with the following:

(a) Index numbers relating to France only—

1. Statistics prepared by Mr. Lucien March, chief of the general statistical office of France, and published in the *Annuaire Statistique de la France*. These show a greater increase for all merchandise in general than for food commodities alone (except in 1895). The index numbers show a rapid increase since 1905.

2. Index numbers calculated by Mr. de Foville. These numbers were based on the difference between the rates of duty, and show prices to have been low in 1900, with an increase in all the following years, especially since 1903.

3. Index numbers calculated by Mr. Levasseur from the duties on 32 food commodities, corresponding closely to those of the high schools. These figures show a rapid rise in prices since 1903.

4. Index numbers calculated on the basis of current prices since 1882 by the purchasing agent of the southern railways. These index numbers verify (or confirm) the index numbers of the high schools of the southwest.

(b) Index numbers relating to foreign countries—

5. England—Sauerbeck's index numbers for 45 articles of general merchandise. These index numbers are published in the *Journal of the Royal Statistical Society*. Sauerbeck's index numbers for food commodities show, like those of the high schools, a slight fall in prices from 1900 to 1902 and also a marked rise in 1907 and 1908.

6. Index numbers computed in Germany for the city of Hamburg.

7. Index numbers computed by the United States Bureau of Labor

<sup>1</sup> Included in the calculation of index numbers in 1 instance only.

<sup>2</sup> Included in the calculation of index numbers in 3 instances only.



Statistics. These index numbers are for wholesale and retail prices, respectively.

In conclusion the author states that "these diverse statistics, despite the differences of detail, confirm the statistics of the 70 high schools and show clearly that the great changes in prices are not due to special or local causes, but to general causes, the results of which are felt at the time in all the great markets which are in constant commercial communication with each other."<sup>1</sup>

#### TABLES OF RESULTS.

The following table, reproduced from page 15 of the publication, shows the variations in the index numbers for food articles in the 70 high schools of Paris and suburbs and of the 9 agricultural sections of France, by years, division into large and small schools being made:

INDEX NUMBERS OF PRICES OF 20 FOOD COMMODITIES AND COAL IN 70 HIGH SCHOOLS OF PARIS AND ITS ENVIRONS AND OF THE 9 AGRICULTURAL SECTIONS OF FRANCE, WITH DIVISION INTO LARGE AND SMALL SCHOOLS.

(Average of prices for 1895 and 1900=100.)

Sections.	1880	1885	1890	1895	1900	1901	1902	1903	1904	1905	1906	1907	1908
Paris.....	115	112	99	101	99	99	97	100	99	96	96	98	99
Environns of Paris....	114	105	100	98	102	99	99	105	99	97	99	102	105
Northwest:													
Large schools....	117	111	105	100	100	96	96	99	103	93	95	95	104
Small schools....	111	100	106	100	100	98	100	101	102	99	102	104	109
North:													
Large schools....	111	98	102	100	100	98	98	99	98	97	96	99	102
Small schools....	114	99	97	105	96	98	98	99	99	100	107	110	109
Northeast:													
Large schools....	111	106	103	101	99	99	98	97	97	95	96	103	107
Small schools....	122	106	98	100	100	101	98	97	98	99	100	102	109
East:													
Large schools....	108	103	101	100	100	97	99	99	101	99	99	102	106
Small schools....	109	108	101	99	101	99	100	100	100	99	99	104	106
Southeast:													
Large schools....	105	104	100	100	100	100	100	99	101	99	98	101	106
Small schools....			106	102	98	99	94	95	100	97	101	106	107
South:													
Large schools....	108	102	95	94	98	95	93	96	90	90	88	99	98
Small schools....	116	102	98	99	101	103	99	101	103	100	100	107	112
Southwest:													
Large schools....	106	102	98	101	99	101	100	98	98	96	98	104	105
Small schools....	115	112	104	102	98	98	101	101	103	100	102	107	109
West:													
Large schools....	108	99	102	99	101	105	102	104	102	98	97	101	108
Small schools....	112	103	109	100	100	104	101	99	98	98	97	102	107
Central:													
Large schools....	111	101	101	104	96	97	93	98	98	95	102	104	104
Small schools....	113	108	100	100	100	103	100	102	102	103	104	113	117
Paris.....	114	109	99	100	100	101	97	100	99	94	96	96	98
Other schools:													
Large schools (37)	110	103	100	100	99	99	98	100	99	96	97	101	105
Small schools (30)	118	105	102	101	99	101	99	100	101	99	101	105	109
Total.....	111	104	101	100	99	100	99	100	100	98	99	103	107

Index numbers computed on the prices of 20 food commodities and coal in 1908 are shown in the following table, the figures being given separately for Paris, its suburbs, and the large and small schools, respectively, of the 9 agricultural sections of France.<sup>2</sup>

<sup>1</sup> Le coût de la vie, p. 11.

<sup>2</sup> Ibid, pp. 22 and 23.

INDEX NUMBERS OF PRICES OF 20 FOOD COMMODITIES AND COAL IN 20 GROUPS (PARIS, ENVIRONS, LARGE AND SMALL SCHOOLS OF THE 9 AGRICULTURAL SECTIONS OF FRANCE) IN 1908.

(Average of prices for 1895 and 1900-100.)

Sections.	Bread.	Fresh pork.	Smoked pork.	Poultry and game.	Red wine.	White wine.	Beer.	Cider.	Butter.	Drippings and lard.	Fresh meats (exclusive of pork).
Paris.....	115.3	117.8	116.4	106.9	47.2	73.1	.....	.....	104.5	121.9	131.2
Environns of Paris.....	120.2	174.4	135.6	99.9	62.2	102.1	.....	.....	112.1	.....	128.8
Northwest:											
Large schools.....	117.6	166.0	164.1	111.7	65.1	64.7	.....	109.5	110.5	104.4	105.3
Small schools.....	121.6	114.2	113.2	124.0	57.9	.....	.....	154.2	108.9	.....	110.3
North:											
Large schools.....	113.3	113.1	109.6	105.8	53.3	80.0	.....	105.7	104.0	.....	103.7
Small schools.....	119.2	106.3	97.1	113.0	73.3	97.8	91.5	.....	107.5	81.1	109.1
Northeast:											
Large schools.....	114.5	106.2	136.8	105.7	59.3	76.3	.....	.....	111.1	136.5	105.5
Small schools.....	119.8	106.1	116.8	106.2	69.3	72.9	.....	.....	113.8	.....	106.0
East:											
Large schools.....	119.9	116.5	121.1	117.6	70.4	71.6	.....	.....	109.4	.....	112.5
Small schools.....	116.6	113.7	116.3	112.9	70.1	88.1	.....	.....	110.1	.....	115.8
Southeast:											
Large schools.....	122.0	123.8	115.7	101.3	65.2	77.7	.....	.....	116.1	135.2	105.2
Small schools.....	120.7	113.5	128.1	97.9	81.2	84.5	.....	.....	102.8	134.6	110.9
South:											
Large schools.....	106.7	97.8	95.7	110.7	68.1	.....	.....	.....	111.5	.....	101.1
Small schools.....	118.7	116.0	107.6	134.7	63.7	103.6	.....	.....	104.4	150.6	100.3
Southwest:											
Large schools.....	122.1	112.8	128.6	117.1	74.3	112.1	.....	.....	110.5	122.0	110.1
Small schools.....	118.4	116.6	101.3	108.7	72.6	116.1	.....	.....	103.1	128.3	108.8
West:											
Large schools.....	136.5	130.2	106.5	130.8	61.2	72.0	.....	.....	119.3	95.2	109.5
Small schools.....	116.7	110.3	135.5	131.3	61.8	82.2	.....	.....	111.1	106.7	108.2
Central:											
Large schools.....	121.5	111.0	110.5	118.6	65.0	56.4	.....	.....	112.6	.....	112.0
Small schools.....	132.5	113.1	140.1	108.2	66.7	84.6	.....	.....	116.7	125.0	104.1
General average.....	119.0	113.0	116.5	111.3	63.3	69.2	.....	.....	110.0	130.8	110.7

Sections.	Oil (table).	Eggs.	Milk.	Cheese.	Sugar.	Fresh fish.	Salted fish.	Cod-fish.	Potatoes.	Coal.
Paris.....	91.3	110.3	95.6	108.0	39.3	71.0	.....	81.6	108.1	112.6
Environns of Paris.....	112.2	107.5	100.0	108.9	69.7	98.4	.....	.....	125.8	110.3
Northwest:										
Large schools.....	108.3	116.1	112.4	116.2	61.0	96.5	.....	108.8	96.9	122.3
Small schools.....	87.9	127.9	96.9	111.2	61.0	108.6	127.2	123.1	.....	117.6
North:										
Large schools.....	83.4	106.2	106.5	110.6	64.7	93.3	112.6	.....	103.7	135.7
Small schools.....	114.1	104.7	104.5	130.5	64.1	88.2	126.2	78.2	130.3	124.6
Northeast:										
Large schools.....	114.8	117.2	107.2	105.4	62.8	79.2	125.2	.....	95.0	117.7
Small schools.....	114.5	125.0	99.0	125.5	61.2	81.4	150.7	.....	.....	128.5
East:										
Large schools.....	107.4	120.6	98.0	59.2	86.7	86.7	118.7	136.1	.....	180.4
Small schools.....	105.1	123.9	105.6	116.3	59.1	91.4	130.8	.....	100.7	124.7
Southeast:										
Large schools.....	102.9	115.3	100.4	120.6	62.5	93.9	104.0	125.2	.....	119.9
Small schools.....	100.3	123.7	125.0	125.0	58.2	100.0	117.0	111.1	.....	121.3
South:										
Large schools.....	74.2	115.6	121.7	104.8	58.8	75.9	109.6	.....	106.5	107.1
Small schools.....	111.6	134.0	111.6	113.0	62.6	78.2	143.2	106.8	119.7	148.8
Southwest:										
Large schools.....	100.2	126.3	99.1	117.0	60.1	74.8	.....	97.9	.....	.....
Small schools.....	84.3	123.4	94.3	109.8	60.6	75.7	128.4	119.6	131.4	.....
West:										
Large schools.....	114.0	103.9	123.5	123.5	61.5	84.0	94.3	99.5	82.6	156.6
Small schools.....	123.1	114.6	100.0	155.8	61.0	85.7	81.7	.....	.....	128.3
Central:										
Large schools.....	95.5	122.3	87.7	112.7	63.3	110.3	.....	109.1	115.3	.....
Small schools.....	138.9	112.2	118.4	151.8	64.9	103.8	128.4	.....	.....	144.9
General average.....	105.1	117.6	105.7	116.2	62.6	89.0	119.3	107.5	110.5	129.5

## GERMANY.

## INDEX NUMBERS OF THE IMPERIAL STATISTICAL OFFICE.

## PUBLICATION.

This series of index numbers, which represents wholesale prices of commodities in German markets, is published yearly in the *Vierteljahrshäfte zur Statistik des Deutschen Reichs*, a publication of the Imperial Statistical Office, and appears regularly for each year in the first quarter of the succeeding year.

The first report, including index numbers, was published in 1905 and covered the years 1899 to 1904. The table of index numbers in late reports regularly covers the 10-year period ending with the date of the publication of the report.

## HISTORY.

Since the year 1879 the German Imperial Statistical Office has published monthly average wholesale prices of commodities of importance in German markets. These were shown in detail in the *Monatshefte zur Statistik des Deutschen Reichs* up to the year 1891, and from 1892 to the present time in the *Vierteljahrshäfte zur Statistik des Deutschen Reichs*.

The object of the price study, as stated at the outset, was the collection of reasonably accurate and adequate average prices representing fixed grades of important articles of the wholesale trade, with a view to the gradual assembling of really useful data for the observation of the movement of prices. It was not until the year 1905 that the publication of relative prices was begun. The official series of index numbers has been extended back only as far as the year 1899.

## SOURCES OF QUOTATIONS.

The number of markets represented in this study has been limited to those with permanent arrangements for furnishing reasonably accurate and representative quotations. The following sources of information, representing 30 wholesale markets, are acknowledged in the report for the year 1911: Chambers of commerce or boards of trade in Augsburg, Berlin, Bielefeld, Brunswick, Bremen, Breslau, Danzig, Dortmund, Frankfort on the Main, Halberstadt, Hamburg, Cologne, Königsberg (in Prussia), Krefeld, Landeshut (in Silesia), Leipzig, Lübeck, Magdeburg, Mannheim, Mühlhausen (in Alsace), Munich, München-Gladbach, Nuremberg, Posen, and Stettin; the administrations of municipal stockyards and slaughterhouses; the mill administration in Bromberg (for wheat flour from Berlin), the stock exchange in Düsseldorf, the board of directors of the stock exchange in the city of Essen, the United German Jute Manufacturers in Brunswick (for raw jute at Hamburg), the Königsberg

Commercial Association in Königsberg (in Prussia) (for petroleum at Danzig), the Merchants' Association at Lindau, the Royal Administration of Mines at Saarbrücken, and the Bureau of Trade Statistics at Hamburg.

From the beginning ordinary published market quotations have been avoided as representing fluctuations in quality and as not being scientifically constructed. The study has been restricted to prices secured currently from the above-named or similar sources.

#### BASE PERIOD.

The 10-year period 1889 to 1898 is taken as the base period. No reasons are assigned for this selection.

#### PRICES: HOW SHOWN AND COMPUTED.

Three tables show the prices involved in the computation of index numbers. The first shows average monthly prices for the current year, the second shows average yearly prices for the 20-year period ending with the current year, and the third shows relative prices for each year of the 10-year period ending with the current year.

All actual prices shown are averages. A tabular statement in the first report (February, 1879) gave for each of the 26 markets then included in the study the intervals at which prices for the Imperial Statistical Office were determined and the methods of determining the quotations. According to this statement the average actual prices represent great variations from market to market in the number of original quotations involved in the computation, some being based on daily determinations while others are based on weekly or even monthly determinations, and some representing a medium price or quality while others are averages of the prices of the highest and lowest or of the highest, medium, and lowest grades of the commodities reported.

A few series of index numbers represent interrupted series of actual prices and a few others represent series of actual prices whose comparability is broken within the period involved in the table.

#### NUMBER AND CLASS OF COMMODITIES.

From the beginning (1899) index numbers have been given in summary form for 44 quotations. Of this number three represent iron and two each represent coal and petroleum. Each of the other commodities is represented by a single quotation. The number of commodities is therefore 40. No index number for the total of the 44 quotations is published, nor are index numbers shown for groups of commodities.

Index numbers are given for 40 articles, representing the 235 quotations of the table of actual prices. The number was originally 238, the two Stuttgart quotations for cotton yarn and the Stuttgart

quotation for cotton goods having been dropped from both actual and relative tables.

The table of actual average yearly prices as published in 1913 contains 320 series of quotations, some of which are themselves calculations from more than one variety, as, for example, the first Mannheim quotation for barley. This table at present includes five commodities not represented in the tables of relatives, namely, raw sugar, refined sugar, molasses, cocoa, and rubber. The comparability of all series of sugar quotations has been interrupted by changes in tariff laws; there is no continuous series of yearly average prices on molasses for the base period, and the last two articles have been added to the list of commodities since the publication of index numbers was begun—cocoa in 1907 and rubber in the following year.

The commodities included are not classified into raw materials and manufactured products. The great majority are raw materials but a number are so-called semimanufactures (*Halbfabrikaten*).

Some commodities originally omitted from the list were considered desirable but were not included because satisfactory data could not be secured. The original number of articles (30) has been considerably increased, but still certain important articles, as, for example, lumber and flax, are not included even in the tables of actual prices.

#### DESCRIPTION AND GROUPING OF COMMODITIES.

Index numbers are shown only for single commodities and not for groups.

The description of commodities in the table of index numbers as published in 1912 follows:

##### *Rye (1,000 kilograms).*

- Berlin, good, minimum 712 grams per liter [51.3 pounds per bushel].
- Breslau, medium grade.
- Danzig, goods for free exchange (*Ware z. freien Verkehr*).
- Frankfort on the Main, minimum 70 kilograms per hectoliter [54.4 pounds per bushel].
- Hamburg, Russian, in bond.
- Königsberg, good, 714 grams per liter [51.5 pounds per bushel].
- Leipzig, German, good.
- Lübeck, Russian, 71.3 kilograms per hectoliter [55.4 pounds per bushel].
- Mannheim, various origins, medium.
- Munich, Bavarian, best.
- Munich, Bavarian, good medium.

##### *Wheat (1,000 kilograms).*

- Berlin, good, minimum 755 grams per liter [54.4 pounds per bushel].
- Breslau, medium grade.
- Danzig, goods for free exchange.
- Frankfort on the Main, minimum 75 kilograms per hectoliter [58.3 pounds per bushel].
- Hamburg, Holstein, Mecklenburg.

Konigsberg, good, 749 to 754 grams per liter [54.0 to 54.4 pounds per bushel].  
 Leipzig, German, good.  
 Lindau, 78 to 79 kilograms per hectoliter [60.6 to 61.4 pounds per bushel], various  
 origins.  
 Mannheim, various origins, medium.  
 Munich, Bavarian, best.  
 Munich, good medium.

*Oats (1,000 kilograms).*

Berlin, good, minimum 450 grams per liter [32.4 pounds per bushel].  
 Breslau, medium grade.  
 Danzig, domestic.  
 Frankfort on the Main, good, native.  
 Konigsberg, good, 447 grams per liter [32.2 pounds per bushel].  
 Leipzig, German, good.  
 Lindau, Bavarian, 44 to 45 kilograms per hectoliter [34.2 to 35.0 pounds per bushel].  
 Mannheim, from Eaden, from Wurttemberg, medium.  
 Munich, Bavarian, best.  
 Munich, Bavarian, good medium.

*Corn (1,000 kilograms).*

Bremen, American, best, in bond.  
 Breslau, Russian, medium grade.  
 Hamburg, American, in bond.  
 Leipzig, various origins.

*Barley (1,000 kilograms).*

Breslau, medium grade.  
 Danzig, brewing, domestic.  
 Frankfort on the Main, brewing.  
 Konigsberg, 647 to 652 grams per liter [46.6 to 47.0 pounds per bushel].  
 Leipzig, German, good.  
 Lindau, Hungarian, 65 to 66 kilograms per hectoliter [50.5 to 51.3 pounds per bushel].  
 Magdeburg, Chevlier, good medium. (Not in 1912.)  
 Mannheim, from Baden, from the Palatinate, medium.  
 Munich, Hungarian, Moravian, etc., best.  
 Munich, Bavarian, best.  
 Munich, Bavarian, good medium.

*Hops (100 kilograms, without wrappings).*

Nuremberg, market.  
 Nuremberg, Wurttemberg.  
 Nuremberg, Hallertauer.  
 Nuremberg, Hallertauer seal.  
 Nuremberg, Spalt.

*Potatoes (1,000 kilograms, without sack).*

Berlin, early red, for distilling.  
 Berlin, early red, for food, assorted.  
 Breslau, good, Silesian, food.  
 Magdeburg, Saxon, for food.  
 Magdeburg, distilling.  
 Stettin, sorted, red, for food.  
 Stettin, sorted, white, for food.

*Butcher's meat.*

Beef (100 kilograms [220.5 pounds]) Berlin, slaughter weight.<sup>1</sup>  
 Pork (100 kilograms [220.5 pounds]) Berlin, slaughter weight.<sup>1</sup>  
 Veal (100 kilograms [220.5 pounds]) Berlin, slaughter weight.<sup>1</sup>  
 Mutton (100 kilograms [220.5 pounds]) Berlin, slaughter weight.<sup>1</sup>

*Rye flour (100 kilograms with sack).*

Berlin, No. 0/1, good average grade.  
 Danzig, No. 0/1, domestic price (*Inlandspreis*).  
 Cologne, No. 0/1.  
 Munich, No. 0.  
 Posen, domestic, No. 0/1.

*Wheat flour (100 kilograms).*

Berlin, No. 00, with sack.  
 Danzig, No. 00, with sack, domestic price  
 Cologne, Rhenish, No. 00, with sack.  
 Lübeck, German, No. 0, without sack.  
 Munich, Bavarian, No. 2, with sack.  
 Posen, domestic, No. 00, with sack.

*Butter (100 kilograms).*

Berlin, I quality.  
 Berlin, II quality.  
 Munich, finest Swiss.  
 Munich, mountain.

*Raw sugar (100 kilograms, net weight).<sup>2</sup>*

Brunswick, 88 per cent centrifugal, without sack, 3 months' time.  
 Halle, 88 per cent centrifugal, without sack, 3 months' time.  
 Magdeburg, I product, 88 per cent centrifugal, without sack, 3 months' time.  
 Stettin, 88 per cent centrifugal, without sack, 3 months' time.

*Refined sugar (100 kilograms).<sup>2</sup>*

Brunswick, without container in paper.  
 Magdeburg, I loaf (*Brot*), without container, in paper.  
 Stettin, I loaf (*Brot*), without container, in paper.

*Molasses (100 kilograms, net weight).<sup>2</sup>*

Magdeburg, for distilling.

*Potato alcohol, crude (100 liters), alcohol.*

Hamburg, with container.

*Rapeseed oil (100 kilograms).*

Berlin, crude, without container.  
 Danzig, crude, with container, export price.  
 Frankfurt on the Main, with container.

<sup>1</sup> Slaughter weight (*Schlachtgewicht*) is the presumptive weight of the four quarters on which the price of the animal, without the deduction of the value of hide, head, feet, entrails, etc., has been apportioned.

Prior to July 1, 1897, quotations were not on slaughter weight. At the time the change was made it was stated that according to information from authoritative sources the quotations on slaughter weight are about 84 per cent higher than on dressed weight.

<sup>2</sup> Descriptions from table of actual prices. Article not included in table of relative prices.

Hamburg, crude, with container.  
 Cologne, crude, good and clear, with container.  
 Königsberg, crude, clear, without container.  
 Leipzig, crude, light color and clear, without container.  
 Mannheim, marketable, with container.

*Herrings (1 cask, 150 kilograms).*

Danzig, with container, Crown and full.  
 Danzig, with container, Crown, Ihlen.  
 Hamburg, with container, in bond, Norwegian.  
 Hamburg, with container, in bond, Scotch West Coast.  
 Stettin, clear, with container, Norwegian, commercial.  
 Stettin, clear, with container, Norwegian, large medium.  
 Stettin, clear, with container, Norwegian, fair medium.  
 Stettin, clear, with container, Norwegian, medium.  
 Stettin, clear, with container, Scotch, Crown, full brand.  
 Stettin, clear, with container, Scotch, Crown, Matfulls.  
 Stettin, clear, with container, Scotch, Crown, Ihlen.

*Coffee (100 kilograms).*

Bremen, clear, with sack, in bond, Sabanilla, fair ordinary.  
 Bremen, clear, with sack, in bond, Santos, good average.  
 Hamburg, net weight, in bond, Santos.  
 Hamburg, net weight, in bond, Rio.  
 Hamburg, net weight, in bond, La Guaira, unwashed.  
 Cologne, net weight, with sack, Java, good medium.  
 Cologne, net weight, with sack, Santos, good medium.  
 Mannheim, Santos, average quality.

*Cocoa (100 kilograms, in bond).<sup>1</sup>*

Hamburg, Akkra current.  
 Hamburg, St. Thome, fine.  
 Hamburg, Bahia, fair, fermented.  
 Hamburg, Trinidad current.  
 Hamburg, Samina current.  
 Hamburg, Arriba, choice, summer.

*Tea (1 kilogram, in bond).*

Hamburg, Kongo, Foochow.  
 Hamburg, Kongo, Shanghai.  
 Hamburg, Souchong.  
 Königsberg, common Moning.  
 Königsberg, fine Moning.  
 Königsberg, finest Moning.

*Rice (100 kilograms, in bond).*

Bremen, Rangoon, shelled, 4 months' time.  
 Bremen, broken, No. 0, shelled, 4 months' time.  
 Hamburg, Rangoon, shelled, highest price, 1 per cent discount.  
 Hamburg, Rangoon, shelled, lowest price, 1 per cent discount.  
 Hamburg, broken, shelled, lowest price, 1 per cent discount.

<sup>1</sup> Descriptions from table of actual prices. Article not included in table of relative prices.



*Pepper (100 kilograms, in bond).*

Bremen, Singapore, 4 months' time.  
Hamburg, Singapore, 1 per cent discount.

*Lard (100 kilograms, in bond).*

Bremen, refined American, 4 months' time.

*Leaf tobacco (100 kilograms).*

Bremen, with packings, in bond, Kentucky, ordinary, 6 months' time.  
Hamburg, in bond, Domingo, wrapper and filler leaves.  
Hamburg, in bond, Brazil.  
Mannheim, in bond, wrapper leaves, Palatinate.  
Mannheim, in bond, wrapper leaves and filler leaves, Palatinate.  
Mannheim, in bond, cut, Palatinate.

*Hides and skins.*

Bremen, 100 kilograms, ox hides, best dry, Buenos Aires, 6 months' time.  
Bremen, 100 kilograms, Buenos Aires, Saladero, 6 months' time.  
Bremen, 100 kilograms, kip hides, Durbunga, arsenic slaughtered, 6 months' time.  
Bremen, 100 kilograms, kip hides, Hugli, slaughtered, 6 months' time.  
Bremen, 100 kilograms, kip hides, Dakka, best, 6 months' time.  
Hamburg, 100 kilograms, ox hides, Rio Grande, salted.  
Hamburg, 100 kilograms, ox hides, dry, West Indian; Central American, etc.  
Cologne, 100 kilograms, ox hides, best, green, Uruguay, 6 months' time.  
Cologne, 100 kilograms, kip hides, dry, East Indian, best Dakka, 6 months' time.  
Munich, 100 kilograms, ox and cow hides, best, green.  
Frankfort on the Main, 100 kilograms, calfskins, 3 to 4 months' time.  
Frankfort on the Main, 100 kilograms, goatskins, 3 to 4 months' time.  
Frankfort on the Main, 100 kilograms, hare skins, 3 to 4 months' time.  
Leipzig, 500 skins, hare skins, German.  
Leipzig, 500 skins, hare skins, Russian.

*Wool (100 kilograms).*

Berlin, North German sheep, medium.  
Bremen, washed, Buenos Aires, I.

*Cotton (100 kilograms).*

Bremen, middling upland.  
Bremen, good Ocmrawuttee II.  
Hamburg, New Orleans, middling.

*Cotton yarn (1 kilogram).*

Augsburg, 36 warp, 42 woof.  
Augsburg, 20 warp, 20 woof.  
Krefeld, English Nos., 40-120, twofold, singed.  
Krefeld, English Nos., 130-200, twofold, singed.  
Mülhausen, in Alsace, metric Nos., warp No. 16, 30 days, 2 per cent discount; cash,  
2½ per cent discount.  
Mülhausen, in Alsace, metric Nos., warp No. 28, 30 days, 2 per cent discount; cash,  
2½ per cent discount.  
Mülhausen, in Alsace, metric Nos., warp No. 40, 30 days, 2 per cent discount; cash,  
2½ per cent discount.

Mülhausen, in Alsace, metric Nos., woof No. 16, 30 days, 2 per cent discount; cash, 2½ per cent discount.

Mülhausen, in Alsace, metric Nos., woof No. 37, 30 days, 2 per cent discount; cash, 2½ per cent discount.

Mülhausen, in Alsace, metric Nos., woof No. 50, 30 days, 2 per cent discount; cash, 2½ per cent discount.

Munchen-Gladbach, Mule No. 8, f. o. b. factory.

Munchen-Gladbach, Water No. 12, f. o. b. factory.

Munchen-Gladbach, Water No. 20, f. o. b. factory.

*Calico (1 meter).*

Mülhausen, in Alsace, 90 centimeters [35.4 inches] wide.

Mülhausen, in Alsace, 78 centimeters [30.7 inches] wide, 16/16 thread.

*Linen yarn (1 kilogram).*

Bielefeld, English Nos., average price for I and II, No. 30, flax yarn.

Bielefeld, English Nos., average price for I and II, No. 50, flax yarn.

Bielefeld, English Nos., average price for I and II, No. 10, tow yarn.

Bielefeld, English Nos., average price for I and II, No. 20, tow yarn.

Landeshut, in Silesia, English Nos., average price for I, No. 30, flax yarn.

Landeshut, in Silesia, English Nos., average price for I, No. 50, flax yarn.

Landeshut, in Silesia, English Nos., average price for I, No. 10, tow yarn.

Landeshut, in Silesia, English Nos., average price for I, No. 20, tow yarn.

*Raw silk (1 kilogram).*

Krefeld, Italian orgazine, 18-20, 9 months' time, or cash 5 per cent discount.

Krefeld, Italian tram, 24-28, 9 months' time, or cash 5 per cent discount.

Krefeld, Italian raw (*grege.*), 12-14, 9 months' time, or cash 5 per cent discount.

Krefeld, Japanese orgazine, 22-24, 9 months' time, or cash 5 per cent discount.

Krefeld, Japanese tram, 34-40, 9 months' time, or cash 5 per cent discount.

Krefeld, Chinese tram, 36-40, 9 months' time, or cash 5 per cent discount.

*Hemp (100 kilograms).*

Lübeck, Petersburg dressed hemp.

*Mexican fiber (100 kilograms).*

Hamburg, in bales.

*Raw jute (100 kilograms).*

Hamburg, Brand  $\begin{matrix} R & F \\ & C \end{matrix}$

Hamburg, Good I, native brands.

Hamburg, Good II, native brands.

*Rubber, crude (1 kilogram).<sup>1</sup>*

Hamburg, South Kamerun.

Hamburg, Benguela II.

Hamburg, Upper Kongo I.

Hamburg, Kassai I, red.

Hamburg, Massai.

Hamburg, Mosambique I.

Hamburg, fine Para, hard.

<sup>1</sup> Descriptions from table of actual prices. Articles not included in table of relative prices.

Hamburg, Manóos, Negro, heads.

Hamburg, Cametá.

Hamburg, Peruvian balls.

Hamburg, Mexican gum.

*Iron (1,000 kilograms).*

German, pig:

Breslau, at the foundry, puddle.

Breslau, at the foundry, foundry pig.

Dortmund, at the foundry, Bessemer.

Dortmund, at the foundry, puddle-1.

Dortmund, at the foundry, Thomas.

Dusseldorf, at the foundry, puddle.

Dusseldorf, at the foundry, foundry pig.

Dusseldorf, at the foundry, Luxemburg No. 3.

English, pig:

Hamburg, Scotch No. 1.

Hamburg, Middlesboro No. 1.

Swedish, bar:

Lübeck, I Stockholm.

*Lead (100 kilograms).*

Berlin, various German brands.

Frankfort on the Main, Rhenish, double refined.

Halberstadt, refined, Harz, soft.

Halberstadt, refined, Silesian, soft.

Hamburg, Harz, soft, double refined.

Cologne, Rhenish, soft, double refined.

*Copper (100 kilograms).*

Berlin, Mansfeld.

Berlin, foreign I, Bede brand.

Frankfort on the Main, German double refined, in sheets.

Hamburg, English, best selected.

*Zinc (100 kilograms).*

Breslau, good, Silesian.

Frankfort on the Main, refined, zinc blend.

Halberstadt, Rhenish Westphalian, crude.

Hamburg, Silesian, in sheets.

Cologne, Rhenish, crude, "W H und S S."

*Tin (100 kilograms).*

Frankfort on the Main, Banca.

Hamburg, Banca, in blocks.

*Anthracite coal (1,000 kilograms).*

German:

Breslau, pit price, Lower Silesian, gas.

Breslau, pit price, Upper Silesian, gas.

Dortmund, at the mine, fallen, lump (run of mine).

Dortmund, at the mine, puddle.

Düsseldorf, at the mine, open-burning.

Düsseldorf, at the mine, anthracite.

Düsseldorf, at the mine, uninflamable.

Düsseldorf, at the mine, gas.

Essen, at the mine, open-burning.

Essen, at the mine, anthracite.

Essen, at the mine, uninflamable.

## German—Concluded.

- Essen, at the mine, gas.
- Saarbrücken, at the mine, open-burning.
- Saarbrücken, at the mine, anthracite.

## English:

- Danzig, f. o. b., English, pea.
- Danzig, f. o. b., Scotch, machine.
- Hamburg, f. o. b., West Hartley.
- Hamburg, f. o. b., Sunderland.

*Petroleum (100 kilograms), with container.*

## American:

- Standard white, Berlin.
- Standard white, Danzig.
- Standard white, Hamburg, in bond.
- Standard white, Magdeburg.
- Standard white, Mannheim.
- Standard white, Posen.
- Standard white, Stettin.

## Russian:

- Breslau.
- Lübeck, "Nobel."

## SUBSTITUTIONS, ADDITIONS, AND OMISSIONS.

Within the period of 13 years covered by index numbers three series of relatives have been changed, namely, those for hides and skins, cotton yarn, and cotton cloth. The change in the series for hides and skins was occasioned by the substitution in 1909 of a new set of quotations for Frankfort hare skins (German and Russian) with no alteration in the description of the article and with some of the earlier actual average prices identical with the old figures. The data for six years of the base period are incomplete for the new series. No reason is assigned for the substitution of the new series and no explanation is given in regard to its source. The later series, being published in the 10-year table 1900-1909, does not include the first year for which index numbers have been regularly shown. Minor substitutions of varieties or brands which apparently do not affect prices are occasionally indicated in footnotes to the tables (e. g. the Mannheim quotations on oats as given in the tables published in 1912). Actual price series printed in "old-style" type on account of a break in the comparability of the figures are in a number of cases represented by relative series (e. g. the Cologne coffee quotations).

The changes in the series of index numbers for cotton yarn and for cotton cloth were occasioned by the discontinuance of quotations from the Stuttgart market. In this case new series of relatives with the Stuttgart quotations eliminated were constructed for the whole period covered by the index numbers. Series of actual prices with data lacking for one or more years are in several cases represented by series of relative prices.

Within the period which affects the index numbers only two new commodities, cocoa and rubber, have been added. In these cases, as in cases where new quotations are added for commodities already included, the actual price series alone is given.

## TABLE OF RESULTS.

The following table of index numbers is taken from more than one report, because no table of relations as published covers more than 10 years. In cases where the earlier and later series of index numbers are not the same both sets of figures have been copied.

## RELATIVE PRICES OF ARTICLES OF WHOLESALE TRADE.

[Source: Vierteljahreshefte zur Statistik des Deutschen Reichs: 1912 and preceding years.]

(Base period, 1889-1898-100.)

Commodity.	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912
Rye.....	100	97	96	97	91	90	98	107	127	123	115	101	113	125
Wheat.....	91	88	94	94	90	98	98	100	116	118	130	116	114	121
Oats.....	98	96	101	108	93	92	102	114	125	114	119	107	120	134
Corn (maize).....	91	103	106	118	106	108	115	119	131	140	139	127	127	147
Barley.....	99	96	98	95	92	94	101	109	114	118	112	103	121	129
Hops.....	106	108	109	117	128	123	134	146	144	136	137	143	146	160
Potatoes.....	93	103	87	81	102	133	126	83	122	121	115	98	146	165
Beef.....	101	104	102	106	113	115	120	129	128	121	115	127	134	145
Pork.....	91	92	107	114	94	94	123	128	106	112	128	127	110	141
Veal.....	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Mutton.....	106	108	109	117	128	123	134	146	144	136	137	143	146	160
Rye flour.....	97	95	94	95	89	87	91	101	122	120	110	97	106	115
Wheat flour.....	91	86	92	92	89	94	94	97	112	115	123	113	111	115
Butter.....	100	100	105	101	105	107	112	115	114	119	120	123	129	134
Potato alcohol.....	122	97	81	71	86	127	107	91	119	143	108	107	104	141
Rapeseed oil.....	90	109	107	100	90	85	87	106	135	129	107	107	118	123
Herrings.....	129	144	116	128	106	99	136	146	115	92	107	121	124	145
Coffee.....	53	83	56	55	51	60	62	62	59	60	62	74	97	107
Tea.....	93	92	84	83	87	90	81	87	94	88	87	94	102	102
Rice.....	106	104	104	95	104	101	100	103	115	113	107	105	116	142
Pepper.....	147	168	164	181	167	159	155	143	123	87	90	103	122	143
Lard.....	82	105	127	152	126	105	109	130	135	133	171	183	136	156
Leaf tobacco.....	103	108	108	101	93	91	92	103	121	118	112	129	141	123
Hides and skins.....	(1)	*113	*111	*122	*117	*121	*132	*146	*137	*125	*143	156	144	180
Wool.....	127	117	94	104	117	118	123	134	138	121	132	135	129	31
Cotton.....	79	120	102	105	128	144	114	130	135	122	137	172	159	142
Cotton yarn.....	*92	*117	*105	*105	*121	*131	*108							
Calico.....	*91	*116	*104	*104	*121	*131	*117	127	145	119	113	121	119	123
Linen yarn.....	*86	*108	*89	*94	*111	*118	*109							
Raw silk.....	96	118	120	102	110	120	116	130	157	132	110	124	134	134
Hemp.....	109	102	91	99	107	93	99	107	133	96	99	96	95	93
Mexican fiber.....	112	124	135	128	121	114	114	125	132	128	130	138	145	167
Raw jute.....	105	112	97	98	117	128	122	121	117	113	106	104	114	113
Iron, German, pig.....	98	114	107	103	111	113	149	194	186	152	128	131	180	191
Iron, English, pig.....	122	153	115	106	105	104	104	119	136	119	101	107	108	123
Iron, Swedish, bar.....	128	145	113	115	108	102	108	117	126	112	110	112	110	129
Lead.....	120	148	118	115	113	112	114	118	118	115	115	124	123	123
Copper.....	130	149	112	97	100	102	113	140	165	116	112	111	129	154
Zinc.....	149	148	141	108	120	119	141	178	179	121	119	116	114	148
Tin.....	131	108	91	98	110	118	133	141	126	107	119	124	135	141
Coal, anthracite, German.....	158	166	148	150	158	158	180	225	216	168	169	193	238	259
Coal, anthracite, English.....	166	129	123	116	112	111	113	118	137	133	129	137	153	130
Petroleum, American.....	113	159	125	118	114	108	108	113	137	129	118	120	118	139
Petroleum, Russian.....	106	110	106	103	110	104	91	90	106	108	113	110	105	125
Petroleum, Russian.....	102	106	97	91	99	98	96	102	106	112	106	103	104	120

1 No index number published.

\* New series occasioned by substitution in Frankfurt quotation for German and Russian hare skins.

† Old series.

‡ New series including Stuttgart quotations.

§ Old series including Stuttgart quotations.

¶ New series excluding Stuttgart quotations.

## INDEX NUMBERS OF THE JAHRBÜCHER FÜR NATIONALÖKONOMIE UND STATISTIK.

## PUBLICATION.

Three general "indexes" and one table of index prices for which no general relative is computed, all based on German wholesale price statistics, are found in the *Jahrbücher für Nationalökonomie und Statistik*, which is published monthly at Jena, Germany. They are, as now published, the work of Dr. Johannes Conrad, a professor of the University of Halle, although in the years through which the index numbers have been carried, different persons have assisted in their compilation.

No distinctive name, so far as known, has become identified with any of the three, though they are variously spoken of as "Conrad's indexes" and the "Jahrbücher indexes," and are now and then referred to as the "Hamburg indexes."

These index numbers appear about two years late, and with some irregularity. Thus the figures for 1911 appeared in the August, 1913, issue and those for 1910 in the issue of July, 1912. Since 1887, however, presentation of the figures at some time during the year has been made. Each issue of the *Jahrbücher* reproduces the figures from the beginning, though those for the earlier years are grouped by periods in the later issues.

