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W H O L E S A L E P R I C E S S E R I E S

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

REVISION OF BULLETIN No. 173



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

INTRODUCTION.

The first edition of this bulletin was published in July, 1915,¹ on the eve of the world-wide revolution in prices caused by the war. Until victory was achieved this revolution was overshadowed by military issues; but it bred problems that forced themselves on everyone's attention soon after the armistice was signed on November 11, 1918. One result of the interest thus excited was a lively demand for this brief treatise on index numbers, exhausting the first edition and calling for a new issue.

In the present edition Part I, "The making and using of index numbers," has been revised, and Part II, "Index numbers of wholesale prices in the United States and foreign countries," has been brought down to the latest date for which complete information is obtainable.

A fundamental change in the method of compiling the Bureau of Labor Statistics' index numbers was under way in 1914-15. But the new results were not ready in time to be utilized in the first edition of this bulletin. Accordingly, free use was made of the bureau's old averages of relative prices on the 1890-1899 base. In revising Part I of the present edition this old material has been kept wherever it was employed merely for illustration. In other sections, notably in the comparison of the leading American index numbers, the latest form of the bureau's index has been substituted for the old series.

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

¹ Bulletin No. 173 of the United States Bureau of Labor Statistics.

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.

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

BY WESLEY C. MITCHELL.¹

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 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 over 150 years old.²

It was in England, however, where practically the same device had been hit upon by Sir George Schuckburg-Evelyn in 1798,³ 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."⁴

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

¹ 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. In revising the paper the writer has made free use of the criticisms of the first edition published by Prof. F. Y. Edgeworth, *Economic Journal*, June, 1818, Vol. XXVIII, pp. 176-197, and by Prof. Frederick R. Macaulay, *American Economic Review*, March, 1916, Vol. VI, pp. 203-209. He is indebted once more to Dr. Royal Meeker for critical and constructive suggestions, and to Prof. W. F. Ogburn for supervising certain computations and for reading the manuscript. Prof. Macaulay has considered the theoretical sections with care and suggested numerous improvements in both text and tables.

² *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 di Economia Politica. Parte Moderna*, Vol. XIII, pp. 297-363, especially pp. 335-354.

³ "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. 133-182, especially pp. 175 and 176.

⁴ *Principles of Political Economy*, London, 1833, pp. 405-408. It is interesting to note, however, that neither David Ricardo, who wrote several pamphlets on currency and prices during the "bank restriction," nor Thomas Tooke, who published an elaborate *History of Prices in 1793-1847*, made use of index numbers.

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."⁵

The problem of price fluctuations entered upon another phase when 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 all civilized countries. Efforts to measure this increase as well as efforts to explain it multiplied.

Index numbers are both troublesome and expensive to compile, yet now in the United States not less than seven wholesale-price series are currently maintained, four of them by financial papers. In England there are four important series; in France one; in Germany, before the beginning of the World War, there were three; while the Governments of Canada, Australia, South Africa, India, Netherlands, and New Zealand now publish official index numbers, and private investigators have made series for Italy, Japan, Belgium, Denmark, Norway, Austria, Spain, and Sweden, although not all of these were kept up during the war period. This list may well be incomplete 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 1869.⁶ 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 1909.⁷

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.

⁵ For the reports of this committee, see the Reports of the British Association, 1887, pp. 247-254; 1888, pp. 181-188; 1889, p. 133; 1890, pp. 485-488. See particularly the memoranda by Prof. Edgeworth subjoined to these reports.

⁶ 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.

⁷ 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.

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 and his series was allowed to lapse after 1884.⁸ 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 1891.⁹ 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, 1900.¹⁰ 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.¹¹ 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, by the *New York Times Annalist* in 1913, and by the Federal Reserve Board in 1918.

This activity in the making of index numbers was 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.¹²

Some of the more important new series known to have been established since the war are the series compiled by the Price Section of the War Industries Board and published in its "History of Prices

⁸ 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, 1884, pp. 497-502. Compare the criticism of this series by Prof. J. Laurence Laughlin, *Quarterly Journal of Economics*, April, 1887, pp. 397 and 398.

⁹ See the description given on pp. 149-159.

¹⁰ See Bulletin No. 27 of the Department of Labor, March, 1900.

¹¹ See the issues for July and October, 1900.

¹² 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 contributions of later date than Laughlin's entries are Prof. Irving Fisher's *Purchasing Power of Money*, pp. 385-429, Mr. C. M. Walsh's "The Problem of Estimation," Prof. Irving Fisher's paper on "The Best Form of Index Numbers," with discussion, in the *Quarterly Publication of the American Statistical Association*, March, 1921, and Mr. A. W. Flux's paper on "The Measurement of Price Changes," with discussion, in the *Journal of the Royal Statistical Society*, March, 1921.

During the War," the series compiled by the Federal Reserve Board from data gathered by the United States Bureau of Labor Statistics, the series designed by the same board for making international comparisons, the series published by the United States Food Administration in 1918 in a pamphlet entitled "General Index Numbers of Food Prices on a Nutritive Value Base," the series established by the London Times for Great Britain and by the Handelstidning for Sweden, the series for Italy compiled by Prof. Riccardo Bachi, the series compiled by the Bank of Japan, and those published by the Governments of South Africa and New Zealand.

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 things as the weight of the atmosphere, the velocity of sound, fluctuations of temperature, and the precession of the equinoxes. 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 a class of permanent wage earners 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;¹³ 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 three commodities; Shuckburg-Evelyn with 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

¹³ 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.

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 newspapers 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 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.¹⁴ 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 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 Bulletin No. 149 of the Bureau of Labor Statistics, published in 1914. 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

¹⁴ The Belgian statistician, Adolphe Quetelet, and Thomas Henry Buckle, author of the *History of Civilization in England*, 1857 and 1861, were perhaps the most effective demonstrators of this fact.

price each year as compared with the year before.¹⁵ Since this section is concerned wholly with problems of method which have no connection with any given period of time, there is no reason for bringing all the illustrative materials down to date.

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 underwent the same changes in price. Some articles rose rather steadily in price and fluctuated on a much higher level in 1913 than in 1890; for example, rosin and crude petroleum. Other articles fell much more than they rose and fluctuated on a much lower level at the end than at the beginning; for example, soda and wood alcohol. Some articles were steady in price, seldom changing from one year to the next; for example, bread and certain kinds of tools. Other articles changed in price every year; for example, cotton and pig iron. (2) In every year a considerable proportion of the commodities rose in price, a considerable proportion fell, and a somewhat smaller proportion remained unchanged. (3) The range covered even by the fluctuations from one year to the next was very wide. For example, in 1896 potatoes fell 54.6 per cent, while coke rose 41.5 per cent; 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.¹⁶

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.¹⁷ 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.

¹⁵ 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.	Year.	Average price per pound.	Relative price.	Per cent of increase(+) or decrease(-) compared with preceding year.
Average, 1890-1899.	\$0.07762	100.0	.....	1905	\$0.09553	123.1	-21.0
1890.....	.11089	142.9		1906	.11025	142.0	+15.4
1891.....	.08606	110.8	-22.4	1907	.11879	153.0	+7.7
1892.....	.07686	99.0	-10.7	1908	.10463	134.8	-11.9
1893.....	.08319	107.2	+8.2	1909	.12107	156.0	+15.7
1894.....	.07002	90.2	-15.8	1910	.15118	194.8	+24.9
1895.....	.07298	94.0	+4.2	1911	.13037	168.0	-13.8
1896.....	.07918	102.0	+8.5	1912	.11503	148.2	-11.8
1897.....	.07153	92.2	-9.7	1913	.12792	164.8	+11.2
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.....	.08932	115.1	+3.5				
1903.....	.11235	144.7	+25.8				
1904.....	.12100	155.9	+7.7				

¹⁶ All of these figures show percentages of rise or fall from the average prices of the commodities in question in the preceding year.

¹⁷ The figures in this table have been brought down to 1918 to harmonize with the material in Section V, on "A comparison of the leading American index numbers for the years 1890 to 1918."

TABLE 1.—CONSPECTUS OF THE CHANGES IN WHOLESALE PRICES IN THE UNITED STATES, BY YEARS, 1891 TO 1918.

[Based upon the percentages of increase or decrease in price from one year to the next, computed from Table 9 of Bulletin of the United States Bureau of Labor Statistics, No. 269, May, 1920.]

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	55	
1893.....	234	114	.....	5	25	44	25	15	42	15	17	21	10	14	1	78
1894.....	236	192	.....	29	70	44	34	15	25	4	6	3	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	6	73	
1897.....	241	118	1	9	22	35	27	24	31	12	20	30	11	17	2	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	23	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	10	9	13	10	28	13	31	52	52	19	.....	167
1907.....	242	48	.....	2	5	9	18	14	32	27	25	43	45	20	2	162
1908.....	242	155	.....	25	50	32	30	18	32	14	14	12	11	4	.....	55
1909.....	253	98	.....	2	15	21	28	32	31	24	24	40	17	16	3	124
1910.....	253	81	.....	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.....	253	80	.....	6	12	18	25	19	36	21	27	34	35	20	.....	137
1913.....	252	84	.....	12	14	16	23	19	35	28	39	30	27	7	2	133
1914.....	329	152	.....	12	35	44	28	33	59	30	21	35	23	8	1	118
1915.....	342	137	2	9	35	29	27	35	36	22	38	39	38	28	4	169
1916.....	342	12	.....	.....	1	5	3	3	10	11	27	37	88	115	42	320
1917.....	337	9	.....	2	.....	.....	3	2	2	2	7	15	30	172	100	326
1918.....	348	56	1	11	16	14	12	2	1	9	18	27	73	136	28	291

CHARACTERISTICS OF PRICE FLUCTUATIONS.

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 1918, 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, ±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 1918.

[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, computed from Table 9 of Bulletin of the United States Bureau of Labor Statistics, No. 269, May, 1920.]

(- 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.
	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>
1891	-30.5	-13.2	-8.0	-4.8	-1.4	± 0	± 0	+ 1.5	+ 5.0	+15.3	+ 53.0
1892	-41.2	-16.0	-11.2	-8.5	-5.4	- 3.1	- 0.5	± 0	+ 1.1	+ 5.5	+ 28.0
1893	-27.5	-11.9	-8.0	-5.5	-2.4	± 0	± 0	+ 1.1	+ 4.8	+11.0	+ 59.1
1894	-44.3	-21.4	-15.8	-13.4	-10.8	- 7.1	- 5.0	- 3.3	- 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	+25.6	+ 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	-35.7	-12.6	-5.3	-2.1	± 0	+ 1.3	+ 3.7	+ 5.3	+ 8.3	+14.1	+ 37.4
1904	-43.8	-15.0	- 7.6	-3.5	- .6	± 0	+ 1.3	+ 3.0	+ 5.9	+11.7	+ 39.9
1905	-44.9	- 7.6	- 3.9	- 1.0	± 0	+ .7	+ 3.2	+ 5.9	+ 9.6	+15.9	+ 46.0
1906	-39.1	- 4.8	± 0	± 0	+ 2.8	+ 5.1	+ 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	- 1.1	± 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	+18.6	+ 49.5
1911	-47.4	-15.1	-9.8	-7.0	-4.2	- .9	± 0	± 0	+ 2.9	+11.0	+ 86.1
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
1914	-37.3	-12.0	- 7.4	-4.1	- 1.3	± 0	± 0	+ 1.5	+ 5.0	+ 9.1	+ 76.4
1915	-60.4	-12.0	- 5.9	- 1.9	- .1	± 0	+ 2.7	+ 6.0	+10.1	+18.7	+172.9
1916	-19.1	+ 2.1	+ 6.7	+10.5	+14.4	+18.6	+24.0	+30.1	+38.7	+53.4	+155.1
1917	-34.1	+ 8.7	+19.4	+25.1	+28.6	+34.8	+42.1	+49.3	+57.5	+69.3	+154.2
1918	-51.0	- 6.0	+ 2.0	+ 8.6	+14.8	+18.5	+22.1	+28.6	+36.1	+46.3	+118.0
Average..	-31.9	-10.1	- 5.0	- 2.9	+ .9	+ 3.0	+ 5.1	+ 7.3	+11.5	+19.0	+ 71.0

CHART 1.—CONSPECTUS OF YEARLY CHANGES IN PRICES, 1891-1918.
(Based on Table 2.)

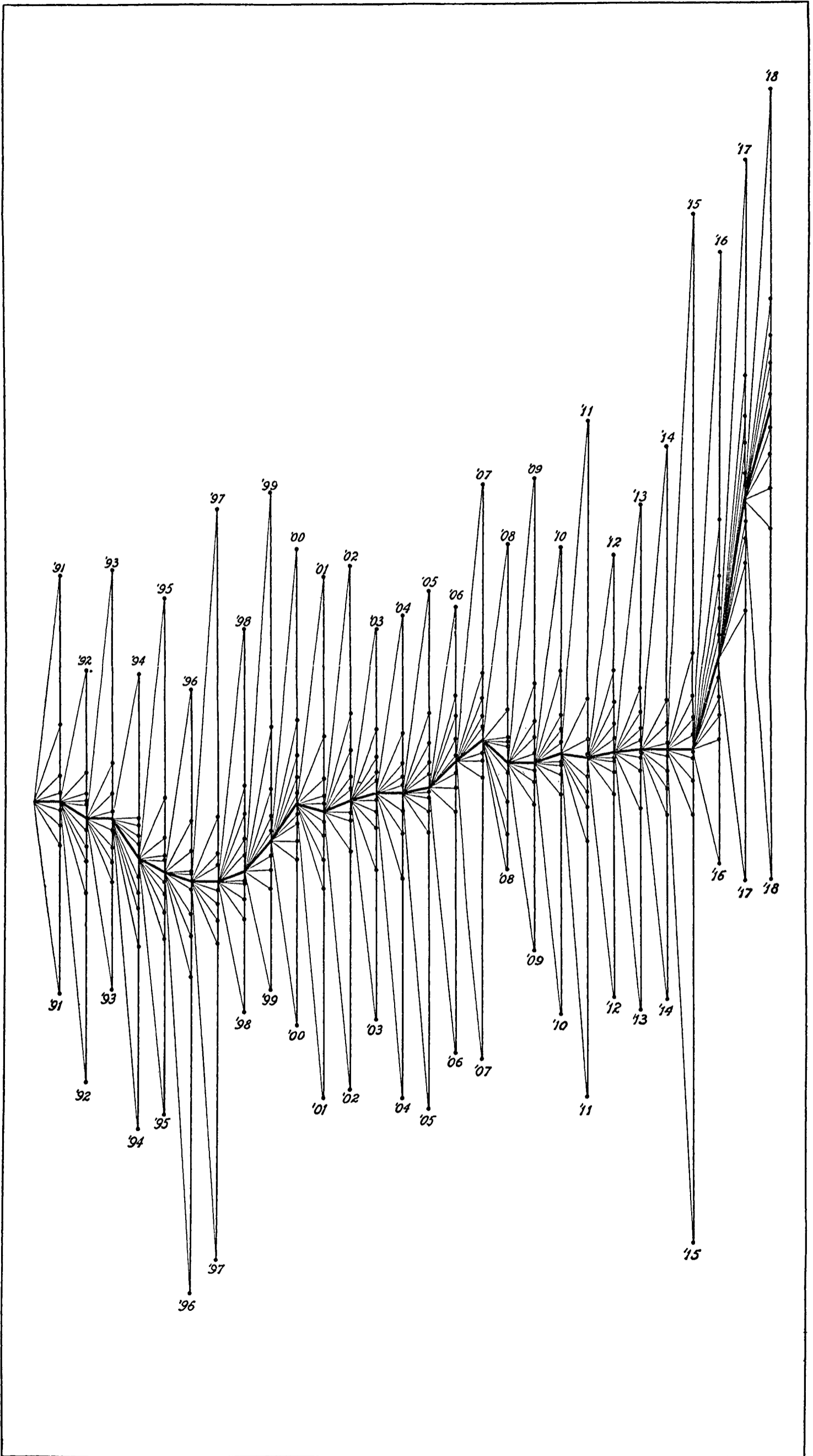


Chart 1, based upon Table 2 and drawn to a logarithmic scale, gives a more vivid idea of these price fluctuations. It shows for each year the whole range covered by the recorded changes from prices in the preceding year by vertical lines, which connect the points of greatest rise with the points of greatest 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 following year. 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 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.¹⁸

Time is well spent in studying this chart, because it is capable of giving a truer impression of the characteristics of price changes than can be given by any other device. 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, the erratic occurrence of extremely large changes, and the fact that the greatest percentages of rise far surpass the greatest percentages of fall 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

¹⁸ Owing to the constant shifting of the base line, no fixed scale of relative prices can be shown on the margin of the chart. 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.