## HISTORY.

The following is a translation of the history of these price studies as given by Dr. Conrad in volume 17 of the *Jahrbücher*, third series, 1899, page 642:

In these *Jahrbücher*, in volume 3, 1864, appeared for the first time the results of an investigation into the course of prices, based upon the Hamburg quotations on imported goods subject to taxation. Prof. Laspeyres was the author. This study was based upon the one already made by Soetbeer which brought the data up to 1856, Laspeyres carrying the figures to 1862 for 48 articles. He compared the years 1851-1862 with both of the two preceding decades, taking the arithmetical mean of the prices, in order to demonstrate the alteration of prices in consequence of the gold importation resulting from the discovery of gold in California.

In the year 1874, in volume 23, Prof. H. Paasche, then a student, at my suggestion carried the investigation further upon the basis of the same materials but by a different method. Instead of computing the arithmetical mean he reckoned the quantities of 22 articles consumed by the population in the current year and multiplied the quantity of each article by the average price for the basic period (1847-1867) and by that for the current year, in order to get a more accurate relative.

Again in the year 1882 Richard van der Borght, now Prof. van der Borght, took up this computation according to the same principles and for the same articles and printed the results of his investigations in volume 5 (new series), 1882. However, he used other figures for the

consumption quantities, since statistics on this subject in the meantime had improved.

In the year 1887 we ourselves in volume 15 (new series) utilized the Hamburg quotations for an investigation of the price reduction in the eighties, and carried the data forward in the same manner. Since then we have annually compared the prices of the current year with those for preceding years, in order to determine how the movement of prices has further developed.

#### SOURCE OF QUOTATIONS.

Two of Dr. Conrad's indexes and one table of 47 articles for which a general index is not printed are based on the actual yearly average prices appearing in the publication entitled "Hamburg's commerce and shipping" (*Hamburgs Handel und Schiffahrt*), issued by the Hamburg Bureau of Trade Statistics (*Handelsstatistisches Amt*).

This publication contains actual prices, per 100 kilograms, net, stated in marks. The report for the year 1911 contains prices for 174 articles and subdesignations of articles. The price is that of sea-borne commerce declared at entry at the port of Hamburg.

In the first study published in the *Jahrbücher*, that appearing in volume 3, 1864, by Dr. E. Laspeyres, professor in the University of Basel, and entitled "Hamburg prices from 1851 to 1863, and the California and Australian gold discoveries since 1848" (*Hamburger Waarenpreise 1851-1863 und die californisch-australischen Goldentdeckungen seit 1848*), Dr. Laspeyres stated that the prices for the 48 articles used by him in preparing his relative had appeared every Friday since the year 1736 in the official "General price-current" (*Allgemeiner Preis Courant*). However, so far as known, no use of them for purposes of a relative had been made prior to Prof. Soetbeer's compilation beginning with 1831. In volume 23, 1874, Prof. Paasche stated that the current report on Hamburg's commerce and shipping for that year contained prices for more than 300 articles for the years 1847-1872. Prof. Soetbeer, in a study entitled "The movement of prices in the years 1886-1890" (*Das Niveau der Warenpreise in den Jahren 1886-1890*), published in the *Jahrbücher*, volume 58 (3d series, vol. 3), 1892, made the same statement for the years 1886-1888. In other words, no material change had occurred in the method of quoting Hamburg prices from 1847 to 1888.

During all these years Hamburg had been a free port, collecting duties on all goods entering the city, even if they came from other States of Germany, and therefore the prices declared at entry on all goods, whether received into the city by sea or river, by rail or wagon, appeared in the official price statistics. On October 15, 1888, however, Hamburg entered the German customs union (*Zollverein*). The following statement as to the effect of this change on the Hamburg quotations is abstracted from Prof. A. Soetbeer's statement in

the *Jahrbücher für Nationalökonomie und Statistik*, vol. 3, 3d series, 1892, pp. 590, 591:

With the entry of Hamburg into the German customs union the Hamburg trade statistics underwent a fundamental alteration which no longer permitted of a direct comparison with former years. The quotations upon articles of domestic commerce—i. e., articles received from neighboring German States—ceased, and quotations upon imports entering by sea only were available from that date. Therefore, for only those articles which had previously been exclusively or in overwhelming proportion brought in by sea were the figures after 1888 comparable. If the long series of preceding calculations of average yearly prices was not to be finally terminated and an entirely new series started, it would be necessary to make a complete revision and recomputation of the preceding tables and a new computation of average actual prices to include through the entire period from 1847 to 1888 only those articles which had been imported by sea.

The great importance of the Hamburg quotations as a basis for price statistics being generally recognized, and the great desirability of a continuous series from 1847 being evident, the director of the Hamburg bureau of trade statistics decided to make this recomputation. By means of subsidiary material, by use of the price declarations on exports by sea for the period 1847-1888, by the utilization of trustworthy market reports for the period, and in some degree by the use of expert estimates, the average actual prices were brought to the more restricted basis for the entire period.

Prof. Soetbeer concludes his discussion in these words: "These combined means—i. e., of recomputation—have cost much work and time, but one may with all good confidence put trust in them that in spite of all difficulties success has been attained in securing the continuity of this most important work on the movement of prices, which is not only desirable but necessary."

The effect of this change is discussed by Dr. Conrad in the *Jahrbücher* for 1893 (3d series, vol. 6, p. 695):

Unfortunately the first source—i. e., Hamburgs Handel und Schifffahrt—has undergone an alteration which has rendered necessary a reconstruction of the tables based upon it. Up to the year 1888 the prices were reckoned upon the customs declarations of goods entering by all means of transportation. As a result of the entry of Hamburg into the German customs union the customs declarations now embrace only goods imported by sea. As a result of this a comparison with preceding years could not be made with any accuracy. Now, however, the yearly average actual prices for 1847-1888 have been recomputed on the basis of 1888. This has been done by restricting the prices for 1847-1888 to those articles which were imported by sea. This reduced the number of articles upon which quotations were given from 320 to 180.

No changes of importance have taken place since Dr. Conrad's article was written. An average actual quotation is now carried for each of 171 articles and subdesignations of articles.



The fourth series of relative prices published in the Jahrbücher and prepared by Dr. Conrad is not based upon the famous Hamburg wholesale price quotations but upon official statistics of the German customs union. The history and source of this series are separately treated on page 232 of the present bulletin.

From this point it will be necessary to consider separately the three series of index numbers based on the Hamburg trade statistics which Dr. Conrad now presents annually in the Jahrbücher.

*Index numbers computed from prices of 39 selected articles.*

The first series contains relatives for each of 39 articles from 1871 to date and appears in current issues of the Jahrbücher. No general relative is now computed for this group. This is the table used in the Report from the Committee on Finance of the United States Senate, 1893.<sup>1</sup>

**BASE PERIOD.**

This table appears in the first study of this series, vol. 3 of the Jahrbücher, 1864, by Dr. E. Laspeyres in practically its present form. For 42 of the 48 articles then included in it the period 1831-1840 was used as a base. Relatives for 3 articles had 1841-1850 as a base, while for 3 articles 1851-1853 was the base. A general relative, not weighted, was computed with 1831-1840 as the base.

When the study of relative prices was resumed in the Jahrbücher by Prof. Paasche, volume 23, 1874, the period 1847-1867 was used as a base and the relative for each of 47 articles was computed, but as at present Prof. Paasche made no general relative for this table.

Of the three articles for which Dr. Laspeyres had been forced to use 1851-1853 as a base, Dr. Paasche dropped two (soda and Java coffee), while rapeseed appeared under a slightly different designation. He makes no comment as to how he adjusted it to the basis of 1847-1867.

Dr. Richard van der Borcht, by whom the work was continued in 1882, did not print this table at all. Its publication was resumed, however, by Dr. Conrad in volume 1, 3d series, of the Jahrbücher, 1891, with 1847-1870 as the base. This base has remained unaltered since that date.

**PRICES: HOW SHOWN AND COMPUTED.**

In the latest available presentation of the table, that published in June, 1914, relatives are shown by articles and decades from 1871 up to and including 1900. Relatives appear for 1901-1905, 1906-1910, and for each of the years separately from 1906 to 1912, inclusive. By the use of the tables in preceding issues, beginning with volume 1, 3d series, 1891, it is possible to get the decennial relative for each article since 1851-1860 and the yearly relative from 1886 to date, on

<sup>1</sup> Report from the Committee on Finance of the United States Senate on Wholesale Prices, Wages, and Transportation. Mar. 3, 1893. 52d Congress, 2d session, Report No. 1394. Pt. 1, pp. 297-301.

the present base. No yearly relatives are printed for the years 1864-1885, inclusive, and the yearly relatives for 1851 to 1863, appearing in the *Jahrbücher* (vol. 3, 1864) are, as already noted, on a different base. Their reduction to the present base has not been made except by decades.

Actual average prices are also shown in the June, 1914, issue of the *Jahrbücher* by zentners (50 kilograms) in marks, for 1847-1870, for the decades 1871-1880, 1881-1890, and 1891-1900, for the five-year periods 1901-1905 and 1906-1910, and by single years from 1906 to 1912. By the use of preceding issues, actual average prices by years are available, beginning with 1886.

A comparison with the official figures shows that from 1891 to date the actual prices of the table under consideration are those of Hamburgs Handel und Schiffahrt as now published in its current issue, reduced from the doppelzentner (100 kilograms) to the zentner (50 kilograms). The data for years prior to 1891, however, are not those shown in the current official publication but those published previous to the complete recomputation of the official figures, which was made after Hamburg entered the German customs union; in other words, Dr. Conrad's table of actual prices for years prior to 1888 has not been readjusted to the basis of 1888, as are the official quotations which are now published for Hamburg.

Two relatives are given for each article for the current year, namely, the per cent which the average price for that year is of the average price for 1847-1850 and for 1871-1880, respectively.

No general relative has ever been printed for this table except as it first appeared in 1864, although the Committee on Finance of the United States Senate in 1893 computed a relative for its own use.<sup>1</sup>

#### NUMBER AND CLASS OF COMMODITIES.

The table shown in the *Jahrbücher* for June, 1914, the latest available, embraces 39 articles. As originally computed by Dr. Laspeyres the table contained 48 articles, but Prof. Paasche in 1874 made a number of changes in his selection and reduced the number to 47. He brought the table from 1847 to 1872 to the basis of his selection, however, and since he computed no general relative, the changes were of no especial significance. As already stated, this table was not printed from 1874 until Dr. Conrad resumed it in 1891. (*Jahrbücher*, 3d series, vol. 1, pp. 916, 917.) In it he used the same 47 articles that Dr. Paasche had used.

In later issues of the *Jahrbücher* actual prices as well as relatives appear for all articles up to the year 1891, inclusive. In 1892, however, neither actual prices nor relatives were shown for raw sugar,

<sup>1</sup> Report from the Committee on Finance of the United States Senate on Wholesale Prices, Wages, and Transportation. Mar. 3, 1893. 52d Congress, 2d session, Report No. 1394. Pt. I, pp. 297-301.

silk, flax, hops, rapeseed oil, horsehair, or butter, and no prices or relatives have appeared for these articles since that year, although they were not finally eliminated from the table until the issue of the *Jahrbücher* for July, 1911. No explanation of the change is made.

All the articles embraced in this table are either raw materials or semimanufactured materials.

#### DESCRIPTION AND GROUPING OF COMMODITIES.

\* No description of the articles in this table has accompanied it after its first appearance in 1864. At that time Dr. Laspeyres gave a detailed description, but his list of articles is not the same as is used in later tables, and the time that has elapsed since its appearance makes his description of no great present significance. It is therefore not reproduced. It may be found in the *Jahrbücher*, vol. 3, pp. 89-92, inclusive.

As the table now stands, the description of articles is an exact copy of the description found in *Hamburgs Handel und Schifffahrt* with the following exceptions:

*Cotton*.—The table as published in the *Jahrbücher* merely says "cotton" (*Baumwolle*), but in the original table the boxhead reads "Cotton and cotton waste" (*Baumwolle und Baumwoll-abfall*). The actual prices are those of "Commerce and shipping" reduced to a basis of 50 kilograms.

*Coal*.—Dr. Conrad's designation is "Coal and coke" (*Steinkohlen und Koks*), but the official designation is "Coal" (*Steinkohlen*). Dr. Conrad's actual prices are the same as the official figures, reduced to zentners.

*Iron, English bar*.—This designation does not appear at all in the official Hamburg figures. "Bar iron from all sources" (*Stangen-Eisen im Ganzen*) and "English strap iron" (*Stangen-Eisen, englisch*) are quoted. Comparison of the actual prices, as quoted by Dr. Conrad in the *Jahrbücher*, shows that from 1881 to 1890 the quotation appearing under the heading "English bar" is "English strap iron." From 1891 to 1905 it is the quotation of the official figures for "bar iron from all sources." From 1906 to 1910 it is again the quotation for "English strap iron." So far as can be ascertained, no explanation of this irregularity is offered.

No grouping of commodities is made in the table. No general relative has been published since 1864. The relative for 1864 was not weighted.

*Index numbers computed from prices of 19 articles in 6 groups.*

A second table of weighted relatives for six groups containing 19 articles, together with a combined weighted relative for all articles, appears in current issues of the *Jahrbücher*. The weighted relative

for all articles is in each issue compared with a simple relative based on all the articles quoted in the official Hamburg prices for which the continuity of the quotations is such as to make them usable. This latter relative is discussed on pages 228-232 of this bulletin.

#### BASE PERIOD.

The weighted relative as now published is calculated on two bases for purposes of comparison: 1847-1880 and 1871-1880. The table also contains a relative for the years 1871-1880 with the period 1847-1867 as a base.

This table first appeared in Prof. Paasche's study published in vol. 23, 1874. At that time 1847-1867 was used as the base. This same period was used as the base period by Dr. van der Borcht in 1882, but he also made a relative for the years 1876-1880, with 1847-1875 as a base. When Dr. Conrad calculated this table in 1887 he reduced it to its present form.

#### PRICES: HOW SHOWN AND COMPUTED.

As the table is now published relatives are shown for the 10-year periods 1881-1890 and 1891-1900, for the 5-year periods 1901-1905, and 1906-1910, and for each year since 1905. By the use of preceding issues a yearly relative for the present 19 articles is available beginning with 1888 and also a relative by 5-year periods beginning with 1881-1885.

#### NUMBER AND CLASS OF COMMODITIES.

The first issue of the table embraced 22 commodities, all raw materials. As it now appears it contains 19 raw materials. The reduction from 22 to 19 articles really occurred in 1892, since in the table of actual prices from which the relatives were made no quotation has appeared for sugar, silk, or unforged zinc since 1891. The table, however, was preserved in its original form until vol. 31 of the Jahrbücher, 1906 (containing the relative for 1904), when the table was recast to include only the 19 articles now quoted. No explanation of the reason for the omission of the three articles noted above was made, but since they are not now quoted in Hamburgs Handel und Schiffahrt, their omission from the official statistics undoubtedly forced their omission also from Dr. Conrad's weighted relative.

#### DESCRIPTION AND GROUPING OF COMMODITIES.

The articles used by Dr. Conrad are described in his table exactly as they appear in their original source (Hamburgs Handel und Schiffahrt), with four exceptions:

1. *Rice*.—The quotation on rice is that for all rice, without distinction of kind.

2. *Cotton*.—In the Jahrbücher the quotation under the heading "Cotton" (*Baumwolle*) is the price appearing in Hamburgs Handel und Schiffahrt under the heading "Cotton and cotton waste" (*Baumwolle und Baumwoll-abfall*).

3. *Fish oil*.—This article appears in the Hamburg tables merely as "Tran," in the Jahrbücher as "Fischtran."

4. *Coal*.—The quotation in Hamburgs Handel und Schiffahrt is for "coal and coke" (*Steinkohlen und Koks*), while in the Jahrbücher the heading used is merely "Coal" (*Steinkohlen*). The price, however, is that for coal and coke.

Actual average prices are also shown in current issues of the Jahrbücher by zentners (50 kilograms) in marks from 1847 to date.

The grouping of articles is as follows:

- I. Coffee, cocoa, tea, pepper, and rice.
- II. Cotton.
- III. Indigo, saltpeter, fish oil, and palm oil.
- IV. Iron (pig and cast), tin, copper, and lead.
- V. Coal.
- VI. Wheat, rye, barley, and oats.

#### WEIGHTING.

The index number under consideration was first weighted by Prof. Paasche according to consumption in the German Empire in 1874. He states that he determined the consumption quantities which he used by various means. For those articles which were not produced in Germany it was possible to get fairly accurate data from the import and export statistics of the German customs union. The articles which came to Germany exclusively by importation were coffee, cocoa, tea, pepper, rice, cotton, indigo, saltpeter, fish oil, and palm oil. Domestic production of sugar being at that time subject to a tax, it was possible to get accurate statistics of the consumption of sugar from the official imperial statistics (*Reichsstatistik*). The same was true of the mineral products, iron, zinc, tin, copper, lead, and coal. Prof. Paasche stated that the least satisfactory were his statistics for the consumption of grain. He found that it was absolutely impossible to make accurate tables of grain production, and he therefore used the figures of Hausner in his "Comparative European Statistics" (*Vergleichende Statistik Europas*), 1864.

The weighted relative was computed according to the method of Drobisch. To illustrate, the relative for each group for the year 1868 was computed as follows:

German consumption for that year of each article in the group was ascertained as indicated above. It was then multiplied by the average price for the base period, 1847-1867, and by the average price

for 1868. The sum of the products for 1847-1867 was then ascertained and likewise the sum of the products for 1868. The relative for 1868 was the ratio of the sum of the products for 1868 to the sum of the products for 1847-1867.

The relative for the entire table of 22 articles (now 19 articles) in six groups was made in the same way. That is, the sum of all the products for 1847-1867 was found and the sum of the products for 1868 was compared with it to get the general relative. Thus, the textile group consisted of cotton and silk. The average price of cotton for 1847-1867 was 26.83 thalers per zentner; for 1868, 25.92 thalers per zentner. The consumption of cotton in 1868 was 1,509,961 zentners. The average price of silk for 1847-1867 was 616.31 thalers per zentner; for 1868, 858.12 thalers per zentner. The consumption of silk for 1868 was 22,088 zentners. The relative for the group was therefore secured as below:

26.83 × 1,509,961 equals	40,512,254	
616.31 × 22,088 equals	13,613,055	
	<hr/>	
	54,125,309	
	<hr/>	
25.92 × 1,509,961 equals	39,138,189	
858.12 × 22,088 equals	18,954,155	
	<hr/>	
	58,092,344	
	<hr/>	
Relative for 1868 $\frac{1847-1867}{1868}$	5,809,234,400	equals 107
	<hr/>	
	54,125,309	

The sum of the 22 products for 1847-1867 was 954,341,370; for 1868 it was 1,130,430,232. The relative for the 22 articles for 1868 therefore was  $\frac{113,043,023,200}{954,341,370}$  equals 118.5.

The table was reweighted for each year from 1868 to 1872, inclusive, according to the consumption for that year.

When Dr. Richard van der Borcht computed this table in 1882, he followed the same method as Prof. Paasche, weighting anew for each year the figures for the years 1873 to 1880, inclusive. As to the source of his statistics of consumption he states that for grains, instead of using Hausner's results for the years 1873-1877, he substituted the figures of X. von Neumann-Spallart which had appeared in his "Review of International Traffic" in 1878. For the years 1878-1880 he used the imperial statistics of domestic grain production which had become available.

The estimates of consumption of other articles were all based on official imperial statistics (*Reichsstatistik*), including statistics of domestic production, and of export and import.

When Dr. Conrad computed the table for the years 1880 to 1886, inclusive (*Jahrbücher*, vol. 15, pp. 322-331), he used the consumption

statistics of 1880 for the entire table, having abandoned Dr. van der Borcht's method of weighting each year separately. Dr. Conrad has continued to weight this table according to the consumption statistics of 1880 to the present time.

So far as can be ascertained, the general relative for the entire 19 articles was weighted for all years prior to 1906, inclusive, as indicated in the preceding paragraphs. From 1907 to date, however, the general relative has been obtained by computing the simple arithmetical average of the relatives for the six groups.

#### TESTING.

It can not be said that any method of testing was applied to Dr. Conrad's weighted relative prior to 1889. From that year, however, the weighted relative has been compared to the unweighted relative for all articles with continuous quotations included in Hamburgs Handel und Schiffahrt. For 1889 this simple relative embraced 318 articles. It now includes but 157 articles. Dr. Conrad has also included in his periodical price studies since that date a relative based on the official imperial quotations (*Reichsstatistik*), and in addition has reprinted Sauerbeck's index as found in the Journal of the Royal Statistical Society, London. These various relatives he has utilized for comparison with his own work.

*Index numbers computed from prices of 157 articles.*

Beginning with volume 1, 3d series, of the Jahrbücher for 1891, Dr. Conrad's price studies have also included, as stated in the preceding paragraph, a simple relative for all the articles contained in Hamburgs Handel und Schiffahrt for which the quotations have been continuous. The relative is printed in the same table as the weighted relative described above and is used for purpose of comparison with it.

#### BASE PERIOD.

The base periods are the same as for the weighted relative already discussed. A relative for the years from 1871 to 1880, with 1847-1867 as the base, and two relatives for the years from 1881 to date are shown. Of the latter the first has as its base the period 1847-1880, while the second is computed upon 1871-1880 as a base.

#### PRICES: HOW SHOWN AND COMPUTED.

In the latest available issue of the Jahrbücher (June, 1914), relatives are shown for each of the decades 1881-1890 and 1891-1900, for the five-year periods 1901-1905 and 1906-1910, and for the years 1906 to 1912 separately. By the use of preceding issues it is possible to get a yearly relative beginning with 1886 and a relative by five-year periods beginning with 1881-1885.

## NUMBER AND CLASS OF COMMODITIES.

As now printed the index number includes 157 articles, largely raw materials, but including also some manufactured and semimanufactured articles, as varied in character as possible. A yearly relative on the present basis of 157 articles is available only from 1902 to date. This is occasioned by the fact that when the relative was recomputed on its present basis the years prior to 1902 were grouped.

When first computed for 1889 and preceding years 318 articles were included. The relative for 1891 and preceding years, which appeared in volume 5, third series, embraces 320 articles. However, by the time that Dr. Conrad prepared his relative for 1892 the recomputation of the Hamburg prices necessitated by the entry of Hamburg into the German customs union, to which repeated reference has been made, had taken place, and Dr. Conrad found it necessary to recompute his relative on the reduced basis of 163 articles.

Dr. Conrad's statement concerning this is as follows:

It became necessary for us to reduce the number of articles included in our computation of the arithmetical mean from 320 to 163 articles, and on this basis we have available figures from 1847 to date. This fact is bound to have an appreciable effect on our results. The decrease in prices as a result of this in recent times is rendered less important, while the rise in prices in the seventies compared to 1847-1867 becomes greater. Thus with the old list of articles the relative for 1871-1880, with 1847-1867 as a base, is 104. With the restricted list it is 111. With 1847-1880 as a base the average of 320 articles for the decennium 1871-1880 has a relative 79, but the relative for the new list of 163 articles is 95.

The difference is yet greater for the years 1890-91, for which the relative according to the old method on the base 1847-1880 was 74, but is now 95, and on the base 1871-1880 was 72 and is now 85 plus. The year 1392, so far as comparison is possible, with the base 1871-1880 would have shown a decrease of from 70 for 1891 to 68 for 1892. With the present list of articles, however, the relative for 1892 is 82.7 as against 87.4 for 1891.

This is a difference of about 15 per cent, arising from the fact that the prices of domestic products had decreased much more than the prices of those imported by sea. This difference will serve to warn against the putting of too great faith in these tables, for they show how results differ according to the number of articles considered and show how necessary it is to use as large a number of articles as possible.

With the publication of the relative for 1906 and preceding years in volume 34, third series, of the *Jahrbücher*, 1907, the number of articles was further reduced to 158 and the relative was recomputed from the beginning on the new basis. Dr. Conrad does not state what articles were dropped. When the index for 1907 was printed the number was still further reduced to 157, without recomputation, where it now stands.



## DESCRIPTION AND GROUPING OF COMMODITIES.

No list of included articles is printed in the Jahrbücher. The 157 articles, however, are from the following list of 174 articles for which average annual prices from 1850 to date appear in "Hamburgs Handel und Schiffahrt." The quotations for the articles marked with an asterisk (\*) are in some degree imperfect, and it seems safe to conclude that the excluded articles are among those so designated:

- |   |  |
|---|--|
| 1. Alces.   | 43. Woolen and half-woolen yarn.                                   |
| 2. Antimony.  | *44. Casings (i. e., for sausages).                                |
| 3. Oranges.   | 45. Yellow metal and brass.  |
| 4. Arrack.  | 46. Gin.   |
| 5. Asphalt.   | 47. Barley.  |
| 6. Balsam of copaiba.                               | 48. Plate glass.   |
| 7. Peruvian balsam.                                 | 49. Natural guano.   |
| 8. Cotton and cotton waste.                         | 50. Gum arabic.  |
| 9. Bay leaves.                                      | *51. Gum benzoin.  |
| 10. Tin plate.                                      | *52. Dammar.   |
| 11. Sheet iron.                                     | 53. Raw rubber.  |
| 12. Lead.   | 54. Copal.   |
| 13. White lead.                                     | 55. Gutta-percha and chicle.                                       |
| 14. Borax.  | 56. India-rubber shoes.  |
| 15. Bristles.                                       | 57. Dried and salted hides.  |
| 16. Cinchona bark.                                  | 58. Oats.  |
| 17. Cochineal.                                      | 59. Hemp.  |
| 18. Divi-divi.                                      | 60. Resin and galipot.   |
| 19. Iron wire.                                      | 61. Herring.   |
| 20. Pig and cast iron.                              | 62. Logwood.   |
| 21. Bar iron from all sources ( <i>im Ganzen</i> ). | 63. Yellowwood.  |
| 22. Strap iron, English.                            | 64. Redwood.   |
| 23. Sheet billets, Swedish.                         | 65. Ebony wood.  |
| 24. Iron rails and fishplates.                      | 66. Rosewood ( <i>Jacaranda</i> ).                                 |
| *25. Elephant's tusks and ivory.                    | 67. Corkwood.  |
| 26. Peas.   | 68. Mahogany.  |
| 27. Extract of logwood.                             | *69. Walnut wood.  |
| *28. Extract of redwood.                            | 70. Cedar wood.  |
| *29. Extract of yellowwood.                         | 71. Honey.   |
| *30. Extract of quercitin (dyer's oak).             | 72. Ox and cow horns.  |
| 31. Figs.   | 73. Indigo, natural and manufactured.                              |
| 32. Deerskins, doeskins, and reindeer skins.        | 74. Raw ginger (zinziber).   |
| 33. Calfskins.                                      | *75. Iodine and iodine preparations.                               |
| 34. Sheep and goat skins.                           | *76. Jute.   |
| 35. Dried fish.                                     | 77. Cheese.  |
| 36. Meats, fresh and cured.                         | 78. Coffee, raw, without designation of kind ( <i>im Ganzen</i> ). |
| *37. Meat extracts.                                 | 79. Coffee, raw, Brazil.   |
| *38. Nutgalls.                                      | 80. Coffee, raw, San Domingo.                                      |
| 39. Cotton yarn.                                    | 81. Coffee, raw, Java.   |
| *40. Coconut fiber yarn.                            | 82. Coffee, raw, La Guaira.  |
| *41. Jute and manila hemp yarn.                     | 83. Coffee, raw, Porto Rico.                                       |
| 42. Linen yarn.                                     | 84. Cocoa.   |
|   | *85. Potassium monochromate.                                       |

86. Camphor.  
 87. Cinnamon.  
 88. Cassia lignea and cassia vera.  
 89. Catechu, brown and yellow.  
 90. Bones.  
 \*91. Bone ash.  
 92. Bone charcoal and bone meal.  
 93. Cognac.  
 94. Currants.  
 95. Corks.  
 96. Madder.  
 97. Copper.  
 98. Licorice.  
 99. Leather.  
 100. Candles.<sup>1</sup>  
 101. Maize.  
 102. Almonds.  
 \*103. Manila hemp, sisal, etc.  
 104. Nutmeg flowers  
 105. Nutmegs.  
 106. Nails, iron.  
 107. Cloves.  
 \*108. Corozo nuts and coconuts (for use in making buttons, etc.).  
 109. Walnuts and hazelnuts.  
 110. Castor oil.  
 \*111. Cottonseed oil.  
 112. Coconut oil.  
 113. Linseed oil.  
 114. Olive oil.  
 115. Palm oil.  
 116. Turpentine.  
 \*117. Oil cake.  
 \*118. Paraffin and vaseline.  
 119. Mother-of-pearl shells.  
 \*120. Refined petroleum.  
 121. Pepper.  
 122. Phosphorus.  
 123. Piassaba.  
 124. Allspice.  
 \*125. Quicksilver.  
 126. Rice, kind not specified (i. e., *im Ganzen*).  
 \*127. Rice, Japanese.  
 128. Rice, Java.  
 129. Rye.  
 130. Raisins.
131. Rum.  
 132. Grass seed.  
 133. Clover seed.  
 134. Flaxseed.  
 135. Rapeseed (*Raps Undrubsaat*).  
 \*136. Sesame seeds.  
 137. Sago and tapioca.  
 138. Saltpeter.  
 139. Anchovies.  
 140. Sardines.  
 141. Shellac, and gum lac.  
 142. Slate.  
 143. Grease.  
 144. Sulphur.  
 145. Sail twine (canvas yarn).  
 146. Soda, calcined and crystallized.  
 147. Steel.  
 148. Stearine.  
 149. Coal.  
 150. Rattan.  
 151. Sumac.  
 152. Tobacco, without designation as to origin (*im Ganzen*).  
 153. Tobacco, San Domingan.  
 \*154. Tobacco, Cuban.  
 155. Tobacco, Porto Rican.  
 156. Tallow.  
 157. Cordage, new.  
 158. Tea.  
 159. Fish oil.  
 160. Wax.  
 161. Baleen.  
 162. Spermaceti and margarine.  
 163. Wines without designation of origin or kind (*im Ganzen*).  
 164. Wines, exclusive of champagne.  
 165. Champagne.  
 166. French wines.  
 167. Portuguese wines.  
 168. Spanish wines.  
 169. Tartar.  
 170. Wheat.  
 \*171. Woolen waste and shoddy.  
 172. Sheep's wool.  
 173. Tin.  
 174. Lemons.

<sup>1</sup> This term is not further defined in current issues. The word "Lichte," which in technical usage is equivalent to "Kerzen," appears without qualification. In the issue for 1889 it was defined as "Stearin-Lichte," i. e., composite candles; but it can not be safely inferred that at present composite candles only are included, since the technical term "Lichte" covers all sorts of candles, as tallow, paraffin, wax, etc.

## TESTING.

The only test of this relative so far as is shown in the Jahrbücher is its comparison with Dr. Conrad's weighted index, with Sauerbeck's index for England, and with that which Dr. Conrad bases on the German imperial statistics (*Reichsstatistik*).

*Index numbers based on prices of the German customs union.*

In addition to the three series of index numbers described in the foregoing paragraphs Dr. Conrad regularly includes in his annual study of prices a table of actual and relative prices derived from official quotations of the German customs union. This table first appeared in the Jahrbücher when Dr. Conrad took up the work of studying German prices, as published in the fifteenth volume of the new series, 1887 (forty-ninth volume of entire series). This index has usually appeared with those based on Hamburg prices, but in a few cases has been issued separately. In general it has appeared more regularly than the Hamburg index.

## SOURCE OF QUOTATIONS.

In the volume of the Jahrbücher in which this table first appeared Dr. Conrad merely states that "Table III, which follows, presents the movement of prices from 1871 to 1886, as they are so satisfactorily published in the official imperial statistics, and we compare the periods 1879-1882 and 1883-1886."

In the next issue, however, the table is credited to the "Monthly Statistical Journal of the German Empire" (*Monatshefte der Statistik des Deutschen Reichs*), and it continued to be so credited until the publication of the table for the year 1892 (Jahrbücher, 3d series, vol. 61, entire series, 1893). From that date to the present it has been from the "Monthly Statistical News of Foreign Commerce in the German Customs Union" (*Statistische Nachweise über den auswärtigen Handel des deutschen Zollgebiets*).

## BASE PERIOD.

As at present issued the index is computed upon two bases—1879-1883 and 1879-1889. The period 1879-1882 was the base as the table was originally printed. It was changed to 1879-1883 with the presentation of the table for the year 1888 (Jahrbücher, vol. 18, whole series vol. 52, 1889). The second index, with the base 1879-1889, was added when the table was printed for 1890 (Jahrbücher, 3d series, vol. 1, whole series vol. 56, 1891).

## PRICES: HOW SHOWN AND COMPUTED.

On the base 1879-1883 the table as now published<sup>1</sup> shows relatives by five-year periods from 1884 to 1913, inclusive, and annual relatives for years since 1908. By the use of preceding issues of the *Jahrbücher* an annual relative is available from 1888 to date, excepting for 1889 and 1902. For these years relatives were not computed, although the actual prices were available.

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Actual prices are presented in the same way, and are available for every year of the period covered.

## NUMBER AND CLASS OF COMMODITIES.

The table as constructed embraces quotations on 33 articles. In this number are included two designations each for sugar, coffee, tobacco, and cotton yarn. However, for the years since 1909 the quotation on herring is lacking, while from 1907 to date no quotation on copper is shown. Therefore the relative as now printed is actually based on 33 articles from 1884 to 1906, 32 articles from 1907 to 1909, and 31 articles for years since 1909.

The relative, however, is not computed on 31 quotations but on 103, as for many articles several quotations are utilized in making up the average annual price on which the relative is based. There has been a slight variation in the number of quotations from time to time, but no change of any significance. As first issued the relative was based upon 96 quotations.

Of the 33 articles in the list some are raw materials, others are finished manufactures, while a few are semimanufactured products.

## DESCRIPTION AND GROUPING OF COMMODITIES.

The articles are not divided into groups. They are described as follows in the current issue of the *Jahrbücher*:<sup>2</sup>

1. Wheat, 14 quotations (1892 to date).
2. Rye, 14 quotations (1892 to date).
3. Barley, 15 quotations (1892 to date).
4. Maize, 5 quotations (1892 to date).

<sup>1</sup> *Jahrbücher für Nationalökonomie und Statistik*, 102. Band (III. Folge, 47. Band), Heft 6. Juni, 1914, p. 800.

Idem, pp. 799-801.

## TESTING.

The only test of this relative so far as is shown in the *Jahrbücher* is its comparison with Dr. Conrad's weighted index, with Sauerbeck's index for England, and with that which Dr. Conrad bases on the German imperial statistics (*Reichsstatistik*).

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Idem, pp. 799-801.

5. Oats, 14 quotations (1892 to date).
6. Wheat flour, 6 quotations (1892 to date).
7. Rye flour, Berlin.
8. Rapeseed oil, Berlin.
9. Potato alcohol, Berlin (1892-1903), Hamburg (1904 to date).
10. Raw sugar, Magdeburg.
11. Refined sugar, Magdeburg.
12. Coffee, Rio, good ordinary, Bremen (Sabanilla, 1896 to date).
13. Coffee, plantation, Ceylon, medium, Frankfort on the Main.
14. Rice, Rangoon table, Bremen.
15. Pepper, Bremen.
16. Herring, Norwegian, Hamburg (Scotch, 1904 to date).
17. Leaf tobacco, ordinary Kentucky, Bremen.
18. Leaf tobacco, second-grade Brazil, Bremen.
19. Cotton, middling upland, Bremen.
20. Wool, Berlin.
21. Hemp, Lübeck.
22. Raw silk, Milan organzine, Krefeld.
23. Cotton yarn, Nos. 40-120, Krefeld.
24. Cotton yarn, warp 16, Mühlhausen, in Alsace.
25. Cotton cloth, Mühlhausen, in Alsace.
26. Linen yarn, No. 30, flax yarn, Bielefeld.
27. Lead, 6 quotations.
28. Copper, Mansfeld, Berlin.
29. Zinc, 5 quotations.
30. Tin, 3 quotations.
31. Pig iron, Scotch No. 1, Hamburg (up to 1900, inclusive, Berlin).
32. Petroleum, Hamburg (up to 1900, Bremen), in bond.
33. Coal, Westphalian, Berlin.

#### SUBSTITUTIONS AND ADDITIONS.

Such substitutions as have been made are with respect to grade or place of quotation and are indicated in the description above. No additions to the list of articles have been made.

#### TESTING.

This relative is presented for purposes of comparison with the two other general relatives published currently in the *Jahrbücher*, namely: The weighted relative of 19 articles (based on Hamburg quotations) and the simple relative of 157 articles (also based on Hamburg quotations)\*.

Dr. Conrad also reprints Sauerbeck's index for comparison with his own, and in addition compares them with other studies which appear from time to time.

TABLES OF RESULTS.

The following tables, compiled mainly from the issue of the Jahrbücher for June, 1914, show the principal index numbers computed by Dr. Conrad:

RELATIVE PRICES OF 39 SELECTED ARTICLES (BASED ON HAMBURG TRADE STATISTICS), BY SPECIFIED PERIODS, 1871 TO 1910, AND BY YEARS, 1906 TO 1912<sup>1</sup>

(Base period, 1847-1870=100.)

Article.	1871-1880	1881-1890	1891-1900	1901-1905	1906-1910	1906	1907	1908	1909	1910	1911	1912
Coffee (Brazil).	155.13	120.29	125.62	75.90	83.37	82.99	73.75	81.84	84.65	102.28	130.44	150.41
Cocoa.	116.53	130.98	119.07	109.48	111.84	103.48	154.58	118.15	97.66	95.80	97.05	102.30
Tea.	86.57	67.20	82.96	53.98	58.83	60.86	69.90	61.04	61.75	60.48	63.50	57.56
Currants.	89.50	80.33	83.44	79.07	96.39	90.88	97.40	95.50	94.32	104.84	109.77	110.71
Raisins.	99.51	88.10	79.43	94.19	102.87	99.51	118.89	102.76	89.10	108.44	119.52	122.88
Almonds.	110.91	111.22	101.34	101.56	122.96	89.96	125.70	114.17	126.09	128.26	135.48	138.64
Pepper.	140.35	182.93	104.63	163.61	127.35	144.41	135.27	115.40	114.99	126.64	143.51	164.27
Cocunut oil.	80.13	68.54	61.26	70.88	76.93	71.92	77.30	71.48	72.40	85.11	78.06	72.83
Palm oil.	100.46	71.04	57.61	62.71	74.67	69.47	76.41	66.83	69.15	85.31	83.16	81.78
Indigo.	111.41	93.38	77.48	54.23	40.85	47.15	61.89	88.24	33.75	24.58	43.95	35.94
Mahogany.	92.56	83.14	68.59	56.97	62.86	48.53	44.29	44.13	37.11	43.28	57.06	7.78
Cotton.	81.06	62.59	45.95	48.24	49.79	48.57	48.87	50.52	55.55	29.43	61.85	61.85
Hemp.	95.01	83.7	80.37	90.13	91.69	83.93	81.88	97.46	96.73	101.17	97.15	83.27
Rice.	81.43	68.15	59.36	57.78	65.39	62.24	68.40	69.84	64.47	62.02	74.60	69.84
Wheat.	104.38	76.26	61.73	60.73	73.24	63.65	67.31	73.97	84.11	73.97	71.69	76.53
Rye.	108.26	82.54	71.34	66.46	80.10	70.84	82.60	90.61	89.96	73.34	76.10	87.48
Barley.	127.79	88.95	57.76	51.34	67.84	63.35	76.15	71.36	69.99	62.02	72.69	86.53
Oats.	109.97	89.34	78.07	82.24	88.93	68.47	101.64	86.48	91.53	86.89	88.66	103.66
Clover seed.	115.02	98.00	82.46	85.84	93.58	78.51	86.80	94.09	90.02	108.48	114.58	111.24
Rape and rapeseed.	97.88	84.99	72.13	68.52	74.68	80.16	76.00	73.82	70.56	76.61	73.75	85.78
Linseed oil.	90.54	69.48	66.22	78.36	77.26	68.06	75.24	76.86	76.57	96.59	115.13	102.06
Calfskins.	103.00	74.42	69.58	70.38	87.89	94.10	82.66	86.45	87.31	86.77	88.70	85.20
Bristles.	156.22	145.76	88.75	74.42	81.07	82.12	78.52	77.91	80.76	85.73	93.92	93.92
Wax.	76.98	54.12	60.99	74.41	75.45	81.98	83.06	72.42	67.14	72.72	80.79	82.48
Tallow.	89.74	74.04	57.52	66.11	74.78	68.82	74.76	78.47	73.51	78.69	76.67	84.69
Fish oil.	82.17	66.65	49.24	32.95	55.64	49.77	57.55	61.97	64.30	62.10	65.61	66.58
Lard.	86.92	78.25	62.50	75.88	87.92	78.23	83.36	84.71	91.89	108.59	98.45	99.65
Herrings.	121.94	106.15	103.77	110.82	117.54	123.41	126.40	111.75	110.35	115.11	117.26	176.49
Iron, pig.	117.71	76.57	78.20	83.38	97.55	94.55	97.28	97.55	96.46	104.09	96.46	103.81
Tin.	96.32	84.72	84.43	95.06	108.88	105.33	111.65	100.27	107.18	118.15	143.34	153.85
Copper.	88.02	83.91	87.20	67.35	68.90	70.30	81.93	64.36	65.77	63.89	63.46	72.31
Lead.	112.19	83.77	86.44	95.06	102.94	112.18	116.70	102.59	90.23	91.14	86.49	98.24
Quicksilver.	129.54	83.40	87.10	102.43	91.37	87.74	84.08	92.43	94.67	95.05	98.04	92.25
Coal and coke.	109.88	77.78	85.85	87.65	87.65	83.95	83.95	83.95	82.59	83.95	86.42	82.72
Saltpeter.	96.71	73.71	66.30	65.62	69.05	75.14	75.70	68.98	66.90	62.11	67.37	74.58
Bar iron (Eng. ish).	113.53	72.37	13.31	86.68	81.37	76.69	83.39	88.35	90.74	74.92	92.51	90.74
Cotton yarn.	115.60	106.39	87.32	95.66	113.48	114.12	100.64	110.96	133.41	121.13	127.38	132.44
Woolen and half-woolen yarn.	101.73	69.98	61.72	54.88	65.61	65.92	68.72	63.18	62.90	66.38	67.65	63.32
Linon yarn.	80.55	98.17	109.91	116.56	117.10	116.30	121.75	117.93	111.35	121.11	126.60	

<sup>1</sup> Jahrbücher für Nationalökonomie und Statistik, 102. Band (III. Folge, 47. Band), Heft 6. Juni, 1914, p. 796.



RELATIVE PRICES OF CERTAIN GROUPS OF ARTICLES WEIGHTED IN PROPORTION TO THEIR CONSUMPTION (BASED ON HAMBURG TRADE STATISTICS), BY SPECIFIED PERIODS, 1871 TO 1910, AND BY YEARS, 1906 TO 1912.<sup>1</sup>

(Base period, 1847-1850=100.)

Article.	Prices 1871- 1890 (based on 1847- 1857= 100).											
		1881- 1890	1891- 1900	1901- 1905	1906- 1910	1906	1907	1908	1909	1910	1911	1912
<b>I.</b>												
Coffee, Brazil.....	141.86	100.46	101.50	66.82	79.69	72.31	87.35	75.47	77.31	80.41	88.98	92.32
Cocoa.....												
Tea.....												
Pepper.....												
Rice.....												
<b>II.</b>												
Cotton.....	81.84	66.28	48.70	61.07	62.68	51.78	61.79	63.54	47.93	53.83	62.98	54.95
<b>III.</b>												
Indigo.....	101.65	78.87	61.65	61.15	42.73	63.38	42.57	39.91	36.26	38.09	46.26	39.05
Saltpeter.....												
Fish oil.....												
Palm oil.....												
<b>IV.</b>												
Pig iron.....	111.80	72.97	73.20	79.51	94.48	80.50	102.72	88.66	91.68	96.96	107.71	117.90
Tin.....												
Copper.....												
Lead.....												
<b>V.</b>												
Coal.....	109.88	76.90	83.74	86.03	85.54	81.93	91.57	90.36	81.93	84.34	80.72	92.77
<b>VI.</b>												
Wheat.....	112.51	78.01	63.90	63.40	69.88	67.06	72.52	72.80	76.02	67.14	66.59	79.29
Rye.....												
Barley.....												
Oats.....												
Average.....	105.54	77.43	68.44	67.93	71.31	70.55	78.42	70.10	68.52	70.79	76.04	79.38
Arithmetical mean, computed from 157 Hamburg average prices	111.31	91.70	84.10	76.37	83.03	80.52	89.47	82.07	80.23	82.87	84.80	86.51

<sup>1</sup> Jahrbücher für Nationalökonomie und Statistik, 102. Band (III. Folge, 47. Band) Heft 6. Juni, 1911, p. 788.

<sup>2</sup> Computed from prices of only 134 articles, since the separate listing of several qualities of an article, such as tea, coffee, rice, wool, oil, etc., has been discontinued.

RELATIVE PRICES OF CERTAIN GROUPS OF ARTICLES WEIGHTED IN PROPORTION TO THEIR CONSUMPTION (BASED ON HAMBURG TRADE STATISTICS), BY SPECIFIED PERIODS, 1871 TO 1910, AND BY YEARS, 1906 TO 1912—Concluded.

(Base period, 1871-1880=100.)

Article.	Prices 1871-1880 (based on 1847-1867=100).	1881-1890	1891-1900	1901-1905	1906-1910	1906	1907	1908	1909	1910	1911	1912
I.												
Coffee, Brazil.....												
Cocoa.....												
Tea.....	79.43	88.23	82.62	74.09	57.16	81.21	70.16	71.67	74.76	82.72	85.82	
Pepper.....												
Rice.....												
II.												
Cotton.....	79.63	56.69	59.44	61.32	59.92	60.29	62.32	55.79	66.61	73.40	64.04	
III.												
Indigo.....												
Saltpeter.....												
Fish oil.....	78.97	61.69	61.22	40.28	93.43	49.57	37.64	34.19	35.91	43.63	36.83	
Palm oil.....												
IV.												
Pig iron.....												
Tin.....	67.19	67.48	73.21	96.76	32.49	106.18	90.83	93.90	99.30	110.31	120.74	
Copper.....												
Lead.....												
V.												
Coal.....	70.79	78.09	80.23	78.76	76.40	85.39	84.27	76.40	78.65	75.28	86.52	
VI.												
Wheat.....												
Rye.....	76.37	62.65	62.07	68.88	65.65	75.48	71.56	74.94	66.18	68.60	78.16	
Barley.....												
Oats.....												
Average.....	74.86	66.19	65.56	70.30	68.12	75.52	69.46	67.85	70.57	75.66	78.69	
Arithmetical mean, computed from 157 Hamburg average prices.....	85.19	78.47	71.07	77.30	74.87	83.19	76.51	74.74	77.21	78.88	80.47	

<sup>1</sup> Computed from prices of only 134 articles, since the separate listing of several qualities of an article, such as tea, coffee, rice, wool, oil, etc., has been discontinued.

## RELATIVE PRICES OF SELECTED ARTICLES 1880 TO 1913 (BASED ON ACTUAL AVERAGE

[Source: Jahrbücher für Nationalökonomie und Statis

(Base period,

Marginal number.	Article.	1880	1891	1902	1903	1904	1905	1906	1907	1908	1909
1	Wheat—14 <sup>1</sup> quotations.....	102.59	118.05	99.73	82.70	72.61	75.78	83.37	92.24	104.15	93.88
2	Rye—14 <sup>1</sup> quotations.....	110.27	136.85	117.35	89.88	77.06	79.00	80.01	85.35	97.77	105.26
3	Barley—15 <sup>1</sup> quotations.....	113.03	112.12	104.26	101.41	83.95	89.15	95.43	99.90	107.92	107.54
4	Maize—5 <sup>1</sup> quotations.....	91.53	116.60	96.35	88.40	82.50	84.84	89.09	68.99	76.98	83.24
5	Oats—13 <sup>1</sup> quotations.....	118.57	115.49	105.43	124.49	98.84	88.61	94.01	101.83	110.00	109.27
6	Wheat flour—3 <sup>1</sup> quotations.....	100.60	115.14	94.53	78.98	70.84	74.62	78.98	88.20	96.88	89.71
7	Rye flour, Berlin.....	112.95	140.41	128.56	85.80	74.77	79.75	78.78	.....	.....	104.59
8	Rapessed oil, Berlin.....	120.15	110.90	95.03	80.51	78.32	79.99	89.28	.....	.....	92.68
9	Potato alcohol, Hamburg <sup>4</sup> .....	112.79	140.46	115.36	106.74	100.90	105.63	107.75	.....	.....	92.68
10	Sugar, raw, Magdeburg.....	63.99	67.51	69.01	58.48	45.66	39.85	44.27	36.48	39.10	47.68
11	Sugar, refined, Magdeburg.....	83.14	83.98	85.22	85.15	73.98	65.49	72.69	69.74	70.36	84.84
12	Coffee, Rio, <sup>5</sup> good ordinary, Bremen.....	153.06	140.79	124.89	141.90	140.79	139.07	124.39	96.73	70.19	62.01
13	Coffee, plantation, Ceylon, <sup>5</sup> medium, Frankfurt on Main.....	120.70	120.37	115.75	120.00	112.78	108.38	106.20	98.87	85.33	81.04
14	Rice, Bangoon, table, Bremen.....	103.13	102.01	95.58	93.51	83.56	78.83	79.76	86.73	104.47	105.29
15	Pepper, Bremen.....	88.57	68.61	52.92	49.07	39.90	39.90	40.29	54.04	73.26	71.79
16	Herring, Norwegian, Hamburg.....	84.82	111.70	96.46	61.16	77.64	107.30	76.28	96.85	62.94	128.70
17	Leaf tobacco, Kentucky, ordinary, Bremen.....	68.78	75.60	85.62	101.31	89.93	76.98	67.64	66.34	81.16	78.43
18	Leaf tobacco, Brazil, second grade, Bremen.....	136.45	120.16	95.56	83.24	71.93	67.63	88.72	107.52	120.67	141.27
19	Cotton, middling upland, Bremen.....	96.64	76.99	107.38	76.76	63.15	63.64	71.44	65.55	54.78	63.27
20	Wool, Berlin.....	94.57	89.59	81.30	76.14	70.81	73.16	77.04	72.34	76.88	108.79
21	Hemp, Lübeck.....	81.57	85.61	83.43	95.08	106.58	107.66	105.72	101.83	107.05	103.19
22	Raw silk, Krefeld.....	95.03	77.73	83.56	102.88	68.44	77.30	73.81	70.48	71.63	94.22
23	Cotton yarn, Nos. 40-120, Krefeld.....	100.94	91.61	81.55	88.47	79.87	81.13	90.57	80.29	75.78	98.88
24	Cotton yarn, warp, 16, Mülhausen, in Alsace.....	90.50	81.56	78.21	84.92	78.77	77.00	81.56	75.20	64.80	60.33
25	Calico, Mülhausen, in Alsace.....	110.13	86.06	80.56	106.95	92.61	95.00	94.78	79.56	76.52	78.33
26	Linen yarn, No. 30, flax yarn, Bielefeld.....	88.63	89.57	90.52	102.84	100.67	85.31	84.55	82.84	82.84	87.38
27	Lead—6 <sup>1</sup> quotations.....	100.89	95.14	81.73	75.97	73.64	80.13	85.41	93.80	99.33	124.53
28	Copper, Berlin.....	101.48	93.45	83.95	79.44	70.63	77.27	82.78	83.86	82.18	159.02
29	Zinc—5 <sup>1</sup> quotations.....	143.22	143.32	130.50	107.19	96.05	91.64	101.25	103.29	127.04	167.46
30	Tin—3 <sup>1</sup> quotations.....	98.40	94.76	97.68	92.34	73.86	66.69	62.66	63.47	73.46	118.98
31	Pig iron, Scotch, No. 1, Hamburg.....	120.35	105.06	95.04	96.32	96.00	94.32	94.04	92.04	.....	.....
32	Petroleum, Hamburg, in bond.....	82.76	84.86	79.02	62.93	64.12	88.92	82.00	70.32	79.88	97.93
33	Coal, Westphalian, Berlin.....	132.60	120.40	117.34	114.13	114.68	114.58	113.64	114.41	117.56	127.59
	Arithmetical average.....	105.71	98.14	95.32	91.52	82.54	81.76	81.82	82.66	84.04	99.60

<sup>1</sup> Present number has varied from time to time.<sup>3</sup> Relative not computed for this year.

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PRICES AS SHOWN BY OFFICIAL STATISTICS OF THE GERMAN CUSTOMS UNION).

tk, S. Folge, 1, 5, 11, 17, 24, 31, 34, 44, 46, and 47.]<sup>a</sup>

1870-1889-1900.)

1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	Marginal number.
85.51	90.04	(*)	85.55	92.55	89.92	95.04	110.62	112.99	124.32	111.66	108.85	115.46	108.33	4
83.13	96.12	(*)	89.70	90.31	83.85	102.10	124.08	121.18	113.67	96.01	110.41	122.20	108.47	2
104.48	106.36	(*)	96.68	100.96	102.97	105.99	111.52	113.57	109.11	99.63	116.28	126.23	106.13	3
80.67	91.84	(*)	91.99	94.35	97.26	103.14	113.08	133.98	125.37	111.12	110.82	127.72	110.40	4
102.30	107.34	(*)	97.71	97.68	108.57	119.44	132.77	120.34	126.51	113.67	137.02	142.78	120.96	5
76.57	81.32	(*)	79.36	85.66	82.02	85.88	95.15	102.10	111.52	100.32	98.90	100.04	98.58	6
83.82	91.16	(*)	86.85	84.82	98.88	101.50	122.52	114.90	107.54	92.80	103.04	110.10	100.77	7
111.15	104.80	(*)	87.63	82.48	85.45	103.93	133.95	126.60	103.54	104.98	117.13	120.94	121.67	8
96.71	80.99	(*)	.....	.....	.....	.....	55.89	66.90	60.50	60.12	48.55	65.92	70.94	9
41.71	85.94	(*)	33.90	37.40	40.26	31.38	31.63	38.70	39.79	46.37	47.34	48.21	34.83	10
78.58	85.57	(*)	78.74	58.72	63.01	54.42	56.51	60.30	61.56	69.97	68.37	71.41	57.73	11
78.54	58.70	(*)	51.62	66.55	69.55	70.56	63.83	62.61	66.60	78.95	110.50	128.14	109.97	12
83.80	78.30	(*)	72.90	75.93	75.81	76.85	76.34	77.41	73.33	82.15	96.25	104.64	96.83	13
94.59	96.38	(*)	99.49	83.07	94.62	95.98	104.96	104.46	97.01	97.94	110.63	129.71	114.68	14
104.88	102.41	(*)	104.49	99.64	96.57	89.15	76.56	54.20	56.83	64.11	76.35	89.37	83.29	15
137.80	125.04	(*)	109.75	.....	116.43	148.26	112.83	101.11	128.38	.....	.....	.....	.....	16
99.34	104.59	(*)	112.54	83.82	92.86	109.51	136.56	156.13	124.47	145.62	155.41	153.98	141.31	17
125.75	100.00	(*)	84.28	80.81	98.86	109.99	187.73	133.58	108.65	108.49	141.08	146.98	151.24	18
80.87	77.19	(*)	100.20	108.47	35.81	99.16	108.08	98.57	104.51	132.41	117.66	104.94	113.09	19
92.10	75.84	(*)	98.11	97.56	102.23	114.23	114.78	103.71	114.23	110.41	108.22	112.57	121.20	20
121.33	132.05	(*)	113.53	111.54	113.29	122.07	129.57	124.83	126.85	135.31	141.93	163.20	164.99	21
83.40	73.21	(*)	87.62	74.56	78.56	86.45	112.71	79.48	82.69	81.22	79.34	74.68	81.52	22
166.77	89.73	(*)	108.39	112.37	107.34	129.77	163.10	126.62	128.09	151.36	141.51	151.45	138.57	23
75.42	65.92	(*)	78.77	98.88	82.77	101.12	118.44	97.76	94.41	109.50	108.38	102.23	107.26	24
101.30	81.74	(*)	103.91	107.39	113.96	118.70	132.61	109.56	104.35	106.52	107.40	113.91	110.87	25
103.92	108.43	(*)	96.87	106.35	104.73	115.16	139.57	115.92	96.38	111.23	122.56	119.26	121.04	26
121.94	98.55	(*)	89.94	90.42	105.08	131.45	145.12	102.51	82.79	98.30	98.55	159.56	166.13	27
125.26	121.12	(*)	102.07	99.63	118.20	147.42	.....	.....	.....	.....	.....	.....	.....	28
126.86	106.55	(*)	129.52	138.60	148.72	165.89	147.48	124.93	139.13	145.33	158.40	165.16	144.91	29
135.95	121.76	(*)	129.78	120.21	145.10	184.41	177.16	137.42	138.26	157.32	194.08	212.03	207.38	30
.....	.....	(*)	105.30	98.11	100.57	110.17	120.02	105.42	103.19	104.64	103.44	119.22	125.60	31
97.76	.....	(*)	97.99	80.58	84.44	92.88	94.33	102.64	93.21	81.20	.....	116.89	116.62	32
137.72	134.51	(*)	122.86	122.86	129.06	125.95	131.14	132.52	128.38	127.00	127.00	111.14	132.52	33
99.21	93.13	(*)	93.82	94.05	95.46	108.01	113.66	104.94	102.13	104.17	112.20	120.31	115.83	34

<sup>a</sup> From 1892 to 1894, No. 00 with sack; from 1895 to date, No. 0/1.

<sup>b</sup> Berlin, 1870-1903, Hamburg, raw, 1904 to date.

<sup>c</sup> Coffee, Sabanilla from 1896 to date.  
<sup>d</sup> Java, 1870-1880.

## INDEX NUMBERS OF OTTO SCHMITZ.

## PUBLICATION.

The data embodying the results of Mr. Schmitz's original study of the course of wholesale prices were published in book form in Berlin in 1903.<sup>1</sup> "Those from 1903 to 1906 are extracted from manuscript figures supplied by the author himself and in the possession of the Royal Statistical Society. As regards later years the index numbers have been taken from the supplement to the *Zeitschrift für Sozialwissenschaft* (Monatliche Übersichten über die allgemeine Wirtschaftslage); only the general index numbers for all articles and for one group (the metal group) are there given, however." (Great Britain. Report of an Enquiry by the Board of Trade into Working-class Rents and Retail Prices, 1912. p. 354.)

## HISTORY.

This study was undertaken in order to furnish a convenient means of measuring the fluctuations in German prices. It was considered highly desirable to construct an index covering a long period of years and reliable data from a single source were not available. By using two sources the author was able to cover the second half of the nineteenth century and to include six price waves, whose duration he fixes as follows:

- From 1849 to 1858.
- From 1858 to 1870.
- From 1870 to 1879.
- From 1879 to 1886.
- From 1886 to 1895.
- From 1895 to 1912.

## SOURCE OF QUOTATIONS.

The earlier series of index numbers (1851-1885) is based on quotations of the bureau of trade statistics at Hamburg.<sup>2</sup> Mr. Soetbeer, who used figures from the same source, says in regard to the way in which the quotations were obtained:

"Throughout this period (1847-1885) Hamburg was an important market for almost all raw materials. Moreover, it has been a free port, without duties or differential taxes. Commodities imported are declared in writing, with a statement of their weight and of their ordinary trade designations. Their value is stated separately for each commodity, either according to its price on 'Change that day, or if there were no quotations, according to the probable price plus the cost of importation. For consigned goods a careful estimate of

<sup>1</sup> Die Bewegung der Warenpreise in Deutschland von 1851 bis 1902; nebst zwei Ergänzungen: Bankdiskont, Goldproduktion und Warenpreisstand, der Weizenpreis, von 400 v. Chr. bis 1900. Von Otto Schmitz. Berlin, 1903. 443 pp.

<sup>2</sup> In regard to Hamburg Bureau of Trade Statistics see also pp. 220 and 221.

the prices sufficed, sometimes supplemented with a statement of their insured value. These declarations, which were carefully supervised, were then collected by the bureau of trade statistics, and tables were made out of the quantity and value of goods exported and imported."<sup>1</sup>

The later index number (1879-1902) is based on data of the Imperial Statistical Office, which publishes for each of the more important commodities several series of quotations representing a number of important markets and varieties. From these the author has selected as a basis for his index number a single series from a representative market, and in connection with the detailed description of the article has stated the manner in which prices are obtained for the Imperial Statistical Office at that market. These statements are retained with the descriptions as given herewith. Eleven markets are represented: Berlin and Bremen by 8 commodities each; Breslau and Hamburg by 3 each; and Danzig, Magdeburg, Krefeld, Bielefeld, Dortmund, Cologne, and Essen by 1 each.

In the few cases in which a hiatus occurs in the official series the source of the substituted data is stated in connection with the description of the commodity.

#### BASE PERIOD.

The average of the 10 annual prices as given by the Imperial Statistical Office for the first 10 years covered by its reports (1879-1888) was taken as the base for both series of index numbers. On the ground that the period was a time of quiet and normal business development and contained a period of falling prices, beginning in 1880, and a period of rising prices, beginning in 1885, the average price was considered comparatively normal and reasonably satisfactory as a basis.

The base period for lard is evidently the 9-year period, 1880 to 1888. The Imperial Statistical Office did not publish quotations on lard for 1879 and no other quotations were substituted.

#### PRICES: HOW SHOWN AND COMPUTED.

The various methods of determining monthly averages are given in the section on description and grouping of commodities. The simple average method is used in computing the various averages for the tables. All index numbers are printed with two decimals.

Data of the Imperial Statistical Office are in almost all cases shown separately from Hamburg data and in much greater detail. The principal table of the study shows for each article and group of articles the index numbers for each month, quarter, half year, and year from 1879 to 1900, while the corresponding table for Hamburg gives the index number for articles and groups by years only. Actual prices of the later series are shown by months and of the earlier by years.

<sup>1</sup> Bimetallism in Europe, by Edward Atkinson, p. 226.

## NUMBER AND CLASS OF COMMODITIES.

The index number based on the Imperial Statistical Office prices (1879-1902) represents 29 commodities, while the earlier number based on Hamburg prices (1851-1885) includes only 24 commodities—corn, linen yarn, petroleum, and one quotation each for iron and coal being lacking. The list of 29 commodities is the original list of the Imperial Statistical Office, with the following modifications: (1) Wheat flour, rye flour, refined sugar, cotton yarn, and cotton cloth are omitted as not being strictly raw materials. Linen yarn, however, is not omitted because the list does not include flax. (2) Two kinds of iron and two of coal are carried as separate commodities instead of one description for each group. (3) Lard and butcher's meat are added as being important commodities introduced early in the period covered by the figures of the statistical office.

For the years 1909 to 1912, inclusive, however, copper and one description of pig iron are excluded.

## DESCRIPTION AND GROUPING OF COMMODITIES.

The descriptions of commodities are based on the descriptions of the selected varieties as given by the Imperial Statistical Office and cover the years 1879-1902.<sup>1</sup> Concerning the descriptions for the period 1851-1885 the general statement is made that Hamburg quotations are for standards of quality similar to those of the Imperial Statistical Office.

The grouping of commodities appears in the list which follows. The description of the first commodity is given in full, but the descriptions of the others are somewhat abbreviated.

## Group I.—Grains.

1. *Wheat.*

Official Berlin quotations. The average monthly price is ascertained by the committee of senior merchants of Berlin on the basis of daily quotations based on hearings of the brokers. The early quotations are for 1,000 kilograms good, sound, yellow wheat of all origins, 71.3 kilograms per hectoliter. On October 1, 1887, the standard was fixed at a minimum of 71.5 kilograms per hectoliter, and since January 1, 1893, the quotation is for good, sound, dry wheat, free from musty odor (hard wheat excluded), of all origins, minimum 72.5 kilograms per hectoliter. In the author's judgment this repeated raising of the standard has exercised no demonstrable influence on prices.

A further rise in the standard grading weight to 75.5 kilograms per hectoliter on January 1, 1893, was caused by the introduction of the new grain tester and was of merely formal nature.

On account of the closing of the Berlin grain exchange there are no official quotations for wheat, rye, and oats from January 1, 1897, to April 1, 1899. Therefore the official Breslau quotations, suitably adjusted (*unter entsprechender Anpassung*), are used. For January, February, and March, 1899, information founded upon the daily publi-

<sup>1</sup> No detailed description is available after 1902.

cations of the central quotation office of the Prussian agricultural chambers was used since the standard of quality was the same. From April, 1899, the official Berlin quotations are again given. The index numbers calculated on the Breslau figures are printed in italics.

1879, duty free.

1880-1885, duty per 1,000 kilograms gross, 10 marks.

1885-1887, duty per 1,000 kilograms gross, 30 marks.

1887-1891, duty per 1,000 kilograms gross, 50 marks.

1891 and following, duty per 1,000 kilograms gross, 35 marks.

#### 2. Rye.

Official Berlin quotations. The monthly average price is ascertained as in the case of wheat up to October, 1887. The quotations are for 1,000 kilograms good, sound rye of all origins. The standard grading weight rose during the period from 65.9 to 67.8 kilograms per hectoliter without demonstrable influence on the price. In the absence of Berlin quotations for the period January, 1897, to April, 1899, the procedure was the same as in the case of wheat.

1879, duty free.

1880-1885, duty per 1,000 kilograms gross, 10 marks.

1885-1887, duty per 1,000 kilograms gross, 30 marks.

1887-1891, duty per 1,000 kilograms gross, 50 marks.

1891 and following, duty per 1,000 kilograms gross, 35 marks.

#### 3. Barley.

Breslau quotations. The price is ascertained every week day by the municipal market commissioner. The monthly average price is derived from the Breslau chamber of commerce. The quotation is for 1,000 kilograms medium heavy barley.

1879, duty free.

1880-1885, duty per 1,000 kilograms gross, 15 marks.

1885-1887, duty per 1,000 kilograms gross, 23 marks.

1887-1891, duty per 1,000 kilograms gross, 23 marks.

1891 and following, duty per 1,000 kilograms gross, 22.50 marks.

#### 4. Oats.

Official Berlin quotations. The monthly average price is ascertained as in the case of wheat. The quotation is for 1,000 kilograms good, sound oats of all origins. The standard grading weight has increased from 38.6 to 41.5 kilograms per hectoliter without demonstrable influence on the price. In the absence of Berlin quotations from January, 1897, to April, 1899, the procedure was the same as in the case of wheat.

1879, duty free.

1880-1885, duty per 1,000 kilograms gross, 10 marks.

1885-1887, duty per 1,000 kilograms gross, 15 marks.

1887-1891, duty per 1,000 kilograms gross, 40 marks.

1891 and following, duty per 1,000 kilograms gross, 28 marks.

#### 5. Corn (maize).

Bremen quotations. The price is determined every Saturday by the chamber of commerce through licensed brokers, and the monthly average price is derived from the medium prices actually paid. The quotations are for 1,000 kilograms mixed American corn of prime quality, in bond. On account of a shortage in corn, occasioned by poor crops in America, there are no quotations from April, 1882, to March, 1883. There are likewise no quotations from September to December, 1884, because



only La Plata and Danube varieties were in the market. Although corn is quoted in bond, duty rates are given for the sake of completeness.

1879, duty free.

1880-1885, duty per 1,000 kilograms gross, 5 marks.

1885-1887, duty per 1,000 kilograms gross, 10 marks.

1887-1891, duty per 1,000 kilograms gross, 20 marks.

1891 and following, duty per 1,000 kilograms gross, 16 marks.

**Group II.—Other products of agriculture and products of fishing.**

**6. Herrings.**

Danzig quotations. The monthly average price is ascertained on the basis of the prices actually paid every Saturday or on the last exchange day of every week as determined by the bourse commission. The quotations are for 1 cask of 150 kilograms gross, "Crown and full," in bond. The custom rate, which is given although the article is quoted in bond, is 3 marks per cask.

**7. Rapeseed oil.**

Berlin quotations. The monthly average price is ascertained as in the case of wheat. The quotations are for 100 kilograms good, raw rapeseed oil. Owing to the closing of the Berlin produce exchange, January, 1897, to December, 1898, Königsberg quotations were used for these two years and continued through 1899 and 1900. Since 1901 Berlin quotations have been used again. The relatives for 1897 and 1898 are printed in italics.

1879, duty per 100 kilograms gross, including container, 3 marks.

1880-1885, duty per 100 kilograms gross, including container, 4 marks.

1885 and following, duty per 100 kilograms gross, including container, 9 marks.

**8. Alcohol.**

Hamburg quotations. The average price is ascertained through the brokers by the chamber of commerce on the basis of prices actually paid and the average of the medium prices of every month. The quotation is for raw potato alcohol (per 100 liters pure alcohol) in bond. For the sake of completeness the customs rates so far as could be ascertained are appended.

January, 1879, to July, 1879, duty per 100 kilograms net, 36 marks.

July 5, 1879 to 1885, duty per 100 kilograms net, 48 marks.

1885-1891, duty per 100 kilograms net, 80 marks.

July 1, 1891, to July 14, 1900, duty per 100 kilograms net, 125 marks.

July 14, 1900, and following, duty per 100 kilograms net, 160 marks.

**9. Raw sugar.**

Magdeburg quotations. The average price is determined on the basis of the highest and lowest prices fixed on Friday of each week by commissions and commissioners of senior merchants. The quotations are for 100 kilograms first quality. The description was 96 per cent polarization until October, 1887, 92 per cent yield until February, 1897, and 88 per cent yield since that date. The first two descriptions are considered as corresponding fairly well. The difference in value between 92 per cent yield and 88 per cent yield is estimated at  $\frac{1}{2}$  mark, but this difference is not taken into account in calculating the index number. From September, 1888, the quotation includes customs duty and excludes excise tax, and the index number has been revised accordingly.

**10. Butcher's meat.**

Berlin quotations. Prices have been quoted regularly by the month since May, 1887. For the years 1881 to 1886 the yearly average prices were subsequently ascer-

tained and communicated by the Imperial Statistical Office in December, 1889. The price for 1881 is the average price for the months March to December. For 1879 and 1880 Hamburg prices form the basis of the index numbers.

The index number is based on the average of the quotations for beef, veal, pork, and mutton. The earlier quotations were for 100 kilograms.

Beef, dressed weight, average of the prices for second grade.

Pork, live weight, with 20 per cent tare, highest quotation for second grade.

Veal, dressed weight, lowest quotation for first grade.

Mutton, dressed weight, medium of the prices for first grade.

Since July, 1897, the prices for beef, veal, and mutton are for 100 kilograms, slaughter weight. Both dressed weight and slaughter weight are estimated on the presumptive weight of the four quarters on which the price of the animal has been apportioned, dressed weight with and slaughter weight without the deduction of the value of the hide, head, feet, entrails, etc. The price based on slaughter weight, according to information obtained by the Imperial Statistical Office from authoritative sources, is about 8½ per cent higher than the price based on dressed weight. In computing the index number, allowance has been made for this change in the manner of quoting.

#### 11. Lard.

Bremen quotations. The monthly average price is ascertained as in the case of corn. The quotations are for 100 kilograms refined American lard, Wilcox brand, in bond. The Imperial Statistical Office did not publish lard quotations until 1880. The prices for September, October, and November, 1888, and for January, 1892, were merely nominal, owing to lack of the commodity, but were included in the yearly average. Although lard is quoted in bond, the rate of duty, 10 marks throughout the period, is given.

#### Group III.—Colonial goods, etc.

#### 12. Leaf tobacco.

Bremen quotations. The monthly average price is ascertained as in the case of corn. The quotations are for 100 kilograms Kentucky ordinary, container included, in bond. Although the article is quoted in bond, the rates of duty are given.

In 1879 the duty on 100 kilograms net was 24 marks.

At present the duty on tobacco leaves, stems, and ribs, as well as tobacco sauce, is 85 marks.

At present the duty on stripped leaves and smoking tobacco is 180 marks.

#### 13. Coffee.

Bremen quotations. The monthly average price is ascertained as in the case of corn. The quotations are for 100 kilograms net, including sack, in bond. Prior to 1896 the quotations were for "Rio, good ordinary," and since January, 1896, for "Sabanilla, fair ordinary." The change was made because Rio, good ordinary, had become relatively of small importance in the Bremen market. Although quoted in bond, the duty rates are given.

Prior to July, 1879, duty per 100 kilograms net, 35 marks.

Since July, 1879, duty per 100 kilograms net, 40 marks.

#### 14. Rice.

Bremen quotations. The monthly average price is ascertained as in the case of corn. The quotations are for 100 kilograms Rangoon table rice, shelled, in bond. Although quoted in bond, duty rates are given.

Prior to July, 1879, the duty per 100 kilograms gross, 3 marks.

Since July, 1879, the duty per 100 kilograms gross, 4 marks.

*15. Pepper.*

Bremen quotations. The monthly average price is ascertained as in the case of corn. The quotations are for 100 kilograms, black Singapore pepper, in bond. Although quoted in bond, duty rates are given.

Prior to July, 1879, duty per 100 kilograms net, 39 marks.

Since July, 1879, duty per 100 kilograms net, 50 marks.

**Group IV.—Raw materials of the textile industry.***16. Cotton.*

Bremen quotations. The monthly average price is ascertained as in the case of corn. The quotations are for 100 kilograms middling upland, in bond, duty free.

*17. Wool.*

Berlin quotations. The monthly average price is ascertained on the basis of weekly quotations by the committee of senior merchants of Berlin after having heard the brokers. The quotations are for 100 kilograms North German sheep wool, medium grade, duty free.

*18. Hemp.*

Hamburg quotations. Quotations every Friday. The monthly average price is ascertained as in the case of alcohol. The quotations are for 100 kilograms Mexican, net, in bales of about 350 pounds, 7 pounds tare, in bond, duty free.

*19. Raw silk.*

Krefeld quotations. Quotations are ascertained on the second Monday of every subsequent month by a committee of merchants and manufacturers on the basis of local transactions and of the medium price. The quotations are for 1 kilogram Milanese organzine, classique, 18-20, duty free.

*20. Linen yarn.*

Bielefeld quotations. Quotations represent prices determined on the first and middle of every month by the secretary of the chamber of commerce on the basis of the prices obtained at the sales occurring at the spinning mills. The quotations are for 1 kilogram linen yarn, No. 30 (English number), medium price, between grades Ia and IIa, but for the sake of accuracy the author has given the yearly average price per 100 kilograms.

1879, duty per 100 kilograms gross, 3 marks.

**Group V.—Metals.***21. Foundry pig iron.*

Breslau quotations. Prices are obtained through private persons at the end of the month from the average of all the quotations for delivery on the last day of the month. The quotations are for 1,000 kilograms Silesian foundry pig iron at the foundry. The grade of Silesian foundry pig iron quoted at Breslau is lower than that quoted at Düsseldorf. Since 1897 other lower prices have been quoted for pig iron sold to points in Lower Silesia, but these have not been included in the index number.

Until June, 1879, duty free.

Since June, 1879, duty per 1,000 kilograms gross, 10 marks.

*22. Bessemer pig iron (from the Ruhr districts, Rhenish Westphalia).*

Dortmund quotations. Prices are determined at the end of every month by a committee of the chamber of commerce or the secretary of the chamber of commerce on the basis of schedules filled out by producers, consumers, and dealers and on the basis of the lowest and highest prices. The quotations are for 1,000 kilograms Bessemer pig iron from the districts of the Ruhr at the foundry.

Until June, 1879, duty free.

Since June, 1879, duty per 1,000 kilograms gross, 10 marks.

*23. Lead.*

Berlin quotations. The monthly average price is ascertained as in the case of wool. The quotations until May, 1899, are for 100 kilograms Tarnowitz lead, Saxonia brand, and since May, 1899, are for 100 kilograms Tarnowitz and Harz lead. For November and December, 1887, on account of the great fluctuation in prices, averages could not be given. Duty free.

*24. Copper.*

Berlin quotations. The monthly average price is ascertained as in the case of wool. The quotations are for 100 kilograms Mansfeld copper. For the year 1887 the Imperial Statistical Office, owing to the great fluctuation in prices, gives a nominal average covering only the months January to May. The author, convinced that this nominal figure was too low, computed an average for the greater part of the second half of the year on the basis of information which he himself obtained. Taking the average of the Imperial Statistical Office for the first five months and his own average as representing the last seven months, he obtained the average which he has used for the year. He states that this is the only case in which he has deemed it expedient to depart from the official figures, and in this case the low nominal figure of the statistical office would have affected the average for the base period sufficiently to have raised the total index number for the period 1889-1900 about 10 points (i. e., one-tenth of a unit. Index numbers are printed with two decimals). In March, 1899, when prices fluctuated greatly the monthly average price given in the tables is merely approximately correct. Duty free.

*25. Zinc.*

Cologne quotations. Quotations are obtained every Wednesday by Cologne wholesale establishments or the chamber of commerce. The information is based on the booking of sales and represents the prices paid by buyers—for the indicated grade of the commodity—settling their accounts regularly. The quotations are for 100 kilograms Rhenish crude zinc, brand "W H und S S." The price for March, 1889, is nominal, since there were no sales. Duty free.

*26. Tin.*

Hamburg quotations. Quotations are obtained every Friday. The average price is ascertained as in the case of alcohol. The quotations are for 100 kilograms Banca tin in blocks. Duty free.

**Group VI.—Coal and petroleum.***27. Ruhr anthracite coal.*

Essen quotations. Quotations are obtained once a month at the industrial exchange in Essen by an exchange committee of the chamber of commerce on the basis of the sales at all the mines in the district and on the basis of the highest and lowest prices. The quotations are for 1,000 kilograms anthracite coal at the mine. From May to August, 1889, there are no quotations on account of the strike. Duty free.

28. *Upper Silesia gas lump coal (Gas-Stückkohle).*

Breslau quotations. The price is obtained through private persons at the close of the month from the average of all quotations for delivery on the last day of the month. The quotations are for 1,000 kilograms. Upper Silesian lump coal for gas, f. o. b. mine. Duty free.

29. *Petroleum.*

Bremen quotations. The monthly average price is ascertained as in the case of corn. The quotations are for 100 kilograms American white refined, including container, in bond. From January 1, 1892, to July 1, 1893, hoghead duty amounting to about 0.95 marks per 100 kilograms net was charged. After the lifting of the hoghead duty, July 1, 1893, the quotation was again for the commodity in bond. Although quoted in bond, the duty rates are given.

From January, 1879, duty free.

From 1891, duty, 6 marks.

## SUBSTITUTIONS AND ADDITIONS.

The report includes parallel data from Hamburg and from the Imperial Statistical Office for the 7-year period 1879 to 1885. Hamburg index numbers were obtained by finding the average actual Hamburg price for the 7-year period and the average relative Imperial Statistical Office price for the same period. It was then calculated what Hamburg price corresponded to the index number 100 and on the basis of the resulting figure index numbers for the Hamburg quotations from 1851 to 1885 were computed.

In the case of a few commodities, breaks occur in the series of quotations. In the absence of Berlin prices Breslau prices have been substituted from January, 1897, to April, 1899, in the series for wheat, rye, and oats. These are said to have been "suitably adjusted" (*unter entsprechender Anpassung*) but the process is not described. Neither is the method of changing from Hamburg to statistical office prices of butcher's meat at the end of 1880 described. No actual prices are given for lard for the year 1879, and the index numbers for all months of that year are given as 100. This procedure is equivalent to the substitution of the average of the actual prices from 1880 to 1888 as the actual price for 1879. The base period for this commodity is therefore the 9-year period 1880 to 1888.