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, 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 upward 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 (29.1 per cent) slightly wider than that covered by the single tenth that represents the heaviest declines (21.8 per cent), and much narrower than that covered by the single tenth that represents the greatest advances (52 per cent).

TABLE 3.—AVERAGE CONCENTRATION OF PRICE FLUCTUATIONS AROUND THE MEDIAN, 1891 TO 1918.

[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.
73.8	12.6	6.3	6.0	4.2	1st tenth, 21.8	4.2	10.2	16.5	29.1	102.9
					2d tenth, 5.1					
					3d tenth, 2.1					
					4th tenth, 3.8					
					5th tenth, 2.1					
					6th tenth, 2.1					
					7th tenth, 2.2					
					8th tenth, 4.2					
					9th tenth, 7.5					
					10th tenth, 52.0					

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.¹⁹ 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 up to 1913 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 magnitude 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).

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.²⁰

¹⁹ See, for example, Prof. F. Y. Edgeworth's article "Probability," Part II, *Encyclopædia Britannica*, 11th ed., and the references there given.

²⁰ Table 4 and Chart 2 might be improved by a change in form. If the "price variations" in each year were computed as percentage deviations from their geometric mean in that year, the distribution of their variations would doubtless be more symmetrical than is the distribution here shown.

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 No. 149 of the Bureau of Labor Statistics.]

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	6.723
98- 99.9	.....	.....	42-43.9	6	.108	4- 5.9	329	5.898
96- 97.9	.....	.....	40-41.9	14	.251	6- 7.9	1 238	4.267
94- 35.9	.....	.....	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	1.328	28-29.9	27	.484
72- 73.9	4	.072	16-17.9	1 102	1.828	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	6.384	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	.....	.....	.....	48-49.9	1	.018
52- 53.9	4	.072	No change.	1 697	12.494	50-51.9	1	.018
50- 51.9	1	.018	.....	.....	.....	52-53.9	.....	.....
48- 49.9	5	.090	.....	.....	.....	54-55.9	1	.018

Summary.

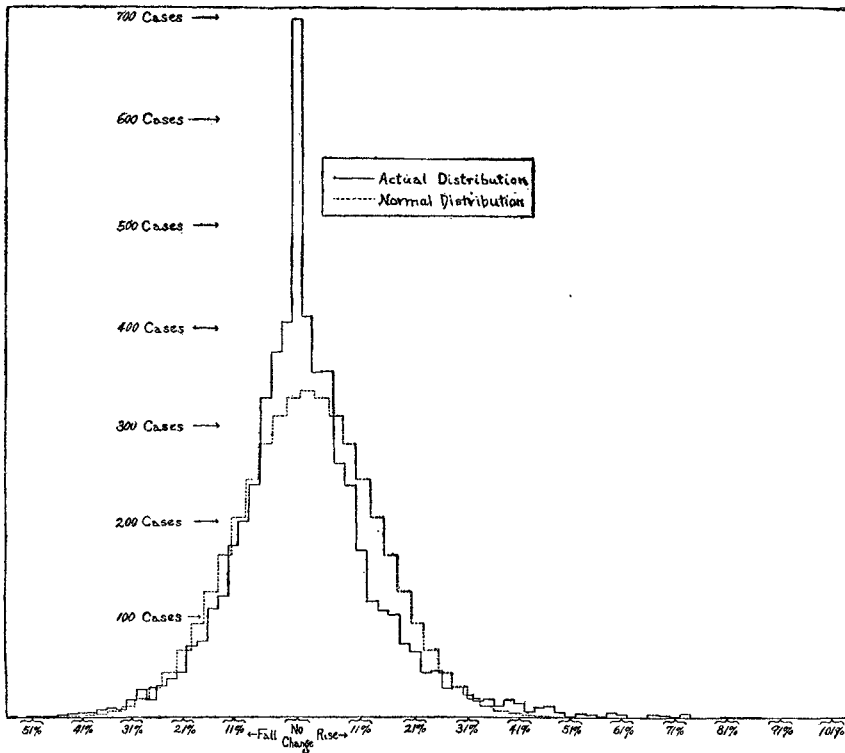
	Number of cases.	Proportion of cases.
Rising prices.....	2,567	46.021
No change.....	697	12.494
Falling prices.....	2,314	41.485
Total.....	5,578	100.000

¹ Location of the decim.

There are several points to notice here. While the actual and the "normal" distributions look much alike, they are not, strictly speaking, of the same type. The actual distribution is much more pointed than the other, and has a much higher "mode," or point of greatest density. On the other hand, the actual distribution drops away rapidly on either side of this mode, so that the curve representing it falls below the curve representing the "normal" distribution. The actual distribution is "skewed" instead of being perfectly symmetrical. The outlying cases of a "normal" distribution extend precisely the same distance from the central tendency in both directions, whereas in the actual distribution the outlying cases run about twice as far to the right (in the direction of a rise of prices) as to the left (in the direction of a fall). This fact suggests that the actual distri-

bution would be more symmetrical if it were plotted on a logarithmic scale, one which represents the doubling of one price by the same distance from zero as the halving of another price. Another aspect of the difference in symmetry is that the central tendency about which the variations group themselves 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; for these three averages coincide. In the actual distribution, on the contrary, these averages differ slightly; the median and the "crude" mode stand at ± 0 , while the arithmetic

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

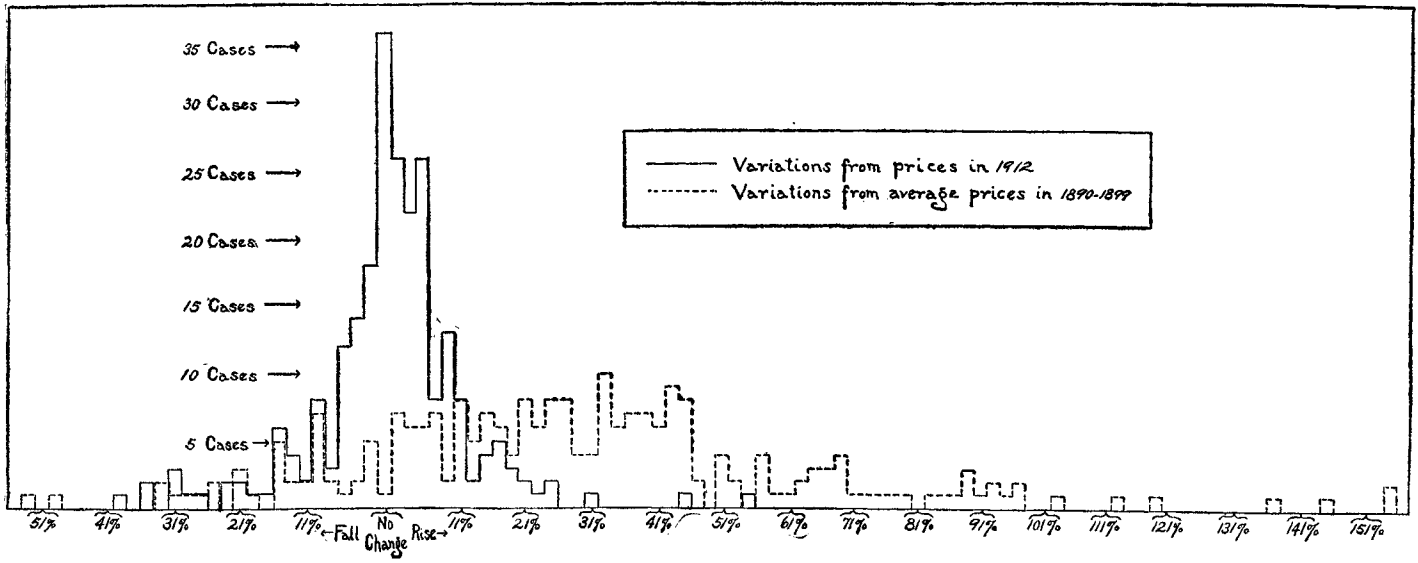


mean is +1.36 per cent.²¹ These departures of the actual distribution from perfect symmetry possess significance; but the fact remains that year-to-year price fluctuations are highly concentrated about their central tendency.

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

²¹ 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.

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



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 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, in its old series, here used for illustration, the Bureau of Labor Statistics measured 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 1913.²² 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 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 has no obvious central tendency; it shows no high degree of concentration around the arithmetic mean (+30.4 per cent) or median (+26 per cent) and 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.²³

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

²² The bureau quoted 252 commodities in 1913; but 11 could not be included in the present comparison because no quotations are given for them in 1890-1899.

²³ In commenting on this chart Prof. Edgeworth has shown that, despite appearances, the distribution of the price variations from the 1890-1899 base, may conform to the normal distribution as closely as the variation from the preceding year base. For, under the condition presented by prices, the quantity observed may move either up or down at each successive interval (here a year), and with a number of observations such as here used, an ideal distribution would appear more or less oblong (as does the dotted line in Chart 3) rather than bell shaped.—*Economic Journal*, June, 1918, Vol. XXVIII, pp. 183-185.

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. Another factor in scattering the percentage variations is probably that the degree of scatter is a function of the degree of variation, and of course variations are likely to be larger between years far apart than between years close together.

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 can be measured with good prospects of success, because such variations show 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 50, 20, or even 10 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 (old series).	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	120.89
Changes.....	+1.6	+ .0209	-3.27	-4.5	-3.55
Percentage changes.....	+1.2	+ .2	-2.3	-7.2	-2.9

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 the same 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 the form of the index number shall be one showing the average variations of prices or the variations of a sum of actual prices; (6) in case average variations are to be shown, choosing the base upon which relative prices shall be computed; and (7) settling upon the form of average to be struck, if averages are to be used.

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.

Mr. C. M. Walsh and Prof. Irving Fisher, indeed, hold that "an index number is itself a purpose." "In averaging price variations," Mr. Walsh explains, "the purpose or object is given: It is to measure variations in the exchange value or purchasing power of money." Hence they logically contend that there is one "best form of index number."²⁴ But this position is untenable. (1) As a statistical device, index numbers have found a wide range of application outside the field of prices. To deny the term index numbers to series which show average variations in municipal water supply, rainfall, railroad traffic, and the like conflicts with established usage. (2) Within the field of prices index numbers are needed which do not aim to measure

²⁴ See Walsh's *The Problem of Estimation*, p. 116, and Fisher's "Rejoinder" in *Quarterly Publication of the American Statistical Association*, March, 1921, p. 547. The merits of the formula which they consider "the best" are discussed below, in section 9, pp. 91-93.

the purchasing power of money. For example, some one should compile a special series for forecasting changes in business conditions. The compiler might select those commodities whose prices in the past have given the earliest and most regular indications of changes that subsequently occurred in the larger index numbers, he might weight these series in accordance with their past reliability as price "barometers," and he might use whatever method of averaging the fluctuations gave the best results for his purpose. Such a series probably would not be a reliable measure of variations in "the purchasing power of money," but it probably would be better adapted to its special purpose than a series made by the formula which Prof. Fisher and Mr. Walsh advocate as "the best." (3) To "measure variations in the exchange value or purchasing power of money" is not a clearly defined aim. For example, in explaining his new form of the British Board of Trade index number to the Royal Statistical Society Prof. A. W. Flux pointed out that he might have aimed either to find the change in the money cost of the things people buy, or to find the net effect of the general economic situation, and especially of currency and credit, on prices. In discussing this paper Prof. G. Udney Yule added a third aim, "To find the effect of price-changes on currency and credit."²⁵ These three aims, which at first sight seem much the same, turn out on closer scrutiny to differ and to call for the use of dissimilar formulas, as Prof. Flux and Prof. Yule argued. Nor is their list of aims in measuring the purchasing power of money exhaustive. (4) What does "the purchasing power of money" include? Merely the standardized wares of the wholesale markets which are sampled with varying thoroughness in the current index numbers? Or does it include also commodities at retail, stocks, bonds, labor of all sorts, farm lands and town lots, loans, transportation, insurance, advertising space, and all the other classes of goods that are bought and sold? As Mr. W. T. Layton remarked in discussing Prof. Flux's paper, "The wholesale price index number is not a measure of the general purchasing power of money, though all the wholesale price index numbers are constantly quoted as such."²⁶

In fine, the problem of measuring the purchasing power of money has not yet been thoroughly explored. To insist that this problem has but one meaning and therefore one "best" solution obstructs progress. It is wiser to exploit all the significant interpretations of the problem and to consider what solution is appropriate to each. And in addition to this general problem we should devise "special-purpose" index numbers to solve particular problems with a view to learning all we can about the fluctuations of economic quantities, physical as well as pecuniary. The making of index numbers is still in the experimental stage, and it will progress by the differentiation of many types of series, each with its clearly defined uses.

The most systematic plan of treating the subject, then, would be to begin with the different uses of index numbers and to consider the methods appropriate to each. But that plan can not be followed in an interpretative study of the currently published series, because most of the wholesale price index numbers are "general-purpose" series designed with no aim more definite than that of "measuring changes in the price level." The only plan feasible

²⁵ Journal of the Royal Statistical Society, March, 1921, pp. 175-179 and 200.

²⁶ *Idem*, p. 206.

for such a study at present is to invert the problem. Instead of studying methods in the light of uses, we must study uses in the light of methods. That is, we 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, 1920, 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: 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 reinforcing what they find good. As yet our knowledge is fragmentary and uncertain. But of all the efforts being made to extend it none is more certain to prove fruitful than 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, INSTITUTION PRICES, AND IMPORT-EXPORT VALUES.

Most 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 (until 1921) the British Board of Trade's official series were made mainly from such material, and the official French series was made wholly from import values until 1911.

A fourth source of quotations often drawn upon in Europe is the 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 Lévassieur's French series are examples.

These four classes of quotations—market prices, contract prices, import and export values, and institution 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.

Institution 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 the prices they pay 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 and contract prices are distinctly the better source. Indeed, institution prices are seldom used for the latter purpose except when well-authenticated market quotations can not be had.

So far as is known, the series of index numbers compiled by the Price Section of the War Industries Board for 1913-1918 is the only series in which free use has been made of contract prices, and even in this series contract prices were not obtained for some important articles handled largely on the contract basis—especially pig iron. Contract prices, indeed, seem more difficult to ascertain than open-market prices, and they are really less appropriate data than the latter when the purpose is primarily to ascertain in what direction prices are tending from one month to the next. But when it is desired to show the fluctuations in the prices at which the bulk of business is carried on, it is clear that the index numbers should be made from both contract and open-market prices and that the two sets of quotations should be weighted in accordance with the volume of transactions which each set represents. In the long run there may be little difference between the fluctuations in the contract and the open-market prices for the same commodity; but within short periods the difference is sometimes wide. In 1915-1918, for example, contract prices made at the beginning of a year were often far below the level attained by open-market prices by the end of the year. The collection of contract prices on a larger scale and the analysis of their relation with open-market prices are matters to which the makers of index numbers may profitably direct greater attention.²⁷

²⁷ The best presentation of contract and open-market prices yet made is in *The Prices of Coal and Coke*, by Carl E. Lesher, War Industries Board Price Bulletin, No. 35.

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.

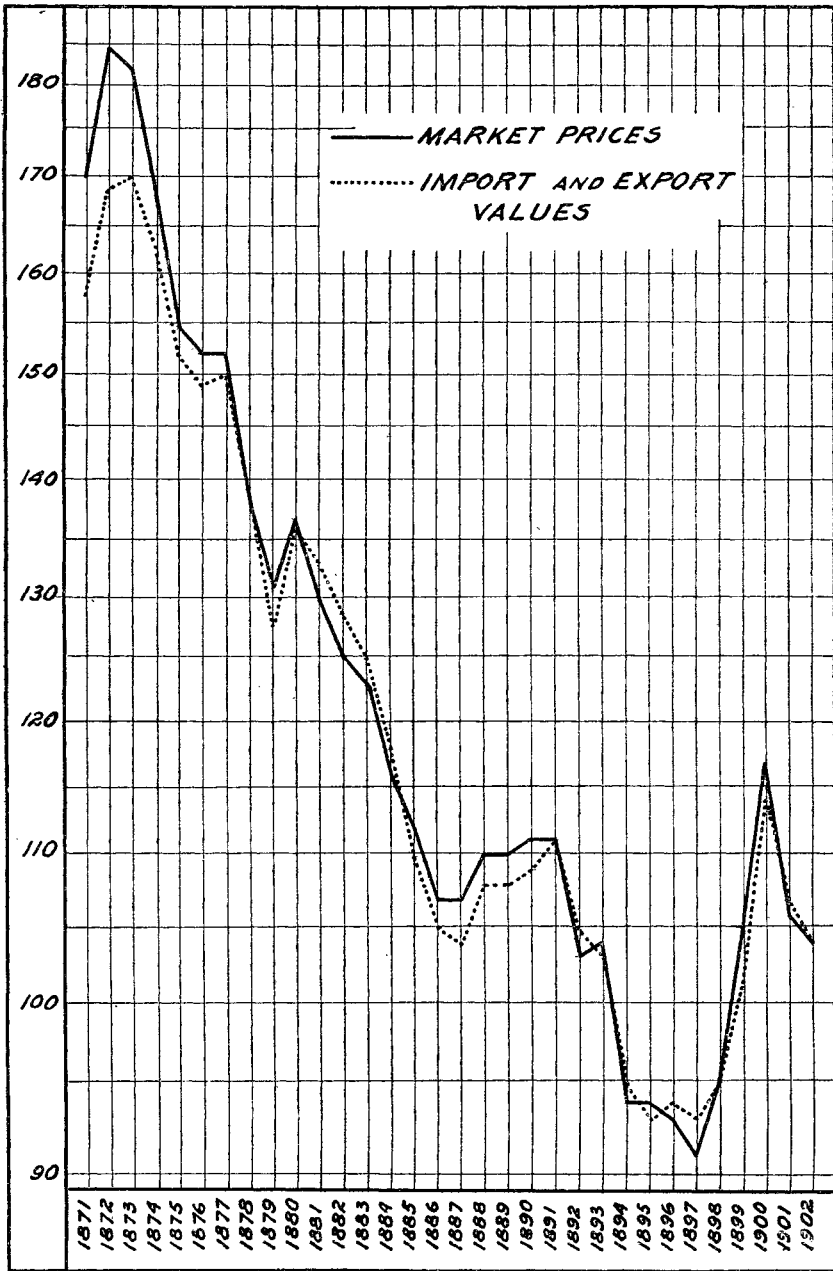
As might be expected, import and export series generally pursue a more even course than market-price series. But this difference may be due less to the sources from which the quotations are obtained than to differences in the lists of commodities used. Fortunately, we can arrange a more certain test 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.²³ Index numbers made from these two

²³ 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 Gazette.
Coal.....	Average export values.	Wallsend, Hetton, in London.
Coffee.....	Average import values	Rio, good channel.
Copper.....	do.....	Chife 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, palma.....	do.....	Palm oil.
Petroleum.....	do.....	Petroleum, refined.
Rice.....	do.....	Rangoon, cargoes to arrive.
Silk.....	do.....	Tsatlee.
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.)¹



¹ This and the succeeding charts have been drawn on a logarithmic, instead of an arithmetic, scale in order that the per cent of change may easily be discerned.

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. But the differences are not wide.

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	168	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.....	95	94
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

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.²⁹ 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.³⁰

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

²⁹ Vol. 50, p. 132.

³⁰ See vol. 48, p. 129.

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 averaged in Table 4 of this bulletin. A second unimportant variant, long practiced by the London Economist, but now seldom used is to publish as the final result the sums of relative prices, instead of their averages.³¹

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.³² 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.³³

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. In 1914 the United States Bureau of Labor Statistics dropped its former practice of averaging relative prices on the 1890-1899 base, and began to use aggregates of actual prices, weighted by quantities entering into exchange and thrown into the form of relatives to facilitate comparison.

Accordingly, three types of index numbers are now in general use:
(1) Averages of relative prices or average percentages of change in

³¹ Gibson's index number is such a sum. See pp. 172 to 175. - 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 2,200, or whatever number is given by the addition of relative prices.

³² For a criticism of this method, see p. 110.

³³ The confidence merited by this index number is discussed in Section V.

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. The differences between these types, it is true, are differences of form, not differences of kind. As will later be shown, by using a certain scheme of weights an aggregate of actual prices can be made to give precisely the same results when turned into relatives that will be given by an average of relative prices computed from the same data. But it will also be shown that the differences of form are important. The advantages and shortcomings of the several types will appear as the various problems encountered in making index numbers are discussed.

5. 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."

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 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 about 300 series of quotations, the official Canadian index number includes 271, the Bureau of Labor Statistics' index number for 1919 has 328, and the index number compiled by the Price Section of the War Industries Board has 1,366 price series. 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 to 1921, the 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 former 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.³⁴

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 advantages over those including 50 or 25 sufficient 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 6 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 in 1913 except the 11 whose prices do not run back of 1908.³⁵ 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 directly into the final results is cut down to 145.³⁶ The third column, which includes 50 commodities, is made up from the list adopted for

³⁴ 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. In 1921 the number of price series used in the British Board of Trade index was increased to 150.

³⁵ To facilitate comparison, decimals have been dropped and the index for each year rounded off to the nearest whole number. Regarding the changes in the number of commodities included, see Bulletin No. 149, p. 11. The reader may be reminded once more that this is the Bureau's old index number, made before the improved method of compilation was introduced.

³⁶ This experimental list of 145 commodities is given below. When the relative prices of closely related articles are averaged to make a single series, the number of these articles quoted by the Bureau and included in the group is indicated. Most of the bureau's series which do not cover the whole period,

the Gibson index number in its original form.³⁷ The fourth series is 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.³⁸ The last two columns contain

1890-1913, are dropped altogether. As the basis of a general-purpose index number, this revised list is worse than the bureau's list in certain respects and better in others. See Section V.

FARM PRODUCTS.

1. Barley.
2. Cattle, 2.
3. Corn.
4. Cotton.
5. Flaxseed.
6. Hay.
7. Hides.
8. Hogs, 2.
9. Hops.
10. Oats.
11. Rye.
12. Sheep, 2.
13. Wheat.

FUEL AND LIGHTING.

1. Candles.
2. Coal, anthracite, 4.
3. Coal, bituminous, 3.
4. Coke.
5. Matches.
6. Petroleum, crude.
7. Petroleum, refined, 2.

FOOD, ETC.

1. Apples, evaporated
2. Beans.
3. Bread, crackers, 2.
4. Bread, loaf, 3.
5. Butter, 3.
6. Cheese.
7. Coffee.
8. Currants.
9. Eggs.
10. Fish, 4.
11. Flour, buckwheat.
12. Flour, rye.
13. Flour, wheat.
14. Lard.
15. Meal, corn, 2.
16. Meat, beef, 3.
17. Meat, pork, 4.
18. Meat, mutton.
19. Milk.
20. Molasses.
21. Onions.
22. Potatoes.
23. Prunes.
24. Raisins.
25. Rice.
26. Salt.
27. Soda.
28. Spice, pepper.
29. Starch, corn.
30. Sugar, 3.
31. Tallow.
32. Tea.
33. Vinegar.

CLOTHS AND CLOTHING.

1. Bags.
2. Blankets, 3.
3. Boots and shoes, 3.
4. Broadcloths.
5. Calico.
6. Carpets, 3.
7. Cotton flannels, 2.
8. Cotton thread.
9. Cotton yarns, 2.
10. Denims.
11. Drillings, 2.
12. Flannels.
13. Gingham, 2.
14. Horse blankets.
15. Hose.
16. Leather, 4.
17. Linen thread.
18. Overcoatings, 2.
19. Print cloths.
20. Sheetings, 7.
21. Shirtings, 5.
22. Silk, 2.
23. Suitings.
24. Tickings.
25. Underwear, 2.
26. Women's dress goods, 6.
27. Wool, 2.
28. Worsted yarns, 2.

METALS AND IMPLEMENTS.

1. Bar iron, 2.
2. Barb wire.
3. Builders' hardware, 3.
4. Copper, ingot.
5. Copper, wire.
6. Lead, pig.
7. Lead pipe.
8. Nails, 2.
9. Pig iron, 4.
10. Quicksilver.
11. Silver.
12. Spelter.
13. Steel billets.
14. Steel rails.
15. Tin, pig.
16. Tools, 11.
17. Wood screws.
18. Zinc.

DRUGS AND CHEMICALS.

1. Alcohol, grain.
2. Alcohol, wood.
3. Alum.
4. Brimstone.
5. Glycerine.
6. Muriac acid.
7. Opium.
8. Quinine.
9. Sulphuric acid.

LUMBER AND BUILDING MATERIALS.

1. Brick.
2. Carbonate of lead.
3. Cement.
4. Doors.
5. Hemlock.
6. Lime.
7. Linseed oil.
8. Maple.
9. Oak, 2.
10. Oxide of zinc.
11. Pine, white, 2.
12. Pine, yellow.
13. Plate glass, 2.
14. Poplar.
15. Putty.
16. Rosin.
17. Shingles, 2.
18. Spruce.
19. Tar.
20. Turpentine.
21. Window glass, 2.

HOUSE-FURNISHING GOODS.

1. Earthenware, 3.
2. Furniture, 4.
3. Glassware, 3.
4. Table cutlery, 2.
5. Woodenware, 2.

MISCELLANEOUS.

1. Cottonseed meal.
2. Cottonseed oil.
3. Jute.
4. Malt.
5. Paper, 2.
6. Proof spirits.
7. Rope.
8. Rubber.
9. Soap.
10. Starch, laundry
11. Tobacco, 2.

³⁷ The list is as follows: Wheat, wheat flour (two kinds), barley, oats, corn, corn meal, potatoes, rye, sugar 89°, sugar 96°, coffee, tea, steers, fresh beef, salt beef, sheep, mutton, hogs, bacon, hams, butter, cotton, cotton yarns (two kinds), jute, wool (two kinds), worsted yarns, raw silk (two kinds), pig iron, bar iron, cement, copper ingots, copper sheets, lead, anthracite coal, bituminous coal (two kinds), hides, leather, cottonseed oil, linseed oil, petroleum (crude and refined), rubber, spruce lumber, yellow-pine lumber, and paper. See J. P. Norton, "A revised index number for measuring the rise in prices," Quarterly Journal of Economics, August, 1910, vol. 24, pp. 750-758.

³⁸ 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.

index numbers each made from the prices of 25 important articles selected at random, the two lists having no items in common.³⁹

TABLE 6.—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. 149.]

(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	96	94	93	92	96
1895.....	94	93	94	95	95	93
1896.....	90	89	87	88	88	85
1897.....	90	89	89	89	90	84
1898.....	93	93	95	95	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.....	116	116	118	122	123	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.....	+8	+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	6.2

³⁹ 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 1890-1899, Portland domestic 1900-1913), tallow, spelter, bar iron, tin (pig), quicksilver, lime, tar, paper, proof spirits.