## WEIGHTING.

The total index is the simple arithmetic mean of the index numbers of the 29 articles. No system of weighting is used. The author holds that the simple average of wholesale prices of important raw materials roughly indicates the course of prices and that this is its only purpose. He does not think that manipulation on the basis of estimated consumption makes it a satisfactory index of the standard of life or increases its value as an index of price movements. He may be considered, however, to have weighted his own index, in a loose sense, for two of the 29 commodities are different varieties of coal and two others are separate varieties of iron.

## TESTING.

No test of the index number is made. A comparison is shown, however, with an index number derived from Soetbeer's figures for the total of the 24 articles in question, as follows:

Period.	Soetbeer.	Schmits.
1851-1855.....	117.18	117.32
1856-1860.....	123.35	122.06
1861-1865.....	121.46	120.68
1866-1870.....	120.38	119.62
1871-1875.....	135.56	130.75

## TABLES OF RESULTS.

The following table shows the index numbers for the total of all articles. The numbers from 1851 to 1878 represent Hamburg quotations for 24 commodities, while the numbers from 1879 to 1902 represent Imperial Statistical Office quotations for 5 additional commodities, or 29 in all. The statement is made that the addition of the 5 articles affects the index number only slightly.

## INDEX NUMBERS OF WHOLESALE PRICES IN GERMANY, 1851 TO 1912, ACCORDING TO OTTO SCHMITZ.

Year.	Total index number: 1879-1888 equals 100.	Year.	Total index number: 1879-1888 equals 100.	Year.	Total index number: 1879-1888 equals 100.	Year.	Total index number: 1879-1888 equals 100.	Year.	Total index number: 1879-1888 equals 100.	Year.	Total index number: 1879-1888 equals 100.
1851	100.60	1860	118.72	1869	120.14	1878	110.62	1887	90.98	1896	83.91
1852	103.33	1861	117.24	1870	117.32	1879	100.87	1888	96.07	1897	85.79
1853	118.91	1862	120.31	1871	123.02	1880	111.71	1889	100.87	1888	90.65
1854	131.79	1863	122.65	1872	136.12	1881	109.26	1890	107.54	1899	96.43
1855	131.96	1864	125.28	1873	141.56	1882	106.52	1891	104.75	1900	106.49
1856	132.59	1865	117.37	1874	130.60	1883	104.06	1892	95.46	1901	100.11
1857	132.78	1866	119.88	1875	122.41	1884	99.62	1893	92.21	1902	99.19
1858	112.08	1867	130.69	1876	119.52	1885	92.88	1894	83.79	1903	100.64
1859	114.10	1868	120.00	1877	119.86	1886	88.00	1895	83.55	1904	100.22

NOTES.—1. Index from 1851 to 1878 inclusive based on actual wholesale prices of the Hamburg Bureau of Trade Statistics; from 1879 to 1912 on actual wholesale prices of the Imperial Statistical Office of Germany.

2. The index numbers for the years 1909, 1910, 1911, and 1912 do not include two articles, copper and pig iron (one kind).

3. Index for 1851 to 1902 inclusive from "Die Bewegung der Warenpreise in Deutschland von 1851 bis 1902"; index for 1903 to 1912 inclusive from the British "Report of an Enquiry by the Board of Trade into Working-class Rents and Retail Prices, 1912."

The two series of index numbers for the 7-year period for which parallel data were available are:

Year.	Hamburg.	Imperial Statistical Office.
1879.....	104.47	100.87
1880.....	109.94	111.71
1881.....	110.19	106.26
1882.....	106.21	106.52
1883.....	104.52	104.06
1884.....	98.31	96.02
1885.....	90.69	92.88

A table of index numbers for each of the 29 articles, and a total index number, has been prepared for a series of 5, 10, and 25 year periods, as well as for the 22-year period 1879 to 1900. These are calculated on the basis of 1879-1888 equals 100. It is obvious that any one of these period indexes could be made the basis (100) of a new series of calculations for the different commodities if so desired.

## INDEX NUMBERS, BY PERIODS.

1851-1855	117.32	1876-1880	112.82	1851-1860	119.69
1856-1860	122.06	1881-1885	102.47	1861-1870	120.10
1861-1865	120.58	1886-1890	96.69	1871-1880	121.63
1866-1870	119.62	1891-1895	91.95	1881-1890	99.58
1871-1875	130.75	1896-1900	93.05	1891-1900	92.50
1851-1875	122.07	1876-1900	99.24	1851-1900	110.70
1879-1900=96.97					

In summary the author shows the price level of the latest decade included in the study, by means of cumulative figures, as follows: The index number for the period 1851 to 1900 is 110.70; for 1879 to 1900, 96.97; for 1891 to 1900, 92.50.

## INDEX NUMBERS OF ADOLF SOETBEER.

## PUBLICATION AND HISTORY.

Dr. Adolf Soetbeer, a German economist, published the results of a study of wholesale prices in Hamburg as early as 1858,<sup>1</sup> but his main contribution to the study of prices and the one that contains the index number which he continued until his death, in 1892, appeared in 1885, under the title "Materials toward the Elucidation of the Economic Conditions affecting the Precious Metals and the Question of Monetary Standards" (*Materialien zur Erläuterung und Beurteilung der wirtschaftlichen Edelmetallverhältnisse und der Währungsfrage. Berlin, 1885; 2. Aufgabe, Berlin 1886*). This publication has been translated into English, in full, by Prof. F. W. Taussig and the translation is included in the United States Senate Document No. 34 (pp. 57-258), 1st session, 50th Congress, 1887. Dr. Soetbeer added the index numbers for 1886 in the Hamburg Börsen-Halle, Nos. 181 and 182 (a translation of which also appears in Senate Document No. 34, pp. 271-276), and published the indexes for succeeding years up to 1890, inclusive, in his article on "The course of prices from 1886 to 1890" (*Das Niveau der Warenpreise in den Jahren 1886-1890*), which appeared in the *Jahrbücher für Nationalökonomie und Statistik*, 1892, 3. Folge, 3, pp. 588-596. The original tables compiled by Soetbeer show average prices and indexes for each individual article,

<sup>1</sup> Beiträge zur Statistik der Preise: I. Ueberblick der Durchschnitts-Preise verschiedener Handelsartikel nach den Angaben im Hamburger Börsen-Preis-Courante in den Jahren 1851-1857 unter Vergleichung mit den Durchschnittspreisen der Jahrzehnte 1831-1840 und 1841-1850; II. Zusammenstellung der jährlichen Durchschnitts-Preise für Weizen in Hamburg, Hannover, Braunschweig, Berlin, Frankreich und England während der Jahre 1851-1857. Hamburg, 1858.

for groups, and for five-year periods from 1851 to 1885. The table for 1886 omits some articles of minor importance but continues the data for the rest and for the groups—with the exception of the group of British exports. The article in the *Jahrbücher* continued the data to include 1890, by groups only, but stated that the figures for the individual articles were in the writer's hands in manuscript but would have to be reserved for future publication on account of lack of room in the *Jahrbücher*. Soetbeer's death in 1892 prevented the realization of his plan. Although his index numbers were not continued beyond 1891, two other important indexes have been based on Hamburg prices, namely, those of Dr. Heinz, published in *Hamburgs Handel und Schiffahrt* by the bureau of trade statistics of Hamburg and those of Prof. Conrad, of Halle, published in the *Jahrbücher für Nationalökonomie und Statistik*.<sup>1</sup>

#### SOURCE OF QUOTATIONS—BASE PERIOD.

Soetbeer used the average wholesale prices published by the bureau of trade statistics of Hamburg. These prices do not go back farther than 1847, since prior to that time no such statistical bureau existed. For that reason Dr. Soetbeer found it necessary to select 1847-1850 for the base period, although he himself states that he would have much preferred to use 1841-1850.

#### PRICES: HOW SHOWN AND COMPUTED.

The annual average prices were computed by a simple arithmetical process from the total quantity and total value of each article imported as recorded by the Hamburg bureau. Since the bureau of trade statistics entered the weight and kind of each article imported into Hamburg, and the price of each on the Hamburg exchange on the day of importation, this was most easy. When the price of an article was not quoted on the exchange, then the invoice value, plus freight, insurance, and other charges, was entered. As long as Hamburg was a free harbor and all goods entering the city in any manner whatever were recorded, these average prices were of the utmost importance. But when, in 1888, Hamburg joined the German customs union, and only articles entering by sea were required to be recorded, the figures for land importations could no longer be obtained with any accuracy, nor could those of articles entering by both land and sea. In consequence the quotations of the bureau of trade statistics, which up to that time had numbered over 300, now dropped to 163. Dr. Heinz, director of the Hamburg Bureau of Trade Statistics, undertook the task of going back over the records of the bureau to separate sea importations from land importations for Soetbeer's list of articles, so as to furnish reliable average prices on them for years up to 1891, inclusive. But after the death of

<sup>1</sup> For a description of these index numbers see pp. 216-222 of the present bulletin.



Soetbeer, in 1892, Dr. Heinz carried on this investigation for a different list of articles, selecting only such as presented data previous to 1888 that could also be quoted subsequent to 1888. This list contains only 70 of Soetbeer's 114 articles, but adds 110 new quotations. The average prices of these 180 commodities were carried back to 1850.

DESCRIPTION AND GROUPING OF COMMODITIES.

The 114 articles on which Soetbeer computed his index numbers were grouped as follows:

*I. Products of agriculture, etc. (20 articles).*

Wheat.	Potatoes.*
Wheat flour.	Hops.
Rye.	Clover seed.
Rye flour.	Rapeseed.
Oats.	Rapeseed oil.
Barley.	Linseed oil.
Malt.	Oil cake.
Buckwheat.	Raw sugar.
Peas.	Refined sugar.
White beans.	Spirits from corn or potatoes.

*II. Animal and fish products (22 articles).*

Beef.*	Leather.
Veal.*	Horsehair.
Mutton.*	Bristles.
Pork.*	Bed feathers.
Milk.*	Bones.
Butter.*	Buffalo horns.
Cheese.	Glue.
Tallow.	Eggs.*
Lard.	Herrings.
Hides.	Dried fish.
Calfskins.	Fish oil.

*III. Southern products (7 articles).*

Raisins.	Olive oil.
Currants.	Wine in casks.
Almonds.	Champagne.
Dried prunes.	

*IV. Colonial products (19 articles).*

Coffee.	Tobacco.
Cocoa.	Indigo.
Tea.	Cochineal.
Pepper.	Logwood.
Allspice.	Redwood.
Cassia bark.	Mahogany.
Rice.	Cane.
Sago.	Palm oil.
Arrack.	Ivory.

V. *Minerals and metals (14 articles).*

Coal.	Copper.
Pig iron.	Quicksilver.
Bar iron.	Sulphur, raw.
Steel.	Saltpeter, raw, Chile.
Lead.	Salt.
Zinc.	Lime.
Tin.	Cement.

VI. *Textile materials (7 articles).*

Cotton.	Silk.
Wool.	Cordage.
Flax.	Rags.
Hemp.	

VII. *Miscellaneous (11 articles).*

Guano.	Potash.
India rubber.	Soda.
Gutta-percha.	Tallow candles.
Rosin.	Tar.
Pearl ash.	Wax.
Pitch.	

VIII. *British articles of export (14 articles).*

Cotton yarn.	Linen, plain.
Piece goods, plain.	Linen sail cloth and sails.
Cotton piece goods, printed.	Woolen and worsted yarn.
Cotton stockings and socks.	Woolen cloths, etc.
Thread for sewing.	Flannels, etc.
Common glass bottles.	Worsteds.
Linen yarn.	Carpets, etc.

NOTE.—The prices of articles marked with an asterisk are the average of the prices paid by Hamburg institutions (hospitals, etc.) for large purchases.

## SUBSTITUTIONS AND ADDITIONS.

Although no substitutions or additions are mentioned specifically as having been made, the procedure of the Hamburg Bureau of Trade Statistics in securing its average annual wholesale prices, as described by Dr. Soetbeer, would readily admit of such being done. Dr. Soetbeer states<sup>1</sup> that since the quantities and kinds of many important articles undergo changes in the course of decades, it had seemed proper to the bureau to take no account of the different kinds of each article but to treat all kinds as one in order to get a general indication of the changes in prices. He also adds that to meet objections to his selection of articles for his compilation, he has carefully revised the list, so as to exclude those for which the Hamburg wholesale prices are not to be considered fairly indicative of prices in the general trade; that a number of very important articles were included for which the official statements give no figures and for which wholesale prices have been ascertained from the yearly accounts of large

<sup>1</sup> U. S. Senate Ex. Doc. No. 34 (p. 226), 50th Cong., 1st sess., 1887.

institutions at Hamburg, as in the case of meat, butter, milk, and eggs; that the prices of yarns and cloths which appeared in the earlier compilation were later excluded, since the indirect influence of the German import duties on the importation of cheaper grades prevents the prices from indicating the general range of prices of such articles, and that in their place have been given corresponding average prices of yarns and cloths exported from England, as well as the prices of some other articles of manufacture, all derived from the British trade statistics. Likewise, to incorporate the results of a thorough and detailed revision made by the Hamburg Bureau of Trade Statistics of its earlier price tables, it was necessary to make some slight changes in the figures for some articles in the second edition of the *Materialien* as compared with the figures for those same articles in the first edition. Since Soetbeer's tables were discontinued only six years after their first publication there was no occasion to resort to interpolation, and no trace of any is evident.

#### WEIGHTING.

Soetbeer's index numbers were not weighted, although the problem was recognized and met half way by his discriminating selection of articles and by his including more than one variety of a commodity in the list, as in the case of wheat, rye, sugar, etc.

#### TESTING.

To test his index Dr. Soetbeer constructed a comparative table showing the successive annual average prices from 1871 to 1890 of three different groups of Sauerbeck's articles as compared with three similar groups of his own, recomputing for this purpose his own index numbers on Sauerbeck's base period of 1867-1877. The comparisons are made, first, between the general index number for Sauerbeck's complete list of 45 articles<sup>1</sup> and his own index number for 100 articles; second, between the index numbers for their respective groups of agricultural products, which include 7 articles in Sauerbeck's list and 20 in Soetbeer's; and, third, between the index numbers for their respective groups of minerals and metals, consisting of 8 articles for Sauerbeck and 14 for Soetbeer. In the same article he makes a further test by contrasting his index number for 100 articles for the separate years from 1881 to 1890 with the index numbers for exports, for imports, and for both, which are published by the Imperial Statistical Office. For this comparison the base period 1881 of the bureau is used.

<sup>1</sup> See pp. 271-273 of this bulletin.

## TABLE OF RESULTS.

In his article on "The course of prices from 1886 to 1890"<sup>1</sup> Dr. Soetbeer presents his last published table, which gives his computations of index numbers for the 114 articles by groups, as follows:

## SUMMARY OF RELATIVE PRICES OF COMMODITIES FOR THE YEARS 1847-1890.

(Base period, 1847-1850=100.)

Year.	I. Agricultural products.	II. Animal products, etc.	III. Southern products.	IV. Colonial products.	V. Minerals and metals.	VI. Textile materials.	VII. Miscellaneous articles.	VIII. British exports.	I-VIII Total articles, 114.
1847-1850..	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1851-1855..	129.99	114.79	110.43	110.97	107.03	105.20	106.65	98.47	112.22
1856-1860..	131.84	132.31	134.72	122.61	113.59	107.12	108.21	102.41	120.91
1861-1865..	124.46	128.24	114.13	118.54	102.11	131.83	144.33	127.56	123.59
1866-1870..	137.74	138.35	121.54	118.32	95.47	129.17	105.90	130.55	123.57
1871.....	144.76	144.14	122.99	120.22	101.85	119.23	117.48	122.64	127.03
1872.....	144.17	155.82	125.36	130.25	121.63	122.79	128.54	130.07	135.62
1873.....	146.21	158.72	132.15	134.32	140.60	119.38	119.14	128.52	138.28
1874.....	150.99	157.76	145.02	138.74	116.70	112.80	112.21	128.06	136.30
1875.....	138.16	158.59	131.35	132.11	107.49	111.47	98.74	124.96	129.85
1871-1875..	144.90	154.57	131.50	130.72	116.90	117.17	114.98	126.44	133.29
1876.....	141.06	155.79	128.69	129.74	106.27	105.54	101.78	119.23	128.33
1877.....	145.34	152.51	140.55	130.29	98.87	106.33	99.80	114.04	127.70
1878.....	132.50	141.83	134.34	125.61	94.14	102.33	97.94	111.03	120.60
1879.....	132.92	137.60	130.10	123.34	84.28	98.76	90.21	105.93	117.10
1880.....	138.11	147.30	154.65	122.92	88.33	96.72	95.23	108.15	121.89
1876-1880..	138.12	146.78	138.91	128.38	94.35	102.33	96.79	111.70	123.07
1881.....	137.50	151.21	146.57	122.60	84.87	99.29	94.89	103.08	121.07
1882.....	138.45	155.17	139.23	122.47	86.99	95.10	90.10	104.72	122.14
1883.....	143.33	156.40	142.38	120.17	82.93	95.93	95.38	104.72	122.24
1884.....	123.85	150.26	120.16	117.90	78.69	97.02	84.82	103.36	114.25
1885.....	110.75	140.45	123.78	116.39	74.23	95.89	81.35	100.48	108.73
1881-1885..	130.77	150.65	134.41	119.91	81.55	96.65	91.11	103.28	117.68
1886.....	101.31	133.53	122.44	115.45	70.52	89.76	78.75	97.03	103.99
1887.....	96.28	129.93	121.81	116.59	72.50	81.42	77.30	95.98	102.02
1888.....	98.18	128.97	120.09	115.41	75.57	82.17	74.31	94.91	102.04
1889.....	102.06	130.85	127.57	118.52	78.55	89.05	86.41	96.60	106.13
1890.....	107.53	129.85	128.61	119.35	83.54	81.92	91.70	94.96	108.12
1886-1890..	101.06	130.41	126.08	117.32	76.12	84.86	81.70	95.90	104.41

## GREAT BRITAIN.

## INDEX NUMBERS OF THE BOARD OF TRADE.

## PUBLICATION.

The first report of this series contains the results of an investigation conducted by the Labor Department for years prior to 1902.<sup>2</sup> Since that year an annual report on the subject has been prepared and published by the Board of Trade in the January issue of The Labour Gazette, London.

## HISTORY.

The inquiry concerning the subject of prices had occupied the Labor Department for several years, and, on account of the great amount of public attention devoted to all questions affecting prices of commodities, it was decided in 1903 to publish the results up to

<sup>1</sup> Jahrbücher für Nationalökonomie und Statistik, 1892, p. 563.<sup>2</sup> Report on Wholesale and Retail Prices, 1902. Great Britain. Board of Trade.

1902 without delay. The first report in 1903 consisted of a series of comparative tables of actual wholesale prices covering the years from 1871 to 1902.

The index of wholesale prices was computed upon 45 selected articles. In respect to most of the articles the actual prices were carried as many years back of 1871 as was regarded safe, considering the nature of the data available. However, the index was not computed back of 1871, even where the actual prices of individual articles were secured for earlier years, as in the instance of bread in the city of London, where the price was carried back to 1758.

To show the average change of general prices, not only from 1871 to 1902 but extending over the whole of the nineteenth century, a chart was published covering the period from 1801 to 1902.

The statement showing the course of prices from 1801 to 1846 is based on Jevons' index number, from 1846 to 1871 on that of Sauerbeck, and from 1871 to 1902 on the Board of Trade index as shown in these reports.

#### SOURCE OF QUOTATIONS.

The data used in the original report were import and export average values, contract prices at hospitals and institutions, prices at markets, ascertained values of coal and iron in different districts used for the determination of wage rates, prices from private firms, associations, etc. The import values were based on the declarations of the importer, those for exports also being declared values, but the report states that various difficulties were encountered "in tracing back the average value of the same article throughout so long a period, arising to a large extent from changes in classifications."<sup>1</sup> The same system of declared values was in force throughout the period. The contract prices of certain articles for hospitals and asylums of the London County Council represent the prices paid, throughout the period, by a somewhat similar class of consumers. Market prices were compiled from official reports, newspapers, and market quotations. The ascertained values of coal and iron were from reports made by accountants for use in the determination of the general rate of wages by sliding scale or otherwise. In a few cases it was found necessary to secure quotations from the original sources and from private corporations. A memorandum states that it was proposed to use either import or export values according as the article was chiefly one of import or export, except for British corn, milk, potatoes, beef, mutton, and brick.<sup>2</sup>

#### BASE PERIOD.

The year 1871 was originally adopted as the base period, and from 1871 to 1906 the index was computed upon this base for the average

<sup>1</sup> Report on Wholesale and Retail Prices, 1902, p. 427. Great Britain. Board of Trade.

<sup>2</sup> *Idem*, p. 439.

price of all the articles. This was used as a standard until 1906, when 1900 was established as the base and the index for the 45 articles as a whole was recomputed on the new basis from 1871 to 1906. Since then 1900 has been used as the base period.

**PRICES: HOW SHOWN AND COMPUTED.**

In the original report the prices were shown as yearly actual averages for the separate articles. In succeeding reports up to 1905 the actual average prices were not shown, but the index numbers for the four groups and the general index number were published. Since 1905 no price data other than the general index number have been shown.

**NUMBER AND CLASS OF COMMODITIES.**

The list of articles covered by the reports numbers 45 and includes principally raw materials or materials at an early stage of manufacture. The January, 1914, issue of the Labour Gazette states that, in compiling the general index number, the index numbers for 47 separate articles were weighted in accordance with their estimated consumption. Counting milk, butter, and cheese as separate articles (heretofore counted one) probably accounts for the new number; however, no explanation is vouchsafed.

**DESCRIPTION AND GROUPING OF COMMODITIES.**

Below is shown the list of the 45 articles included in the group and general index, the weight allotted to each article, and the source of the quotations.<sup>1</sup>

*Group I.—Coal and metals (6 articles).*

Article.	Allotted weight.	Source of price quotations.
Coal.....	34	Export values of coal.
Pig iron.....	16	Export values of pig iron.
Copper (ore and regulus).....	5	Import values of copper regulus.
Crude zinc.....	1½	Import values of crude zinc.
Block tin.....	1½	Import values of block tin.
Lead.....	1½	Import values of pig and sheet lead.
Total.....	50½	

*Group II.—Textiles (raw materials—6 articles).*

Cotton, raw.....	38	Import values of raw cotton.
Wool, British.....	6	Export values of sheep and lambs' wool.
Wool, foreign.....	13	Import values of sheep and lambs' wool.
Jute, raw.....	3	Import values of jute.
Flax, raw.....	4	Import values of flax.
Silk, raw.....	9	Import values of silk.
Total.....	73	

<sup>1</sup> Report on Wholesale and Retail Prices, 1902, pp. xxxv-xxxvii. Great Britain. Board of Trade.

## Group III.—Food and drink (23 articles).

## A. Corn, etc.

Article.	Allotted weight.	Source of price quotations.
Wheat, British.....	14	Gazette average of British wheat.
Barley, British.....	17	Gazette average of British barley.
Oats, British.....	12	Gazette average of British oats.
Wheat, foreign.....	33	Import values of wheat.
Barley, foreign.....	5	Import values of barley.
Oats, foreign.....	4	Import values of oats.
Maize.....	8	Import values of maize.
Hops.....	4	Import values of hops.
Rice.....	1	Import values of rice.
Potatoes.....	33	Contract price, potatoes at St. Thomas' Hospital.
Total.....	131	

## B. Meat, fish, and dairy products.

Beef.....	52	Beef (live), 1st class, Metropolitan Cattle Market.
Mutton.....	31	Mutton (live), 1st class, Metropolitan Cattle Market.
Bacon.....	21	Import values of bacon.
Milk, butter, cheese, etc.....	45	Average price of milk at Bethlem Royal Hospital and St. Thomas's Hospital.
Eggs.....	5	Import values of eggs.
Herrings.....	7	Export values of herrings.
Total.....	161	

## C. Tea, tobacco, wine, and sugar.

Sugar.....	20	Import values of refined sugar.
Tea.....	8	Import values of tea.
Coffee.....	1	Import values of coffee.
Cocoa.....	1	Import values of cocoa.
Rum.....	1½	Import values of rum.
Wine.....	5	Import values of wine.
Tobacco.....	2	Import values of unmanufactured tobacco.
Total.....	38	

## Group IV.—Miscellaneous (10 articles).

Cotton seed.....	2	Import values of cotton seed.
Linseed.....	5	Import values of linseed.
Olive oil.....	1	Import values of olive oil.
Palm oil.....	½	Import values of palm oil.
Paraffin.....	½	Import values of paraffin.
Petroleum.....	2	Import values of petroleum.
Bricks.....	3	Price of stocks at Glasgow.
Hewn fir.....	23	Import values of hewn fir.
Caoutchouc.....	1½	Import values of caoutchouc.
Hides.....	8	Import values of hides.
Total.....	41½	
Grand total.....	506	

## SUBSTITUTIONS AND ADDITIONS.

Various difficulties, as was previously stated, were met in tracing average values throughout so long a period. Changes in classification were the cause to a large extent. The methods adopted in making substitutions are not fully explained. Apparently no new articles have been added since the publication of the first report.

## INTERPOLATION.

In the discussion of sources of information the statement is made that where the data related only to some of the earlier years of the period covered, or could not be continued to the present, they were omitted, and that when large gaps existed in the records it was the general practice as far as possible to start the table from dates subsequent to the gaps in order to preserve continuity.<sup>1</sup>

## WEIGHTING.

The method of weighting used in computing this index number was that based on the amount of consumption of the various articles in the United Kingdom. The consumption of an article is defined to mean any process by which the commodity is substantially changed in character. The original report in its explanation of the "consumption standard" states that "the theoretical basis of the consumption standard is the proposition that the true measure in the change of the value of money is the change in the amount of gold that must be paid by consumers throughout the country for all commodities in their finished state consumed by them per unit of time."<sup>2</sup> The value of the national consumption of the 23 raw materials which were derived almost entirely from foreign sources was taken to be the declared value of the imports less the declared value of the exports. The value of the consumption of the 22 remaining articles was the value of the quantity produced plus the value of the amount imported, if any, minus the value of the exports, if any. The results thus obtained represent the estimated value in millions sterling of the annual consumption of the articles. The millions sterling constitute the weights allotted.

The weights assigned to the various articles were placed against the percentage variations in prices. The percentage variations were computed for each year by using 1871 as the base, or 100. For example, the percentage price of coal in 1872 was 161.1 per cent, the price in 1871 being 100. This percentage multiplied by 34—the weight allotted to coal—produced 5,477.4, or what was termed the weighted percentage. The sum of the weighted percentages of all the articles in a group divided by the sum of the weighted percentages for the base period produces the index number for the group in the specified year. For example, the weights for the group of coal and metals were 5,950.0 for the base year, and for 1872 the total was 9,178.2, which divided by the figure for the base year equals 154.1, the published index number of the group for 1872. A continuation of this process produces the other group indexes and the general index for the 45 commodities is computed in like manner.

<sup>1</sup> Report on Wholesale and Retail Prices, 1903, p. 426. Great Britain. Board of Trade.

<sup>2</sup> *Ibidem*, p. 432.



## TESTING.

Some comparison of results was made with the results of other indexes. The principal test was made by using certain articles as given by Sauerbeck. These articles covered only 28 of the 45 price quotations in his report, but they formed nine-tenths of the total weight of the Board of Trade index number. These articles were used to form a special index number, making use of the weights allotted as above. The results are shown below.

COMPARISON OF A SPECIALLY WEIGHTED NUMBER FROM THE BOARD OF TRADE AND SAUERBECK'S NUMBER.<sup>1</sup>

Year.	Specially weighted number.	Sauerbeck's number.
1867.....	100	100
1868.....	100	99
1869.....	95	98
1870.....	94	96
1871.....	95	100
1872.....	107	109
1873.....	113	111
1874.....	104	102
1875.....	97	96
1876.....	96	95
1896.....	62	61

<sup>1</sup> Report on Wholesale and Retail Prices, 1902, p. 449. Great Britain. Board of Trade.

## TABLES OF RESULTS.

The principal table of the original report shows the index numbers for the four general groups, three subgroups under food and drink, and the index for all the 45 commodities.<sup>1</sup> This table is reproduced below and carried forward to 1905, the last year that the index was computed upon the basis of 1871 as 100.

BOARD OF TRADE INDEX NUMBERS, BY GROUPS, 1871 TO 1905.

(The index numbers are the sum of the weighted percentages divided by the sum of the weights.)

Year.	Index number for all the 45 commodities.	I. Coal and metals.	II. Textiles (raw materials).	III. Food and drink.			Total, group III.	IV. Miscellaneous.
				III A. Corn, etc.	III B. Meat, fish, and dairy produce.	III C. Sugar, tea, wine, and tobacco.		
1871..	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1872..	110.6	154.1	114.0	104.0	102.0	102.0	102.7	105.1
1873..	118.8	194.8	110.2	106.7	106.3	98.1	108.2	106.5
1874..	113.6	138.8	102.6	110.8	110.1	94.9	108.6	108.4
1875..	107.8	126.3	100.2	99.9	115.6	83.0	107.3	99.3
1876..	104.2	107.2	93.6	98.7	117.2	90.7	106.8	97.9
1877..	105.3	99.9	91.7	107.9	114.9	95.9	110.3	97.3
1878..	96.3	92.9	88.5	98.9	112.2	88.4	104.2	88.3
1879..	94.9	86.8	84.1	97.4	106.7	85.2	100.5	81.5
1880..	97.4	94.0	88.6	98.0	106.6	86.2	100.8	88.2
1881..	95.7	91.1	87.0	94.9	106.7	84.4	99.4	88.5
1882..	97.3	91.8	84.1	95.8	112.0	83.6	102.3	89.1
1883..	90.5	90.3	82.0	93.9	113.7	80.9	102.1	87.5

<sup>1</sup> Report on Wholesale and Retail Prices, 1902, p. 34. Great Britain. Board of Trade.

BOARD OF TRADE INDEX NUMBERS, BY GROUPS, 1871 TO 1905—Concluded.

Year	Index number for all the 45 commodities.	I. Coal and metals.	II. Textiles (raw materials).	III. Food and drink.				IV. Miscellaneous.
				III A. Corn, etc.	III B. Meat, fish, and dairy produce.	III C. Sugar, tea, wine, and tobacco.	Total group III.	
1884..	88.3	86.4	78.8	81.1	104.7	70.7	91.4	82.2
1885..	83.0	82.1	75.7	78.7	96.3	66.7	85.1	80.2
1886..	78.5	78.8	69.0	71.8	92.7	63.7	81.1	73.8
1887..	76.7	80.1	70.7	71.2	88.2	61.4	81.3	69.3
1888..	79.3	83.0	70.0	71.7	94.0	65.0	81.8	71.0
1889..	80.8	94.1	72.4	70.6	92.8	68.0	81.1	74.3
1890..	82.8	113.8	72.9	72.0	91.7	63.8	80.6	72.9
1891..	84.1	106.6	70.1	83.2	91.1	64.8	84.9	70.1
1892..	80.1	98.8	66.1	73.4	91.8	63.9	81.3	68.1
1893..	78.7	89.4	66.6	68.3	95.2	65.0	81.1	66.2
1894..	75.1	91.7	60.8	65.1	92.2	59.5	76.9	62.7
1895..	72.2	85.8	57.7	62.2	88.2	56.2	74.2	62.6
1896..	69.8	83.3	64.0	57.6	81.9	57.0	69.4	63.6
1897..	71.3	84.4	59.7	62.7	84.0	54.9	72.4	63.9
1898..	73.6	92.7	54.8	73.1	81.8	54.2	75.1	65.5
1899..	74.5	107.6	57.2	63.7	85.8	52.5	73.2	67.9
1900..	83.2	151.9	70.0	62.4	90.3	52.4	74.9	74.3
1901..	79.2	124.7	65.7	64.0	89.5	50.1	75.3	71.7
1902..	75.8	114.9	65.0	63.7	94.4	46.1	76.7	69.2
1903..	78.6	111.2	71.2	63.8	92.1	47.0	75.7	68.4
1904..	78.7	106.1	78.7	66.7	89.0	48.3	75.5	66.0
1905..	77.7	105.0	73.5	64.8	88.4	52.1	74.8	68.7

A second table, reproduced below, shows the index as now published, the price in 1900 being used as the base, or 100. No group index figures have been regularly published since the revision. The exact method of computation upon the new base period is not stated, but a note to the report for 1906, issued in January, 1907, states that "the index number has, however, now been recalculated with the year 1900 as its base year instead of 1871."<sup>1</sup> It is presumed that the calculation is made in the same way as in the original report.

BOARD OF TRADE INDEX NUMBERS, 1871 TO 1913.

[Source: The Board of Trade Labour Gazette, January, 1914, p. 5.]

Year.	Index number.	Year.	Index number.	Year.	Index number.	Year.	Index number.	Year.	Index number.
1871...	135.0	1880...	129.0	1889...	103.4	1898...	93.2	1907...	106.0
1872...	145.2	1881...	126.6	1890...	103.3	1899...	92.2	1908...	103.0
1873...	151.9	1882...	127.7	1891...	106.9	1900...	100.0	1909...	104.1
1874...	146.9	1883...	125.9	1892...	101.1	1901...	96.7	1910...	108.8
1875...	140.4	1884...	114.1	1893...	99.4	1902...	96.4	1911...	109.4
1876...	137.1	1885...	107.0	1894...	93.5	1903...	96.9	1912...	114.9
1877...	140.4	1886...	101.0	1895...	90.7	1904...	93.2	1913...	116.5
1878...	131.1	1887...	98.8	1896...	88.2	1905...	97.6		
1879...	125.0	1888...	101.8	1897...	90.1	1906...	100.5		

INDEX NUMBERS OF THE ECONOMIST.

PUBLICATION.

This index represents the course of wholesale prices of commodities in the United Kingdom.

<sup>1</sup> The Board of Trade Labour Gazette, vol. 15, 1907, p. 4.

It is compiled and published each month in the *Economist*, London, the general results for each year appearing in the first issue of January of the following year.

#### HISTORY.

The object of this compilation originally was to throw some light on the relation between the gold supply and prices. In 1849 gold had been discovered in California and in 1850 in Australia, and the pouring of this gold into Europe seemed to be accompanied by a general upward movement of prices. It was to ascertain whether there had been such a movement and, if so, its extent that the *Economist* index numbers were developed.

In 1859 William Newmarch, then editor of the *Journal of the Royal Statistical Society*, published an article in that journal on the prices of the previous year, in which the prices of 19 commodities in the London market were expressed as percentages of the average of the prices of 1845-1850. These commodities were as follows: Coffee, sugar, tea, tobacco, wheat, butcher's meat, cotton, silk, flax and hemp (average), wool, indigo, oils (average of 3 varieties), timber, tallow, leather, copper, iron, lead, and tin. In 1860 and 1861 similar articles appeared in the journal, when in addition to these 19 commodities 3 others were added: Raw cotton, cotton yarn, and cotton cloth—all at Manchester prices. The prices of these 22 commodities were expressed in the form of percentages, but no general index number was constructed from them.

The *Economist* stated in its issue of February 20, 1864, in which it published for the first time its commercial history and review of the past year, that in the table of actual wholesale prices it was following the arrangement and method which were adopted by Tooke and Newmarch in their history of prices, and continued by Newmarch in the *Journal* for 1859, 1860, and 1861.

The first table in the *Economist* report of 1864 presented the actual prices in pounds sterling of 45 articles for the base period of 1845-1850 and for succeeding years down to 1862. The prices were for a given date, being either those for January 1 or July 1 for all years previous to 1863, for which year they were the prices for the 1st of each month.

The 45 articles were coffee, sugar (3 kinds), rum, tea, tobacco, butter, wheat, beef (2 kinds), mutton (2 kinds), pork, cotton, silk, flax, hemp, wool (4 kinds), dyes (2 kinds), oils (3 kinds), timber (2 kinds), tallow, leather, saltpeter, ashes, copper, iron (2 kinds), lead, steel, tin, raw cotton (3 kinds), cotton yarn, and cotton cloth (2 kinds). For a few of the articles the prices were not continuous throughout the period.

A second table was printed entitled "Proportionate results," being the percentage that the actual price of each article for the given date

was of the actual average price for 1845-1850. In this table, instead of 45 series of percentages, the number was reduced to 22. This number was made up of 37 of the 45 series of quotations under the heads of coffee, sugar, tea, tobacco, wheat, butcher's meat, cotton, raw silk, flax and hemp, sheep's wool, indigo, oils, timber, tallow, leather, copper, iron, lead, tin, raw cotton (cotton wool), cotton yarn, and cotton cloth. Of these 22 series of percentages, the 9 composed of more than one description or grade of the article were sugar (2 kinds), butcher's meat (2 kinds of beef and 2 of mutton), flax and hemp (2 articles), sheep's wool (4 kinds), oils (3 kinds), iron (2 kinds), raw cotton (3 kinds), cotton cloth (2 kinds), and timber (2 kinds).

The articles were divided into five groups as follows:

- I. Colonial and tropical produce (food).
- II. Wheat (England and Wales) and butcher's meat (New-gate market).
- III. Raw materials of manufacture.
- IV. Metals.
- V. Manchester markets.

The articles under the fifth head were raw cotton, cotton yarn, and cotton cloth.

During the years 1864 to 1867 the composition of these tables remained the same, except that in 1865 the percentage for raw cotton was computed upon one grade instead of three, as formerly.

The commercial history, published by the Economist, for 1868 gave for the first time the total index number. However, this was simply the total at each date of the 22 percentage columns, no general index being computed, and it was not until 1869 that the numbers were added together and divided by 22, the result thus becoming the "Economist" index number, which has been published year by year since that date.

It was announced in the Economist of February 4, 1911, that it was deemed desirable to change the basis upon which the index number had been calculated. This statement recited the intention of the publication to make this review of prices more far-reaching by embodying in the index quotations of some important articles which play a large part in modern commerce, and at the same time to retain its character as a wholesale market index number. On account of the inclusion of new articles, it became necessary to adopt a base period sufficiently recent to include standardized quotations of modern commodities.

It was stated that, owing to the fact that many commodities are now important in the business life that were not so regarded at the time of beginning the index, the list of commodities had been revised and the number increased. The result of this recasting was published in the issue of November 18, 1911, showing how the new

index number was made comparable with the old figures by dividing the total index number for the 44 commodities by two, thus reducing it to that of 22 articles as used formerly.

The chief change made is in respect of the coal and iron trades, which were formerly represented by one quotation only, but are now given a weight of 5 quotations out of 44. Quotations are added, for the first time, for barley, oats, potatoes, and rice among foodstuffs; Egyptian cotton and jute among textiles; iron bars, steel rails, and coal among minerals; and petroleum, oil seeds, rubber, and soda crystals in the miscellaneous group.

In order to show the relation between the percentage index as computed by the old method and the index number obtained by the new plan, the latter has been reduced to the same basis. The index number, however, is based on the prices of 44 articles, while the old percentage number was computed on but 22. They have been made comparable, as stated, by dividing the index number for the 44 articles by 2.

#### SOURCE OF QUOTATIONS.

The quotations used in compiling this index are market prices as published weekly in the *Economist*, which represent those of the London or Manchester markets.

#### BASE PERIOD.

As has been explained, the base period formerly was 1845-1850, but in November, 1911, it was announced that the base period had been changed to 1901-1905.

#### PRICES: HOW SHOWN AND COMPUTED.

As was previously stated, the quotations used are those published weekly in the *Economist*. The weekly prices for the selected articles are published each month in the discussion of the index number.

#### NUMBER AND CLASS OF COMMODITIES.

The original number of commodities, as has been stated, was 22. In 1911 the number was increased to 44. Raw, or what might be termed primary, commodities only are included in these quotations.