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

Year.	145 com- modities.	50 com- modities.	40 com- modities.	25 com- modities, first list.	25 com- modities, second list.
1890.....	+ 1	+ 1	± 0	+ 2	± 0
1891.....	+ 1	+ 2	+ 2	± 0	+ 6
1892.....	± 0	- 1	- 1	- 3	+ 6
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	- 1	- 1	± 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	+ 3	+ 9	+ 3	+ 4
1903.....	± 0	+ 1	+ 4	+ 4	+ 3
1904.....	+ 1	+ 3	+ 5	+ 9	- 1
1905.....	± 0	+ 2	+ 6	+ 7	- 1
1906.....	- 1	± 0	+ 5	+ 7	- 1
1907.....	± 0	+ 2	+ 8	+ 2	+ 2
1908.....	- 1	+ 3	+ 7	+ 8	± 0
1909.....	- 1	+ 7	+ 10	+ 8	+ 3
1910.....	+ 1	+ 5	+ 11	+ 3	+ 4
1911.....	+ 4	+ 3	+ 9	+ 3	+ 5
1912.....	+ 4	+ 8	+ 12	+ 10	+ 8
1913.....	+ 1	+ 9	+ 8	+ 12	+ 3
Arithmetic sums.....	23	60	129	97	70
Algebraic sums.....	+ 9	+ 14	+ 105	+ 73	+ 22
Average differences computed from the—					
Arithmetic sums.....	1.0	2.5	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

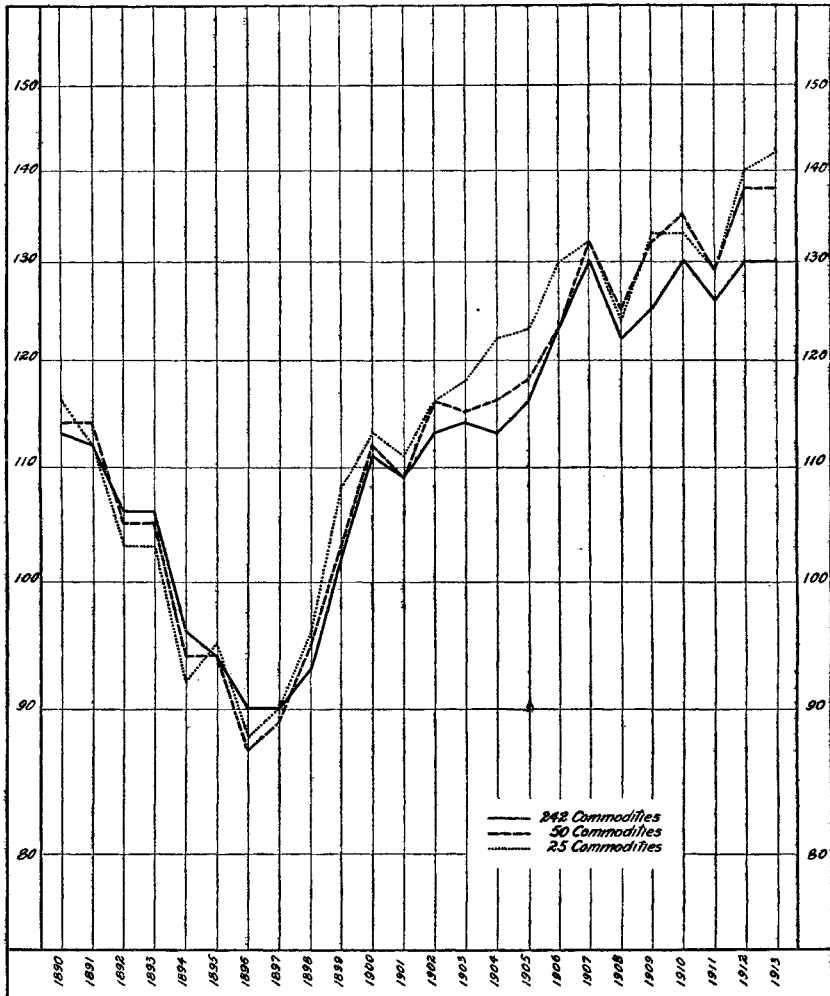
Number of points by which each index number rose (+) or fell (-) in each successive year.

Year.	242 to 261 commod- ities.	145 com- modities.	50 com- modities.	40 com- modities.	25 com- modities, first list.	25 com- modities, second list.
1891.....	- 1	- 1	± 0	+ 1	- 3	+ 5
1892.....	- 6	- 7	- 9	- 9	- 9	- 6
1893.....	± 0	- 1	- 7	- 8	± 0	- 5
1894.....	- 10	- 9	± 0	- 4	- 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	+ 8	+ 9	+ 7	+ 6	+ 6
1901.....	- 2	- 1	- 3	+ 1	- 2	- 2
1902.....	+ 4	+ 4	+ 7	+ 6	+ 5	+ 10
1903.....	+ 1	± 0	- 1	- 4	+ 2	± 0
1904.....	- 1	± 0	+ 1	± 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 from 1890 to 1913 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

CHART 5.—GENERAL-PURPOSE INDEX NUMBERS, INCLUDING 25, 50, AND 242 COMMODITIES, BY YEARS, 1890 TO 1913.

(Based on Table 6.)



in 1910–1913. 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 6, 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 products. 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:⁴⁰

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	109
1864.....	145	112
1865.....	136	106

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 7 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 in 1913 and of the 183 to 193 more or less manufactured commodities in its list.⁴¹ 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.⁴² Then

⁴⁰ 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, Mar. 3, 1893, 52d Cong., 2d sess., Senate Report No. 1394, Part I, pp. 226 and 255.

⁴¹ See Bulletin No. 149, 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.

⁴² The articles included here are those from which the index number of 40 commodities in Table 6 was made. For the list, see p. 35 and note.

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.⁴³ 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 were 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.⁴⁴ 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.

⁴³ For the list of textiles and of tools, see Bulletin No. 99 of the Bureau of Labor, March, 1912, pp. 554-556 and 682-683.

⁴⁴ 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 7.—INDEX NUMBERS MADE FROM THE PRICES OF RAW MATERIALS

[Data from Bulletin No. 149 of the

(Arithmetic means. Average

Year.	49 raw ma- teri- als.	183 to 193 man- u- fac- tured prod- ucts.	Twenty pairs.		Five triplets.			Wheat group.		
			Raw ma- teri- als.	Man- u- fac- tured goods.	Raw ma- teri- als.	Inter- me- di- ate prod- ucts.	Fin- ished goods.	Wheat.	Wheat flour.	Bread.
Number of commodities included.....								1	2	2
1890.....	115	112	113	112	125	119	108	119	121	101
1891.....	116	111	114	114	117	116	107	128	126	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	96	89	89	95	80	84	98
1896.....	94	92	85	92	87	88	95	85	91	97
1897.....	88	90	88	89	94	90	94	106	110	101
1898.....	94	93	98	92	101	95	95	118	109	101
1899.....	106	101	114	103	111	107	98	95	88	101
1900.....	112	110	118	111	120	110	105	94	88	101
1901.....	111	108	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	128	115	110	138	125	106
1905.....	121	115	127	117	132	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	123	143	127	149	126	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	+36	+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.

Bureau of Labor Statistics.]

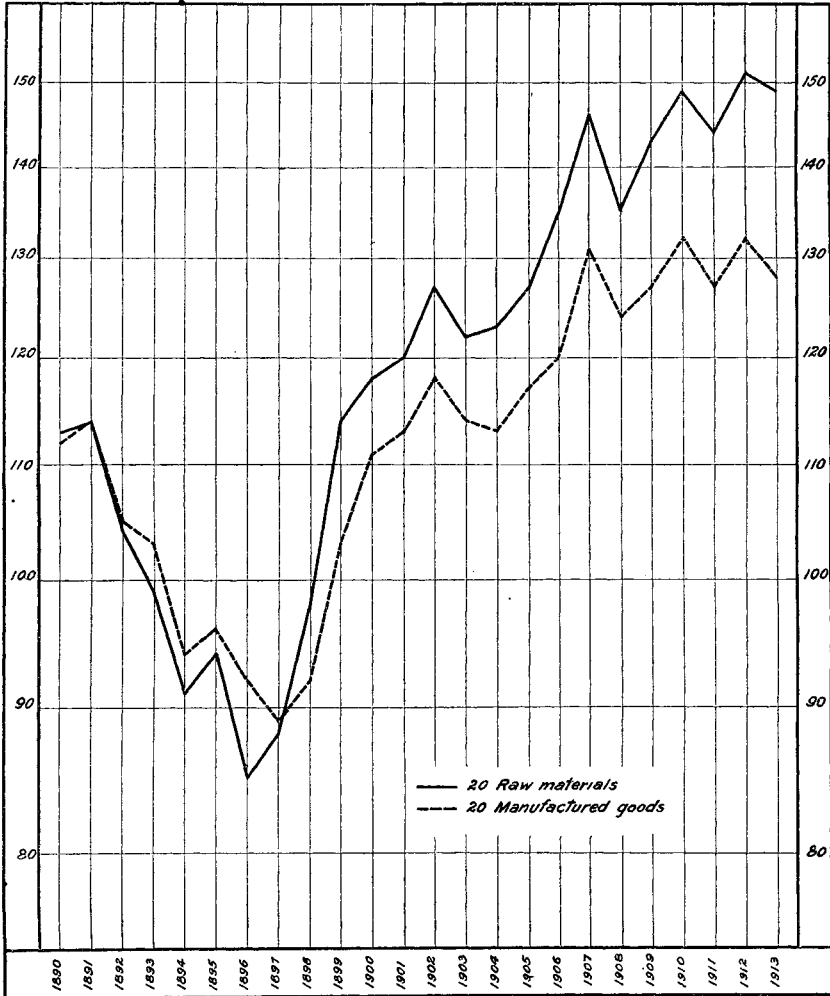
prices in 1890-1899=100.)

Cotton group.			Wool group.			Iron group.			Leather group.			Year.
Raw cotton.	Cotton yarns.	Cotton textiles.	Raw wool.	Worsted yarn.	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.
99	117	111	113	117	112	106	110	105	93	97	103	1892.
107	111	109	102	110	109	96	95	103	80	97	101	1893.
90	93	98	79	91	86	83	77	99	68	92	99	1894.
94	92	84	70	74	85	91	86	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	108	101	88	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	99	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	1905.
142	121	117	121	129	125	145	128	134	165	120	119	1906.
153	134	133	122	128	124	175	136	138	155	124	120	1907.
135	109	116	118	118	121	125	122	134	143	119	114	1908.
156	119	117	127	130	122	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	120	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.
169	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	+87	+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	38	98	75	44	128	47	43	Difference between highest and lowest relative prices.
18.1	9.8	6.1	9.1	8.1	3.9	17.5	16.0	3.7	14.7	5.0	3.7	Average change from year to year.

Third, there are characteristic differences among the price fluctuations of the groups consisting of mineral products, forest products, animal products, and farm crops. Table 8 presents index numbers for these four groups. Fifty-seven commodities are included, all of them raw materials or slightly manufactured products.⁴⁵ Here the

CHART 6.—INDEX NUMBERS OF THE PRICES OF 20 RAW MATERIALS AND 20 PRODUCTS MANUFACTURED FROM THEM.

(Based on Table 7.)



⁴⁵ 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 jute—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.

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

CHART 7.—INDEX NUMBERS OF THE PRICES OF WOOL, COTTON, HIDES, WHEAT, AND PIG IRON IN THEIR RAW, PARTIALLY MANUFACTURED, AND FINISHED FORMS.

(Based on Table 7.)



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.⁴⁶ 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.

TABLE 8.—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	109	110
1893	98	98	116	105
1894	87	95	94	101
1895	91	96	95	92
1896	92	94	82	76
1897	88	95	88	83
1898	92	99	97	92
1899	117	112	105	96
1900	120	121	111	105
1901	113	113	112	114
1902	119	123	128	120
1903	124	137	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	126	124
1909	121	164	144	130
1910	120	181	152	134
1911	120	172	131	151
1912	132	168	146	158
1913	136	169	150	135
Averages, 1890-1899	100	100	100	100
1900-1909	123	143	124	119
1910-1913	127	173	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	+11
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

⁴⁶ 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 8 would probably show even more decline between January and December in these years.

least is the story told by Table 9. 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.⁴⁷ Though consisting more largely of the erratically fluctuating farm products, the consumers' goods are steadier in

CHART 8.—INDEX NUMBERS OF THE PRICES OF 19 MINERAL PRODUCTS AND OF 18 FARM CROPS.

(Based on Table 8.)



⁴⁷ The consumers' goods are bread, crackers, butter, cheese, salt fish, evaporated apples, prunes, raisins, beef, mutton, pork, molasses, cornstarch, sugar, vinegar, shoes, cotton textiles, woolen textiles, candles, 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, rosin, 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—

price than the producers' goods, because the demand for them is less influenced by changes in business conditions.

TABLE 9.—INDEX NUMBERS MADE FROM THE PRICES OF CONSUMERS' GOODS AND OF 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,⁴⁸ 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 6. 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.

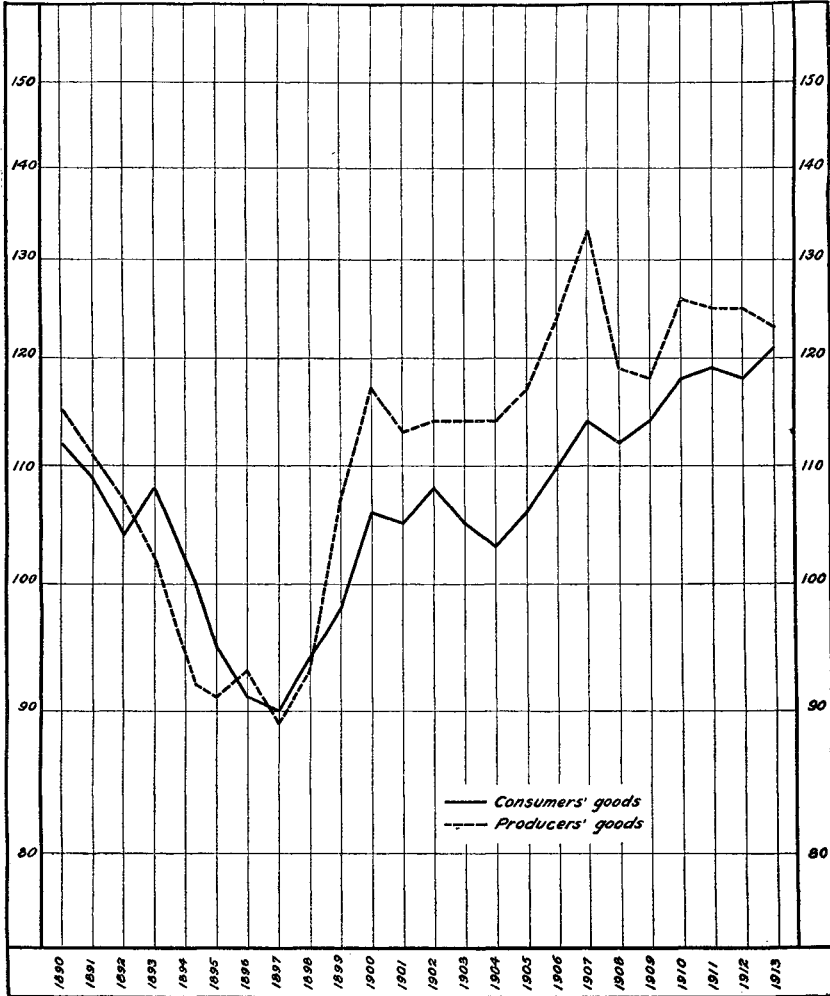
First, the list of commodities used by the Bureau of Labor Statistics includes 29 quotations for iron and its products, 30 quotations for cotton and its products, and 18 for wool and its products, besides 8 more quotations for fabrics made of wool and cotton together. On the other hand, it has but 7 series for wheat and its products, 8 for coal and its products, 3 for copper and its products, etc. The iron,

⁴⁸ For example, there is evidence that the products of industries characterized by a large measure of concentration in business control are steadier in price than products of industries characterized by unhampered competition.—See W. C. Mitchell, *Business Cycles*, pp. 462-464.

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 9.)