The following table, appearing in the *Economist* of November 18, 1911, shows the number of quotations for each commodity, comparing the old with the new base period:

NUMBER OF COMMODITIES: SERIES OF QUOTATIONS UNDER THE OLD BASIS OF 1845-1850, COMPARED WITH THAT UNDER THE NEW BASIS OF 1901-1905\*

Commodities.	Old basis quotation number.	New basis quotation number.	Commodities.	Old basis quotation number.	New basis quotation number.
Wheat and flour.....	1	3	Pig iron.....	1	1
Barley.....	1	1	Steel rails.....	1	1
Oats.....	1	1	Iron bars.....	1	1
Potatoes.....	1	1	Coal.....	1	2
Rice.....	1	1	Copper.....	1	61
Beef.....	1	1	Tin.....	1	1
Mutton.....	1	2	Lead.....	1	1
Pork.....	1	2	Timber.....	1	2
Sugar.....	1	2	Leather.....	1	1
Coffee.....	1	1	Oil.....	1	1
Tea.....	1	1	Oilseeds.....	1	1
Tobacco.....	1	1	Petroleum.....	1	1
Butter.....	1	1	Rubber.....	1	1
Cotton (raw, yarn, cloth).....	4	4	Tallow.....	1	1
Wool.....	1	2	Indigo.....	1	1
Flax.....	1	1	Soda crystals.....	1	1
Hemp.....	1	2			
Jute.....	1	1	Total.....	22	44
Silk.....	1	1			

## DESCRIPTION AND GROUPING OF COMMODITIES.

The detailed table of prices week by week as published includes 33 series of quotations. The articles are arranged in four groups as follows:<sup>1</sup>

*Minerals (8 articles).*

Iron, Cleveland, No. 5, G. M. B.  
 Iron, common bars.  
 Iron, steel rails.  
 Coals, best steam Newcastle.  
 Copper, standard.  
 Tin, standard.  
 Lead, English pig.  
 Saltpeter, Bengal.

*Textiles (7 articles).*

Cotton, middling American.  
 Cotton, yarn, 32's, twist.  
 Wool, N. S. Wales, greasy, average.  
 Silk, Canton.  
 Flax, Riga Z.K.  
 Hemp, manila.  
 Jute, native firsts.

*Food products (9 articles).*

Wheat, Gazette averages (English grain).  
 Barley, Gazette averages (English grain).  
 Oats, Gazette averages (English grain).  
 Flour, town-made, household.  
 Beef, inferior.  
 Beef, prime.  
 Mutton, prime.  
 Potatoes, good English.  
 Rice, Rangoon.

*Miscellaneous (9 articles).*

Sugar, West India sirups.  
 Sugar, beet, German.  
 Tea, Congou, middling, common.  
 Tea, Congou, medium, good.  
 Coffee, Santos, good average.  
 Oils, petroleum.  
 Oils, olive, Levant.  
 Tallow, town.  
 Rubber, fine hard Para.

## SUBSTITUTIONS AND ADDITIONS.

It is stated that over so long a period of time some variations have inevitably arisen in the mode of quoting prices, but in all such cases the nearest approach possible has been made to a uniform quotation. The articles cited are raw cotton, tea, sugar, flax, and wool. It is further stated that in some cases, where it has been considered desirable to introduce a commodity to replace one no longer actively dealt in, the current price of the substituted article has been taken as equivalent to the same percentage of the basis price as was represented by its predecessor.

## INTERPOLATION.

The supplying of missing data, if such has been found necessary, has not been noted.

## WEIGHTING.

The index is computed by means of simple arithmetical average. Indirect weighting is attained by the selection of articles.

This method, as applied to the present index, has been frequently criticized because of the small number of articles included. An attempt to correct the fault of giving each article an equal weight was made by Mr. R. H. Inglis Palgrave, in 1886, in a memorandum to the Royal Commission on the Depression of Trade and Industry. The method used by him was to give each relative price an importance proportional to the consumption of the article, which was ascertained by adding to the production the imports and deducting the exports. He thus obtained a series of figures representing the importance, in each year, of the consumption of each commodity, and used these in connection with the Economist figures for the years 1865 to 1885 upon the basis, 1865-1869 equals 100. The data prepared by Mr. Palgrave in 1886 have not been continued for subsequent years (see Report of United States Senate Finance Committee on Wholesale Prices, Wages, and Transportation, 1893, Pt. I, pp. 228, 229).

## TESTING.

The testing of the accuracy of the results secured in this index is made by comparison with the results in other index compilations.

The table below shows a comparison by decades of the weighted and unweighted indexes of the Economist with those of Sauerbeck (an unweighted index) and the Board of Trade (a weighted one). The weights for the Economist index have been calculated on the basis of consumption in the country as estimated by the Board of Trade.<sup>1</sup> The decade 1891 to 1900 is considered as the base or 100.

INDEX NUMBERS OF THE LEVEL OF PRICES IN THE UNITED KINGDOM, BY DECADES, 1861 TO 1910.

(Base period, 1891-1900=100.)

Decade.	Economist.		Sauerbeck.	Board of Trade.
	Weighted.	Unweighted.		
1861-1870....	146	152	151	138
1871-1880....	121	131	144	138
1881-1890....	107	108	113	112
1891-1900....	100	100	100	100
1901-1910....	110	108	110	111

The Economist of August 26, 1911, presents as a test of the accuracy of its index a table to show that retail prices have pursued much the same course as wholesale prices. The following comparison is made of the Economist index with that of the Board of Trade for retail prices in London from 1895 to 1910, in each case the year 1900 being taken as the base.

COMPARISON OF WHOLESALE AND RETAIL PRICES, 1895 TO 1910.

(Base period, 1900=100.)

Year.	Economist index number on Jan. 1 of each year.	Board of Trade index number of retail prices in London.
1895.....	80	93.2
1896.....	88	92.0
1897.....	91	95.2
1898.....	85	100.8
1899.....	80	95.4
1900.....	100	100.0
1901.....	99	101.9
1902.....	91	101.6
1903.....	93	103.2
1904.....	103	104.3
1905.....	90	103.7
1906.....	109	103.2
1907.....	117	105.8
1908.....	108	108.4
1909.....	103	108.2
1910.....	112	109.9

#### TABLES OF RESULTS.

The following table, covering the period from 1851 to 1910, shows the total index number for the 22 commodities in the form in which it was published in earlier years.

<sup>1</sup> The Economist, Aug. 26, 1911, pp. 422, 423.



THE ECONOMIST INDEX (ORIGINAL).<sup>1</sup>

(Base period, 1845-1850-2200.)

1845-50: Average	2200	1875: January	2778	1887: January	2050	1918: January	1918
1851: January	2310	July	2682	July	2116	July	2028
1853: July	2463	1876: January	2711	1888: January	2239	1900: January	2145
1857: July	3059	July	2631	July	2121	July	2211
1858: January	2667	1877: January	2715	1889: January	2187	1901: January	2126
1859: January	2558	July	2625	July	2161	July	2007
1860: January	2713	1878: January	2554	1890: January	2236	1902: January	1948
1861: January	2751	July	2457	July	2259	July	1966
1862: January	2878	1879: January	2225	1891: January	2224	1903: January	2003
1863: January	3492	July	2290	July	2190	July	2111
1864: January	3787	1880: January	2577	1892: January	2133	1904: January	2107
1865: January	3575	July	2479	July	2081	July	2130
1866: January	3564	1881: January	2376	1893: January	2120	1905: January	2136
1867: January	3024	July	2302	July	2106	July	2163
1868: January	2582	1882: January	2435	1894: January	2082	1906: January	2342
July	2826	July	2442	July	1974	July	2362
1869: January	2666	1883: January	2343	1895: January	1923	1907: January	2499
July	( <sup>2</sup> )	July	2220	July	1931	July	2594
1870: January	2689	1884: January	2221	1896: January	1999	1908: January	2310
July	2711	July	2169	July	1947	July	2190
1871: January	2590	1885: January	2098	1897: January	1950	1909: January	2197
July	2640	July	2048	July	1885	July	2240
1872: January	2835	1886: January	2023	1898: January	1890	1910: January	2390
July	3054	July	2023	July	1915	July	2362
1873: January	2947	1887: January	2098	1899: January	1890	1911: January	2390
July	2914	July	2048	July	1915	July	2362
1874: January	2891	1888: January	2023	1900: January	1890	1912: January	2390
July	2779	July	2023	July	1915	July	2362

<sup>1</sup> The Economist, Sept. 2, 1911, pp. 490 and 491.<sup>2</sup> Figures not calculated for July 1, 1869.

A comparison of the Economist index number as computed on the old and new bases is afforded in the following table:

COMPARISON OF ECONOMIST INDEX NUMBERS COMPUTED ON OLD AND NEW BASES.<sup>1</sup>

Date.	Old basis (1845-1850- 100).	New basis (1901-1906- 100).	Date.	Old basis (1845-1850- 100).	New basis (1901-1906- 100).
1896: January 1	91	90	1904: January 1	100	102
July 1	85½	88	July 1	97	99
1897: January 1	89	89	1905: January 1	97	104
July 1	86	90	July 1	98	102½
1898: January 1	88	89	1906: January 1	106	109
July 1	87	95	July 1	107	110
1899: January 1	87	93	1907: January 1	114	115
July 1	92	98½	July 1	118	121
1900: January 1	97½	110	1908: January 1	105	111½
July 1	100½	111	July 1	100	106½
1901: January 1	97	106	1909: January 1	100	104
July 1	91	103	July 1	102	110
1902: January 1	89	98	1910: January 1	100	113½
July 1	91	101	July 1	107	113
1903: January 1	91	99½	1911: January 1	114	114
July 1	96	104½			

<sup>1</sup> These data are taken from the Economist of Nov. 28, 1911, p. 1035.

The following table, reproduced from the Economist of December 5, 1914, shows the manner in which the information relative to the index number is now presented. The quarterly index figures represent the average of the figures for the months of the quarter. It will be noted that the method of grouping here employed is not the same as is used in the detailed table of prices.

## INDEX FIGURES BY GROUPS.

Date.	Cereals and meats.	Other food products (tea, sugar, etc.).	Textiles.	Minerals.	Miscellaneous rubber, timber, oils, etc.	Total.	Percentage change.
Basis (average 1901-1905).....	500	300	500	400	500	2,200	100.0
<b>1912.</b>							
First quarter.....	615	405	571	523	576	2,890	122.3
Second quarter.....	634	379	577	502	603	2,695	122.5
Third quarter.....	624	376	600	531	605	2,730	124.4
Fourth quarter.....	602	364	619	537	608	2,730	124.1
<b>1913.</b>							
End of January.....	606	383	623	534½	605½	2,732	124.1
End of February.....	602½	364½	630½	519	600½	2,717	123.4
End of March.....	594	358	641	529	585	2,717	123.4
End of April.....	603	352	638½	542	593½	2,729	124.0
End of May.....	583	343	630	542	596	2,684	122.4
End of June.....	580	345½	623½	522½	597½	2,669	121.3
End of July.....	584	345½	620	530	609½	2,689	122.2
End of August.....	581½	359	638½	529	585	2,689	122.4
End of September.....	583	359	671	533	578	2,714	123.3
End of October.....	567	365	667	514	671	2,684	122.1
End of November.....	569½	367	654	496	575½	2,661	121.0
End of December.....	563	355	642	491	572	2,623	119.2
<b>1914.</b>							
End of January.....	562½	356	626	502	571½	2,618	119.0
End of February.....	573½	352	630	491½	569	2,616	118.9
End of March.....	560	350½	626½	493	567	2,597	118.0
End of April.....	560½	346	633½	482½	562½	2,585	117.5
End of May.....	570½	349	644½	480	551	2,585	118.0
End of June.....	563½	345	616	471½	551	2,549	115.9
July.....	579	352	616½	464½	553	2,565	116.6
August.....	641	369	626	474	588	2,698	122.6
September.....	646	405	611½	472½	645	2,780	126.4
October.....	656½	400½	560	453	632	2,732	124.2
November.....	683	407½	512	473	684½	2,760	125.5

## INDEX NUMBERS OF AUGUSTUS SAJERBECK.

## PUBLICATION.

This index number represents the course of wholesale prices in the United Kingdom. Prior to 1910 statements were published only once a year. From January, 1910, to January, 1913, the general result was published each month for the preceding month, and the yearly résumé in March, in the Journal of the Royal Statistical Society, London, but since January, 1913, the information has appeared in The Statist, London. The general discussion of the results for the past year is now also published in the April number of the Journal of the Royal Statistical Society.

## HISTORY.

During 1885, or in the early part of 1886, Mr. Augustus Sauerbeck, a London wool merchant, prepared a paper upon the gold supply and its relation to prices, which was published in the September, 1886, *Journal of the Royal Statistical Society*.<sup>1</sup> In much of the discussion relating to the causes of an "extraordinary and almost unprecedented fall of prices" that had continued for 12 years, Mr. Sauerbeck recognized the lack of statistical information and prepared this paper in order to supply data upon the subject.

The work thus begun was continued by Mr. Sauerbeck until the end of 1912, when he relinquished the task and it was taken up by Sir George Paish, editor of *The Statist*.

## SOURCE OF QUOTATIONS.

The statement is made in the appendix to the first article that such of the prices from 1846 to 1885 as are not official returns were received from private firms or collected from the *Economist* and other publications. Further than this no information concerning the source of price quotations is given.

## BASE PERIOD.

The 11 years 1867-1877 are taken as the standard period. At the time the period was chosen the study covered the 40 years 1846-1885 and the base period included the years of the highest prices as well as a number of years of low prices. The index number for the 11-year-period was found to correspond exactly with the index number of the 25 years 1853-1877, so that "a comparison of the aggregate prices of all commodities in a certain year with the 11 years 1867-1877, is equivalent to a comparison with the whole 25 years 1853-1877."<sup>2</sup>

## PRICES: HOW SHOWN AND COMPUTED.

The prices upon which the index number is based are average prices for each year. The prices quoted in the report covering the years 1846-1885 are, with but few exceptions, "the average prices in each year, either those officially returned or the averages of the 12 quotations at the end of each month."<sup>3</sup> Where a range of prices is given the mean is taken between the highest and the lowest quotations. The prices as given in later reports are the averages of 12 monthly or 52 weekly quotations; in the case of potatoes, of 8 monthly quotations, January to April and September to December. These annual averages are shown in the tables by articles, as are also the corresponding relatives. The actual prices from which the yearly averages are computed are nowhere shown, but relatives based

<sup>1</sup> *Journal of the Royal Statistical Society*, September, 1886, vol. 49, p. 581.

<sup>2</sup> *Idem*, p. 592.

<sup>3</sup> *Idem*, p. 632.

on the quarterly averages are shown by groups of commodities, covering the period from 1884 to the present time.

The statement is made in the report of 1893 that all articles have been calculated at their actual prices and no corrections have been made for extraordinary fluctuations. The treatment of cotton prices at the time of the American Civil War is cited as an example.

The prices of all imported articles are quoted "in bond."

In the first report the general statement is made that in constructing his table of prices the author has on the whole been guided by the system adopted in the Economist reports on the course of prices.

#### NUMBER AND CLASS OF COMMODITIES.

The number of articles used directly in computing the index number was 43 from 1846 to 1866, 44 from 1867 to 1872, and 45 from 1873 to the present time. All are considered raw materials. In the original report the statement is made that only commodities were included which in the United Kingdom at that time represented a value of about a million pounds or more, counting both domestic production and imports. A few important articles, like wine, spirits, and tobacco, had to be left out, as no reliable data were obtainable.

Certain important commodities are represented by more than one of the 45 articles; for example, two varieties of wheat are quoted, and each variety is considered a separate article. The relative prices of certain others of the 45 articles, as for example coffee, were obtained by averaging two relatives representing different varieties or grades of the article. Thus in 1911, when the relative price of Ceylon coffee was 95 and of good Rio was 91, the relative used for coffee was 93, the average of these two. This method was followed in cases where the price of a single variety was not considered sufficiently representative of the article. The number of quotations, including these additional quotations used only indirectly in the computation of the index number in the report for 1911, was 57. The table of average actual prices, however, comprised 60 quotations, one each for tea, copper, and coal being shown in the actual price form without being represented in the index number. At the time the original report was published the series of quotations in the table of average prices comprised a total of 55.

An index number based on the prices of "the 31 principal commodities" from 1818 to 1845 was prepared by Mr. Sauerbeck and published in his original report. These commodities are not enumerated.

#### DESCRIPTION AND GROUPING OF COMMODITIES.

The 45 articles are divided into six groups. The grouping is shown in the following table, which also shows the number of series of price quotations secured for each commodity, and the number of relative

prices for each commodity used directly in the computation of the index for the year 1911. The table has been compiled from data appearing in the Journal of the Royal Statistical Society, March, 1911, pages 415 to 420.

NUMBER OF SERIES OF PRICE QUOTATIONS SECURED AND NUMBER OF RELATIVE PRICES USED IN INDEX, BY COMMODITIES.

Commodity.	Number of series of quotations secured.	Number of relative prices used in index.	Commodity.	Number of series of quotations secured.	Number of relative prices used in index.
Wheat.....	2	2	Iron.....	3	2
Flour.....	1	1	Copper.....	2	1
Barley.....	1	1	Tin.....	1	1
Oats.....	1	1	Lead.....	1	1
Maize.....	1	1	Coal.....	3	2
Potatoes.....	1	1	Total minerals.....	10	7
Rice.....	1	1	Cotton.....	2	2
Total vegetable food.....	8	8	Flax.....	2	1
Beef.....	2	2	Hemp.....	2	1
Mutton.....	2	2	Jute.....	1	1
Pork.....	1	1	Wool.....	3	2
Bacon.....	1	1	Silk.....	1	1
Butter.....	1	1	Total textiles.....	11	8
Total animal food.....	7	7	Hides.....	3	1
Sugar.....	3	2	Leather.....	2	1
Coffee.....	2	1	Tallow.....	1	1
Tea.....	3	1	Oil.....	2	2
Total sugar, coffee, and tea.....	8	4	Linseed oil and linseed (flaxseed).....	2	1
Total food.....	23	19	Petroleum.....	1	1
			Soda crystals.....	1	1
			Nitrate of soda.....	1	1
			Indigo.....	2	1
			Timber.....	2	1
			Total sundry materials.....	16	11
			Grand total.....	60	45

A description of the various articles included in the six groups of commodities follows:<sup>1</sup>

*Vegetable food (8 price series).*

- |                             |                                      |
|-----------------------------|--------------------------------------|
| 1. Wheat, English Gazette.  | 5. Oats, English Gazette.            |
| 2. Wheat, American.         | 6. Maize, American, mixed.           |
| 3. Flour, town-made white.  | 7. Potatoes, good English.           |
| 4. Barley, English Gazette. | 8. Rice, Rangoon, cargoes to arrive. |

*Animal food (7 price series).*

- |                       |  |
|-----------------------|--|
| 9. Beef, prime.       | 13. Pork, large and small, average.    |
| 10. Beef, middling.   | 14. Bacon, Waterford.                  |
| 11. Mutton, prime.    | 15. Butter, Friesland, fine to finest. |
| 12. Mutton, middling. |  |

*Sugar, coffee, and tea (8 price series).*

- |   |                                 |
|---|---------------------------------|
| 16a. Sugar, British West Indian refining.     | 18b. Coffee, Rio, good.         |
| 16b. Sugar, beet, German, 88 p. c. f. o. b.   | 19a. Tea, Congou, common.       |
| 17. Sugar, Java, floating cargoes.            | 19b. Tea, average import price. |
| 18a. Cdttee, Ceylon plantation, low middling. | 19c. Tea, Indian, good medium.  |

<sup>1</sup> Journal of the Royal Statistical Society, March, 1911, pp. 415-420.

*Minerals (10 price series).*

- |  |   |
|--|---|
| 20a. Iron, Scotch pig.                   | 23. Tin, Straits.                       |
| 20b. Iron, Cleveland (Middlebrough) pig. | 24. Lead, English pig.                  |
| 21. Iron, bars, common.                  | 25a. Coal, Wallsend, Hetton, in London. |
| 22. Copper, Chile bars.                  | 25b. Coal, Newcastle steam.             |
| — Copper, English tough cake.            | 26. Coal, average export price.         |

*Textiles (11 price series).*

- |                                    |  |
|------------------------------------|--|
| 27. Cotton, middling American.     | 32a. Wool, merino, Port Phillip, average fleece. |
| 28. Cotton, fair Dhohera.          | 32b. Wool, merino, Adelaide, average grease.     |
| 29a. Flax, St. Petersburg.         | 33. Wool, English, Lincoln half hogs.            |
| 29b. Flax, Russian average import. | 34. Silk, Tsatlee.                               |
| 30a. Hemp, Manila fair roping.     |  |
| 30b. Hemp, St. Petersburg clean.   |  |
| 31. Jute, good medium.             |  |

*Sundry materials (16 price series).*

- |                                  |   |
|----------------------------------|---|
| 35a. Hides, River Plata, dry.    | 40b. Seeds, linseed.                        |
| 35b. Hides, River Plata, salted. | 41. Petroleum, refined.                     |
| 35c. Hides, average import.      | 42. Soda, crystals.                         |
| 36a. Leather, dressing hides.    | 43. Nitrate of soda.                        |
| 36b. Leather, average import.    | 44. Indigo, Bengal good consuming.          |
| 37. Tallow, town.                | 45a. Timber, hewn, average import.          |
| 38. Oil, palm.                   | 45b. Timber, sawn or split, average import. |
| 39. Oil, olive.                  |   |
| 40a. Oil, linseed.               |   |

## SUBSTITUTIONS AND ADDITIONS.

The method of calculating the index adopted when it was deemed necessary to add or drop quotations for articles is not disclosed. No mention is made of the necessity of quoting other grades of commodities than those formerly quoted, but it is reasonable to believe that in a period of this length it has been found necessary to do so.

## INTERPOLATION.

It may have been impossible to secure complete statistical material during the full period, but, if so, the author makes no mention of the fact. Where prices were abnormal, as cotton during the Civil War in the United States, no corrections were made, quotations being used as found.

## WEIGHTING.

The index number is unweighted. The author has, however, given to certain important commodities a larger influence in computing the index number by quoting as separate articles several different varieties or grades of the same commodity. For example, English wheat and American wheat constitute two separate articles, as do prime beef and middling beef; also prime mutton and middling mutton. Similarly, sugar, iron, coal, cotton, wool and oil are each given double importance in the computation of the index.

## TESTING

Beginning with the index numbers of the year 1892<sup>1</sup> two tests were applied, the one consisting of weighting the relative prices according to the "money-values" of the commodities in accordance with their importance in the trade of the United Kingdom during the 3-year period 1889-1891; the second method consisting of weighting them according to their "mass-quantities" of other years. In the latter method the quantities of imports and exports of any one year are reduced to a nominal money value by multiplying the number representing the quantity of the article by the number representing the average prices of said articles during the years 1867-1877.

In his presentation for the year 1895<sup>2</sup> Mr. Sauerbeck used the geometric average<sup>3</sup> of Jevons and calculated by that means a total index for his 45 articles for the years 1880, 1894, and 1895, and compared it with his own arithmetic averages, both simple and weighted.

After 1907 the single test of weighting according to average "money-values" of the commodities for the 3-year period 1904-1906 was employed.

The author makes no direct statement in regard to the process of finding the nominal values of the several articles, beyond stating that one factor is the average price of the article during the base period 1867-1877. The other factor, or that quantity which represents the "importance in the United Kingdom" of the article, appears to be the average of the annual production plus imports for the chosen 3-year period. Due warning is given that this figure, which represents the total trade in the commodity including reexports, must not be considered as representing the actual consumption of the commodity in the United Kingdom.

A second test was in use up to and including the report for 1907. It is stated that the estimated actual values of the 45 articles consumed in the United Kingdom were obtained by taking the production on the basis of Mr. Sauerbeck's price and the imports at British Board of Trade values. The ratio of these actual prices to the nominal values on the basis of the average prices from 1867 to 1877 constituted a second weighted index. The explanation of this second test is not fully stated.

## TABLE OF RESULTS.

The principal table in this compilation shows the index number for the four general groups, and the grand total index. In addition there are three subindexes of food and an index of all materials contained

<sup>1</sup> Journal of the Royal Statistical Society, June, 1893, pp. 215-247, 254.

<sup>2</sup> *Idem*, March, 1896, pp. 193, 194.

<sup>3</sup> To find the geometrical mean, the logarithm is taken of the percentage figure of each article, the total of all logarithms is divided by 45—the number of articles—and the antilogarithm, the number corresponding to the average logarithm, is the geometrical index number. (Journal of the Royal Statistical Society March, 1896, p. 194.)

in the groups of minerals, textiles, and sundry materials. The following data, showing the variations in the group index numbers and in the general index, have been compiled from various issues of the Journal of the Royal Statistical Society.<sup>1</sup>

SUMMARY OF INDEX NUMBERS, 1846 TO 1913.

(Base period, 1867-1877-100.)

Date.	Food.				Materials.				Grand total.
	Vegetable food (corn, etc.).	Animal food (meat, etc.).	Sugar, coffee, and tea.	Total food.	Minerals.	Textiles.	Sundry materials.	Total materials.	
1846	106	61	98	85	92	77	86	85	89
1847	129	88	87	103	94	78	86	86	86
1848	92	83	69	84	78	64	77	73	78
1849	79	71	77	76	77	67	75	73	74
1850	74	67	87	75	77	78	80	78	77
1851	73	68	84	74	75	75	79	76	75
1852	80	69	75	75	80	78	84	81	78
1853	100	82	87	91	105	87	101	97	95
1854	120	87	85	101	115	85	109	104	102
1855	120	87	89	101	109	84	109	101	101
1856	109	89	97	99	110	89	109	102	101
1857	105	89	119	102	108	92	119	107	105
1858	87	83	97	88	96	84	102	94	91
1859	85	85	102	89	98	88	107	98	94
1860	99	91	107	98	97	96	111	100	99
1861	102	91	96	97	91	92	100	99	98
1862	96	86	98	94	91	123	106	107	101
1863	87	85	99	89	93	149	101	115	103
1864	79	89	106	88	96	162	98	119	105
1865	94	97	91	91	91	134	97	108	101
1866	95	96	94	95	91	130	92	107	102
1867	115	89	94	101	87	110	100	100	100
1868	113	88	96	100	85	106	102	99	99
1869	91	96	98	94	89	109	100	100	98
1870	88	98	95	93	89	106	99	99	95
1871	94	100	100	98	93	103	105	101	100
1872	101	101	104	102	127	114	108	115	109
1873	106	109	106	107	141	103	106	114	111
1874	105	103	105	104	115	92	96	100	102
1875	93	108	100	100	101	88	92	93	95
1876	92	108	98	99	90	85	95	91	95
1877	100	101	103	101	84	85	94	89	94
1878	85	101	90	96	74	78	88	81	87
1879	87	94	87	90	73	74	85	78	83
1880	89	101	88	94	79	79	81	83	84
1881	84	101	84	91	77	77	80	80	85
1882	84	104	76	89	79	73	85	80	84
1883	82	103	77	89	76	70	84	77	82
1884	71	97	83	79	68	68	68	61	73
1885	68	88	63	74	66	65	76	70	72
1886	65	87	60	72	67	63	69	67	69
1887	64	79	67	70	69	65	67	67	68
1888	67	82	65	72	73	64	67	69	70
1889	65	86	75	75	75	70	68	70	72
1890	65	82	70	73	80	66	69	71	72
1891	75	81	71	77	76	69	69	68	72
1892	65	84	69	73	71	67	67	65	68
1893	59	85	75	72	65	59	67	65	68
1894	55	80	65	66	64	63	64	60	63
1895	54	78	62	64	62	52	65	60	62
1896	53	73	59	62	63	54	63	60	61
1897	60	79	62	65	65	61	62	59	62
1898	67	77	51	68	70	51	63	61	64
1899	60	79	53	65	92	65	65	70	68
1900	62	85	54	69	108	66	71	80	75
1901	62	85	46	67	89	60	71	72	70
1902	63	85	41	67	82	61	71	71	69
1903	62	84	44	66	83	69	69	72	69
1904	63	83	50	68	81	71	67	70	67
1905	63	87	52	69	87	72	68	75	72
1906	62	89	46	67	101	80	74	83	77
1907	69	88	48	72	107	77	78	86	80

<sup>1</sup> September, 1886, p. 648; March, 1891, p. 128; March, 1911, p. 408; April, 1914, p. 556.



## SUMMARY OF INDEX NUMBERS, 1846 TO 1913—Concluded.

Date.	Food.				Materials.				Grand total.
	Vegetable food (corn, etc.).	Animal food (meat, etc.).	Sugar, coffee, and tea.	Total food.	Minerals.	Textiles.	Sundry materials.	Total materials.	
1908.....	70	89	48	72	89	62	73	74	73
1909.....	71	89	50	73	86	64	76	75	74
1910.....	65	96	54	74	89	73	81	81	78
1911.....	70	90	61	75	93	76	81	83	80
1912.....	78	96	62	81	110	76	82	88	85
1913.....	69	99	54	77	111	84	83	91	86
Average:									
1902-1911.....	66	88	49	71	90	70	74	77	74
1890-1899.....	61	80	63	68	71	56	66	64	66
1878-1887.....	79	95	76	84	73	71	81	76	79

The general index was 83.5 for January, 1914; 83.8 for February; 82.8 for March; 82.3 for April; and 82.8 for May.

## INDIA.

## INDEX NUMBERS (RUPEE PRICES) OF FRED. J. ATKINSON.

## PUBLICATION AND HISTORY.

Index numbers of rupee prices in India for the years 1861-1895 were first published by Fred. J. Atkinson, Accountant General, United Provinces, India, in the Journal of the Royal Statistical Society for March, 1897. Those for the years 1896 and 1897 were presented in the Journal for June, 1898, and those for the years 1898 to 1901 in the number for March, 1903. In the number for September, 1909, they were brought up to the end of 1908.

In the March, 1907, issue Atkinson makes the following remarks introductory to his study:

The extraordinary fall in gold prices led to the preparation by several economists of figures detailing the course that prices had taken annually for many years back. No attempt has, however, hitherto been made to deal with the course of silver prices. The consequence is that various contradictory statements have been made on the subject at different times, and the general impression prevails, probably based on the declared values of exports from India, that silver prices have been practically stable for the past 25 years, and the inference drawn is that silver as a measure of value possesses qualities of stability which gold is declared not to possess. It is with the object of coming to some definite conclusion that the present figures have been worked out with considerable difficulty, and whether the conclusions arrived at hereafter are agreed to or not, the figures themselves will, it is hoped, prove useful to economists generally.

This paper deals only with silver prices in India—it would perhaps be more accurate to say "rupee prices in India"; but the rupee price represented the silver price up to the year 1893, and it seems probable that up to that time India practically fixed silver prices throughout the world. Since 1893, the year in which the mints were closed, the rupee and silver have diverged, and the prices given are rupee prices.

## SOURCE OF QUOTATIONS.

In preparing his index numbers, Atkinson, while adopting Sauerbeck's principles, did not base his figures on the prices of imported articles but on those of the native products of India. This was necessary, because the bulk of the trade of India is concerned with the products of the country, imports representing only some 8 or 9 per cent of the exported products. Moreover, a considerable portion of the articles produced are mainly for the purpose of export and are but little used by the natives of the country. It is evident, therefore, that prices must necessarily be affected rather by the production in common use than either by imports or exports.

Sauerbeck takes the majority of the prices he quotes from the London market. In India, however, the production and prices vary so greatly in different parts of the country that to take only one market, as Calcutta or Bombay, and treat every article as of equal or nearly equal importance would give a very inaccurate idea of the actual state of affairs. To avoid this, Atkinson prepared a statement based on the agricultural returns and financial and commercial statistics published by the Government of India, and the administration reports of the various native States, giving for the year 1893, with a fair degree of accuracy, the agricultural and manufactured products of India and the relative importance of each.<sup>1</sup>

Next, accepting the fact that India in its economic conditions represents a cluster of different countries, it had to be ascertained in what particular markets the prices of the various articles should be taken. Atkinson accordingly prepared a table showing the area of cultivation in 1893-94 of each product in each Province of India, and the price of each product was, as far as possible, taken in the Province or Provinces in which the area of its cultivation is greatest.

The prices taken were obtained from various sources; partly from the prices current which the chambers of commerce of Calcutta, Bombay, and Madras issue; partly from the publication "Prices and Wages of India," issued by the Government of India, and partly from private sources. A few only, when figures were not elsewhere obtainable, were taken from the export accounts. •

## BASE PERIOD.

In the first table of index numbers prepared in 1897 Atkinson took the year 1871 to represent the number 100. This year was selected because in it Sauerbeck's index number of gold prices was 100, and the price of silver was approximately the same (99.7). This selection had the advantage of permitting a ready comparison of the course of rupee prices with that of gold prices, which was useful in connection with the currency question. It is obvious, however, that prices of a

<sup>1</sup> See Journal of the Royal Statistical Society, March, 1897, Vol. LX, pp. 124 and 125.

single year can not be regarded as representing normal prices. As a matter of fact, rupee prices in 1871 were exceptionally low, and as the currency question had been settled, Atkinson in 1903 thought it best to use the average of the years 1868-1876, which may be regarded as fairly normal years, as the base period for another table of index numbers. Both tables, that with 1871 and that with 1868-1876 as the base period, were in 1908 brought up to date.

#### PRICES: HOW COMPUTED.

Briefly, the procedure adopted in preparing the index numbers was to ascertain the relative importance of each article as compared with the total value of all production in India as shown by the table of production for the year 1893. In computing the index numbers for each month and year for the whole of India, one or more prices at different important places of production were taken for each article in proportion to its relative importance to the whole. The general index number is based on the prices of 38 different commodities. Of these rice, representing three-tenths of the value of all products of India, was allotted 30 prices out of a total of 100 taken. Similarly wheat was allotted 5 prices and other grains 5, sugar 4, jowar 3, raggee, gram, bajra, and meat 2 each, and maize, barley, potatoes, spices, and ghee 1 each; making a total of 60 prices for food articles. For raw produce, seeds were allotted 4 prices, cotton 3, hides and skins 3, jute, indigo, opium, tobacco and timber 2 each, and tea, coffee, salt-peter, cutch, myrobalans, animal bones, coal, raw silk, and raw wool 1 each, making 29 in all. For manufactures, hides and skins were allotted 3 prices, cotton goods, jute goods, and oils 2 each, and silk piece goods and shellac 1 each, making 11 in all. Summarized, the division was:

	Prices.
Articles of food.....	60
Raw produce.....	29
Manufactures.....	11
Total.....	100

#### DESCRIPTION AND GROUPING OF COMMODITIES.

The individual commodities included in the general index numbers and the markets in which their prices were obtained are the following:

##### Articles of Food.

1-30. *Rice (15 prices)*.<sup>1</sup>—Monghyr, Calcutta; common, Bengal, eastern division; common, Calcutta; common, Patna; common, Bengal, Deltaic division; common, Bengal, Orissa division; common, Madras, southeast coast division; common, Madras, Salem; common, northwest provinces, eastern division; common, northwest provinces, central division; common, Burma, Rangoon; common, Burma, Tenasserim division; common,

<sup>1</sup> As rice is given an importance of 30 and only 15 prices were taken, each price has been doubled in computing the general index number.

central provinces, Nagpur; common, central provinces, Jubulpore; and common, Hyderabad, Bolaram. The quotations used are those published in "Prices and Wages" and from prices supplied by dealers.

31-35. *Wheat* (5 prices).—Common, northwest provinces, Cawnpore; common, Punjab, Delhi; common, central provinces, Nagpur; first quality, Central India, Nussirabad; and flour, Bombay, Poona.

36-38. *Jowar* <sup>1</sup> (3 prices).—Bombay; Madras, Salem; and Hyderabad, Bolaram.

39-40. *Raggee* <sup>2</sup> (2 prices).—Madras, southeast coast division; and Mysore.

41-42. *Gram* <sup>3</sup> (2 prices).—Punjab, central division; and northwest provinces, central division.

43-44. *Bajra* <sup>4</sup> (2 prices).—Bombay, Deccan division; and Madras, Salem.

45. *Maize* (1 price).—Chota, Nagpur.

46. *Barley* (1 price).—Delhi.

47-51. *Other grains* (5 prices).—Arhar, Allahabad; arhar, northwest provinces, Sub-Montano division; mung, Dal, Lucknow; masur, Lucknow; and chenna, Cawnpore. This classification in the agricultural returns includes a large number of different varieties of minor grains and pulses grown in different parts of the country, though the northwest provinces are preeminent in their cultivation. Reliable figures could be obtained for only a few, and the figures for some of these are not complete. Arhar (*Cajanus indicus*), the most important of these minor pulses, for which two prices have been given, and mung (*Phaseolus mungo*) are represented by complete figures. The prices for masur (*Erva lens*) and chenna (*Cicer arietinum*), were supplied by the commissariat department and commence only from 1875 and are averages of the financial year.

52. *Vegetables* (1 price).—Potatoes, Bombay.

53-56. *Sugar* (4 prices).—Gurputty, Calcutta; Dhulloah, Calcutta; Jaggery, cane, Madras; and Jaggery, Palmyra, Madras. Prices for the two refined sugars have been taken from the Calcutta prices current, supplemented by prices supplied by Bisouath, Law & Co., and those for raw sugar from the Madras prices current. Considerable difficulty was experienced in the case of refined sugar, as indeed in most of the quotations taken from the prices current, by the changes in nomenclature, which in some cases meant a change in actual quality. To continue the same quality throughout the entire period involved a method of calculation of comparisons. The result, however, is said to be approximately accurate.<sup>5</sup>

57. *Spices* (1 price).—Ginger, export accounts. Prices taken from the export accounts.

58. *Ghee* <sup>6</sup> (1 price).—Bombay.

59-60. *Meat* (2 prices).—Mutton, Bombay; beef, Bombay.

#### Raw Produce and Materials.

61. *Tea* (1 price).—Taken from the export accounts.

62. *Coffee* (1 price).—Taken from the export accounts.

63-65. *Cotton* (3 prices).—Dharwar; Broach; and Dholera. All obtained from the Bombay prices current.

66-67. *Jute* (2 prices).—Picked; and double triangle M. From Calcutta prices current.

<sup>1</sup> A cheap Indian grain used in making a kind of unleavened bread.

<sup>2</sup> A cereal grass (*Eleusine Carocana*) largely cultivated for food.

<sup>3</sup> The chick-pea (*Cicer arietinum*) of the East Indies, there extensively used as food for men, horses, and cattle.

<sup>4</sup> The spiked or pearl millet (*Pennisetia spicata*) one of the commonest food cereals of southern Asia.

<sup>5</sup> Journal of the Royal Statistical Society, March, 1897, Vol. LX, p. 90.

<sup>6</sup> Butter clarified by boiling or heating and skimming or straining until it becomes a liquid or semifluid oil, capable of being kept for many years. It enters into the composition of nearly everything eaten by the Brahmans.

68-69. *Indigo* (2 prices).—Bengal, good; and consuming. From Calcutta prices current.

70-71. *Opium* (2 prices).—Behar; and Malwa. From the monthly figures published by the Government of India.

72-73. *Tobacco* (2 prices).—Central India, Nussirabad; and Bombay.

74-77. *Seeds* (4 prices).—Linseed, bold; til; rape-yellow, mixed; and castor. The prices for linseed and rape were taken from the Calcutta prices current, those of til and castor seeds from the monthly figures published by the Government of India.

78-84. *Miscellaneous* (7 prices).—Saltpeter, 5 per cent refined; cutch,<sup>1</sup> Rangoon; myrobalans;<sup>2</sup> manure, animal bones; coal; raw silk, Surdales; and raw wool. The prices of saltpeter and raw silk were taken from the Calcutta prices current, those of cutch, myrobalans, and manure from the export accounts, and those of coal were furnished by the Bengal Coal Co.

85-87. *Hides and skins* (3 prices).—Raw hides, buffalo, Patna, slaughtered, arsenic; raw hides, cow, Burdwan, slaughtered; and raw skins, goat, Calcutta. Prices taken from the Calcutta prices current.

88-89. *Timber* (2 prices).—Bamboos, Calcutta; teak, Rangoon. The prices for bamboos are taken from the figures published in the Government of India publication "Prices and Wages." The prices on 1st of January of each year beginning from 1871 only are given. Monthly prices for the series of years were not obtainable. The prices for Rangoon teak were taken from the Calcutta prices current.

#### Manufacturers.

90-91. *Cotton goods* (2 prices).—Yarn 1/203, and T cloth, 44 inches. These are taken from "Prices and wages" and represent the prices as given to the Government of India by the Bombay Mill Owners' Association on 1st of January and July of each year.

92-93. *Jute goods* (2 prices).—Bags, No. 2 twill; and bags for California. Prices taken from the Calcutta prices current.

94-95. *Oils* (2 prices).—Castor and coconut. The prices for castor oil were taken from the Calcutta prices current. Those for coconut oil are from "Prices and wages" the prices on January 1 of each year beginning from 1871 only are given, and monthly prices not being obtainable.

96. *Silk piece goods* (1 price).—Corah No. 1, from the Calcutta prices current.

97-99. *Hides and skins* (3 prices).—Tanned hides; cow; tanned skins, goat; and tanned skins, sheep. Prices are taken from the Madras prices current.

100. *Shellac* (1 price).—First quality, orange; from the Calcutta prices current.

#### WEIGHTING.

As has been mentioned above, Atkinson has weighted his general index numbers by giving to each commodity included as many quotations as corresponded to its importance in the whole production value of India in 1893. Since 1893 changes have occurred and some of the articles included are of more and some of less importance now than they were then; for example, indigo has declined while coal and cotton goods have materially increased in importance. But all the changes combined, according to Atkinson, would not make any material difference in the percentages as computed. He also remarks

<sup>1</sup> An extract from the bark of the mangrove used in tanning and dyeing.

<sup>2</sup> Prune-like fruits of several tropical plants of the genus *terminalia*, used for tanning and calico printing.

that during recent years the trade descriptions in some cases and the quality in others of articles entered in the various chamber of commerce prices current, from which several prices are taken, have undergone a change and that it has been a matter of difficulty to fit the changes, with accuracy, to the previous order of things.<sup>1</sup>

## TABLE OF RESULTS.

In the table printed in the *Journal of the Royal Statistical Society* for September, 1909, pp. 500-502, Atkinson gives, in addition to the index numbers of 100 articles of Indian production, index numbers for 11 articles of import. These are taken from data published annually since 1905 by the Commercial Intelligence Department of India. Under the title "Variations in Indian Price Levels" this department has published index numbers prepared on different lines from the system adopted by Atkinson—39 articles only being taken, of which 11 are imported, and all articles being given equal weight. As imported articles are regulated by their gold price and as the individual articles are not weighted according to their importance, it is not surprising that the two sets of index numbers do not agree, though their general trend is practically the same. It having been suggested, however, that so far as the dweller in India is concerned the prices of imports now materially affect his annual expenditure, Atkinson shows in column 6 of his table the index number of 11 articles of import equated to 1868-1876, as given by the commercial intelligence department, and then adds the index numbers of these 11 articles of import to those of the 100 articles of Indian production to which his own index numbers relate, and shows the total index number in column 7 of his table. In column 8 are shown Sauerbeck's index numbers for gold prices; in column 9 the gold price of silver; in column 10 the gold price of the rupee; in column 11 index numbers of articles of export; in column 12 Sauerbeck's gold prices index number of the 11 articles of import shown in column 6; and in column 13 Sauerbeck's gold prices index number of 11 articles exported by India.

This table is reproduced below with the exception of the data contained in columns 12 and 13.

<sup>1</sup> *Journal of the Royal Statistical Society*, September, 1909, Vol. LXXII, p. 497.

## INDEX NUMBERS OF PRICES IN INDIA, 1870 TO 1908.

[Source: Journal of the Royal Statistical Society, September, 1909, Vol. LXXII, pp. 800-802.]

Year.	Index numbers (percentages) of rupee prices in India (average of 1868-1876=100).				Index numbers of 11 articles of import.	Index numbers of 11 articles including 11 articles of import.	Sauerbeck's gold prices (average 1867-1877 =100).	Gold price of silver (60.84d. per ounce =100).	Gold price of rupees (22.54d. =100).	Index number of articles of export (1868-1876 =100).
	Food (90 articles).	Raw produce (29 articles).	Manufactures (11 articles).	All prices (100 articles).						
1	2	3	4	5	6	7	8	9	10	11
1870.....	104	103	106	105	100	105	96	100	100	103
1871.....	85	99	106	91	93	91	100	100	100	97
1872.....	91	108	105	85	96	95	109	99	99	101
1873.....	96	99	100	97	105	98	111	99	99	102
1874.....	107	103	105	105	104	105	103	98	96	108
1875.....	92	96	100	94	95	94	96	93	93	98
1876.....	98	98	88	97	96	97	95	87	87	96
1877.....	142	102	90	125	93	122	94	90	90	105
1878.....	155	102	93	135	88	130	97	86	86	107
1879.....	137	104	95	123	87	119	83	84	84	109
1880.....	108	108	103	105	93	105	88	86	86	105
1881.....	93	103	102	96	95	95	85	85	85	100
1882.....	93	100	97	85	89	94	84	85	85	96
1883.....	96	100	97	96	83	85	82	83	83	97
1884.....	107	100	91	104	82	102	76	83	83	100
1885.....	107	98	85	103	79	101	72	80	80	94
1886.....	103	99	90	100	84	98	69	76	75	93
1887.....	103	101	96	101	87	100	68	73	73	97
1888.....	111	106	100	108	97	107	70	70	70	101
1889.....	116	111	109	114	96	112	72	70	70	106
1890.....	118	108	102	114	96	112	72	78	78	103
1891.....	123	106	100	116	88	113	72	74	74	105
1892.....	139	115	103	128	88	124	68	65	65	115
1893.....	131	117	113	125	94	122	68	58	64	122
1894.....	121	118	115	119	88	116	63	48	48	118
1895.....	113	125	118	116	91	114	62	49	57	115
1896.....	133	120	111	127	99	124	61	50	61	113
1897.....	171	114	103	149	90	143	63	45	65	115
1898.....	121	90	98	122	84	118	64	44	68	102
1899.....	122	111	102	117	91	114	68	45	69	102
1900.....	152	120	104	139	102	135	75	46	68	112
1901.....	148	117	106	135	101	132	70	45	68	110
1902.....	131	113	112	124	90	121	69	49	69	110
1903.....	124	113	108	119	93	116	69	41	69	108
1904.....	118	115	118	117	98	115	70	43	69	114
1905.....	139	116	121	130	101	127	72	46	66	113
1906.....	167	128	140	153	110	149	77	51	69	128
1907.....	178	134	144	162	122	158	80	50	69	138
1908.....	202	127	122	174	113	168	78	40	68	131

## ITALY.

## INDEX NUMBERS OF THE ANNUARIO STATISTICO ITALIANO.

## PUBLICATION.

Index numbers based on the prices of a limited number of commodities at wholesale are contained in the annual statistical report for Italy (*Annuario Statistico Italiano*), issued from the Office of the Director General of Statistics and Labor (*Direzione generale della statistica e del lavoro*).

## HISTORY.

Since 1886 the *Annuario Statistico Italiano* has presented tables showing fluctuations in the prices of a large number of commodities, both raw and manufactured, during a series of years. In the earlier reports these prices were shown for a period extending, in some

instances, back to 1862. In more recent issues the figures have been limited as a rule to the last five years preceding the date of publication.

Prior to 1912 no index numbers appear to have been computed, the data being given only in the form of actual average prices. In the report for 1912, however, was begun the publication of two series of index numbers based in the one case on the prices of a few articles of food furnished to the army, and in the other case on a larger number of articles of the same class supplied to 43 national boarding schools (*convitti nazionali*) of Italy. These index numbers were continued in the report for 1913.

#### SOURCE OF QUOTATIONS.

The price quotations on which the index numbers are based were furnished by the directors of the schools and by the minister of war (*ministero della guerra, direzione generale dei servizi logistici e amministrativi*).

#### BASE PERIOD.

The five years 1890-1894 constitute the base period in the series relating to the boarding schools. In the series for the army the relatives are based on the period 1900-1904.

#### PRICES; HOW SHOWN AND COMPUTED.

Only the average annual prices of the different commodities included in the two indexes are given in the reports. In several instances data for earlier years are lacking from the figures relating to the army.

#### NUMBER AND CLASS OF COMMODITIES.

The table of index numbers for supplies furnished to the army contains 8 commodities, while that for boarding schools contains 13 commodities. All articles belong to the food group.

#### DESCRIPTION AND GROUPING OF COMMODITIES.

The following articles are included in the table of index numbers for the army: Corn, bread (ration), Italian paste, rice, beef (young steer), coffee (roasted), sugar, and wine. The list of articles supplied to boarding schools for which index numbers are shown includes bread, Italian paste, rice, beef, sausage, fish (in oil), eggs, butter, oil, milk, coffee, sugar, and wine. In the latter series the index for beef is based on the average of the prices paid for young steer flesh and veal in a single institution. No further description of the commodities is furnished.

#### SUBSTITUTIONS, ADDITIONS, AND INTERPOLATION.

So far as can be determined from the information at hand, no additions to the list of articles or substitutions of one grade or quality of an article for another have been made. No prices appear to have been interpolated.



## WEIGHTING.

All commodities are given equal weight in the computation of the general index number for each series.

## TESTING.

The accuracy of these index numbers is not tested by comparison with similar data or by other means, so far as the published results show.

## TABLE OF RESULTS.

The table following contains the index numbers for the 13 commodities furnished to boarding schools during the period 1890 to 1913, inclusive.

INDEX NUMBERS BASED ON PRICES PAID BY THE NATIONAL SCHOOLS (CONVITTI NAZIONALI) FOR COMMODITIES NECESSARY FOR THE NOURISHMENT OF THE PUPILS, 1890 TO 1913.

(Base period, 1890-1894=100.)

Commodity.	Average prices for 1890-1894.	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901
Bread, kilograms.....	40.356	99.7	101.1	107.6	99.2	92.1	95.5	92.4	94.1	103.9	103.1	102.8	100.0
Italian paste, kilograms.....	.515	102.1	101.2	103.1	99.6	94.2	91.8	91.7	97.9	99.8	100.0	99.0	98.1
Rice, kilograms.....	.500	102.1	101.7	103.1	96.5	96.3	97.5	96.1	101.3	99.1	98.5	95.7	93.9
Beef, kilograms.....	1.624	99.4	104.7	100.5	98.8	95.4	97.0	95.2	93.8	91.4	90.7	90.6	93.5
Sausage, kilograms.....	2.681	99.8	98.9	101.1	101.1	98.8	100.3	101.3	101.5	102.2	98.2	104.2	104.8
Fish (in oil), kilograms.....	2.123	100.0	101.0	101.7	98.5	98.5	100.0	101.4	102.0	102.6	100.8	103.1	100.2
Eggs, dozens.....	.815	101.1	99.3	100.4	96.0	100.3	99.7	100.7	100.9	101.7	100.2	107.8	108.9
Butter, kilograms.....	2.792	99.5	97.4	101.0	100.2	101.7	101.0	100.2	102.4	98.8	97.4	98.4	102.0
Oil, liters.....	1.251	99.3	99.4	102.1	101.1	98.3	97.6	92.8	91.5	105.0	100.7	110.8	111.1
Milk, liters.....	.288	103.8	102.1	97.2	100.6	96.5	97.5	95.4	91.6	93.0	93.7	89.2	89.9
Coffee, kilograms.....	4.051	98.8	99.1	98.5	99.5	106.0	105.1	102.7	98.9	93.9	85.3	83.8	82.4
Sugar, kilograms.....	1.596	97.4	96.2	98.6	100.1	107.5	106.9	101.7	100.3	99.8	101.0	101.1	100.9
Wine, liters.....	.357	115.5	110.0	90.7	90.7	93.2	94.6	102.8	91.3	94.3	95.2	94.9	93.8
General index number.....	.....	101.4	100.9	100.3	98.8	98.4	98.3	98.0	97.5	98.9	97.3	98.6	98.4

Commodity.	Average prices for 1890-1894.	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913
Bread, kilograms.....	40.356	96.9	95.5	91.3	91.3	93.8	93.0	97.2	103.7	106.8	104.8	108.2	111.1
Italian paste, kilograms.....	.515	95.7	91.7	89.7	90.5	91.8	94.4	100.6	102.5	102.1	99.2	103.5	107.3
Rice, kilograms.....	.500	93.7	93.7	93.3	92.1	93.7	94.3	96.0	98.4	100.5	96.5	95.3	103.9
Beef, kilograms.....	1.624	93.8	92.6	96.6	101.4	102.6	102.8	102.6	111.2	112.0	124.7	132.6	124.6
Sausage, kilograms.....	2.681	104.3	107.6	109.1	111.6	109.4	111.7	118.9	118.4	130.6	139.1	138.3	146.5
Fish (in oil), kilograms.....	2.123	103.6	115.0	104.2	102.4	104.8	106.9	117.3	127.5	133.6	140.1	134.6	147.0
Eggs, dozens.....	.815	111.0	111.2	110.9	114.9	115.9	121.4	126.2	131.5	133.4	140.0	140.9	145.3
Butter, kilograms.....	2.792	99.9	101.3	101.7	100.6	103.1	104.9	107.4	111.0	112.4	113.9	118.1	120.0
Oil, liters.....	1.251	103.8	102.7	96.2	100.0	94.3	101.0	105.1	145.3	135.8	146.6	138.1	140.1
Milk, liters.....	.288	92.7	92.0	89.8	91.8	93.4	96.6	99.6	103.8	109.3	112.5	114.9	121.1
Coffee, kilograms.....	4.051	78.3	75.6	74.8	74.5	75.7	75.6	77.4	78.4	78.1	84.2	92.9	98.0
Sugar, kilograms.....	1.596	90.6	93.8	92.2	97.4	96.0	96.7	96.8	96.4	97.8	100.1	104.8	97.6
Wine, liters.....	.357	87.3	89.3	89.6	89.8	92.1	93.8	84.6	71.7	77.5	123.5	133.8	122.0
General index number.....	.....	98.8	97.1	95.3	94.7	97.4	100.0	102.3	107.5	109.8	117.2	119.7	121.8

<sup>1</sup> The prices used represent the average prices paid for beef (steers) and veal in one school. *Annuario Statistico Italiano*, 1912, p. 138; 1913, p. 184.

## INDEX NUMBERS OF ACHILLE NECCO.

## PUBLICATION AND HISTORY.

A volume entitled "La Curva dei Prezzi delle Merci in Italia negli Anni 1881-1909" (The Price Curve of Commodities in Italy during 1881-1909), which was published in Turin by Achille Necco in 1910,<sup>1</sup> contains four series of index numbers based in each case on the import or export values of certain important articles of commerce. Comparative tables showing the price fluctuations in several countries on a common basis, that of the year 1881, are also contained in the volume.

A continuation of the two principal series of these index numbers has been published by Necco in *La Riforma Sociale* for 1911, pages 68-72, and 1913, pages 621-635; also in a special bulletin entitled "Prezzi della Merci in Italia nel 1912" (Prices of commodities in Italy during 1912), appearing in 1914. In the last-named publication which also was issued by *La Riforma Sociale*, the figures for 1910, 1911, and 1912 have been supplied.

## SOURCE OF QUOTATIONS.

The data used in computing the index numbers were those formulated by the commissione centrale dei valori per le dogane (central commission for customs valuation) and published in the reports of the Ministry of Agriculture, Industry, and Commerce.

## BASE PERIOD.

The values of imported and exported articles for the year 1881, taken as 100, constitute the bases on which the two principal series were computed. The other two series appearing in the first volume issued in 1910 are based on the method employed by Pantaleoni and have for the standard of measurement the values of imports and exports, respectively, in 1878.

## NUMBER AND GROUPING OF COMMODITIES.

In each of the two main series of index numbers the groupings adopted in the collection of the customs revenue have been followed. Within the 16 principal groups there are approximately 400 different articles, each of which in turn may comprise several varieties.

The 16 groups of commodities are as follows:

1. Spirits, beverages, oils.
2. Colonial products, spices, tobacco.
3. Chemical products, medicinal substances, resins, gums, etc.
4. Coloring and other materials for dyeing and tanning.
5. Hemp, flax, jute, and other fibrous plants.
6. Cotton.

<sup>1</sup> Società Tipografica-Editrice Nazionale (via Roux e Viarengo), Torino. The same information also was published as a supplement to *La Riforma Sociale*, Vol. XXI, September-October, 1910.

7. Wool, horsehair, and other hair.
8. Silk.
9. Wood and straw.
10. Paper and books.
11. Hides.
12. Minerals, metals and their manufactures.
13. Stone, earthen, glass, and crystal ware.
14. Cereals, flour, Italian paste, and vegetable products.
15. Animals and animal products.
16. Miscellaneous commodities.

The two index numbers of import and export values computed according to the method adopted by Pantaleoni are likewise based on commodities selected from the tariff schedules. There are 19 import and 12 export commodities as follows:

## Imports:

1. Petroleum, refined.
2. Coffee, raw.
3. Sugar, second grade.
4. Dyes, in dry state.
5. Cotton, raw.
6. Cotton cloth, unbleached.
7. Wool, natural or unwashed.
8. Woolen cloth (combed wool).
9. Woolen cloth (carded wool).
10. Hides of oxen and cows.
11. Leather.
12. Cast iron (in pigs or plates).
13. Bar iron and steel in sheets.
14. Copper, brass, and bronze.
15. Machinery (not specified).
16. Grain

## Imports—Concluded.

17. Cheese.
18. Dry goods, ordinary.
19. Dry goods, fine.

## Exports:

1. Wine in bottles.
2. Olive oil.
3. Boric acid.
4. Sulphate of quinine.
5. Soap (common).
6. Hemp, raw.
7. Silk, raw.
8. Straw braid for hats.
9. Sulphur, raw and refined.
10. Oranges and lemons.
11. Almonds (shelled).
12. Coral (polished).

## WEIGHTING.

In the computation of his two main series of index numbers Necco adopted the method employed by De Foville in following the changes in the import and export values of France from 1826 to 1880. It consists in weighting the prices of the first of any two consecutive years with the mass quantities of imports or exports of the second year. The price of the preceding year in any instance is multiplied by the mass quantity of the current year, giving what is termed the "provisional value." The price of the current year is then multiplied by the mass quantity to produce the "actual value." These provisional and actual values of the imports or exports are then summed and compared to ascertain the increase or decrease which has taken place in these values as between the two years under comparison. For example, it might be found that the import values of 1881 were 2 per cent lower than those of 1880; those of 1882, 4 per cent higher than those of 1881; those of 1883, 3 per cent lower than those of

1882; and so on. Assuming now that the import values of the year 1880 are taken as the base, or 100, the index for 1881 would be 98, since the import values in 1881 decreased 2 per cent from those of 1880. Again in 1882 the import values increased 4 per cent over what they were in 1881; that is, 4 per cent of 98, or 3.92. Therefore the index for 1882 is 98 plus 3.92, or 101.92. In like manner, since import values in 1883 were 3 per cent lower than in 1882, the index for 1883 becomes 97 per cent of 101.92, or 98.86.

It is seen that under Necco's system there is a constantly changing weight, namely, the quantity of an article imported or exported each year. No direct relationship exists between the index number of any one year and that of the basic year, since, as has been said, the relative importance of a commodity changes from year to year according to the quantity imported or exported, as the case may be.

Pantaleoni likewise employed a fluctuating weight in determining the relative importance of the commodities entering into his index number. Under his original plan there was determined each year the percentage which the value of each commodity imported or exported, as the case might be, formed of the total value of all imported or exported commodities. This figure was then used as a weight for each commodity included in the final index number. To simplify this rather laborious process from year to year, Pantaleoni suggested—and Necco followed the suggestion in extending Pantaleoni's indexes—that it would be advisable to ascertain the average import or export value of each commodity concerned over a period of years and then calculate the ratio between the average value of each commodity so ascertained and the total average value of all imports and exports over the same period and use the result as a weight for each commodity for each of the years involved in the period under consideration. Necco has done this for each of the three periods, 1890–1895, 1896–1901, and 1902–1908, in the case of imports and for each of the two periods, 1890–1898 and 1899–1908, in the case of exports.

The result of this method is that there is employed a constant weight over a limited number of years, a weight which may be termed the average importance of the particular commodity as determined by its proportionate value in the total import or export trade of the country, as the case may be.

#### TABLE OF RESULTS.

On page 32 of Necco's original work<sup>1</sup> are given the following index numbers for imports and exports, respectively. The first series in each case is Necco's own number computed according to the method of Benini. The two remaining series are those of Pantaleoni and

<sup>1</sup> *La Curva dei Prezzi delle Merci in Italia negli Anni 1881–1900.*

Benini reduced for the sake of comparison to a common-base period, that of the year 1881. Necco's figures for the years 1910 to 1912 have been supplied from the "Prezzi della Merci in Italia nel 1912," published in 1914.

## INDEX NUMBERS OF ITALIAN IMPORTS AND EXPORTS.

(Base period, 1881=100.)

	Imports.			Exports.		
	Necco.	Pantaleoni.	Benini.	Necco.	Pantaleoni.	Benini.
1881.....	100.00	100.00	100.00	100.00	100.00	100.00
1882.....	96.85	98.38	96.43	96.54	92.71	94.44
1883.....	93.01	94.90	94.05	91.96	85.46	91.43
1884.....	87.42	86.73	87.64	88.08	85.42	85.62
1885.....	82.68	78.57	82.49	84.64	79.17	81.95
1886.....	81.95	74.49	80.81	84.11	84.37	81.64
1887.....	79.53	71.43	79.61	79.62	80.21	77.80
1888.....	81.19	73.47	79.97	78.73	69.79	74.40
1889.....	82.58	73.47	81.58	80.49	78.12	76.89
1890.....	83.23	73.47	82.24	81.72	78.12	79.58
1891.....	79.25	71.43	78.62	76.31	67.71	74.25
1892.....	77.43	68.37	77.04	76.37	77.08	74.33
1893.....	76.73	66.33	76.41	78.18	77.08	74.15
1894.....	71.81	61.22	71.14	71.97	68.75	70.59
1895.....	71.04	60.20	69.47	72.83	70.83	71.60
1896.....	70.96	60.20	69.87	69.02	63.50	67.72
1897.....	70.42	60.20	69.30	67.80	62.60	66.40
1898.....	74.49	62.24	73.23	69.09	64.67	67.79
1899.....	79.77	66.33	76.81	75.56	79.17	74.02
1900.....	86.47	66.33	83.17	75.10	72.92	73.58
1901.....	79.65	65.31	77.87	72.73	69.79	71.25
1902.....	76.75	63.27	74.48	74.10	72.92	72.14
1903.....	77.73	64.30	.....	76.92	78.12	.....
1904.....	80.05	66.33	.....	76.07	72.92	.....
1905.....	79.53	67.35	.....	77.12	73.96	.....
1906.....	84.29	71.43	.....	79.54	78.12	.....
1907.....	87.96	73.47	.....	83.72	86.46	.....
1908.....	84.55	73.47	.....	77.88	69.79	.....
1909.....	85.45	76.53	.....	79.29	72.92	.....
1910.....	86.55	.....	.....	82.12	.....	.....
1911.....	87.35	.....	.....	83.44	.....	.....
1912.....	89.85	.....	.....	83.54	.....	.....

## JAPAN.

## INDEX NUMBERS OF THE DEPARTMENT OF AGRICULTURE AND COMMERCE.

## PUBLICATION.

Wholesale prices, with index numbers for the same, are published annually in the reports issued by the Department of Agriculture and Commerce of Japan. These reports, which are printed in English as well as Japanese, contain various data of a statistical nature relating to the agricultural, mining, manufacturing, and other industries of the Empire and its dependencies. No text analysis is given of the tables included in the reports.

## HISTORY.

The quotations of prices, according to N. Hanabusa, director of the Japanese bureau of statistics, were not matters of record prior to 1886 except for the four standard commodities: Rice, barley, beans,

and sake, for which there were incomplete records for earlier years. The latest available report, issued in March, 1914, is the twenty-ninth of the series.

#### SOURCE OF QUOTATIONS.

Wholesale prices of the articles for which index numbers are compiled are obtained from the cities of six statistical divisions of the Empire by the Department of Agriculture and Commerce. No statement is made in the reports as to the methods of securing this information.

#### BASE PERIOD.

The base period for each year from 1901 to 1912, inclusive, is the year 1900 taken as 100. In each of the reports for this series of years, except the one issued in 1905, index numbers are computed for the years from 1900 to two years earlier than the date of publication. For example, the report published in 1908 contains index numbers for the years 1900 to 1906, inclusive. The latest report, issued in 1914, comprises index numbers for the years 1904 to 1912 only, 1900 being still retained as the base or 100.

The report of 1905, which is the earliest one available, uses the year 1887 as a base or 100 and shows average annual prices and index numbers for each year for the several commodities from 1887 to 1903 inclusive. In the case of a few commodities for which data for 1887 were lacking, a subsequent year was used as the base. There is no general index number in this volume for the groups of commodities as in those for succeeding years.

#### PRICES: HOW SHOWN AND COMPUTED.

Average annual prices are published for each commodity taken separately for all years subsequent to and including 1900. In the report of 1905 there is no grouping of the commodities, while in those for other years the commodities are divided into three main groups—food, clothing, and material.

Following the average annual prices of the different articles for the Empire as a whole, there is a table showing for each commodity the average monthly price and the average price for the year of that commodity in each of the principal cities of the several statistical divisions and in the country at large, all data being for the year prior to the one preceding the publication of the report.

#### NUMBER AND CLASS OF COMMODITIES.

Sixty-five commodities are quoted in the report for 1912, which is the latest year for which data are available. Leaf tobacco was not quoted after 1905, nor cut tobacco after 1907.

<sup>1</sup> Bulletin de l'Institut International de Statistique, tome XIX, 3<sup>e</sup> livraison, p. 227.

The 65 commodities, including both raw and manufactured articles, are as follows:

Rice, superior.	Calico.
Rice, medium.	Silk tissue, for lining.
Rice, inferior.	Kaiki silk.
Barley.	Petroleum.
Naked barley.	Coal.
Wheat.	Firewood.
Soy beans.	Charcoal.
Small red beans.	Rapeseed oil.
Salt.	Mino paper.
Soy (sauce).	Hanahi paper.
Miso (sauce, soy beans, rice, water).	Indigo (Japanese).
White sugar, domestic.	Balk (beam) pine.
White sugar, foreign.	Balk (beam) sugi.
Brown sugar, domestic.	Balk (beam) keyaki.
Brown sugar, foreign.	Balk (beam) fir.
Sake (rice liquor).	Plank, pine, 6 bu (.7155 inch) thick.
Tea.	Plank, sugi, 6 bu (.7155 inch) thick.
Bonito (fish), dried.	Plank, pine, 4 bu (.477 inch) thick.
Beef.	Plank, sugi, 4 bu (.477 inch) thick.
Eggs.	Log, pine.
Milk.	Log, sugi.
Umehoshi (pickled plum).	Shingles.
Takuwan (pickled radish).	Sleeper, chestnut.
Ginned cotton, domestic.	Sleeper, Hinoki.
Ginned cotton, foreign.	Pig iron, domestic.
Cotton yarns, domestic.	Pig iron, foreign.
Cotton yarns, foreign.	Nails, foreign.
Raw silk, superior.	Straw.
Raw silk, medium.	Hay.
Raw silk, inferior.	Dried sardine (for manure).
Hemp.	Herring (for manure).
Bleached cotton fabric, domestic.	Rapeseed cake.
Grey shirting, foreign.	

#### DESCRIPTION AND GROUPING OF COMMODITIES.

In the report for 1904 and in subsequent issues the commodities for which average yearly prices and index numbers are given are divided into three groups: (1) Food, etc.; (2) clothing; (3) materials. Under food the following articles are listed: Rice, barley, naked barley, wheat, soy beans, red beans, salt, sake, soy (soy-bean sauce), miso, tea, bonito (dried fish), beef, eggs, milk, umehoshi (pickled plum), takuwan (pickled radish), sugar (4 grades), tobacco (2 grades)—a total of 23 articles.

Under clothing are listed ginned cotton (2 grades), cotton yarns (2 grades), raw silk, hemp, bleached cotton fabric, gray shirting, calico, silk tissue, kaiki silk—11 articles in all.

Under materials are listed the following: Petroleum, coal, firewood, charcoal, rapeseed oil, paper (2 grades), indigo, beams (4 grades),

planks (4 grades), logs (2 grades), shingles, sleepers (2 grades), pig iron (2 grades), nails, straw, hay, manure (fish, 2 grades), rapeseed cake—altogether 29 articles.

As previously stated, leaf tobacco was discontinued after 1905 and cut tobacco after 1907.

#### SUBSTITUTIONS AND ADDITIONS.

So far as the reports show, no substitutions of a particular grade or quality of an article for another grade or quality of the same article or for a different article have been made at any time. Additions to the list of articles have apparently been made from time to time as data became available. In all such cases the average price for the earliest year for which data were available was taken as the base, or 100. No additions have been made since 1901, in which year logs (pine and sugi<sup>1</sup>) appear to have been included for the first time.

#### INTERPOLATION.

No interpolation of prices has been made in any of the reports so far as can be determined. In cases where prices for a particular month in a given locality were lacking, the averages for the year and for the country at large have been based on the data for the remaining months and localities.

#### WEIGHTING.

There is no attempt at weighting any of the commodities for which index numbers have been computed, apart from the inclusion in the tables of several grades of the more important articles.

#### TESTING.

No comparison of these index numbers with those for other countries has been made in the reports, nor have other means of testing their accuracy been employed, so far as the published results show.

#### TABLES OF RESULTS.

The index numbers for average wholesale prices of four staple articles, viz, rice, barley, beans, and sake,<sup>2</sup> from 1881 to 1909, inclusive, are shown in the following table published in the bulletin of the international statistical institute.<sup>3</sup> This table was compiled by the director of the Japanese imperial statistical bureau, Mr. N. Hanabusa, and is based on data collected annually during the months of March, June, September, and December from six principal cities of the Empire by the minister of agriculture and commerce. Only medium grades of the articles for which quotations were secured have been included in the compilation.

<sup>1</sup> A genus of evergreen trees of the pine family.

<sup>2</sup> A native beer made from rice.

<sup>3</sup> Bulletin de l'Institut International de Statistique, tome XIX, 3<sup>e</sup> livraison, p. 239.



## INDEX NUMBERS FOR FOUR PRINCIPAL COMMODITIES, 1881 TO 1909.

Year.	Rice.	Barley.	Beans (Japanese).	Sake (rice wine, clear).	General index.
1881.....	100	100	100	100	100
1882.....	84	88	102	89	90
1883.....	60	63	77	78	72
1884.....	52	59	61	75	64
1885.....	64	64	64	64	77
1886.....	56	55	57	80	66
1887.....	52	46	58	83	66
1888.....	48	41	57	78	61
1889.....	61	47	71	90	69
1890.....	90	72	78	85	83
1891.....	75	70	74	84	78
1892.....	77	64	72	84	78
1893.....	78	64	79	83	79
1894.....	91	72	81	91	87
1895.....	90	73	84	102	92
1896.....	103	71	93	118	103
1897.....	129	94	113	146	129
1898.....	145	117	119	170	147
1899.....	108	85	123	165	133
1900.....	126	84	115	192	147
1901.....	127	72	108	201	149
1902.....	133	81	104	201	150
1903.....	153	113	110	205	164
1904.....	143	137	147	208	172
1905.....	137	123	146	223	175
1906.....	155	85	139	239	189
1907.....	173	108	149	240	189
1908.....	167	113	134	253	192
1909.....	139	103	117	251	180

The following table, compiled from the 28th and 29th reports of the Japanese Department of Agriculture and Commerce, shows the index numbers for each of the three groups—food, clothing, and materials, and for the three groups combined, by years, from 1900 to 1912. The indexes for the groups as a whole apparently were obtained by taking the simple average of the index numbers for all articles included in the three groups reported.

## INDEX NUMBERS FOR THE THREE PRINCIPAL GROUPS OF COMMODITIES, 1900 TO 1912.

Years.	Food.	Clothing.	Materials.	All groups combined.
1900.....	100	100	100	100
1901.....	98	100	95	97
1902.....	102	98	92	97
1903.....	111	102	94	101
1904.....	124	109	95	108
1905.....	135	120	100	118
1906.....	129	123	101	114
1907.....	135	120	110	122
1908.....	136	120	113	122
1909.....	133	119	107	118
1910.....	132	124	110	130
1911.....	139	133	114	126
1912.....	154	130	119	138

<sup>1</sup> For index numbers of the separate commodities of each group see the statistical reports of Department of Agriculture and Commerce for 1911 and 1912.

## NETHERLANDS.

## INDEX NUMBERS OF THE NETHERLANDS STATISTICAL OFFICE.

## HISTORY AND PUBLICATION.

This index of wholesale prices has been prepared by the Netherlands Statistical Office and appeared for the first time in the monthly journal of that office in June, 1914.<sup>1</sup> It grew out of a compilation of tables on wholesale prices presented by the Statistical Office in its yearbook of 1913, and covered the years 1885 to 1913; it is being continued in the monthly journal of this same office.

## SOURCE OF QUOTATIONS.

Price quotations are reported from the different wholesale markets, the number and place of these markets not being specifically mentioned. Monthly price quotations are averaged annually.

## BASE PERIOD.

The base period is 1893, the average price of that year representing 100.

## NUMBER AND DESCRIPTION OF COMMODITIES.

There are twelve commodities for which separate index numbers are given; no general index for all commodities combined has been presented. A graphical presentation is shown for each of the commodities in four groups: (1) Wheat, maize, and rye; (2) crude grain alcohol, rapeseed, and flaxseed oil; (3) oleomargarine (best quality), coffee (Java), and beet sugar; (4) petroleum, tin (Banca), and refined grain alcohol.

## WEIGHTING.

A simple arithmetical average has probably been employed, no mention being made of any kind of weighting.

## TABLE OF RESULTS.

Index numbers for each of the twelve commodities are shown in the table which follows.

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<sup>1</sup> Maandschrift van het Centraal Bureau voor de Statistiek. The Hague, 1914, vol. 9, No. 6 (June) pp. 461-466.

## RELATIVE PRICES (INDEX NUMBERS) FOR TWELVE COMMODITIES IN THE WHOLE SALE MARKETS OF THE NETHERLANDS, 1885 TO 1913.

[Source: Maandschrift van het Centraal Bureau voor de Statistiek. The Hague, 1914, vol. 9, No. 6 (June), p. 462.]

(Base period, 1882-100.)

Year.	Wheat, Odessa.	Matze, Ameri- can.	Rye, Petro- grad.	Alco- hol, grain, crude.	Rapo- seed.	Oil, flax- seed.	Oleo- marga- rino, first qual- ity.	Coffee, Java.	Sugar, beet.	Kero- sene, 70° Abel test.	Tin, Banca.	Spir- its, grain, re- fined.
1885.....	124.19	106.88	102.96	113.42	110.94	108.09	95.73	48.85	93.48	162.67	97.95	116.93
1886.....	124.58	100.79	90.81	80.93	94.60	100.68	86.21	57.05	79.11	143.82	110.13	78.91
1887.....	123.83	101.42	81.94	90.07	94.89	102.14	92.41	94.33	80.07	139.40	125.32	90.76
1888.....	122.03	112.49	81.16	85.91	106.39	93.28	81.69	80.22	103.20	147.72	132.33	101.56
1889.....	119.01	96.84	105.16	102.68	129.69	98.72	83.55	93.96	107.04	154.28	105.43	120.70
1890.....	126.52	98.97	106.77	112.02	121.18	112.43	81.55	106.83	82.29	146.17	124.36	123.24
1891.....	137.22	137.63	150.51	135.53	119.50	105.00	99.53	110.20	89.24	134.81	102.52	131.12
1892.....	107.45	107.29	125.50	106.02	105.97	88.49	91.35	103.47	90.39	119.57	104.93	104.69
1893.....	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1894.....	78.96	98.52	81.19	66.06	85.91	97.84	81.23	98.50	75.42	104.60	79.72	68.23
1895.....	84.99	63.90	76.03	76.72	84.61	97.46	71.98	102.81	64.41	169.32	71.72	82.16
1896.....	96.88	71.85	73.50	74.18	90.94	86.36	53.35	96.78	68.77	144.91	67.54	81.38
1897.....	118.59	71.66	81.49	71.36	100.46	68.12	58.54	88.01	57.68	153.92	68.78	81.05
1898.....	124.77	84.61	101.82	110.30	99.26	75.71	57.22	66.22	61.18	163.48	79.84	114.00
1899.....	110.16	85.12	108.32	109.57	94.64	93.86	73.70	54.63	65.21	197.93	136.77	115.43
1900.....	109.45	95.60	103.32	96.95	111.64	146.08	69.81	67.74	95.58	218.67	140.32	115.62
1901.....	110.23	105.39	95.04	100.44	118.74	141.49	70.84	63.16	55.82	177.73	131.33	104.75
1902.....	106.01	127.40	102.99	94.80	93.99	140.56	96.31	65.91	44.44	176.99	138.09	103.87
1903.....	109.84	104.85	102.69	106.82	79.43	102.05	69.39	52.52	53.82	188.14	141.91	110.35
1904.....	131.64	104.97	100.06	132.34	74.52	78.59	69.59	57.40	65.37	192.65	141.88	128.09
1905.....	120.93	110.05	110.01	121.50	86.19	80.03	85.18	58.93	75.09	180.31	160.62	117.42
1906.....	123.52	101.07	119.81	109.46	105.43	96.87	81.85	63.19	57.40	199.05	202.25	126.79
1907.....	137.96	117.88	146.99	130.89	121.22	112.28	84.79	65.14	63.04	215.06	192.18	138.35
1908.....	137.01	137.27	140.98	130.53	129.43	103.67	104.31	68.30	68.68	220.02	150.38	130.02
1909.....	158.37	131.85	125.78	120.30	116.84	116.03	108.85	75.50	71.70	220.02	151.78	128.97
1910.....	137.85	115.02	110.92	101.81	90.88	185.65	100.92	81.27	83.33	217.49	172.92	128.61
1911.....	142.45	121.08	119.44	111.89	100.33	204.33	85.39	91.60	82.99	205.77	212.20	111.85
1912.....	150.14	144.92	133.68	161.62	121.05	170.08	112.30	100.51	80.53	235.57	234.53	181.38
1913.....	135.09	123.78	121.12	148.10	126.13	120.47	96.98	88.90	62.88	243.46	227.23	160.88
1914 (Jan. to July) 1.....	143.78	130.24	118.60	128.83	131.04	121.90	83.14	78.07	62.46	243.46	163.40	123.40
1914 (Aug. to Dec.) 1.....	206.94	.....	127.63	.....	149.04	113.40	83.83	74.17	243.40	222.55	208.27	.....
1915 (Jan.) 1.....	200.00	.....	160.99	.....	191.25	124.77	88.50	81.44	243.46	223.17	201.56	.....
1915 (Feb.) 1.....	202.58	.....	174.62	.....	214.12	132.62	88.50	80.23	243.46	176.68	200.21	.....