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 7. 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.⁴⁹ 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 result 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.⁵⁰

This similarity among the price fluctuations of manufactured goods arises from the fact demonstrated by Table 7 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 6? 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.

TABLE 10.—NUMBER AND PER CENT OF RAW AND MANUFACTURED COMMODITIES INCLUDED IN THE SIX INDEX NUMBERS OF TABLE 6.

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	19	6	76	24
Sixth.....	25	10	15	40	60

* 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.

⁵⁰ 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. 40.)

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 6 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 11.—CLASSIFICATION OF THE MANUFACTURED COMMODITIES INCLUDED IN THE SIX INDEX NUMBERS OF TABLE 6.

Index number.	Number of—				Per cent of—			
	Manu- factured articles.	Con- sumers' com- modities.	Pro- ducers' com- modities.	Both con- sumers' and pro- ducers' com- modities.	Manu- factured articles.	Con- sumers' com- modities.	Pro- ducers' com- modities.	Both con- sumers' and pro- ducers' com- modities.
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 8 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 6 by appealing to this schedule and to Table 8

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 12.—FARM, ANIMAL, FOREST, AND MINERAL PRODUCTS IN RAW OR SLIGHTLY MANUFACTURED FORM, INCLUDED IN THE SIX INDEX NUMBERS OF TABLE 6.

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 6 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,⁵¹ 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 in the period covered by Table 6 were 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, etc., are all part and parcel of the fluctuations 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.

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 13 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 6, 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 old series for foods, with decimals dropped and new arithmetic means for 1908-1913.

⁵¹ Compare p. 36.

TABLE 13.—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 number from Table 6.		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	108	116	110	110
1894.....	96	92	102	98	100
1895.....	94	95	95	94	95
1896.....	90	80	81	81	84
1897.....	90	90	84	87	88
1898.....	93	96	92	96	94
1899.....	102	107	93	96	98
1900.....	111	113	99	100	104
1901.....	109	111	105	106	106
1902.....	113	116	117	118	111
1903.....	114	118	107	107	107
1904.....	113	122	109	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.....	129	136	138	139	131
Number of points by which prices rose (+) or fell (-) in—					
1890-1896.....	- 23	- 27	- 29	- 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

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.⁵² The bureau

⁵² Of the 56 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. 149, pp. 90-107.

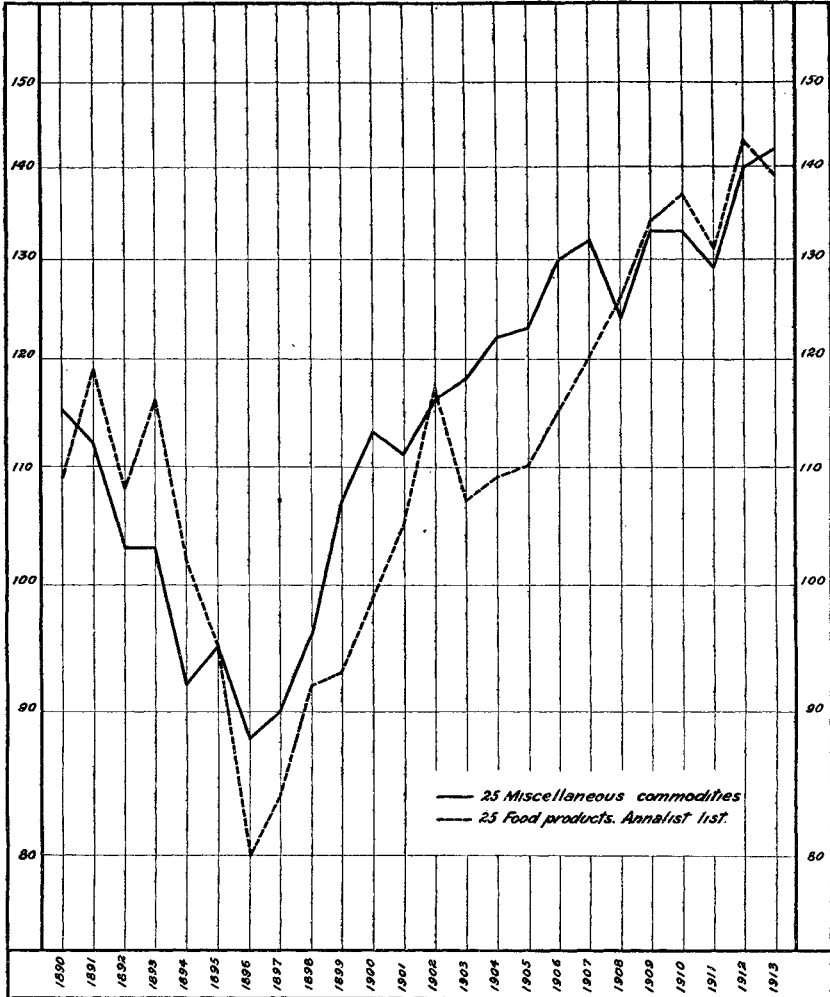
The Annalist list runs—oats, cattle, fresh beef, salt beef, hogs, bacon, salt pork, lard, sheep, mutton, butter (two kinds), cheese, coffee, sugar, wheat flour (two kinds), rye flour, corn meal, rice, beans, potatoes, prunes, evaporated apples, and codfish.

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.

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

CHART 10.—INDEX NUMBERS OF THE PRICES OF 25 FOOD PRODUCTS AND OF 25 MISCELLANEOUS COMMODITIES.

(Based on Table 13.)



are moving,⁵³ 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

⁵³ 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.

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 8 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 pieces of vegetable crops, food animals, and their derivatives.⁵⁴ 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 always follow closely those in the wholesale markets.

But while it is clear that an index number intended to measure fluctuations in "the general level of prices" should grant due representation to the various groups of prices that behave in specific ways, it is not possible to give a definitive list of these groups. For our knowledge of the interrelations among prices even in the recent past is very limited. Moreover, a change in the social conditions under which business is done may at any time produce new groupings of commodities important to the maker of index numbers, or may cause old groups to fluctuate in novel ways. For example, the distinction between commodities over which the Government assumed some form of price control and commodities whose prices were left unrestricted became of first importance in the summer of 1917. After July the controlled prices dropped; and while they advanced again in the latter part of 1918, they did not again attain the high level at which they stood when the price control began. Uncontrolled prices, on the contrary, which stood lower than the other group in July, 1917, advanced month by month until the armistice was signed.⁵⁵ Forest products in 1915-1918 illustrate the way in which a group may change its characteristic price behavior. The demand for lumber has been declining jerkily in the United States since 1909, primarily because of the increased use of cement for building. Further, the terms on which many large lumber holdings are financed compel the owners to cut and market their timber as fast as possible. Finally, in 1917-18 the War Industries Board discouraged the construction of buildings that were not called for by the military program. Under these circumstances, the price of forest products lagged behind most classes

⁵⁴ The exceptions are salt and soda, and of these articles the Annalist and Gibson quote neither.

⁵⁵ See the tables in Government Control Over Prices, by Paul W. Garrett, War Industries Board Price Bulletin, No. 3.

The following index numbers, while not covering the whole ground, bring out the main point. One series shows the fluctuations of 586 commodities that were subjected to price control at some time during American participation in the war; the second series shows the fluctuations of 780 commodities that were left uncontrolled in price. Since the practice of "fixing" prices did not begin until several months after the declaration of war (April, 1917), and was extended gradually month by month until the signing of the armistice (November, 1918), the "controlled" list contains many articles that remained uncontrolled until late in 1918. The two series therefore minimize rather than exaggerate the differences between the behavior of prices that were controlled earlier in the war and prices that were left to find their own levels. That this understatement is not more serious arises from the fact that the Government naturally took the most important (and therefore most heavily weighted) commodities under control at an early date. It may be

of commodities in the wartime rise.⁵⁶ To give another illustration, rubber is rapidly passing from the group of forest products to the group of cultivated crops. These cases give force to the warning that the groupings with which the economic statistician deals do not always rest on permanent foundations. It would be as unwarranted to draw up a list of groups that should be represented in index numbers for all periods as to draw up a list of groups to be represented for all purposes. In every case in which an investigator plans to measure changes in the general level of prices he should canvass his particular field to see whether there are not hitherto unrecognized groups of commodities that fluctuate in similar ways, and then try to represent each group in the due measure of its importance. Such investigations may add much, not only to the accuracy of index numbers but also to our knowledge of the interrelations among price fluctuations.

In most large index numbers the commodities quoted are divided into several classes; but these classes seldom have economic significance or even 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," "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.

pointed out also that the commodities early brought under control were articles that, as a group, had risen more than the average in price before we entered the war.

Index numbers of commodities that were and of commodities that were not subjected to price control by the Government during the war with Germany.

[From War Industries Board Price Bulletin No. 3.]

(Relatives made from weighted aggregates of actual prices. Average prices in July, 1913, to June, 1914=100.)

Year and month.	Controlled commodities.	Uncontrolled commodities.	Year and month.	Controlled commodities.	Uncontrolled commodities.
1917			1918		
January.....			January.....	195	178
February.....			February.....	198	180
March.....			March.....	197	182
April.....	183	146	April.....	196	187
May.....	192	149	May.....	192	189
June.....	201	152	June.....	189	191
July.....	209	160	July.....	195	194
August.....	204	162	August.....	199	195
September.....	205	163	September.....	204	199
October.....	198	167	October.....	201	201
November.....	200	172	November.....	200	200
December.....	193	174	December.....	204	197

⁵⁶ See R. B. Bryant, *The Prices of Lumber*, War Industries Board Price Bulletin, No. 43, and Homer Hoyt, *The Prices of Building Materials*, War Industries Board Price Bulletin, No. 6.

Another interesting experiment has recently been made by the Price Section of the War Industries Board. This section was able to collect quotations for so large a number of price series (1366 in form to be used in the index number) that it attempted to classify its commodities according to industries by which they are manufactured. The advantage of this arrangement is that many users of index numbers desire to follow the fluctuations of the prices that are paid for materials and received for products in different lines of business and to compare fluctuations in one line with those in others. There are many industries in which the plan works well, because the demarcation between industries follows, at least roughly, commodity lines; for example, in the cotton, woolen, silk and leather trades. But many commodities are used in such a variety of industries, and many industries use such a variety of commodities, that the classifier is forced to resort at times to other criteria, such as the physical characteristics of commodities, their uses, or their sources of supply.

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. 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.⁵⁷

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 such causal lines seems to be the most promising line of progress.

Where means permit, it is desirable to supplement this general scheme by a series of special indexes for classes of commodities that possess interest for whatever reason. These supplementary indexes would not rest on classifications which include all the commodities, and they might, therefore, employ many different criteria and employ each one only in those cases in which it was significant. Some commodities might appear in several of the special indexes, and others might appear in none. There need, then, be no artificial forcing of a criterion upon facts which it does not fit, and no hesitation about presenting any classes that merit separate attention.

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

⁵⁷ Since the first edition of this bulletin appeared, the Federal Reserve Board has adopted this suggestion with interesting results. In its monthly bulletin the board publishes the index number compiled by the Bureau of Labor Statistics recast into the six groups mentioned.

10 or 20 sets of quotations than when it is represented by only one or two sets. 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.

6. 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 supposedly allowed just the same chance to influence the result as every other commodity, the index number is said to be unweighted, or simple.

This expression, however, that "every commodity has just the same chance to influence the result as every other commodity" conveys no clear meaning. It is better to think of all index numbers as weighted, for so they are whether their maker knows it or not, and to ask whether the scheme of weights is good or bad. 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.⁵⁸ 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.⁵⁹ 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 more than eight times as many chances to influence the results as they gave 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 every article will always exercise equal influence upon the results. For when 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 for outweigh in influence those commodities whose prices are declining.

Lack of attention to weighting, then, does not automatically secure a fair field and no favor to every commodity; on the contrary, it

⁵⁸ For details, see pp. 161-168.

⁵⁹ See p. 31.

results in what Walsh happily termed haphazard weighting.⁶⁰ Perhaps "unconscious weighting" would be an even better expression. The real problem for the maker of index numbers is whether he shall have 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.⁶¹ Second, there are high authorities who hold that the results turn out much the same whether or not formal weights are used.⁶² Certainly "the weights are of * * * less importance in determining an index number of prices than the prices themselves."⁶³ 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.⁶⁴

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 wholesale-price index numbers for current years we may reasonably try to get not two, but three, significant figures; and the third figure is

⁶⁰ C. M. Walsh, *The Measurement of General Exchange-Value*, pp. 81 and 82. Haphazard weighting is not necessarily the worst weighting; indeed, it may be 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. 78.

⁶¹ See p. 26. When the (then) Department of Labor started its former 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 No. 39, of the Department of Labor, p. 234, March, 1902.) 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. 48 and 49.

⁶² Compare A. L. Bowley, *Elements of Statistics*, 2d ed., pp. 113 and 220-224.

⁶³ 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.

⁶⁴ 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 articles, 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. 63 and 64.) (2) These physical quantities were multiplied 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, 5,409,760,011 lbs.; flaxseed, 20,106,433 bu.; hay, 10,685,894 tons; hides, 922,243,894 lbs.; hogs, 76,438,923 cwt.; hops, 48,076,921 lbs.; oats, 267,859,660 bu.; rye, 29,520,508 bu.; sheep, 11,498,090 cwt.; wheat, 683,416,528 bu.

Food, etc. Beans, 8,468,355 cwt.; butter, 1,042,709,708 lbs.; cheese, 353,641,892 lbs.; coffee, 1,038,439,285 lbs.; eggs, 926,690,112 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, 1,594,354 bbls.; wheat flour, 107,306,408 bbls.; currants, 32,163,998 lbs.; prunes, 138,795,607 lbs.; raisins, 12,438,044 boxes; glucose, 7,701,223 cwt.; lard 1,243,572,129 lbs.; corn meal, 53,353,466 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, 4,760,690 bbls.; milk, 7,749,070,256 qts.; molasses, 55,689,983 gals.; rice, 1,042,538,693 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, 2,166,529,067 lbs.; barbed wire, 6,471,300 cwt.; copper, ingot, 1,312,437,919 lbs.; copper wire, 278,964,000 lbs.; lead, pig, 732,152,538 lbs.; lead pipe, 1,058,280 cwt.; nails, wire, 13,916,097 kgs.; 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.

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.

TABLE 14.—COMPARISONS OF WEIGHTED AND UNWEIGHTED INDEX NUMBERS.

[1. From the report of the Senate Committee on Finance, Mar. 3, 1893. By years, 1860 to 1891.]