1 Maandschrift van het Centraal Bureau voor de Statistiek. The Hague, 1915, vol. 10 (March), p. 262.

## NEW ZEALAND.

## INDEX NUMBERS OF JAMES W. McILRAITH.

## PUBLICATION.

This index, which is based on the wholesale prices of certain important articles in New Zealand from 1861 to 1910, was published by the Government of that Dominion in 1911 in "The Course of Prices in New Zealand," by James W. McIlraith. It is stated in the introduction to the volume that the author intends to continue the tables from year to year, the results to appear annually in the "New Zealand Official Yearbook."<sup>1</sup>

## HISTORY.

The report is the result of a post-graduate research in economics at Canterbury College. It has two main objects: (1) To measure the changes in the general level of prices, year by year, since 1860; and (2) to attempt to ascertain the causes of the changes in the local price level. In the absence of any official index numbers for New Zealand the study was undertaken in the hope that it would "help all engaged in the solution of those practical problems of social life in which the changes in the purchasing power of money are an important factor."<sup>2</sup>

## SOURCE OF QUOTATIONS.

The author states that prices for all imported goods and for a few colonial products have been obtained at Wellington, the geographical and political center of New Zealand, while for all the cereals (including flour) and for pastoral products he has used prices at Christchurch, a city in the heart of the agricultural district of New Zealand. He further states, however, that while it seemed inadvisable to use Wellington prices for certain articles for certain years and then to use the prices from some other city for the same articles for other years, the nature of things demanded that the principle of continuity must be subordinated to that of accessibility. The data contained in the report were secured mainly from Wellington and Christchurch newspapers: "The New Zealand Trade Review and Price Current" (Wellington), "The Press" (Christchurch), and "The Lyttleton Times" (Christchurch) being the principal sources of information.

## BASE PERIOD.

The base or standard period is the decade 1890-1899. The author at first felt inclined to use 1867-1877, because this would have enabled

<sup>1</sup> An examination of the yearbooks for 1911, 1912, and 1913, however, fails to disclose any data bearing on this subject.

<sup>2</sup> The Course of Prices in New Zealand, James W. McIlraith, p. 3.

him to compare his figures more directly with those of Sauerbeck, but he decided that the period was too early in the development of New Zealand and that the data were insufficient. He found the decade chosen a period of comparatively stable prices, the average being almost identical with that for the 20 years 1886-1905.

#### PRICES: HOW SHOWN AND COMPUTED.

Wholesale prices for the articles upon which the index number is based were taken quarterly, during the first week of January, April, July, and October, or as near as possible to those dates. The simple average of the four prices was taken as the average price for the year. From these averages the simple average for 1890-1899 was computed and was taken as the base, or 100, the prices for each of the years included in the report being reduced to percentages of this figure. For each year the percentages representing the prices of the several articles were then added together and the result divided by the number of articles. The resulting figure is the general index number for the year.

#### NUMBER AND CLASS OF COMMODITIES.

The index number from 1887 to 1910 is based on the prices of 45 commodities, both raw and manufactured. Previous to 1887, according to the tables, the number of articles included was smaller and varied from time to time, being lowest in 1861 and 1862, when only 33 articles were represented. Since 1875 the index number has in every year been based on 41 or more commodities. The author states that his aim has been to make the list include, as far as data were available, the articles of the greatest importance in the trade of the country. He considers his selection of commodities superior to the selections of Sauerbeck and the Economist, because in his judgment these indexes contain undue proportions of raw materials.

#### DESCRIPTION AND GROUPING OF COMMODITIES.

Concerning nearly all of the 45 articles the statement is made that only the best grade is quoted. Further description of the articles, as far as given, appears in the following list which classifies the 45 commodities under 8 heads:

##### *Agricultural products (5 articles).*

Wheat, best on Christchurch market.	Oats, best on Christchurch market.	
Flour, best brands of New Zealand roller flour.		Outmeal, first-class New Zealand manufacture.
Barley, best on Christchurch market.		

*Pastoral products (8 articles).*

Wool, best merino, greasy. <sup>1</sup>	Lamb, carcasses exported. <sup>2</sup>
Wool, best half-bred, greasy. <sup>1</sup>	Bacon, best New Zealand product.
Beef, best quality, Addington (Christ-church) sales yard.	Cheese, best New Zealand product.
Mutton, carcasses exported. <sup>2</sup>	Butter, best New Zealand product.

*Liquors (5 articles).*

Beer (ale), Bass's "Dog's Head."	Claret (in bond).
Whisky, Teacher's (in bond).	Brandy, Hennessy's (in bond).
Port, Superior (in bond).	

*Beverages (3 articles).*

Tea, Congou, fine.	Cocon, Van Houten's.
Coffee, ground.	

*Oils (3 articles).*

Kerosene.	Castor oil.
Linseed oil (boiled).	

*Minerals (6 articles).*

Iron, galvanized, "Orb" brand (26 gauge).	Zinc.
Iron, bar.	Wire, black fencing, No. 8.
Lead, sheet.	Coal, Newcastle (New South Wales), on ship.

*Materials (7 articles).*

Cement, Portland.	Hops, Nelson (New Zealand). <sup>3</sup>
Soap, New Zealand.	Soda, carbonate.
Matches, plaids.	Soda crystals.
Candles, Price's London Sperm.	

*Other foods (8 articles).*

Sugar, Auckland (New Zealand), refined No. 1. <sup>4</sup>	Sago.
Currants.	Salt, Liverpool, fine.
Sultanas (raisins).	Salmon, in tins.
Rice.	Pepper, white.

**SUBSTITUTIONS AND ADDITIONS.**

The substitution of one description of an article for another description can not, except in a few cases, be traced in the report, owing to the vagueness of the descriptive terms employed. It appears quite probable, however, from the extensive period of time covered by the tables that a considerable number of such substitu-

<sup>1</sup> The quotations are prices of New Zealand wool at the London wool sales, minus freight from New Zealand, as reported by the London agents of H. Watson & Co., one of the principal wool-broking firms in New Zealand.

<sup>2</sup> Prices are deduced from estimated values of carcasses exported, as published in the "Statistics of New Zealand."

<sup>3</sup> This kind is quoted in later decades; Kentish is quoted in earlier periods.

<sup>4</sup> Best imported sugar was quoted prior to the opening of the Auckland refinery.

tions must have been made. In a number of instances additions to certain groups of commodities have been made since the initial year of the series. In such cases the index numbers for the added articles have been carried into the total of index numbers for the year and this total divided by the number of articles to obtain the level of prices for that year.

#### INTERPOLATION.

Much difficulty was experienced in securing data for the earlier years covered by the report, and for years prior to 1875 there was an occasional quotation lacking which the author deemed it necessary to supply by an interpolated figure. He thus describes his method of interpolation.

"I examined the price of the particular commodity in preceding and succeeding years. If those prices showed a continuous rise or fall, that was strong evidence of the probability of the missing price being one of an uninterrupted series. To test this probability, I referred to similar products which would most likely vary in price in the same manner as the commodity whose price was missing; and if the price movement in these commodities was in the same direction as the movement in the latter one, I presumed that the missing price would most probably vary in the same manner as the price of the similar articles in the same year. This method was applied chiefly where there was a causal connection between the fluctuations in the prices of the two articles, e. g., where both were produced from the same raw material (as galvanized iron and bar iron), or where one was raw material and the other the finished product (as wheat and flour), or where the production of both would be affected by the same causes, as by drought (in the case of wheat and oats, mutton and beef)."<sup>1</sup>

All index numbers based on interpolated prices are inclosed in brackets.

#### WEIGHTING.

The author does not attempt to assign definite weights to all commodities. He has, however, quoted prices on more than one variety of certain articles considered as of great importance. He illustrates as follows: "Thus, I have taken three cereals, and to emphasize the importance of wheat I have taken flour as well. I have sought to give wool adequate representation by including two kinds, greasy merino and greasy half-bred. Iron is represented by bar iron and galvanized iron, while meat is represented in a similar manner by beef, mutton, lamb, and bacon."<sup>2</sup>

<sup>1</sup> The Course of Prices in New Zealand, James W. McIlraith, p. 29.

<sup>2</sup> *Idem*, p. 29.

## TESTING.

The tables of the report compare the index numbers derived by the author with—

(1) A series of index numbers based on the median instead of the simple arithmetic mean.

(2) The figures of the Economist and Sauerbeck reduced to the New Zealand basis: Annual average prices 1890–1899 = 100.

(3) Index numbers indicating the local movements in certain related phenomena, as, for example, the marriage rate, the bankruptcy rate, world gold production, and New Zealand gold production.

The third set of comparisons is made by single years; the first and second are made both by single years and by decades.

## TABLE OF RESULTS.

The first eight tables of the report show for the several groups of commodities and for each year the index numbers by articles, and also the prices from which the index numbers were computed.

The next table summarizes the data contained in the preceding tables by showing the index number for the total of all articles.

Other tables compare the New Zealand results with the figures of Sauerbeck and the Economist (1) in their original form, and (2) reduced to the New Zealand basis: Average annual prices 1890–1899 = 100.

Tables similar to these show index numbers for decades (e. g., 1861–1870, 1862–1871, 1863–1872, etc.) instead of for single years.

In the two succeeding tables are shown the New Zealand index numbers for farm products and for nonfarm products (1) by single years, and (2) by decades.

The remaining tables show for New Zealand (1) an annual index number of prices based on the volume of foreign trade and the tonnage of vessels carrying such trade, (2) an annual index number of prices based on the volume of foreign trade per head of population, (3) a comparison of index numbers of prices (*a*) of farm products and (*b*) of all commodities with the index numbers of the marriage rate and the bankruptcy rate, and (4) the index numbers (*a*) of the gold production of the world, (*b*) the gold production of New Zealand, and (*c*) the price of wheat. The last table also gives the New Zealand wheat yield per acre, in bushels.

The table showing the comparison of the index numbers<sup>2</sup> for New Zealand derived by the author with those of Sauerbeck and the Economist reduced to the same base period, and also with index numbers based on the median, instead of the arithmetic mean, is reproduced herewith.



## COMPARISONS OF INDEX NUMBERS COMPUTED UPON THE SAME BASE PERIOD.

Year.	New Zealand, 1890-1899 =100.0.	"Econo- mist," 1890-1899 =100.0.	Sauer- beck, 1890-1899 =100.0.	New Zealand (by median).	Year.	New Zealand, 1890-1899 =100.0.	"Econo- mist," 1890-1899 =100.0.	Sauer- beck, 1890-1899 =100.0.	New Zealand (by median).
1881.....	194	133	149	172	1888.....	108	99	105	107
1882.....	186	141	153	172	1887.....	103	101	103	102
1883.....	193	171	156	176	1888.....	103	109	106	104
1884.....	195	185	159	185	1889.....	111	106	109	101
1885.....	189	175	153	183	1890.....	107	110	109	108
1886.....	200	174	155	187	1891.....	108	110	109	108
1887.....	187	149	152	192	1892.....	104	104	103	102
1888.....	184	131	150	189	1893.....	100	103	96	100
1889.....	164	130	149	163	1894.....	98	102	96	100
1870.....	154	131	146	148	1895.....	93	94	94	96
1871.....	150	127	152	137	1896.....	96	98	92	98
1872.....	154	139	165	154	1897.....	97	95	94	98
1873.....	164	144	168	152	1898.....	97	93	94	96
1874.....	161	140	155	160	1899.....	98	94	103	93
1875.....	148	135	146	148	1900.....	101	104	114	99
1876.....	140	132	144	134	1901.....	96	104	106	98
1877.....	144	132	142	148	1902.....	100	96	105	100
1878.....	135	124	132	133	1903.....	100	98	105	100
1879.....	127	109	126	125	1904.....	95	106	106	95
1880.....	130	124	133	129	1905.....	98	108	109	99
1881.....	125	116	129	125	1906.....	101	115	116	100
1882.....	123	119	127	122	1907.....	107	121	121	101
1883.....	118	114	124	118	1908.....	104	109	111	101
1884.....	115	109	115	113	1909.....	101	110	112	104
1885.....	111	102	109	110	1910.....	103	.....	118	101

The author has this to say concerning the foregoing table: "A general review of this table shows a marked similarity in the movements of columns 1 and 3. The fluctuations in both columns are parallel, i. e., a rise or fall in both is synchronous. The index numbers are fairly even in both columns, and particularly so since 1872, the numbers in column 4—those calculated by the median—being on the whole slightly lower than those in column 1, thus indicating that exceptional variations have been of the nature of a rise more often than of a fall."

## NORWAY.

## INDEX NUMBERS OF EINAR RUUD.

## PUBLICATION AND HISTORY.

This index of wholesale prices, based on the prices of imports into Norway, was first published in 1911 in the official journal of the Norwegian Labor Office,<sup>1</sup> No. 9-10 of that year. It covers a period from 1880 to 1910, but whether or not it has since been brought down to date is not known, although the prices on which it is based continue to be published in the annual summary of commercial statistics issued by the Norwegian office of general statistics.<sup>2</sup>

<sup>1</sup> Sociale meddelelser (fortsettelse av maanedsskrift for socialstatistik) utgit av Socialavdelingen under Departementet for sociale saker, handel, industri og fiskeeri. Christiania, 1911-1915. 1ste aargang, Nr. 9-10, 1911, pp. 136-149.

<sup>2</sup> Norges handel, 1908- (Statistique du commerce de la Norvege pendant l'annee 1908-) Utgit av det Statistiske centr. bureau. (Norges officielle statistik, V, 37, 116.)

## SOURCE OF QUOTATIONS.

The summary of commercial and customs statistics alluded to presents the average annual prices of some 135 different commodities imported into the Kingdom each year, and from this list the compiler of the index has selected 39 articles for inclusion in his series. The prices of these articles are obtained from a number of manufacturers and wholesalers in different parts of the Kingdom.

## BASE PERIOD.

The base period chosen extends from 1891 to 1900. This period was selected, it is explained, because it contained both a rising and a falling tendency of prices, not only in Norway but also in foreign countries, and therefore, when taken as a whole, may be regarded as representing average market conditions.

## NUMBER AND CLASS OF COMMODITIES.

The 39 articles chosen from the larger list of 135 imports are divided into five groups: (1) Food commodities; (2) grains and flours; (3) imports from the East; (4) manufactured products; (5) miscellaneous. Group I includes beef, pork, cheese, oleomargarine, eggs, and potatoes; Group II, barley, oats, wheat, rye, also hulled and prepared barley and oats, and flour or meal ground from the above grains; Group III includes coffee, tea, sugar (two kinds, loaf and granulated), tobacco (smoking and chewing), and rice; Group IV is made up of wool yarn (plain and dyed), cotton yarn (single and several twist), cotton cloth or goods (three kinds, printed, dyed and bleached, and unbleached); and Group V includes petroleum, coal and coke, dressed skins or leather, pig iron, steel, bar and hoop iron, zinc, lead, and tin.

## WEIGHTING.

In the construction of the index a simple arithmetic average is employed, there being no weighting. The total index is the mean of the indexes for each of the five groups.

## TABLE OF RESULTS.

The following table, which appears in the journal of the Norwegian Labor Office for September and October, 1911 (No. 9-10)<sup>1</sup> shows in detail the main results of this series of index numbers, as published.

<sup>1</sup> Maanedsskrift for socialstatistik. Udgitt av det Statistiske Centralbyraa, 1ste aargang, Nr. 9-10, 1911, pp. 141-148.

## INDEX NUMBERS OF WHOLESALE PRICES.

(Based on 7 food commodities imported, into Norway, 1880-1910. Base period, 1891-1900=100.)

Year.	Beef.	Pork.	Cheese.	Butter.	Oleo-margarina.	Eggs.	Potatoes.	All 7 commodities.
1880.....	141	124	103	.....	.....	71	97	107
1881.....	138	129	113	.....	.....	86	97	115
1882.....	151	149	98	.....	.....	97	150	129
1883.....	154	134	94	.....	.....	97	140	124
1884.....	136	112	96	.....	.....	97	133	115
1885.....	121	102	87	.....	.....	97	117	105
1886.....	103	98	87	.....	.....	86	100	95
1887.....	92	110	96	.....	.....	88	100	97
1888.....	90	122	96	98	96	91	100	9
1889.....	90	107	100	98	101	91	100	9
1890.....	90	97	104	98	101	91	100	9
1891.....	95	98	109	105	112	91	100	10
1892.....	92	112	104	101	112	97	100	10
1893.....	100	136	104	105	112	97	100	10
1894.....	95	115	96	98	107	97	100	10
1895.....	95	95	91	97	96	97	100	9
1896.....	92	75	96	91	90	102	100	9
1897.....	95	76	95	94	84	102	100	9
1898.....	105	93	100	105	92	102	100	10
1899.....	108	86	100	105	96	102	100	10
1900.....	113	115	100	105	96	108	100	10
1901.....	113	121	100	105	96	108	83	10
1902.....	118	153	104	105	96	108	83	11
1903.....	110	132	104	105	96	108	83	10
1904.....	103	114	104	105	96	108	92	10
1905.....	115	119	104	108	96	108	88	10
1906.....	128	136	113	105	101	108	72	10
1907.....	133	139	122	108	101	108	88	11
1908.....	123	132	113	115	112	108	111	11
1909.....	123	166	113	115	112	108	97	11
1910.....	131	180	113	129	112	108	83	12

(Based on 10 grains and flours imported into Norway, 1880-1910. Base period, 1891-1900=100.)

Year.	Barley.	Oats.	Wheat.	Rye.	Pot or pearl barley.	Hulled oats.	Barley flour.	Rye flour.	Oatmeal.	Wheat flour.	All 10 commodities.
1880.....	153	126	156	164	166	124	146	141	108	156	144
1881.....	157	136	163	164	139	129	155	165	114	167	146
1882.....	137	126	140	130	133	112	146	153	108	144	133
1883.....	134	110	156	124	146	112	138	143	102	139	133
1884.....	132	105	117	115	133	97	130	129	95	121	117
1885.....	119	105	111	104	126	135	130	114	95	110	115
1886.....	106	99	107	92	122	107	114	127	92	110	108
1887.....	97	84	105	84	113	79	98	103	83	107	95
1888.....	102	80	109	84	119	84	106	90	86	111	96
1889.....	109	110	113	94	119	90	114	101	98	108	100
1890.....	114	99	113	102	119	96	114	109	105	112	108
1891.....	134	115	132	148	136	112	142	146	111	129	131
1892.....	109	115	115	126	123	132	118	135	120	104	120
1893.....	94	105	97	96	96	120	87	97	108	95	100
1894.....	78	80	78	79	80	88	83	81	95	81	83
1895.....	98	76	82	78	83	87	89	82	89	85	84
1896.....	87	89	89	86	90	87	85	71	95	96	87
1897.....	87	103	105	96	88	87	85	71	95	110	92
1898.....	101	105	105	102	96	96	103	103	95	107	101
1899.....	109	102	100	102	105	98	107	111	95	103	103
1900.....	115	102	96	97	105	93	99	103	95	96	100
1901.....	108	107	96	93	97	93	98	96	95	92	98
1902.....	108	107	97	94	96	112	102	101	108	95	102
1903.....	98	97	97	93	94	103	95	96	102	97	98
1904.....	97	105	109	93	86	105	98	95	102	107	100
1905.....	105	105	104	103	87	104	100	101	210	100	101
1906.....	109	112	102	100	93	110	105	101	108	95	104
1907.....	131	127	118	128	108	121	138	132	117	112	123
1908.....	134	126	125	128	103	122	130	125	117	115	123
1909.....	126	112	128	121	101	121	118	116	100	127	118
1910.....	111	105	111	100	91	106	106	92	102	117	104

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INDEX NUMBERS OF WHOLESALE PRICES—Continued.

(Based on 6 commodities imported into Norway from the East, 1880-1910. Base period, 1891-1900=100.)

Year.	Coffee.	Tea.	Sugar.		Tobacco.	Rice.	All 6 commodities.
			Leaf.	Other.			
1880	96	138	187	177	80	148	138
1881	82	146	194	192	80	119	136
1882	70	131	187	173	80	105	124
1883	70	151	171	162	76	95	121
1884	72	131	139	123	107	95	111
1885	64	128	123	119	107	90	105
1886	74	121	113	108	107	90	102
1887	111	116	113	108	107	90	108
1888	100	106	119	116	107	90	106
1889	117	106	126	127	107	95	113
1890	120	106	116	119	108	100	112
1891	117	106	113	115	103	105	110
1892	117	106	116	123	103	100	111
1893	125	106	119	123	99	138	118
1894	121	106	103	108	99	90	105
1895	101	122	94	92	99	83	99
1896	112	98	94	88	90	90	97
1897	82	95	84	81	99	95	89
1898	70	95	84	85	99	100	89
1899	61	95	87	89	99	100	89
1900	69	94	90	92	99	100	91
1901	63	93	84	81	99	100	87
1902	54	93	74	69	99	95	81
1903	51	95	77	73	99	100	83
1904	56	95	90	80	96	100	88
1905	63	95	97	100	95	100	92
1906	61	95	81	81	92	100	85
1907	52	101	81	81	92	110	86
1908	58	103	87	89	88	100	88
1909	61	101	90	92	92	105	90
1910	70	103	103	108	95	105	98

(Based on wool and cotton yarns and cotton goods (7 articles) imported into Norway, 1880-1910. Base period, 1891-1900=100.)

Year.	Wool yarn.		Cotton yarn, unbleached.		Cotton goods.			All 7 commodities.
	Undyed and unbleached.	Dyed, mixed, etc.	Single thread.	Multiple twist.	Printed.	Bleached or dyed.	Unbleached.	
1880	144	148			142	134	128	139
1881	144	148			142	134	128	139
1882	144	148			120	118	117	129
1883	132	140			120	118	117	125
1884	126	132			120	118	114	122
1885	121	119			114	118	110	116
1886	122	120			114	110	103	114
1887	122	120			108	104	107	112
1888	122	119			108	106	110	113
1889	115	114			108	108	114	112
1890	115	112			107	108	114	111
1891	100	106			101	102	107	105
1892	100	103			98	99	103	102
1893	106	106			97	100	103	102
1894	103	101			91	94	99	98
1895	103	101			99	94	98	99
1896	101	98			99	94	99	98
1897	86	93	67	100	103	98	95	95
1898	86	93	93	93	99	98	92	93
1899	92	95	93	93	103	102	92	96
1900	106	106	117	113	108	112	110	110
1901	101	103	106	120	108	102	99	106
1902	101	103	109	117	103	102	99	105
1903	93	111	121	127	108	110	114	112
1904	95	111	121	133	114	114	124	116
1905	102	116	113	120	117	122	135	118
1906	115	132	125	133	121	124	142	127
1907	115	138	137	143	125	128	149	134
1908	101	116	133	133	125	128	142	125
1909	100	122	113	133	124	123	142	125
1910	118	127	144	147	126	134	146	134

## INDEX NUMBERS OF WHOLESALE PRICES—Concluded.

(Based on 6 metals, and leather, fuels, and petroleum imported into Norway, 1880-1910.  
Base period, 1891-1900=100.)

Year.	Leath- er.	Petro- leum.	Pig iron.	Steel.	Bar and hoop iron.	Zinc.	Lead.	Tin.	Coal, coke, etc.	All 9 com- modi- ties.
1880.....	157	188	109	148	112	.....	144	.....	86	135
1881.....	141	150	100	157	110	103	108	101	78	116
1882.....	140	131	95	157	110	77	104	101	78	110
1883.....	134	131	87	144	102	72	104	101	85	107
1884.....	122	131	78	135	99	66	80	91	87	99
1885.....	115	131	75	135	99	72	80	91	91	99
1886.....	113	122	71	126	93	72	88	101	93	98
1887.....	107	113	75	117	90	80	96	126	95	103
1888.....	101	127	77	112	89	86	104	120	90	101
1889.....	98	127	96	121	101	100	104	107	90	105
1890.....	101	122	103	128	106	114	108	116	103	111
1891.....	95	113	98	117	99	114	100	110	98	105
1892.....	92	103	89	99	92	100	100	110	94	98
1893.....	92	94	86	94	81	86	100	107	98	94
1894.....	89	94	87	90	86	86	95	88	94	90
1895.....	107	122	87	90	86	74	92	82	86	92
1896.....	101	113	84	94	91	86	88	79	81	91
1897.....	101	89	90	94	95	86	92	77	87	90
1898.....	104	85	99	99	99	114	96	91	96	98
1899.....	110	94	125	133	118	129	104	113	111	112
1900.....	110	94	154	121	142	114	128	145	158	130
1901.....	113	85	104	132	105	100	100	126	150	110
1902.....	110	75	104	94	101	103	92	142	107	103
1903.....	110	75	104	90	96	100	92	142	96	101
1904.....	110	75	96	85	95	114	92	142	90	100
1905.....	110	69	107	81	95	129	100	160	83	104
1906.....	116	77	112	82	103	143	132	195	87	116
1907.....	116	77	120	82	107	129	144	189	106	119
1908.....	104	86	107	72	89	109	106	157	94	103
1909.....	116	81	104	68	86	114	104	157	88	102
1910.....	128	75	104	72	94	114	104	173	86	106

(Based on 39 articles imported into Norway, 1880-1910, by groups of commodities.  
Base period, 1891-1900=100.)

Year.	I. Food products.	II. Flour and grain.	III. Articles Imported from the East.	IV. Manufac- tured arti- cles (col- ton and woolen yarn and goods).	V. Miscellane- ous (metals prin- cipally).	All com- modities.
1880.....	107	144	138	.....	139	135
1881.....	115	149	136	.....	139	116
1882.....	120	133	124	.....	129	110
1883.....	124	130	121	.....	125	107
1884.....	115	117	111	.....	122	99
1885.....	105	115	105	.....	116	99
1886.....	95	108	102	.....	114	98
1887.....	97	95	108	.....	112	100
1888.....	99	98	106	.....	113	101
1889.....	98	106	113	.....	112	106
1890.....	97	108	112	.....	111	111
1891.....	101	131	110	.....	105	106
1892.....	103	120	111	.....	102	98
1893.....	108	100	118	.....	102	94
1894.....	101	83	105	.....	98	95
1895.....	96	84	99	.....	99	92
1896.....	92	87	97	.....	98	91
1897.....	92	62	99	.....	96	90
1898.....	100	101	99	.....	93	96
1899.....	100	108	99	.....	96	112
1900.....	105	100	91	.....	110	130
1901.....	105	98	87	.....	105	110
1902.....	110	102	81	.....	106	103
1903.....	105	98	83	.....	112	101
1904.....	108	100	88	.....	116	100
1905.....	105	101	92	.....	118	104
1906.....	109	104	85	.....	127	118
1907.....	114	123	86	.....	134	119
1908.....	116	123	88	.....	125	108
1909.....	119	118	90	.....	125	102
1910.....	122	104	98	.....	134	108

## RUSSIA.

INDEX NUMBERS OF MINISTRY OF COMMERCE AND INDUSTRY,  
PETROGRAD.

## PUBLICATION.

The Ministry of Commerce and Industry of Russia publishes annually a "Summary of Prices for Commodities in Representative Russian and Foreign Markets," in which is included an index number based on the average annual prices of the various articles under consideration. Wholesale prices are used in this summary.

## HISTORY.

The history of the index number shown in connection with the prices can not be learned from the translations of the reports at hand.

## SOURCE OF QUOTATIONS.

Quotations of prices on Russian and foreign exchanges as printed in the bulletins of these exchanges are used as the original material for compilation. In the absence of exchange quotations for some of the articles, information has been secured from special periodicals such as: "Commerce and Industry," "Baltische Wochenschrift," "Iron and Coal Trades Review," etc. Prices for cereals in some markets, as well as data on freight charges and insurance premiums on cereal freight, are taken from the reports of the Bureau of Commerce in Cereals of the Department of Commerce which compiled them from telegrams of its special agents. They have been supplemented by quotations from the bulletins of local exchanges, and are to be found on the last pages of the 1908 report. Prices of dutiable foreign articles on foreign markets are given without the inclusion of the Russian customs duties; those articles the prices of which include customs duties are marked with a star. Prices on Russian markets are always given including custom duties.

## BASE PERIOD.

The average price for the ten-year period, 1890-1899, taken as 100, is used as a base.

## PRICES: HOW SHOWN AND COMPUTED.

The following is a translation of the introduction to the summary of 1908:

The present bulletin (1908) of wholesale prices contains data relating to the principal commodities in Russian and foreign markets and is compiled in the same way as the preceding issues. In addition to detailed prices for each month of the present year, the average prices for each of the preceding years—1907, 1906, 1905—are given, as well as the general average prices for the 5 years, 1900-1904, and the 10 years, 1890-1899.

In the summary table (see pp. ii-vii) average annual prices of the principal commodities in Russian markets for each year of a period of 19 years, 1890-1908, are shown. For each article included in this table the prices in one or two of the representative markets furnishing sufficiently accurate data are given. In order to minimize the influence of local conditions on the prices of the principal cereals, general average prices are quoted for several markets combined in the following three groups:

1. Markets in northern ports (Petrograd, Reval, Riga, and Libau).
2. Markets in southern ports (Odessa, Nicolaie, Taganrog, Rostov on Don, and Novorossysk).
3. Markets in central Russia (Moscow, Yelts, Samara, and Saratov).

For purposes of comparison of the average prices for the years 1890-1895 with those of the following years, the former have been converted from paper into gold values (1 ruble equals 1-15 imperial), taking as a base the average quotations for the corresponding years as follows:

	Rubles in gold.					
	1890	1891	1892	1893	1894	1895
100 rubles in paper money equals.....	108.86	100.14	94.58	97.91	100.53	101.22

#### NUMBER AND CLASS OF COMMODITIES.

Prices and index numbers were reported in 1912 for 66 commodities. Wholesale prices are used in the computation of the tables for all years. Both raw and manufactured articles are included.

#### DESCRIPTION AND GROUPING OF COMMODITIES.

The 66 articles for which prices were secured in 1912 are combined in the following 7 groups or classes:

1. Cereals and by-products.
2. Cattle and cattle products.
3. Oils.
4. Spinning materials.
5. Minerals (including petroleum, etc.).
6. Drugs and chemicals.
7. Groceries.

The commodities quoted are as follows:

#### 1. Cereals and by-products.

Articles.	Markets of—
Rye.....	Northern ports and southern ports.
Wheat.....	Riga (Russian), southern ports, and central Russia.
Oats.....	Northern ports, southern ports, and central Russia.
Barley.....	Southern ports.
Corn.....	Odessa.

Articles.	Markets of—
Peas.....	Saratov and Rybinsk.
Buckwheat.....	Yelts.
Buckwheat groats.....	Moscow, large groats.
Millet.....	Moscow, from Orenburg and Ural.
Wheat flour.....	Moscow (highest quality in Saratov).
Rye flour.....	Moscow (sifted).
Bran.....	Libau, of wheat, medium; Rybinsk, of wheat.
Malt.....	Moscow, imported.

*2. Cattle and animal products.*

Large horned cattle.....	Petrograd, highest quality.
Small cattle.....	Petrograd, calves, hogs.
Meat.....	Petrograd, best quality, beef; Moscow, pork.
Hides, steer.....	Moscow, gray.
Lard.....	Petrograd, for gruel.
Butter.....	Moscow, fresh made of warmed cream.
Herring.....	Riga, Scotch.

*3. Oils.*

Flaxseed.....	Petrograd, 95 per cent.
Hempseed.....	Orel.
Sunflower seed.....	Saratov, for oil.
Linseed oil.....	Moscow.
Hempseed oil.....	Petrograd.
Sunflower-seed oil.....	Moscow.
Rapeseed oil.....	Warsaw, raw.
Olive oil.....	Petrograd.
Oil cake, flax.....	Riga.
Oil cake, hemp.....	Riga.

*4. Spinning materials.*

Flax.....	Riga, Livonian; Petrograd, from Vologda.
Hemp.....	Riga; Orel, pure.
Cotton.....	Moscow, from Fergan; of American seeds.
Cotton yarn.....	Petrograd, spool, No. 14-20.
Coarse calico.....	Petrograd, 16 verahok <sup>1</sup> wide by 585 arahin <sup>2</sup> long, 80 funt <sup>3</sup> in weight.
Wool.....	Moscow, medium quality.

*5. Minerals.*

Coal.....	Petrograd, from Newcastle; Rostov on Don, Anthracite.
Naphtha.....	Baker, near wells; Moscow.
Crude naphtha.....	Baker, near wells; Moscow.
Petroleum.....	Baker, on ships and in kettles; Moscow.
Cast iron.....	Petrograd, southern.
Iron.....	Petrograd, sheet iron, Russian bar.
Copper.....	Petrograd, foreign, in bars.
Tin.....	Petrograd, in bars.
Zinc.....	Petrograd, Silesian.
Lead.....	Petrograd, ordinary ingots.

<sup>1</sup> 1 verahok equals 1.76 inches.

<sup>2</sup> 1 arahin equals 0.77 yard.

<sup>3</sup> 1 funt equals 0.9 pound.



6. *Drugs and chemicals.*

Articles.	Markets of—
White lead.....	Petrograd.
Indigo.....	Moscow, from Bengal.
Dry paints.....	Moscow, blue.
White resin.....	Petrograd.
Tragacanth.....	Moscow, highest quality.
Borax.....	Petrograd, in crystals.
Vitriol.....	Petrograd.
Potash.....	Petrograd.
Soda (caustic).....	Petrograd.
Saltpeter.....	Petrograd, from Chile.
Sulphur.....	Petrograd, in lumps.

7. *Groceries.*

Salt.....	Rybinak.
Granulated sugar.....	Kiev, in territory of the Southwestern R. R.
Lump sugar, refined...	Kiev, lump.
Coffee.....	Petrograd, round, various qualities.
Tea.....	Moscow, from Kyakhta.
Rice.....	Odessa, Patua, highest quality.
Pepper.....	Petrograd, black, from Singapore.
Currants.....	Riga.
Almonds.....	Odessa, from Messina.
Hops.....	Riga, from Bavaria.

## SUBSTITUTIONS AND ADDITIONS.

No substitutions or additions have been made so far as the reports disclose, but certain commodities reported in 1908 were dropped in subsequent years. This changes the index number for the group affected and also the general index number.

Alcohol and woolen yarn were dropped in 1909. Tea in 1909-1912, inclusive, is reported in a different market and with a different unit of measure from that used in 1908.

In the group "Cattle and animal products" lard is given an average price of 6.90 for the year 1909 in the report for that year, while in all subsequent reports it is quoted at 6.60 for 1909. In the 1912 report new index numbers are published for the group embracing "Cereals and by-products" and for the "Groceries" group, also for all groups combined, owing to the substitution in some cases of other markets for those carried in reports for preceding years.

## INTERPOLATION.

If any interpolations of prices have been made, they are not called to the attention of the reader.

## WEIGHTING.

Whatever weighting there is consists in the use of a number of different descriptions of the same commodity.

TABLE OF RESULTS.

Index numbers for each of the 7 groups into which the total number of commodities is divided, together with a general index for the 66 commodities taken as a whole, are shown in the following table compiled from the 1912 report:

INDEX NUMBERS FOR 7 GROUPS OF COMMODITIES (66 ARTICLES) AND GENERAL INDEX FOR ALL COMMODITIES.

Year.	Cereals and by-products.	Cattle and cattle products.	Oils.	Spinning materials.	Minerals.	Drugs and chemicals.	Groceries.	General index for all commodities.
1880-1889.....	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1890.....	108.2	99.3	102.0	100.9	109.8	103.0	113.3	105.4
1891.....	128.8	93.9	108.3	93.7	99.3	100.8	106.5	104.2
1892.....	126.4	95.7	104.5	94.1	88.0	102.7	97.5	101.6
1893.....	103.1	104.6	109.3	108.0	96.1	105.5	104.7	104.6
1894.....	78.6	102.5	103.8	105.1	91.0	100.0	97.1	97.0
1895.....	76.2	98.7	86.1	99.4	93.9	97.9	91.8	92.0
1896.....	77.3	94.6	80.1	101.4	96.1	96.6	92.4	91.2
1897.....	87.2	94.9	92.7	98.9	98.7	98.4	95.2	94.9
1898.....	106.3	104.0	110.4	96.1	102.7	98.0	99.7	102.2
1899.....	107.3	112.0	102.2	100.3	119.0	99.4	103.3	106.2
1900-1909.....	119.9	131.4	111.1	133.0	118.7	107.2	105.4	118.1
1900.....	98.7	117.8	108.0	124.5	131.1	103.2	103.8	112.4
1901.....	106.8	115.3	132.1	131.0	109.1	101.5	108.0	114.8
1902.....	112.8	121.8	113.3	124.8	96.5	99.4	102.6	110.2
1903.....	102.0	121.0	94.3	130.0	98.2	98.9	104.5	107.1
1904.....	106.3	121.7	96.7	134.1	106.9	102.7	108.7	111.0
1905.....	117.0	127.8	102.0	127.0	119.0	105.3	108.2	115.2
1906.....	122.7	137.3	115.4	139.8	137.9	112.7	108.4	124.9
1907.....	146.7	148.4	109.5	146.4	141.8	121.0	106.7	131.5
1908.....	147.4	148.4	106.1	134.7	124.4	116.8	102.4	125.6
1909.....	138.5	152.5	130.9	138.6	121.7	111.6	101.1	127.8
1910.....	117.8	154.6	140.7	154.3	116.7	113.6	104.8	128.9
1911.....	128.0	143.9	134.1	151.9	129.9	117.9	110.4	130.9
1912.....	145.7	153.7	126.8	152.2	155.6	122.4	117.1	139.1

## SPAIN.

## INDEX NUMBERS OF FRANCISCO BERNIS.

## PUBLICATION.

A series of index numbers based on food prices in Spain is found in *El Problema de las Subsistencias* (The Problem of the Food Supply), by Francisco Bernis, professor of political economy in the University of Salamanca, which was published in pamphlet form in 1911. The volume is divided into two parts, the first of which refers to prices of food commodities in general use, and the second to laws and regulations in regard to food commodities, their distribution and prices.

A general study of the variations of prices is included in the first part, but the information does not show whether wholesale or retail prices are considered.

## HISTORY.

The author of *El Problema de las Subsistencias* made a survey of the various attempts of the State to deal with the subject of the increased cost of living as it affected the working classes. The results

of this survey were published at the request of the Asociación de Patronos Mineros de Vizcaya, in order that this association might make a study of the strike in 1910 of the miners of that locality. The tables of prices and of index numbers contained material that was considered sufficiently comprehensive to be used as a basis for the work undertaken by the association.

#### SOURCE OF QUOTATIONS.

The data on which Bernis based his tables were taken from unpublished records of the chief statistician of Barcelona, and, in the absence of information of an official character, from the works of college directors and others who have made a study of the subject.

Some specific sources of information are as follows:

The Asociación de Patronos Mineros de Vizcaya published in 1907 a pamphlet in which appears a table of comparative prices of food-stuffs for 1903-1907. The document is entitled "El trabajo en las minas de Vizcaya."

El Instituto de Reformas Sociales issued a bulletin in 1904 relative to labor conditions in the mines of Vizcaya, which gives a table of comparative prices for 1893-1903.

The Camara Oficial de Comercio of Madrid, in its report entitled "Información publica sobre el problema de las subsistencias," 1905, presents a study of variations of prices for several years.

"El presupuesto de reconstrucción," by Garcia Alix, gives under the title of "Subsistencias" average prices for Spain.

#### BASE PERIOD.

The year 1901, taken as 100, is used as the base period.

#### PRICES: HOW SHOWN AND COMPUTED.

Prices are shown for yearly periods, and cover the years 1891 to 1908, inclusive. The compiler states that "the prices for forming my indexes are wholly those which I possess, though these had to be corrected and completed."<sup>1</sup> At times market prices were used when there were no others available.

#### NUMBER AND CLASS OF COMMODITIES.

The table of prices includes 13 articles of food, as follows: Wheat, potatoes, bread, rice, pulse (chick-peas), kidney beans, beef, mutton, pork, codfish, sugar, salt, and coffee.

#### DESCRIPTION AND GROUPING OF COMMODITIES.

There is no separation of the commodities into groups except in the case of meats, of which three kinds are listed. No description of the articles is given.

<sup>1</sup> El Problema de las Subsistencias, Francisco Bernis, p. 57.

## WEIGHTING.

Two index numbers are computed for all articles combined, one unweighted and the other weighted.