(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.....	148.6	122.1	132.2	26.5	16.4	10.1
1864.....	190.5	149.4	172.1	41.1	18.4	22.7
1865.....	216.8	190.7	232.2	26.1	15.4	41.5
1866.....	191.0	160.2	187.7	30.8	3.3	27.5
1867.....	172.2	145.2	165.8	27.0	6.4	20.6
1868.....	160.5	150.7	173.9	9.8	13.4	23.2
1869.....	153.5	135.9	152.3	17.6	1.2	16.4
1870.....	142.3	130.4	144.4	11.9	2.1	14.0
1871.....	136.0	124.8	136.1	11.2	.1	11.3
1872.....	138.8	122.2	132.4	16.6	6.4	10.2
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.....	110.9	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	96.6	95.0	.....	1.6	1.6
1880.....	106.9	103.4	104.9	3.5	2.0	1.5
1881.....	105.7	105.8	108.4	.1	2.7	2.6
1882.....	108.5	106.3	109.1	2.2	.6	2.8
1883.....	106.0	104.5	106.6	1.5	.6	2.1
1884.....	99.4	101.8	102.6	2.4	3.2	.8
1885.....	93.0	95.4	93.3	2.4	.3	2.1
1886.....	91.9	95.5	93.4	3.6	1.5	2.1
1887.....	92.6	96.2	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	95.7	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. 27, 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.....	84.7	93.5	90.5	8.8	5.8	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 14.—COMPARISONS OF WEIGHTED AND UNWEIGHTED INDEX NUMBERS—Con.

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

(Arithmetic means. Average prices in 1899-1899=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.....	109.7	110.5	.8
1892.....	104.9	102.8	2.1	1904.....	110.6	111.4	.8
1893.....	103.9	102.5	1.4	1905.....	113.8	113.8	.....
1894.....	97.2	97.2	.....	1906.....	120.1	120.0	.1
1895.....	95.6	95.6	.....	1907.....	129.2	126.2	3.0
1896.....	90.6	92.5	1.9	1908.....	125.1	123.8	1.3
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 computations by the Bureau of Labor Statistics.]

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

Year.	13 farm products.			37 food products.			14 metallic products.		
	Un-weighted.	Weighted by estimated expenditures upon each article in 1909.	Dif-fer-ences.	Un-weighted.	Weighted by estimated expenditures upon each article in 1909.	Dif-fer-ences.	Un-weighted.	Weighted by estimated expenditures upon each article in 1909.	Dif-fer-ences.
1890.....	113	109	4	114	144	0	128	131	3
1891.....	124	117	7	136	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	99	97	2	88	84	4
1895.....	93	95	2	95	94	1	88	86	0
1896.....	78	86	8	83	86	3	93	91	2
1897.....	84	93	9	87	90	3	82	80	2
1898.....	97	97	0	93	96	3	83	81	2
1899.....	98	98	0	93	96	3	124	124	0
1900.....	109	109	0	108	109	1	124	123	1
1901.....	117	115	2	110	102	8	114	113	1
1902.....	130	129	1	114	108	6	114	114	0
1903.....	129	129	0	110	104	6	114	113	1
1904.....	139	128	11	113	110	3	105	102	3
1905.....	125	123	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	150	16	128	125	3	111	103	8
1912.....	173	164	9	137	137	0	120	114	6
1913.....	152	161	9	138	127	11	119	115	4

¹ See explanations in footnote, p. 60.

If rational weighting is worth striving after, then by what method shall the weights of the different commodities be arrived at? 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 total money 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 faithfulness with which the quotations included reflect business conditions. 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 strike a simple arithmetic average of relative prices. 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 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 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.⁶⁵ 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 the 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."⁶⁶ 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 two criteria—that is, to take "either the total product or the total consumption according as the one or the other is the greater."⁶⁷ 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."⁶⁸ 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

⁶⁵ 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.

⁶⁶ Report on Wholesale and Retail Prices in the United Kingdom in 1902. London, 1903, p. 441. 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.

⁶⁷ C. M. Walsh, *The Measurement of General Exchange-Value*. New York, 1901, p. 95.

⁶⁸ Irving Fisher, *The Purchasing Power of Money*, revised edition. New York, 1913, pp. 217 and 218.

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 relatively 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 little corn and export but a 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 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 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 caption of pork, beef, etc.⁶⁹

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

⁶⁹ 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.

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. 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 the wide gaps and weak places that will be revealed among the available data. That this system of weighting is feasible in practice as well as desirable in theory, however, was proved by the Bureau of Labor Statistics in 1914, when it gave up averaging relative prices and began multiplying actual prices by the quantities of commodities that entered into trade in the base year 1909.⁷⁰

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 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.

Like most of the issues on which authorities differ, the question whether it is desirable to change weights at frequent intervals depends upon the precise end in view. Most makers of index numbers have wished to isolate the price factor from other changes in the economic complex. Hence they have preferred to keep their weights as nearly constant as possible. For when the weights are altered the index number 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.⁷¹ Yet it is clear that a system of fixed weights applied over a long period is certain to become inaccurate for most of the years, however carefully it is adjusted to conditions prevailing at some base period. Practically, then, a compiler who wishes to ascertain how prices have changed must choose between

⁷⁰ For details see Bulletin No. 181 of the Bureau of Labor Statistics.

⁷¹ See the criticism of index numbers made from import-export values, pp. 29-31.

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. 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.⁷² A further practical reason in favor of this compromise is found in the heavy expense in time and labor required for frequent revisions of the weights.

Writers like Mr. Walsh, Prof. Pigou, and Prof. Fisher, who urge the adoption of a formula in which the weights are changed every year, put another aim in the foreground. Their primary purpose is to secure the utmost possible nicety in measuring the rise or fall of prices in each pair of years treated. Of course an index number made with these changing weights "measures neither the varying cost of a constant amount of goods nor the varying amount of goods which a dollar will buy."⁷³ But, since the importance of price fluctuations depends largely upon the accompanying changes in the quantities of goods bought, there is use for index numbers that do not attempt to measure the price factor in isolation. By changing weights each year it is possible to make these constantly occurring changes in quantities bought influence the price index, and therefore to secure results better fitted for certain uses than the results of an unambiguous measure of fluctuations in prices.⁷⁴

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 producers and by consumers, etc. Is an accurate measure of changes in the level of all wholesale prices 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 exhibiting each type?

How can such representation be attained? If all the commodities bought and sold could be included on a strictly uniform basis 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 desirable 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

⁷² 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.

⁷³ Prof. Warren M. Persons: "Fisher's formula for index numbers," *Review of Economic Statistics*, May, 1921, p. 115, note.

⁷⁴ See the discussion of the "ideal" formula in section 9, p. 91.

for each recognized group, and these subtotals would be weighted again in making up the grand totals.

Such a plan was adopted by the Price Section of the War Industries Board in making their index number of prices in 1913-1918. As noted above, the subdivisions used by the Price Section were 50 classes of commodities based, so far as possible, on the organization of industries. Within each class, raw materials were weighted according to quantities used by the industry represented, and products were weighted according to the quantities produced. A separate index number was made in this way for each of the 50 classes. These indexes and the materials from which they were made, both price quotations and weights, seemed fairly satisfactory as such matters go; but before the aggregates of the commodity prices times commodity weights for these 50 classes were assembled to make aggregates for "all commodities," it was clear that there would be wide differences in the fullness with which prices in the various industries had been covered. In some industries 75 to 90 per cent of the value of the transactions was represented by the prices multiplied by the weights; in other industries the percentage sank below 25. Again, there were industries in which it had been possible to quote commodities at three stages—raw materials, partly manufactured goods, and finished products—while in other industries the available data represented only raw materials or only finished products. That is, while the weights within each class had been systematized, and while the plan of systematizing the weights was uniform in all classes systematized, the weights as between different classes were haphazard to a degree. To overcome the difficulty, the Price Section prepared a second set of weights. It estimated the value of the products sold by each industry represented, divided these estimates by the aggregate of commodity prices times commodity weights, and so obtained a set of factors which when applied to the class aggregates give each class an influence upon the index for "all commodities" proportioned to its estimated importance.⁷⁵

Professor Edgeworth has pointed out a yet further desideratum in weighting. Most index numbers are made from samples of the data which logically fall within the field investigated; and the task is to make from these samples the best approximation to a measure of the unknown whole. Now "the theory of errors-of-observation shows that in the combination of the given observations, 'less weight should be attached to observations belonging to a class which are subject to a wider deviation from the mean. Such would be prices of articles which, exclusive of the common price movement of all the selected articles, are liable to peculiarly large *proper* fluctuations.'"⁷⁶

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

⁷⁵ See History of Prices During the War, Summary, War Industries Board Price Bulletin, No. 1.

⁷⁶ Economic Journal, June, 1918 (Vol. XXVIII, p. 188). The quotation within the quotation is from the British Association Memorandum, 1887 (p. 36). To make his point clearer, Prof. Edgeworth adds in a footnote this remark from the corresponding memorandum of 1889 (p. 157): "If more weight attaches to a change of price in one article rather than another, it is not on account of the importance of that article to the consumer or the shopkeeper, but on account of the importance to the calculators of probabilities as affording an observation which is peculiarly likely to be correct."

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.

7. AVERAGES AND AGGREGATES.

Among all the problems involved in the making of index numbers the one that has been most discussed 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 considerations. Indeed, the two problems of finding out how prices have actually changed, and finding the best method of measuring 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.⁷⁷

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 usually 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, half above the median and half below. In one famous investigation,⁷⁸ 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, though Mr. A. W. Flux has just adopted

⁷⁷ The best systematic discussions of averaging for the purpose in hand are to be found in Prof. Edgeworth's papers referred to in the 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, and his new treatise, *The Problem of Estimation*, 1921.

⁷⁸ W. S. Jevons, "A serious fall in the value of gold ascertained," 1863. Reprinted in his *Investigation in Currency and Finance*, 1884, pp. 13-118.

the geometric mean for the new form of the British Board of Trade index number. The other standard forms of averages—the mode and the harmonic mean—have been discussed frequently, but so far as is known they have never been consciously used in making index numbers.⁷⁹

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 years would show a greater difference. There is indeed no limit to the possible percentage of rise in prices, while the possible percentage of fall can not exceed 100.⁸⁰ The cases of extraordinary advance, accordingly, tend to raise the arithmetic mean more than the cases of extraordinary decline tend to depress it. If, for example, one commodity rose tenfold in price and another commodity fell to one-tenth of the old price, the arithmetic mean would show an average rise of 505 per cent $(1,000 + 10 \div 2)$, while the geometric mean would show no change in the average, since $\sqrt{1,000 \times 10} = 100$.

This favorite imaginary case of 10 and 1,000 seems extreme, but contrasts approximately as violent as that actually occurred in the recent war. The Price Section of the War Industries Board has computed the relative prices of 1,437 commodities in 1918 on the basis of their average prices in the twelve months, July, 1913, to June, 1914. These figures are reproduced in somewhat condensed form in Table 15. Here the array of relative prices is far more elongated in one direction than in the other, and the highest relative price is upwards of 100 times as great as the lowest relative price.⁸¹ Accordingly, the arithmetic mean (217) stands high above the geometric mean (194) and median (191).⁸²

⁷⁹ Concerning the properties of these averages see, for example, F. Zizek, *Statistical Averages* (translated by W. M. Persons), 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."

⁸⁰ Negative prices are conceivable of course; but do they ever occur in the sources which the maker of index numbers uses? Suppose that some kind of factory waste, which usually commands a low price, should fail of its market, and accumulate so as to become a nuisance. The factory manager might logically set it down at a negative price; but he is much more likely to offer a positive price for another commodity—the removal of the waste.

⁸¹ This ratio of 100 to 1 was indeed surpassed in some months. The highest relative price found was 5,081 (acetiphenetidin, November, 1916).—See *History of Prices during the War* (War Industries Board Price Bulletin, No. 54, p. 18).

⁸² From the skewed distribution characteristic of relative prices when arranged on the ordinary arithmetic scale, Prof. Frederick R. Macaulay has developed an ingenious argument in favor of the geometric mean.

He puts the matter in this way: "What is the *most probable value* for the general percentage movement? If the 'errors' (variation due to the influence of particular commodity factors) were distributed *arithmetically* according to the normal law, the arithmetic mean—least mean square deviation—would certainly seem indicated. But if the logarithms of the percentages and not the percentages themselves follow more closely the curve of error, is not the geometric mean indicated? From that point the curve of the squares of the logarithms of the percentage deviations will be a minimum; and is not this what sound theory should demand?" American Economic Review, March, 1916, Vol. VI, p. 207.

The answer to Prof. Macaulay's final question is that what sound theory demands depends upon the precise magnitude one desires to measure. It is argued hereafter in the text that if the purpose be to measure the average ratio of change in prices, the geometric mean is in strictness the only proper average to employ. Those who can utilize measures of average change for their purposes will be gratified to know that the arrays from which their averages are made usually conform better to the normal law of distribution than the arrays from which arithmetic means of relative prices are derived. As Prof. Edgeworth humorously admits, "it is a merit in a statistical group to conform to the normal law." (Economic Journal, June, 1918, Vol. XXVIII, p. 182). But, of course, the symmetry of the distribution of data from which different averages are derived is but one, and generally a subordinate, consideration in the choice of averages.

TABLE 15.—DISTRIBUTION OF THE RELATIVE PRICES OF 1,437 COMMODITIES IN 1913.

(Average prices in July, 1913, to June, 1914=100.)

Relative prices.	Number of cases.	Relative prices.	Number of cases.	Relative prices.	Number of cases.	Relative prices.	Number of cases.
36.....	1	250-269.....	76	490-509.....	4	849.....	1
49.....	1	270-289.....	54	510-529.....	5	900.....	1
50-69.....	4	290-309.....	42	530-549.....	3	1,165.....	1
70-89.....	17	310-329.....	30	550-569.....	4	1,355.....	1
90-109.....	61	330-349.....	31	587.....	1	1,585.....	1
110-129.....	64	350-369.....	16	627.....	1	1,764.....	1
130-149.....	130	370-389.....	13	727.....	1	2,049.....	1
150-169.....	212	390-409.....	7	730.....	1	2,853.....	1
170-189.....	219	410-429.....	7	743.....	1	3,009.....	1
190-209.....	164	430-449.....	8	761.....	1		
210-229.....	135	450-469.....	4	784.....	1		
230-249.....	104	470-489.....	4	826.....	1		

The second merit claimed for geometric means is that they can be shifted from one base period to another without producing results that seem to be inconsistent. 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 of these relative prices 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 $100 \div 70.71 = 141.42$.⁸³ By 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 not made in terms of prices at the original base period give results that may present formal inconsistencies and results whose meaning is difficult to grasp and put into words.

A third advantage of geometric means is that they are likely to be nearer the modes of the distributions which they represent than are arithmetic means. The importance of this point will be more generally appreciated as statisticians come to study the whole array of the price fluctuations with which they deal, instead of concentrating their attention merely upon averages.

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.⁸⁴ Finally, geometric means are somewhat 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 sum by the number of logarithms, and look up the natural numbers corresponding to the quotients.⁸⁵ 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

⁸³ See the discussion of shifting bases, pp. 33-90.

⁸⁴ This point is more fully explained on pp. 76 and 77.

⁸⁵ 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 $\left. \begin{array}{l} p_o, p_x \\ p'_o, p'_x \\ p''_o, p''_x \end{array} \right\}$ 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

$$\frac{p_x}{p_o}, \frac{p'_x}{p'_o}, \dots, \frac{p''_x}{p''_o}$$

The geometric mean of these relatives is

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

But this expression is equal to

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

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

other forms of index numbers. Like geometric means, aggregates of actual prices, or relatives made directly from them, can be shifted to any base desired without raising difficult problems of interpretation. Like geometric means, again, medians are not more affected by cases of exceptionally great advances in price than by cases of exceptionally great declines. Hence in practice most makers of index numbers who distrust arithmetic means abandon the practice of averaging relative prices or use medians instead of geometric means.

Medians, indeed, have several distinguished champions among theoretical statisticians.⁸⁶ It is generally claimed that of all averages medians are the easiest to compute, for a quick ordering of the data, followed by a counting of the items, takes the place of casting sums and dividing by the proper number. But in this day of adding machines the palm for ease of computation has shifted to the arithmetic mean and the aggregate of actual prices. More important is the fact demonstrated by Prof. Edgeworth 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.⁸⁷

But medians have their drawbacks. (1) They are not perfectly reversible; that is, they can not be shifted from one base to another by simple division without ambiguity. (2) Medians of different groups can not be combined, averaged, or otherwise manipulated with ease as can arithmetic means. For example, in making up its old form of index number the Bureau of Labor Statistics could 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 reexamine and rearrange the relative prices of those commodities which fell near the respective medians. 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 medians.⁸⁸ (3) 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 mid-most 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

⁸⁶ 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, does not recognize the median as a mean. See *Quarterly Publication of the American Statistical Association*, March, 1921, p. 542, and the numerous references to medians in his *Problem of Estimation*.

⁸⁷ 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.

⁸⁸ 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 old-style index numbers for the 10-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.

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.⁸⁹ (4) If the number of commodities included in an index number is even, the position of the median may be indeterminate, though within a determinate range.

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 (and aggregates of actual prices) stand first in ease of computation, when an adding machine is available, especially when the items are to be averaged first in small and later in large groups. (2) Their familiarity to all readers is supposed to be an advantage in work intended for wide reading though perhaps this familiarity means a dangerous lack of curiosity rather than clear understanding of the figures. (3) They can themselves be averaged and manipulated algebraically in various other ways.⁹⁰ On the other side of the score it must be said (4) that arithmetic means are liable to distortion from the occurrence of a few extremely high relative prices, (5) that arithmetic means of relative prices can not consistently be shifted from one base to another without recomputation in full,⁹¹ and (6) that they may conceivably give contradictory results concerning the direction in which prices are moving, according as relative prices are computed on one base or on another.⁹²

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

⁸⁹ "This objection is met," says Prof. Edgeworth, "by denying that the interval between two adjacent observations at the middle of the group is likely to be 'considerable'; large relatively to the magnitude with which it is proper to compare that interval—that is, the *minimum mensurable*, as we may say—that interval which is equal to (or of the same order as) the smallest degree which the compared method of measurement is capable of distinguishing with accuracy. For this minimum we may take at the least the 'probable error' incident to the arithmetic mean. That the interval between adjacent observations is likely to be small compared with this minimum is sufficiently evidenced by the following proposition: When the number of observations (n) is large the interval at the middle of the group, which is as likely as not vacant, within which it is an even chance that no observation falls, is most probably very small compared with the probable range of the arithmetic mean (in the ratio of about 1: \sqrt{n}). When the number of observation is not large the proposition is less accurate. But it remains roughly true, as the number can not be supposed very small consistent with the applicability of the theory of probabilities." *Economic Journal*, June, 1918, Vol. XXVIII, p. 193.

Granting the justness of these general remarks, the writer has found several cases in his own work where the medians of groups numbering 25 or more items moved in a way not representative of the whole array. For examples see "A critique of index numbers of the prices of stocks," *Journal of Political Economy*, July, 1916, Vol. XXIV, pp. 674, 675. It may, indeed, be set down as an advantage of medians that working with them may bring the full array of fluctuations under the eye and lead to the detection of peculiarities which would have escaped notice had arithmetic means been employed. When medians are used in averaging small groups the practice of scrutinizing the whole set of data is strongly recommended as a means of guarding against the occasional cases of erratic movement.

⁹⁰ See, for example, G. U. Yale, *Introduction to the Theory of Statistics*, pp. 114-116.

⁹¹ See section 8 below.

⁹² Take, for example, the following data:

	1913	1914
Wheat, per bushel.....	\$3.50	\$1.00
Coin, per bushel.....	.48	.24

geometric mean. For example, if the relative prices of the 145 commodities represented in the second index number of Table 6 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 more striking example of differences among the averages was incidentally remarked above. The relative prices of Table 15 yield the following figures:

Geometric mean, 194; median, 191; arithmetic mean, 217.

A fuller study of the relations between medians and arithmetic means is provided for by the following table.⁹³ In the chain index⁹⁴ 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 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 behavior of medians and arithmetic means when used to average small groups. Here the median is greater than the arithmetic mean in 13 years, the same in 1 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 median drops 9 points in 1913 while the arithmetic mean rises 2 points. Scrutiny of the full array of relative prices in this year as compared with 1912 shows that this violent drop is not an apt

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 inconsistency is 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.

⁹³ 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. 627.

⁹⁴ On the character of chain indexes, see the following section (pp. 81 to 91).

summary of the combined movements.⁹⁵ 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 16.—COMPARISONS OF MEDIANS AND ARITHMETIC MEANS AS AVERAGES OF RELATIVE PRICES.

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

Year.	Chain index number (prices in preceding year=100). ^a		Relative prices of 145 commodities (aver- age prices in 1890- 1899=100). ^b		Relative prices of 25 commodities (aver- age prices in 1890- 1899=100). ^c	
	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.....	- 1.2	- 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	+ 6.0	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	129
1912.....	+ 1.0	+ 3.4	127	134	136	140
1913.....	+ .5	+ 1.2	127	131	127	142
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	5.09

^a Compare Tables 2 and 17. ^b Compare Table 6, second series. ^c Compare Table 6, fifth series.

⁹⁵ Of the 25 commodities 13 rose in price and 12 fell; the median percentage of change from prices in the year before is +1.0.

TABLE 16.—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. 59, 60.]

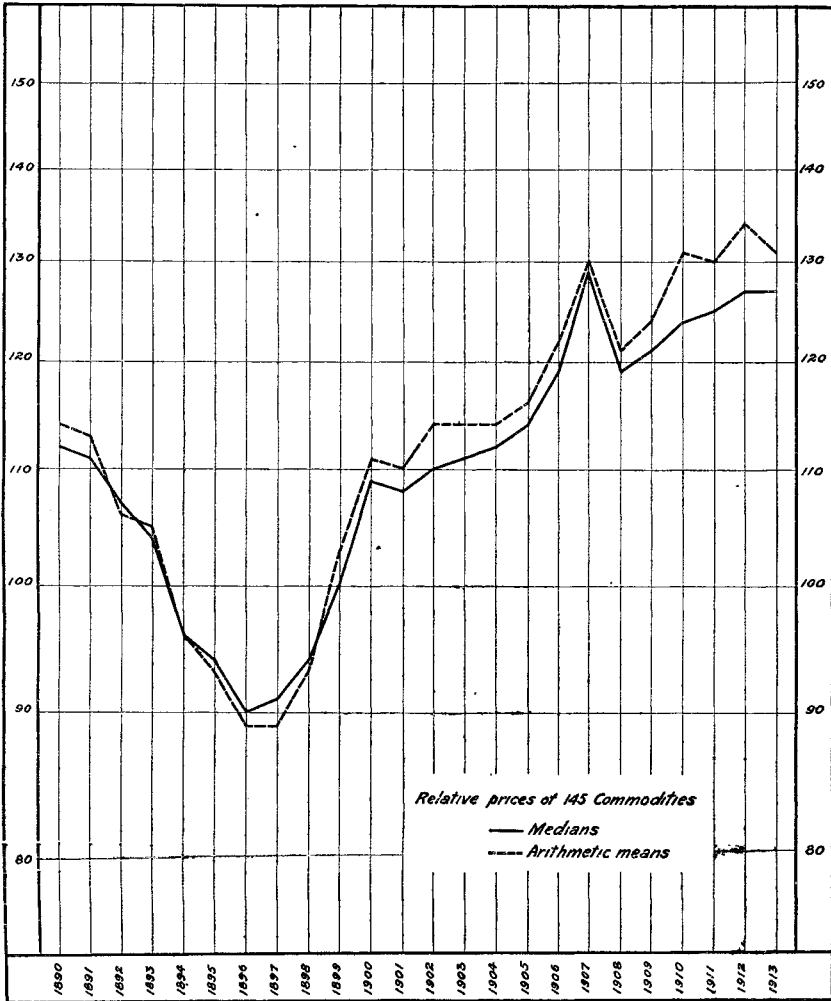
92 commodities at wholesale (prices in 1866=100).								
Year.	Me- dians.	Arith- metic means.	Year.	Me- dians.	Arith- metic means.	Year.	Me- dians.	Arith- metic means.
1860, January.....	100	102	1867, January.....	169	179	1874, January.....	130	140
April.....	100	102	April.....	166	175	April.....	129	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.....	154	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	160	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	105
July.....	194	236	July.....	130	137	July.....	90	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	98
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—on one interpretation of that somewhat indefinite problem. 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 a given bill of goods costs. 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

CHART 11.—A COMPARISON OF MEDIANS AND ARITHMETIC MEANS OF THE RELATIVE PRICES OF 145 COMMODITIES.

(Based on Table 16.)



large upward variation should count for more than a small downward variation, for it requires more currency;"⁹⁶ provided always that the changes in prices are not offset or more than offset by contrary changes in quantities bought. For such purposes the arithmetic 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.⁹⁷ 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 in the index number is small, however, medians may occasionally prove 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 without raising difficult problems of interpretation, deserves 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. This should constitute a great safeguard against crude work, though in view of Bradstreet's method of weighting one can not claim that it always is effective. 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.⁹⁸ It is 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

⁹⁶ Irving Fisher, *The Purchasing Power of Money*, revised edition, p. 426, note 2. Mr. Flux and Mr. Yule hold that to measure changes "in the money cost of the things we buy" is "the retail-prices problem," and is not the appropriate aim of a wholesale-price index; but they do not consider the arguments which Prof. Fisher advances. *Journal of the Royal Statistical Society*, March, 1921, pp. 175-9, and 200, 201.

⁹⁷ 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. 65.)

⁹⁸ See the example from *Hunt's Merchant's Magazine* given on pp. 31 and 32. 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 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 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 even easier to understand than 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.⁹⁹ 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. 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 comprehensive in scope and weighted on a sound system, they are not likely to 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

⁹⁹ The legitimacy of shifting these relatives by the "short" method is best shown by the use of symbols.

Let p_o, p_x, p_y } represent the money prices of the two commodities p and p' in three years $o, x,$ and y .
 p'_o, p'_x, p'_y }

Then the sums of these actual prices will be—

$p_o + p'_o$ in the year o .

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

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

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

$\frac{p_x + p'_x}{p_o + p'_o}$ on the basis of prices in the year o , 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—

$\frac{p_y + p'_y}{p_o + p'_o}$ on the basis of prices in the year o .

Now the relative price in the year x , computed on the basis of prices in the year o , 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 o by the relative for the year y on the basis of prices in the year o . For

$$\frac{p_x + p'_x}{p_o + p'_o} \div \frac{p_y + p'_y}{p_o + p'_o} = \frac{p_x + p'_x}{p_y + p'_y}$$

The reason why ordinary arithmetic means of relative prices can not be consistently shifted to another base by this simple method is explained on p. 83.

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.

But the main issue has still to be faced. 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 76 to 78 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 value 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 quantities to be used as weights 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.¹

But while an arithmetic mean of relative prices is always equivalent to some aggregate of actual prices turned into relatives, this fact does not mean that the arithmetic mean of relatives is as desirable a form of general-purpose index number as its rival. For the particular aggregate of actual prices to which a given arithmetic mean of relatives corresponds is one difficult to grasp. It is that aggregate in which the price of each commodity included, quoted in terms of its ordinary commercial unit, has been multiplied by the number of commercial units which is necessary to make its price in the base period some predetermined multiple of 100. Now this is a much more complicated idea to carry in mind and to make clear to readers than the idea of the price of the commodity multiplied by the number of units that are ordinarily produced, exchanged, or consumed. In other words, the arithmetic average of relatives has the same relation to its corresponding aggregate of actual prices that a complicated mathematical expression has to the same expression reduced to a simpler form. The difference is one of form, but simplicity of form greatly increases the efficiency of thinking.

8. BASE PERIODS, CHAIN INDEX NUMBERS, AND FIXED-BASE SERIES.

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. When aggre-

¹ The explanation given in the text may be put in the form of algebraic formulae for readers willing to study symbols.

Let p_o, p_x
 p'_o, p'_x represent the prices of the commodities from which an index number is to be made in the
 p_o^n, p_x^n base year o 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:

$$\frac{p_x}{p_o} + \frac{p'_x}{p'_o} + \dots + \frac{p_x^n}{p_o^n}$$

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

$$\frac{p_x q + p'_x q' + \dots + p_x^n q^n}{p_o q + p'_o q' + \dots + p_o^n q^n}$$

A weighted arithmetic mean of relative prices with money weights corresponding to the physical weights of the expression immediately above is represented by the following formula:

$$\frac{p_x (q p_o) + p'_x (q' p'_o) + \dots + \frac{p_x^n}{p_o^n} (q^n p_o^n)}{p_o q + p'_o q' + \dots + p_o^n q^n}$$

But in the numerator of this fraction, $p_o, p'_o,$ and p_o^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 relative as the weighted arithmetic mean of relative prices, and gives them with less work.

gates of actual prices are first made and then turned into relatives the problem of selecting a proper base period has to be faced at the end of the computation.

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.² 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 low or high, and the very high relative prices will exercise much more influence upon arithmetic means than the very low ones. 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."³ 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 for the relative prices 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.⁴ 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 1890–1899. In 1918, however, when people cared less about knowing changes in terms of what prices had been 19 to 28 years earlier, the Bureau shifted its base to 1913. Similarly, Sauerbeck's index number, which uses prices in 1867–1877 as a base, suffers in significance for recent comparisons because it forces one to make all comparisons in terms of prices in a period that ended before most of the people now living were old enough to know the meaning of prices.

Index numbers made on a base many years in the past, moreover, encounter all the difficulties that inhere in the problem of measuring price variations through long periods of time. As was shown in Section III of this bulletin (pp. 11 to 23), price variations become dispersed over a wider range and less concentrated about their mean as the time covered by the variations increases. That is, the longer a fixed-base series is maintained, the more scattered as a rule become the relative prices. The difficulty is particularly serious when arithmetic means are used. The commodities that have a con-

² 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.

³ 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. Or, to speak with more precision, the choice of base is itself part of the problem of weighting in its inclusive sense.