The weighting is accomplished by dividing the commodities into four groups, each of which represents a certain percentage of the whole number as regards importance in consumption. The four groups are as follows:<sup>1</sup>

	Per cent.
I. Wheat, potatoes, bread.....	30
II. Rice, pulse (chick-peas), kidney beans.....	30
III. Beef, mutton, pork, codfish.....	20
IV. Sugar, coffee, salt.....	10

The importance assigned to each of these four groups is based on an estimate of the relative values of the articles of food as consumed in the family of a laborer.

## TESTING.

The only test made of the index numbers is their comparison with index numbers for the United Kingdom, Germany, and France. Diagrams are added to show the variations of these index numbers during the same period of time.

## TABLES OF RESULTS.

The following table shows the variations in the weighted relative prices of the different food articles in Spain for the years from 1891 to 1908, inclusive. Weighted and unweighted price relatives for all commodities combined are also shown in the last two columns:

VARIATIONS IN WEIGHTED RELATIVE PRICES OF FOOD COMMODITIES IN SPAIN  
1891 TO 1908, BY YEARS.<sup>2</sup>

(Base period, 1901=100.)

Year.	Potatoes.	Wheat.	Bread.	Rice.	Pulse (chick-peas).	Kidney beans.	Beef.	Mutton.
1891.....	85.2	82.2	100.0	101.5	89.4	85.8	86.1	92.3
1892.....	77.5	96.3	120.0	102.3	76.5	85.3	80.9	94.1
1893.....	90.7	92.2	101.0	102.1	84.6	89.3	86.4	93.2
1894.....	89.5	79.2	104.6	99.7	73.9	90.1	82.7	94.4
1895.....	88.0	73.1	97.0	99.9	85.7	85.9	93.9	76.4
1896.....	92.9	94.8	94.8	102.5	95.3	88.7	94.8	86.9
1897.....	94.5	106.8	97.6	108.6	98.2	91.9	91.9	90.4
1898.....	102.0	116.4	103.3	102.9	96.0	95.0	92.4	89.1
1899.....	102.0	104.4	108.4	102.1	96.0	94.6	97.2	95.6
1900.....	99.3	101.9	101.5	100.0	91.8	94.3	100.0	97.6
1901.....	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1902.....	99.8	91.9	99.6	107.6	98.6	104.0	403.7	110.8
1903.....	122.5	97.0	97.2	110.1	96.5	99.7	95.1	93.1
1904.....	111.8	109.4	106.4	112.2	103.5	105.7	102.4	114.6
1905.....	131.7	112.3	96.8	111.9	109.1	105.5	100.7	105.2
1906.....	115.6	97.2	98.3	109.3	118.7	114.6	100.7	105.2
1907.....	115.0	96.3	98.1	105.8	115.2	108.9	100.7	105.2
1908.....	116.8	108.5	100.6	105.5	104.3	83.1	100.7	103.9

<sup>1</sup> It will be noted that the figures used to represent the groups show a total of only 90. Evidently the remaining 10 per cent includes commodities not in general use, and for this reason not included in the study.

<sup>2</sup> El Problema de las Subsistencias, Francisco Bernis, p. 68.

VARIATIONS IN WEIGHTED RELATIVE PRICES OF FOOD COMMODITIES IN SPAIN,  
 1891 TO 1908, BY YEARS—Concluded.

Year.	Pork.	Codfish.	Sugar.	Salt.	Coffee.	All commodities.	
						Weighted.	Un-weighted.
1891.....	90.9	83.5	83.3	75.0	99.0	89.6	84.1
1892.....	96.3	80.5	83.3	75.0	108.1	92.1	91.4
1893.....	89.5	72.2	83.3	75.0	96.0	90.7	89.2
1894.....	89.5	74.4	83.3	62.5	98.6	87.7	84.8
1895.....	91.0	74.4	78.9	62.5	98.6	85.6	84.9
1896.....	83.5	78.9	87.7	62.5	98.6	91.7	89.9
1897.....	91.3	79.7	83.3	62.5	101.0	95.2	92.5
1898.....	100.2	70.4	87.7	62.5	105.0	97.3	94.7
1899.....	101.9	91.0	95.8	87.5	102.0	99.5	98.5
1900.....	99.5	100.0	99.1	87.5	102.4	97.6	98.0
1901.....	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1902.....	100.4	105.3	96.5	100.0	108.9	101.5	101.8
1903.....	91.4	103.8	100.0	100.0	108.0	102.3	101.7
1904.....	104.5	113.5	104.4	100.0	112.3	108.0	107.2
1905.....	101.4	111.5	107.0	87.5	112.3	108.8	107.4
1906.....	101.4	103.0	92.1	87.5	110.5	108.0	104.2
1907.....	96.9	87.9	96.5	87.5	112.3	101.5	101.9
1908.....	96.9	101.5	117.5	75.0	112.3	102.6	102.4

A second series of index numbers is contained in a pamphlet published by Bernis in 1914<sup>1</sup> as a contribution to the current literature on the economic condition of the working classes in Spain. Under the subject of cost of living (*el coste de la vida*) the author traces the movement of food prices through a period of years by means of index numbers based on commodities purchased by contract in certain charitable institutions of Salamanca.

The information was gathered directly from the records of the institutions and covered the years from 1892 to 1913, inclusive. The base period selected was the year 1901.

Average yearly prices, both absolute and relative, are shown for 17 articles, viz, flour, bacon, pulse (chick-peas), beef, potatoes, wine, codfish, vermicelli, rice, sugar, milk, vinegar, lard, oil, pepper, salt, and charcoal. There is no grouping of commodities and no description of kinds or grades is furnished.

Three general index numbers are published. The first two are un-weighted and were obtained by computing the arithmetic mean and the geometric mean respectively of the several price ratios based on the prices in 1901. In calculating the weighted index the relative price for each article on the 1901 base was multiplied by a figure denoting its importance in family expenditure, as determined by a study of 13 family budgets collected by the author, and the sum of the products thus obtained was divided by the sum of the weights. The 3 index numbers are as follows:<sup>2</sup>

<sup>1</sup> Estudios estadísticos. Contribución a la investigación de la situación económica de los trabajadores en España. Barcelona, Tipografía "La Académica" de Serra Hnos y Russell, Ronda Universidad, 8.

<sup>2</sup> Estudios Estadísticos, pp. 10-13.

(Base period, 1901=100.)

Year.	Arithmetic mean.	Geometric mean.	Weighted Index.
1892.....	88.6	88.07	94.8
1893.....	92.5	91.75	90.2
1894.....	97.9	95.59	90.9
1895.....	91.8	91.23	91.0
1896.....	87.9	87.32	86.8
1897.....	92.7	92.09	94.3
1898.....	96.0	96.15	98.5
1899.....	97.3	96.88	95.8
1900.....	95.8	95.55	95.7
1901.....	100	100	100
1902.....	104.5	102.60	112
1903.....	102.9	101	107
1904.....	107.6	106.40	112.7
1905.....	104.6	103.50	107.2
1906.....	108.4	104.66	111.9
1907.....	109	108	114.4
1908.....	106.9	104.56	107.8
1909.....	102.3	100.79	104.2
1910.....	104.8	103.32	104
1911.....	102.9	101.88	100.5
1912.....	97	96.05	96.5
1913.....	98.8	97.71	99.9

#### CONFERENCE ON INDEX NUMBERS OF THE INTERNATIONAL INSTITUTE OF STATISTICS, SEPTEMBER, 1911.

At the thirteenth session of the International Institute of Statistics held at The Hague, September 4 to 8, 1911, the section of economic statistics devoted a part of its time to a discussion of index numbers.<sup>1</sup> In order to secure a basis for a possible international study of the variations of prices and the increased cost of living, a circular had been sent to the members of the section in the various countries early in January of that year, requesting each to prepare a table of index numbers. A free translation of the circular reads as follows:

At the present time the high cost of living is disturbing many countries. Economists are endeavoring to ascertain how far the phenomenon may be attributed to unfavorable seasons, to the effect of labor and social legislation, to the supply of gold in the world, etc. But it is for statisticians primarily to measure and correlate the fluctuations in prices as far as possible. And since the thirteenth session of the International Institute of Statistics this year will bring together at The Hague specialists from many countries, it seems desirable to solicit from them answers to this question of universal interest.

We wish to request each of our colleagues to prepare a complete series of index numbers for the common period 1881-1910 (namely 30 years), and beg of them to send in with the results obtained a statement of what prices were used for the computations and what methods were employed. Of course, it is understood that whatever supplementary explanations may accompany the tables will be most welcome.

<sup>1</sup> Bulletin de l'Institut International de Statistique, tome XLX, 1<sup>re</sup> livraison, p. 66.

## FORM OF TABLE.

The average of the prices for the year 1881 being taken as 100, the general course of prices in the following years is as follows:

Year.	Index number.
1881.....	100
1882.....	
1883.....	
* *.....	* *
1910.....	

Signature: \_\_\_\_\_

Address: \_\_\_\_\_

When the section of economic statistics met on September 5, Mr. Waxweiler's report for Belgium was presented printed in completed form. The substance of all the papers received had been summarized by Mr. de Foville for the use of the section, and he also read the following list of index numbers submitted:

*Germany.*—Mr. Zahn (for Bavaria), Mr. Zimmermann (for Brunswick), Mr. Hartwig (for Lübeck).

*Austria-Hungary.*—Mr. Mario Alberti (for Trieste), Dr. von Jankovich.

*Belgium.*—Mr. Hector Denis, Mr. Armand Julin, Mr. Nicolai, Mr. Sauveur, Mr. Waxweiler (for Brussels).

*Denmark.*—Mr. Michael Koefoed.

*France.*—Mr. de Foville, Mr. Levasseur (for Lycées français), Mr. L. March.

*Italy.*—Mr. Achille Necco.

*Netherlands.*—Mr. Falkenburg (for Amsterdam), Mr. Methorst.

*Australia.*—Mr. Coghlan (for New South Wales).

*Canada.*—Mr. Godfrey.

*Japan.*—Mr. Hanabusa.

Since no papers were sent from England Mr. de Foville included in his summary the English index numbers of Sauerbeck and a few others.

When it was proposed to have these tables of index numbers printed in the Bulletin of the International Institute of Statistics and to take up their discussion at the next meeting of the institute after the members had had an opportunity to study the fluctuations of prices shown in the tables and possibly the causes that produced them, some discussion arose as to the period of years selected, the disparity appearing between similar tables by different authors, and the choice of wholesale or retail prices.

Upon the first point Mr. Denis (Belgium) objected to the year 1881 being taken as the beginning of the series of index numbers, particularly if the various tables constructed were to be used in attempting to get an insight into the possible causes of the fluctuation of prices. He summed up the periods of rise and fall of prices as evidenced in all tables of indexes and pointed out that 1881 was a year in the midst

of a period of depression of prices going back as far as 1874, and suggested that therefore the authors of the tables submitted be asked to lengthen their series by going back to an earlier date.

Mr. de Foville (France) justified the use of 1881 as the initial year upon two grounds: The period of 30 years thus included from 1881 to 1910 represents approximately the lifetime of a generation, and in going back even for so short a period it had been found difficult to secure the earlier data in many countries. Furthermore, 1881 is placed halfway between the extreme high level of prices in 1873 and the lowest depression following it in 1896.

No action was taken and Mr. Waxweiler (Belgium) raised the next question as to the disparity between similar tables. He noted that while the curves for the price of wheat in Belgium as presented by Mr. Sauveur and by himself are almost identical, those of meat are quite different<sup>1</sup> and that it might be desirable to have authors adjust such discrepancies before publishing the tables. But Mr. Sauveur explained the disparity in the indexes for meat by the fact that Mr. Waxweiler chose his prices from the purchases of charitable institutions in Brussels, whose consumption is exceptional in that it is confined to meat of first quality and does not include pork. Both of these meats are exactly the ones that presented the greatest fall in prices after 1881, while his own prices covered consumption of meat in general, which includes a large proportion of second quality meat as well as a large quantity of pork that is used particularly in country districts. He concluded by saying that the explanations added by the authors to their tables seemed sufficiently complete to clear up such points, but also called attention to the fact that some general rule ought to be followed by the authors of index numbers to insure the comparability of the statistics so gathered. It was finally voted to print the tables with such comments as their respective authors thought desirable to add in view of this discussion so that the minutes of the meeting of this section as printed in the bulletin would clear up the matter of the comparability of the tables even to the least experienced of readers.

The question of including retail as well as wholesale prices was brought up by Mr. Bowley, a member of the section, upon the ground that the fluctuations in retail prices for both long and short periods were less abrupt than those of wholesale prices. Mr. Lucien March (France) called to the attention of the member the extreme difficulty of identifying the class of articles sold at retail—a difficulty which existed even in wholesale trade as exemplified by the disparity pointed out by Mr. Waxweiler previously. He concluded with the statement that as long as the level of retail prices followed that of wholesale prices in general, it justified the exclusive use of the more easily

<sup>1</sup> See Bulletin de l'Institut International de Statistique, tome XIX, 2<sup>e</sup> livraison, pp. 209, 216, et 217.



ascertained wholesale prices. He added that in his opinion the task before the Institute was to compare the tables already prepared, to note the discrepancies that appeared, and to ascertain the reasons for such discrepancies so that the Institute would be in a position to prescribe the precautions that ought to be taken in comparing the prices of different countries or of different periods of time. With this the discussion of index numbers practically closed.

\* Among the tables of index numbers submitted to the meeting of the Institute in response to the request quoted, the following already existed in printed form and were not reprinted in the Bulletin of the International Institute of Statistics:

H. Denis.—Index numbers of moral phenomena.

A. Julin.—Indexes of the economic progress of Belgium from 1890 to 1908, which appeared in the *Revue des Questions Scientifiques*.

E. Levasseur.—Cost of living, which appeared in the *Revue Economique Internationale*.

M. Alberti.—The cost of living, salaries and wages in Trieste.

Irving Fisher.—The purchasing power of money.

A. Necco.—The course of prices of commodities in Italy.

A. Sauerbeck.—Prices of commodities in 1910, which appeared in the *Journal of the Royal Statistical Society*.

Réne Théry.—Variation of prices in India, which appeared in the *Économiste Européen*.

A brief description of the tables printed in Bulletin XIX of the Institute follows:

#### GERMANY.

##### Bavaria.

The course of prices in Bavaria, 1881-1910. By Dr. Fr. Zahn, director of the Royal Bavarian State Statistical Office. pp. 126-131.

Dr. Zahn utilizes the results of an investigation by the German Imperial Statistical Office concerning household budgets. Of the 19 articles that were thus found to represent a typical family budget, he expands flour into 2 independent varieties, meat into 3, and groups the rest into 7 articles, thus obtaining a list of 12 food articles instead of 19, but he retains the relative proportion of consumption for each as ascertained by the imperial office.

Three tables are presented by him:

1. Prices of food articles (12 as explained above) per pound (one-half kilogram). These actual average annual prices were obtained from the reports of the Bavarian Statistical Office.

2. The course of the cost of living in Bavaria, 1881-1910. The prices of Table 1 are here multiplied by the per cent of consumption in the typical budget for the respective food articles.

3. The general index number for each year is computed from the totals of Table 2 and for the base year, 1881.

##### Brunswick (city).

The course of prices in the city of Brunswick, 1881-1910. By F. W. R. Zimmermann, city treasurer. pp. 132-133.

The single table presented gives a general index number computed for the base year 1881 for each year from 1881 to 1910. The average annual prices used for this computation were obtained from the monthly average prices of the city for 14 food articles and straw and hay.

#### LÜBECK.

The course of prices in Lübeck, 1886-1910. By Dr. Hartwig, director of the statistical office of the free Hanse town of Lübeck. pp. 134, 185.

The table begins with the year 1886 because data previous to that were not available. Therefore the general index number had to be computed on the base 1886 instead of 1881 as requested by the Institute. Average annual prices are given for 27 food articles, 10 wholesale and 17 retail. The sources of quotations were various.

#### AUSTRIA-HUNGARY.

Index numbers of 45 commodities in the Austro-Hungarian Monarchy, 1867-1909 (according to the system of Sauerbeck, partially revised by the author). By Dr. Béla von Jankovich, vice president of the Hungarian Chamber of Deputies. pp. 136-156. These tables are discussed in detail on pages 166 to 168 of this bulletin.

#### BELGIUM.

Tables of index numbers. By Hector Denis, professor in the University of Brussels. pp. 157-195.

Besides the comparative tables and the tables of exports already described on pages 172 to 175 of this bulletin, more than 20 tables are presented to illustrate various places of economic history. These tables make no attempt to confine themselves to the period 1881-1910 or to the base period 1881, as requested by the circular of the Institute.

Paper on index numbers for Belgium. By Edmond Nicolai. pp. 195-200.

The paper presents a table and chart covering 40 articles placed in eight groups, with the various sources of prices designated in a separate column. Index numbers are given yearly from 1881 to 1910, both for individual articles and for groups; 1881 is used as the base.

Variation in prices in Belgium from 1881 to 1909. By Maurice Sauveur. pp. 201-209

The two tables of index numbers and chart submitted by Mr. Sauveur are based on the wholesale prices published in the *Annuaire Statistique de la Belgique*—official figures ascertained by the Department of Agriculture. The indexes are computed on the base period 1881. Table I presents yearly unweighted indexes of 18 articles—16 foods, and hay and straw. Table II groups these into cereals, vegetables, both groups combined, and meats; and weights the indexes for each group in proportion to the amount of home consumption.

Course of prices of 10 articles of current consumption in Brussels, 1881-1910. By Prof. E. Waxweiler, director of the Solvay Institute of Sociology. pp. 210-218.

Prof. Waxweiler prepared his two tables and six charts in strict conformity with the purpose of the International Institute in requesting such information, namely a possible international study of the causes of the increase in the cost of living. He used as a base the year 1881, computed indexes for the period 1881-1910, and selected such commodities as he considered most important of those available influencing the cost of living. His prices were taken from the accounts of a large charitable institution of Brussels and are the yearly average wholesale prices paid by that institution through public bids. The 10 commodities selected by him are meats, eggs, wheat, potatoes, butter, milk, linen cloth, cotton cloth, coal, and wood. Table I shows the average yearly prices and Table II the yearly index number of each commodity and also a general index number for each year. The charts present these index numbers graphically.

## DENMARK.

\* Variation of prices in Denmark from 1881 to 1910. By M. Koefoed, director of the Danish Bureau of Statistics. pp. 219-220.

The single table submitted shows only the yearly general index number from 1881 to 1910, 1881=100, of 38 commodities, unevenly weighted. For computing this index number the 38 commodities were arranged in three groups, according to their importance in commerce, and the prices of those in group 2 were multiplied by 2 and those of group 3 by 3. No prices are given, but they were taken from the *Statistique de l'Échange extérieur*.

## FRANCE.

Variation of prices in France from 1881 to 1910. By A. de Foville, member of the Institute of France and chief counsellor of the Government auditing department (*Cour des comptes*). pp. 220-222.

A double table of index numbers shows indexes for imports and for exports separately. These were computed from values calculated by the administration of customs (*Direction Générale des Douanes*). To ascertain the variation in the value of exports and imports the administration of customs first multiplied the total imports and exports, respectively, in any given year by the price for the previous year, then also by the price for the given year, and from the two computed the per cent rise or fall of the price of exports and of imports. These proportions form the basis for the table that appears, but no details of commodities, prices, etc., are given.

Wholesale prices in France (index numbers computed for the base period 1881). By Lucien March, director of the statistical office of France. pp. 222-223.

The table is computed for three index numbers—one for food articles, one for miscellaneous articles, and one for the two together, or a general index number. Forty-three articles were used, almost the same as those of Sauerbeck, but they are not specified. Sauerbeck's method of computation also was used and the prices are those fixed every year by the permanent commission on customs values.

## NETHERLANDS.

Variation of prices in Amsterdam from 1881 to 1911. By Ph. Falkenburg, director of the bureau of statistics. pp. 224-229.

A table of index numbers is presented for 23 food articles separately and an index number for each of three groups into which these are classified, as well as a general index number for all of them. The base period used is 1881. A second table gives the actual prices of these 23 food articles besides 10 other commodities. Both tables are based on the contract prices paid by the Amsterdam municipal hospitals.

Variation of prices in the Netherlands. By H. W. Methorst, director of the Central Bureau of Statistics of Netherlands. pp. 230-234.

Table I presents index numbers for eight food articles based on contract prices paid by two prisons, three workhouses, and an asylum for the insane. 1881 is used as the base, and the table covers the period from 1881 to 1911. Besides the separate index numbers for each article a general index is also given.

For Table II data previous to 1903 were not available. It covers the period from 1903 to 1911 and gives relative prices for four kinds of bread and a general index number for all. The base period is 1903 and the prices were obtained from bakeries in cities of 10,000 population or over.

Table III presents index numbers for 29 commodities from 1893 to 1911, based on retail prices of six cooperative societies. 1893 is used as the base.

## CANADA.

Variation of prices in Canada from 1890 to 1910. pp. 235-236.

Reliable data previous to 1890 could not be secured in Canada and the table of general index numbers presented is computed on the base period 1890-1899 and was

taken from the report of R. H. Coats of the Department of Labour as presented in the volumes entitled "Wholesale Prices in Canada, 1890-1909," and "Wholesale Prices in Canada, 1910."

#### JAPAN.

Statement of prices in Japan. By N. Hanabusa, director of the bureau of general statistics. pp. 237-243.

Table I gives average wholesale prices, index numbers, and a general index for four food articles—rice, barley, Japanese beans, and sake (rice wine)—for the years 1881-1909. 1881 is used as the base. The prices were taken from the figures obtained by the Ministry of Agriculture and Commerce in its quarterly investigations into prices in six large cities.

Table II gives average prices, index numbers, and a general index of 26 commodities selected from among 60 which the Ministry of Agriculture and Commerce reports regularly since 1886. The table covers the years 1886-1909. 1886 is taken as the base. A more complete account of the index numbers compiled by Mr. Hanabusa appears on pages 288 to 292 of this bulletin.

#### NEW SOUTH WALES.

Variation of prices in New South Wales. By T. A. Coghlan, general agent for New South Wales, p. 244.

The single table presents a general index number from 1860 to 1910 with 1881 as the base. No explanations accompany the table.

### SELECT BIBLIOGRAPHY OF ADDITIONAL INDEX NUMBERS.

[The publications that are starred were not available for reference either in the Library of Congress or in the library of the Bureau of Labor Statistics, and statements concerning them are based upon information found in the works of other authors.]

Avenel, Vicomte Georges d'. *Histoire économique de la propriété, des salaires, des denrées, et tous les prix en général depuis l'an 1200 jusqu'en l'an 1800.* Paris, 1894-1912. 6 vol.

"Apparently draws, very roughly, an average of the mass-quantities of goods purchasable with given amounts of silver at different epochs from 1200 to 1890."<sup>1</sup>

Barker, Wharton. *The course of prices.* (Published in *The American*. Philadelphia. 1896-1900.)

Beginning in January, 1896, quarterly index numbers and a general index are given for 13 groups of 100 articles, going back as far as the year 1891 and continued until October, 1900, shortly after which the publication of *The American* was discontinued. The prices of January 1, 1891, were used as base.

Bourne, Stephen. *On some phases of the silver question.* (Published in the *Journal of the Royal Statistical Society of London*, 1879.)

The chapter "On the fall of prices" presents a general index number for the 22 articles used by *The Economist*, but combines the four kinds of cotton into a single index and adds coal. The indexes are computed yearly from 1847 to 1879 for the base period 1845-1850.

On index numbers. (Published in the Reports of the British Association for the advancement of science for 1885 and 1888 and concluded in the *Journal of the Royal Statistical Society of London* in 1889.)

Yearly index numbers and a general index are given for the total imports and exports of Great Britain from 1876 to 1888, computed for the base year 1883. This base year was taken as equal to 1,000. The component parts of this 1,000 and of the index numbers for 1888 are shown in two tables, one for imports and one for exports.

<sup>1</sup> C. M. Walsh, *The Measurement of General Exchange-Value.*

Bulgaria. Index nombres des marchandises les plus importantes et des salaires des ouvriers, d'après leur prix dans les villes principales de la principauté. (Published by the Direction Générale de Statistique in the "Statistique des prix moyens des animaux domestiques, des principaux articles alimentaires et des salaires des ouvriers en Bulgarie pendant la période décennale 1893-1902. Sofia. 1906.)

Index numbers are given for 99 articles computed yearly from 1893 to 1902 for the base period 1888-1892.

— Annuaire statistique du royaume de Bulgarie. (Published by the Direction Générale de Statistique. Sofia. 1<sup>re</sup> année 1910. 2<sup>e</sup> année 1911.)

A yearly general index is given for 86 articles from 1899 to 1910, computed for the base 1894-1898.

Burchard, H. C. Tables are published in the Finance Reports of the Secretary of the Treasury, Washington, 1881, 1882, 1883, and in the Report of the Director of the Mint on the production of the precious metals in the United States in 1884.

In these reports a series of tables appears comparing the yearly average prices of over 80 articles in each of the years 1881, 1882, 1883, and 1884, with the average prices of each of the preceding years, respectively, and also with the average prices of the 56 years preceding 1881.

Calwer, Richard. Das Wirtschaftsjahr. Annual numbers. Jena. (These are published in two parts and several years late. The last year to appear is 1909, of which Part I was published in 1912 and Part II in 1914.)

Beginning with the year 1907, a permanent chapter is published on "Einkommen und Konsum. Waarenpreise." Three tables of index numbers are given for 17 articles of consumption in Germany. One shows the monthly index numbers for these articles for the year, another the general index computed as far back as 1895, and a third the yearly index for each article computed back to 1903.

\*Carli, G. R. Del valore e della proporzione de' metalli monetati con i generi in Italia prima delle scoperte dell' Indie col confronto del valore e della proporzione de' tempi nostri. —, 1764.

Prices of grain, wine, and oil in the year 1750 are reduced to proportions of those in the year 1500.

Commons, Prof. John R. Comparative prices, freight rates, stock quotations for the years 1876 to 1900, shown by percentages or index numbers. (Published in No. 1 of the Quarterly Bulletin of the Bureau of Economic Research. New York. 1900.)

Yearly index numbers are given for 66 articles individually and also as arranged in 5 groups and 10 subgroups from 1878 to 1900, computed for the base period 1878-1889.

— Wholesale prices by monthly and quarterly averages, 1896 to 1900 and 1878 to 1882. Shown by index numbers and diagrams. (Published in No. 2 of the Quarterly Bulletin of the Bureau of Economic Research. New York. 1900.)

Monthly index numbers are given for the same 66 articles from 1896 to 1900 and also by groups and subgroups, as above, and for the same base. Quarterly index numbers are given for the groups and subgroups only and for the years from 1878 to 1882 only.

Daggett, Elsworth. A quarter of a century of prices. Salt Lake City. 1896.

By the use of a "commodity unit" he computes yearly index numbers and a general index for 21 articles in the United States from 1870 to 1894, for the base period 1870-1872.

Drobisch, Moritz Wilhelm. Ueber die Berechnung der Veränderung der Waarenpreise und des Geldwerthes. (Published in the Jahrbücher für Nationalökonomie und Statistik. 1871.)

He illustrates his own method of computing index numbers by applying it to Hamburg prices of 26 articles for the years 1854 and 1867.

- \*Dutot, ———. *Réflexions politiques sur les finances et le commerce.* The Hague. 1738.  
Prices at the time of Louis XII and of Louis XIV are compared.
- \*Ellis, A. The money value of food and raw materials. (Published in the London Statist. June 8, 1878.)  
Index numbers are given for 25 articles for the years 1859, 1869, 1873, 1876, and the first quarter of 1878, computed for the base year 1869.
- Eulenberg, Dr. Franz. *Die Preissteigerung des letzten Jahrzehnts.* (Published in the *Vorträge der Gehe-Stiftung zu Dresden.* 4. Band, 1912.)  
Yearly index numbers and a general index are computed for 9 groups of 45 articles from the prices of the "*Vierteljahrsheft zur Statistik des Deutschen Reiches, 1912,*" from 1899 to 1911 and for the base period 1889-1898.
- Evelyn, Sir George Shuckburgh. An account of some endeavors to ascertain a standard of weight and measure. (Published in the *Philosophical transactions of the Royal Society of London, 1789, part I*; reprinted in the *Bulletin de l'Institut International de Statistique, 1887.*)  
Index numbers are given for wheat, butcher's meat, day labor, and 12 agricultural products at irregular periods from 1050 to 1800, computed for the year 1550 as base.
- Flux, A. W. Some old trade records reexamined: A study in price movements during the present century. (Published in the *Transactions of the Manchester Statistical Society.* London. 1898-99.  
General index numbers are given for the total export values and total import values of British products, for seven-year periods from 1798 to 1869, computed for the base year 1694. The same is done for France from 1873 to 1897 and for Germany from 1891 to 1897.
- \*Forbes, Francis B. The causes of depression in the cotton industry of the United Kingdom. London. 1886. (Occasional paper of the Bimetallic League, No. 3.)  
The period 1884-85 is compared with 1875-76 for 12 classes of exports and 7 of imports.
- Foville, Alfred de. *La mouvement des prix dans le commerce extérieur de la France.* (Published in a series of articles in the *Économiste Français, July 5, 19, Nov. 1, 1879, and Apr. 29, 1882.*)  
Index numbers are given for imports and exports of France from 1847 to 1880, computed for the base year 1862.
- Giffen, Sir Robert. Report to the Secretary of the Board of Trade on recent changes in the amount of the foreign trade of the United Kingdom and the prices of imports and exports. (Parliamentary Document. Session 1885, c. 4456.)  
Index numbers are given at irregular intervals of one to four years for 67 exports from 1840 to 1883 and for over 100 imports from 1854 to 1883, computed for the base 1861. These exports and imports include several varieties of many articles. Earlier and less complete forms of these tables appeared, also as parliamentary documents, in 1879 (c. 2247), 1880 (c. 2484), and 1881 (c. 3079).
- \*Hanauer, A. *Études économiques sur l'Alsace ancienne et moderne.* Vol. II. *Denrées et salaires.* Paris. 1878.  
The average of 10 articles purchasable with one franc in 1351-1375 is compared with that of 1851-1875 at 25-year periods from 1351 to 1875.
- Hansard, Luke. On the prices of some commodities during the decade 1874-1883. (Published in the *Journal of the Institute of Bankers.* London. 1885.)  
Yearly index numbers are given for 25 articles in Great Britain from 1874 to 1885, computed for the base year 1874.

Hooker, R. H. The course of prices at home and abroad 1890-1910. (Published in the Journal of the Royal Statistical Society. London. 1912.)

Various index numbers of Great Britain, United States, Germany, France, Belgium, and Italy are all reduced to the same base period, 1890-99, and a comparison is made between the resulting indexes for several groups of articles and also for 16 separate articles.

Hungary. Preisstatistik. (Published by the K n. ungarische statistische Zentrallamt in "Ungarische statistische Mitteilungen. n. s. bd. 44. Budapest. 1913.)

In the neighborhood of 40 tables of index numbers of wholesale prices are included in this exhaustive study of prices. Many tables are computed for three different bases: 1867-1877, 1890-1899, and 1899-1903, and for five-year as well as for yearly periods, while in a few cases even monthly indexes are shown. Index numbers of the most important grains are given for the leading countries of Europe and the United States. For Hungary individual articles as well as a list of articles are given for the country as a whole and for different markets. General index numbers are also given for various countries for the several bases, usually based on existing price studies in those countries.

Inama-Sternegg, Dr. Karl T. M. von. Der R ckgang der Waarenpreise und die oesterreichisch-ungarische Handelsbilanz 1875-1888. (Published by the k. k. Statistische Zentral-Kommission in the "Statistische Monatschrift." XVI Jahrgang. 1890.)

Index numbers are given for 30 imports and 26 exports of Austria-Hungary from 1880 to 1888, computed yearly for the base period 1875-1879.

The same author also published a pamphlet "Beitr ge zur Geschichte der Preise," in which he describes the various tables of index numbers and prices that were submitted for exhibition in the exposition in Vienna in 1878.

India. Prices and Wages in India. Compiled in the office of the Director General of Commercial Intelligence. Calcutta. 1913.

Half-yearly and yearly index numbers are given for staple articles of import, 11 at Calcutta and 3 at Bombay, from 1873 to 1913, for the base 1873. The same is done for exports for prices selected mainly at Calcutta.

Another table compares the index of prices of 9 articles at Calcutta and London, yearly from 1888 to 1912, base 1873.

Index numbers are also given for 8 staple articles in Calcutta in January of each year from 1888 to 1913, base 1873.

Yearly index numbers are also computed for the prices of articles of consumption of troops at 16 stations in India from 1887 to 1912, base 1882-83, for each station and for each article.

\*James, Henry. The state of the nation. Causes and effects of the rise in value of property and commodities from the year 1790 to the present time. London. 1836.

Average prices of British produce from 1798 to 1823 as compared with 1694 are given.

Jevons, Prof. William Stanley. Investigations in currency and finance. London. 1909. (Reprints of various articles published earlier, including: A serious fall in the value of gold ascertained and its social effects set forth, 1863; The variation of prices and the value of currency since 1782, 1865; The depreciation of gold, 1869.)

Three sets of index numbers appear. One series gives yearly index numbers for 39 articles from 1845 to 1865, computed for the base period 1845-1850. The second gives yearly index numbers and a general index for 12 groups of 40 articles from 1762 to 1865, computed for the base 1782. The general index for these 40 articles is also given in 10-year periods from 1789 to 1869, but for the base year 1849. The third series gives a general index for 60 leading articles of commerce from 1847 to 1869, computed yearly for the base 1849.

Juergens, Carl H. Movement of wholesale prices in New York City, 1825-1863. (Published in the quarterly publications of the American Statistical Association. 1910-11.)

Yearly index numbers are given for each of 74 articles whose prices were taken from the report of the Secretary of the Treasury for June 30, 1863. A general index is also given for each year for the whole period covered, 1825-1863. The year 1860 is used as base.

Julin, Armand. The economic progress of Belgium from 1880 to 1908. (Published in the Journal of the Royal Statistical Society. 1912.)

In a presentation of a large number of index numbers that do not concern prices there appear also yearly index numbers for exports, imports, agricultural products, and several other articles from 1880 to 1908, computed for the base year 1884.

Levasseur, Émile. La question de l'or. Paris. 1858.

Yearly index numbers are given for 2 groups (8 articles) of exports and 3 groups (28 articles) of imports from 1847 to 1856, computed for the base 1826.

March, Lucien. Le mouvement des prix et l'activité productrice. (Published in the Bulletin of the Bureau de la Statistique Générale. Paris. 1911.)

In making a comparative table of general index numbers for France, Germany, England, and the United States he computes a yearly index for France of 43 articles out of Sauerbeck's 45 from 1840 to 1910 and for the base period 1891-1900.

Mulhall, Michael George. History of prices since the year 1850. London. 1885.

Several tables of index numbers are given. Yearly, 5-yearly, and 10-yearly index numbers are given for total imports, total exports, and both together from 1854 to 1884, base 1841-1850. Likewise 10-yearly indexes are given for each of 50 imports and 50 exports from 1850 to 1884, base 1854-1860. Another table shows 10-yearly index numbers for each of 7 agricultural products and 7 manufactured products from 1782 to 1884, base 1782-1790.

Netherlands. Prijzen van levensmiddelen te Amsterdam. Amsterdam. 1911.

(Published by the Bureau van statistiek in the "Statistische mededeelingen uitgegeven door het Bureau van statistiek der gemeente Amsterdam" No. 35.)

The contract prices paid by the municipal hospitals are used for computing the yearly index numbers of 26 articles from 1881 to 1911 for the base year 1881. A general index is also computed.<sup>1</sup>

Maandschrift van het centraal bureau voor de statistiek. 1913; 1914.

The series of index numbers published in the 1913 volume is based on the contract prices paid by 5 large institutions. Yearly indexes and a general index are given for 9 articles, computed for the base year 1881, from 1881 to 1912.

New South Wales. Index numbers of exports at Sydney, principal articles of domestic produce. Published in the Official Yearbook 1913.

Index numbers are given for two groups and also for the total of exports, computed yearly from 1901 to 1913, for the base year 1901. The monthly index numbers for this table are also given for the year 1913, and this latter table likewise appears in the Monthly Statistical Bulletin of New South Wales.

Palgrave, Sir R. H. Inglis. Currency and standard of value in England, France, and India, and the rates of exchange between these countries. (Published in the Third Report of the Royal commission appointed to inquire into the depression of trade and industry. London. 1886.)

The index numbers of the Economist are presented as reduced to the base 1865-1869 and computed for each article yearly and five-yearly from 1870 to 1886. The same is done for 22 articles in France, corresponding as nearly as possible to those of the Economist and computed from 1865 to 1885. Each of these series is then weighted to form a new table. The series for India gives yearly, five-yearly, and general indexes for 10 articles (also as arranged in three groups) from 1870 to 1884 for the same base 1865-1869.

<sup>1</sup> Compare pp. 293 and 294 of this bulletin.



Porter, George Richardson. *The progress of the nation, in its various social and economic relations, from the beginning of the nineteenth century.* London. 2d edition. 1847.

A monthly general index number is given for 50 articles in London, also for wheat separately, from January, 1833, to December, 1837. This is computed upon the prices of the first week in January, 1833, as base.

Powers, Le Grand. *Modern variations in the purchasing power of gold; an investigation into the extent and causes of recent price variations.* (Published in the fifth biennial report of the Bureau of Labor of the State of Minnesota. St. Paul. 1896.)

Index numbers are given for 16 articles of farm production for the years from 1862 to 1895, computed yearly for the base year 1872, and combined in a great variety of ways, i. e., by States, years, groups of articles, etc.

Rogers, J. E. Thorold. *A history of agriculture and prices in England from the year after the Oxford parliament (1259) to the commencement of the continental war (1793); compiled entirely from original and contemporaneous records.* Oxford. 1887. Vol. V.

The prices of 39 articles are compared for the periods 1541-1582, 1583-1702, 1583-1642, 1643-1702, the average prices of each period in turn being compared with those of the period immediately preceding.

Rumania. *Bulletin statistique de la Roumanie. La Statistique Générale.* Bucharest. 1911.

The rise and fall per cent of prices as compared with the period immediately preceding is shown semi-monthly, monthly, quarterly, semiannually, and annually from 1908 to 1911 for five grains.

Tyszka, Carl von. *Die Bewegung der Preise einiger wichtiger Lebensmittel, insbesondere der Fleischpreise in Deutschland und im Auslande, unter besonderer Berücksichtigung Englands.* (Published in the *Jahrbücher für Nationalökonomie und Statistik.* 3. F. 42. 1911.)

Index numbers are computed for 10-year periods for 10 articles (8 meats, wheat, rye) from 1881 to 1910, for the base 1891-1900. Other tables compare similar indexes for Berlin with those of London, New York, Paris, from 1895 to 1910.

United States. *Index numbers of production per capita and price of important farm products.* Published by the Department of Agriculture in *The Crop Reporter*, Washington. April, 1912.

These index numbers are not given in figures, but are represented by graphs. Yearly indexes for the total of 10 important crops are computed from 1866 to 1911 for the base period 1866-1908.

Walras, Léon. *Études d'économie politique appliquée.* Lausanne and Paris. 1898.

Yearly index numbers and a general index are given for 20 articles at Berne, Switzerland, from 1871 to 1884, computed for the base period 1871-1878.

Wasserab, Karl. *Preise und Krisen. Gekrönte Preisschrift "Über die Veränderungen der Preise auf dem allgemeinen Markt seit 1875 und deren Ursachen."* Stuttgart. 1889.

Index numbers are computed for 31 articles in Germany by comparing the average price of the period 1882-1885 with that of 1861-1870 as base.

Whitehead, Thomas Henderson. *The critical position of British trade with Oriental countries.* (Paper read before the Royal Colonial Institute, February 12, 1895, and reprinted from the proceedings of the Institute.)

On page 35 of this volume the author presents a table of yearly index numbers compiled by W. S. Wetmore, of Shanghai, from official returns, covering 20 staple commodities of China from 1874 to 1893, computed for the base year 1873.

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