⁴ This form of index number was invented by Prof. Alfred Marshall. See *Contemporary Review*, March, 1887.

sistent long-period trend gradually climb far above or fall far below the average relative price. Then the high relative prices of the commodities that have risen exercise a much stronger pull upon the position of the arithmetic mean than do the low relative prices of the commodities that have fallen. For most purposes this constitutes a defect, since commodities that have increased greatly in price are likely to have become scarce, and commodities that have become cheaper are likely to be more abundant. The changes in the influence exercised on the mean by the relative prices are likely to be in inverse ratio to the changes in the importance of the commodities. In other words, the use of the distant base itself introduces a surreptitious set of weights into the figures to be averaged, and a set which may well counteract in large measure the formal set of weights which the investigator uses to show the importance of his articles.

It is not uncommon, of course, to shift fixed-based index numbers from a remote to a recent base. For example, Sauerbeck's index as continued by the Statist was 85 in 1913 on the 1867-1877 base. If one wishes to find how much English prices rose in 1914-1918 as compared with their prewar level, he may put $85 = 100$, and recast the indexes for the years of war on that scale. But this is a purely formal manipulation of the results. It does not diminish the scattering of the relative prices from which the averages are computed, and it does not give the same result that recomputing the relative prices of the 45 commodities on the 1913 base and averaging them afresh would give. The first point is obvious; the second requires explanation.

Averages of relative prices on a given base may be regarded as averages of actual prices made with a peculiar scheme of haphazard weights. That is, the quotation of every commodity is in effect multiplied by the factor necessary to make its price in the base period equal 100.⁵ To change the base is of course to change this set of implicit haphazard weights for another set, which may be better or worse—the computer is unlikely to know which—but which will be different unless the ratio of change in prices between the old and new base periods has been precisely identical for all the commodities included. Of course, different sets of weights applied to the same set of price quotations will probably alter the average variations somewhat. Hence, if one really wants to know how a given set of prices have varied with reference to their standing at any given time, the only way to find out accurately is to weight the variations of each commodity by the factors which the chosen base determines; that is, in practice, to compute new relative prices article by article. But if the purpose in hand is such that one set of haphazard weights will serve as well as another, then there is no objection to shifting the base by the short method of manipulating merely the averages, provided the results are properly explained.

⁵ Compare F. R. Macaulay, "Index numbers for retail prices," *American Economic Review*, December, 1915, Vol. V, pp. 923, 929.

It is easy to arrange examples in which wide discrepancies appear between the results of the two methods of shifting the base.⁶ 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.⁷ The conclusion which these experiments suggest is that the two 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

⁶ 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

⁷ 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.

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

(Arithmetic means.)

Year.	Sauerbeck's index number, 1890-1913.				Bureau of Labor Statistics index number (old series).				Year.	Sauerbeck's index number, 1890-1891.			
	Original form, 1867-1877=100.	Shifted to 1890-1899=100, by short method.	Recomputed on basis 1890-1899=100, by long method.	Discrepancies.	Bureau's series on basis 1890-1899=100.	Chain index made by short method.	Chain index made by long method.	Discrepancies.		Original form, 1867-1877=100.	Shifted to 1890=100, by short method.	Recomputed on basis 1890=100.	Discrepancies.
1890..	72	109	109	.....	112.9	.....	.....	.....	1890.	99	100.0	100.0	.....
1891..	72	109	109	.....	111.7	-1.1	-0.2	0.9	1861.	98	99.0	99.6	0.6
1892..	68	103	103	.....	106.1	-5.0	-4.4	.6	1862.	101	102.0	105.5	3.5
1893..	68	103	103	.....	105.6	-.5	-.2	.3	1863.	103	104.0	109.3	5.3
1894..	63	95	95	.....	96.1	-9.0	-8.7	.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	.6	1866.	102	103.0	106.5	3.5
1897..	62	94	93	1	89.7	-.8	+.2	.4	1867.	100	101.0	103.9	2.9
1898..	64	97	97	.....	93.4	+4.1	+4.8	.7	1868.	99	100.0	103.1	3.1
1899..	68	103	104	1	101.7	+8.9	+10.4	1.5	1869.	98	101.0	101.9	2.9
1900..	75	114	115	1	110.5	+8.7	+9.4	.7	1870.	96	99.0	100.3	3.3
1901..	70	106	107	1	108.5	-1.8	-1.1	.7	1871.	100	97.0	102.6	1.6
1902..	69	105	106	1	112.9	+4.1	+4.6	.5	1872.	109	101.0	112.5	2.4
1903..	69	105	106	1	113.6	+.6	+1.2	.6	1873.	111	112.1	116.6	4.5
1904..	70	106	108	2	113.0	-.5	-.1	.4	1874.	102	103.0	107.0	4.0
1905..	72	109	111	2	115.9	+2.6	+2.9	.3	1875.	96	97.0	100.3	3.3
1906..	77	117	119	2	122.5	+5.7	+5.8	.1	1876.	95	96.0	97.5	1.5
1907..	80	121	123	2	129.5	+5.7	+6.0	.3	1877.	94	95.0	97.4	2.4
1908..	73	111	112	1	122.8	-5.2	-5.6	.4	1878.	87	87.9	91.2	3.3
1909..	74	112	114	2	126.5	+3.0	+3.2	.2	1879.	83	83.8	86.7	2.9
1910..	78	118	120	2	131.0	+4.0	+4.1	.1	1880.	88	88.9	91.8	2.9
1911..	80	121	123	2	129.2	-1.8	-1.9	.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

Chain index numbers on the base, prices in the preceding year = 100, have the advantage pointed out in Section III, that the variations which they represent are highly concentrated and therefore apt for averaging. That is, year-to-year variations are relatively easy to measure with approximate accuracy. It is true that makers of index numbers find chain relatives more troublesome to compute than fixed-base series, since most of the prices used as divisors change every year; but that fact weighs lightly with such laborious folk in comparison with an improvement in their results. Why, then, should they not make successive averages of year-to-year variations covering as long a period as desired and weld the successive links together by multiplication to form a continuous chain?

For example, in Table 17 it is shown that the old Bureau of Labor Statistics index in 1890 on the 1890-1899 base was 112.9 and that prices fell 0.2 per cent in 1891. On multiplying, we get 112.9×0.998

=112.7. In 1892 the average change of prices was a fall of 4.4 per cent. $112.7 \times 0.956 = 107.7$. Once more, in 1893 prices fell 0.2 per cent on the average. Adding this new link to the chain, we have $107.7 \times 0.998 = 107.5$. The next table shows this process carried through to 1913. The result is a new index number covering 24 years, in which each successive step is taken by averaging relatives which are probably better fitted for averaging, since they are more highly concentrated, than the corresponding relatives on the 1890-1899 base. Is it not better than the old index on the fixed base?

One may answer, first, that while each successive step in the chain index may be taken with confidence, any errors which do inhere in the steps are likely to accumulate. There is no magic in the year-by-year computation which makes the final comparison between prices in 1913 and 1890 more reliable on the one basis than on the other. Second, the interpretation of the final result is certainly simpler in the case of the fixed-base than in the case of the chain index. The figures say in the first case that between 1890 and 1913 there was an average net increase of prices equal to 22.3 per cent of average prices in 1890-1899. The chain index says that there was an increase between these two years of 37.1 per cent; but when one asks, "Per cent of what?" the answer is complicated. Third, the chain index which was begun arbitrarily on a par with the fixed-base series drifts away from it upward, and by the end of the period has opened a gap of nearly 15 points, or more than 11 per cent—a notable discrepancy. Stated in another way, the chain series makes the percentage increase in prices from 1890 to 1913 more than half again as great as the fixed-base series makes it.

TABLE 18.—A FIXED-BASE INDEX NUMBER, A CHAIN INDEX NUMBER MADE FROM THE SAME DATA, AND THE CHAIN INDEX MADE INTO A CONTINUOUS SERIES.

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

(Arithmetic means.)

Year.	Bureau's index number on basis prices in 1890-1899=100.	Chain index number, on basis prices in preceding year=100.	Chain index number made into a continuous series.	Year.	Bureau's index number on basis prices in 1890-1899=100.	Chain index number, on basis prices in preceding year=100.	Chain index number made into a continuous series.
1890.....	112.9	.....	112.9	1902.....	112.9	104.6	123.4
1891.....	111.7	99.8	112.7	1903.....	113.6	101.2	124.9
1892.....	106.1	95.6	107.7	1904.....	113.0	99.9	124.8
1893.....	105.6	99.8	107.5	1905.....	115.9	102.9	128.4
1894.....	96.1	91.3	98.2	1906.....	122.5	105.8	135.9
1895.....	98.6	98.5	96.7	1907.....	120.5	106.0	144.1
1896.....	90.4	97.2	94.0	1908.....	122.8	94.4	136.0
1897.....	89.7	100.2	94.2	1909.....	126.5	103.2	140.3
1898.....	93.4	104.8	98.7	1910.....	131.6	104.1	146.1
1899.....	101.7	110.4	109.0	1911.....	129.2	98.1	143.3
1900.....	110.5	109.4	119.3	1912.....	133.6	103.4	148.2
1901.....	108.5	98.9	118.0	1913.....	135.2	101.2	150.0

Why should the annual shifting of the base on which relatives are computed make such a difference in the results? On looking at the figures in Table 17 from which the continuous chain in Table 18 is forged, we see that when prices are falling the percentage of change on the preceding-year base is generally smaller than the corresponding change on the fixed base. On the contrary, when prices are rising

the preceding year base gives the larger percentage of change. In two years the percentages are the same (1912 and 1913), and in two other years the rule is reversed (1908 and 1911); but the rule holds in 19 cases out of 23.⁸ The problem is to account for the fact that chain relatives usually rise more than fixed-base relatives when prices are rising and fall less when prices are falling.

The following numerical examples give the clue to the solution. We have in the first two columns of each example two relatives on a fixed base, for two successive years. First the larger of the two relatives is made to increase 25 per cent in the second year, and then to fall 25 per cent in the second year, the smaller relative remaining constant. Afterwards the smaller of the two relatives is made to rise and then to fall by 25 per cent in the second year, the larger relative being constant. In the third column the figures for the second year are turned into chain relatives. Index numbers are computed for both sets of relatives and the percentages of change on the two bases are given.

1. When a relative above the average of the relatives rises, its rise makes a smaller percentage addition to the chain than to the fixed-base index.

Fixed base.		Preceding-year base—
First year.	Second year.	Second year.
240	300	125
160	160	100
<u>2)400</u>	<u>2)460</u>	<u>2)225</u>
200	230	112.5
Per cent of change..... +15		Per cent of change... +12.5

2. When a relative above the average of the relatives falls, its fall makes a smaller percentage subtraction from the chain than from the fixed-base index.

Fixed base.		Preceding-year base—
First year.	Second year.	Second year.
240	180	75
160	160	100
<u>2)400</u>	<u>2)340</u>	<u>2)175</u>
200	170	87.5
Per cent of change..... -15		Per cent of change... -12.5

⁸ The fact was pointed out and the explanation of it suggested by Professor F. R. Macaulay, in *American Economic Review*, March, 1916, Vol. VI, pp. 237, 208.

3. When a relative below the average of the relatives rises, its rise makes a larger percentage addition to the chain than to the fixed-base index.

Fixed base.		Preceding-year base—
First year.	Second year.	Second year.
240	240	100
160	200	125
<u>2)400</u>	<u>2)440</u>	<u>2)225</u>
200	220	112.5
Per cent of change..... +10		Per cent of change.. +12.5

4. When a relative below the average of the relatives falls, its fall makes a larger percentage subtraction from the chain than from the fixed-base index.

Fixed base.		Preceding-year base—
First year.	Second year.	Second year.
240	240	100
160	120	75
<u>2)400</u>	<u>2)360</u>	<u>2)175</u>
200	180	87.5
Per cent of change..... -10		Per cent of change.. -12.5

All that these figures show is that in certain cases the fluctuations will be greater in the chain relatives and in other cases greater in the fixed-base relatives. The vital point is, however, that cases 2 and 3 occur in price quotations much more frequently than cases 1 and 4. Relative prices above the average seem more likely to fall than to rise further; relative prices below the average seem more likely to rise than to fall further. That is, the prices of individual commodities tend to conform to the average movement, and when they have already diverged from this average they move back toward it more often than they move away. These cases that occur more frequently than the others are those that make the chain relatives rise more (case 3) or fall less than the fixed-base relatives (case 2).⁹

The net difference to be expected on this ground in a large body of quotations between the movements of the relatives on the two bases

⁹ Of course this argument can be more generally, as well as more compactly, stated in algebraic terms. Prof. W. M. Ogburn contributes the following formulation:

Let p'_1, p''_1, \dots stand for relative prices of commodities during the first year, and p'_2, p''_2, \dots stand for relative prices of commodities during the second year. Let n be the number of commodities and m_1 the arithmetic mean of the relative prices during the first year.

The fixed-base index is obtained by getting the average of the relative prices; the fixed-base index for the first year is:

$$\frac{p'_1 + p''_1 + \dots}{n}$$

And that for the second year is:

$$\frac{p'_2 + p''_2 + \dots}{n}$$

is small in any one year. A glance at the figures in Table 18 will show that the observed differences are generally less than 1 per cent. But though small the differences are tolerably constant in direction, and therefore when cumulated by multiplication they become significant in 10 or 20 years.

The conclusion is that close agreement is not to be expected between efforts to measure the change of prices between years far apart when the measures are made first on a fixed base and then by the chain method. The chain method is perfectly legitimate, of course, when its results are carefully interpreted; but, as remarked above, the interpretation is difficult to put into words. Where means permit it is well to make from the original quotations two series of index numbers, one a chain index, the other a fixed-base series, and then to call attention to the differences between the two.

The per cent increase, or the rise, is the ratio of the second to the first, or

$$Rf = \frac{p_2' + p_2'' + \dots}{p_1' + p_1'' + \dots} \tag{1}$$

Let the per cent increase from first year to second in the prices of individual commodities be $r', r'' \dots$ then the relation between the prices during the first and second year can be expressed by the following equations:

$$p_2' = p_1' (1+r')$$

$$p_2'' = p_1'' (1+r''), \text{ etc.}$$

By substitution in (1):

$$Rf = \frac{p_1'(1+r') + p_1''(1+r'') + \dots}{p_1' + p_1'' + \dots}$$

$$Rf = \frac{p_1' + p_1'' + \dots + p_1'r' + p_1''r'' + \dots}{p_1' + p_1'' + \dots}$$

$$Rf = \frac{\Sigma p_1 + \Sigma p_1 r}{\Sigma p_1} = 1 + \frac{\Sigma p_1 r}{\Sigma p_1}$$

Putting $p_1 - m_1 = x_1$ where x_1 is the size of the relative, we have:

$$Rf = 1 + \frac{\Sigma(m_1 + x_1)r}{\Sigma p_1}$$

$$Rf = 1 + \frac{m_1 \Sigma r}{\Sigma p_1} + \frac{\Sigma x_1 r}{\Sigma p_1}$$

$$\Sigma p_1 = n m_1$$

$$Rf = 1 + \frac{m_1 \Sigma r}{n m_1} + \frac{\Sigma x_1 r}{\Sigma p_1} = 1 + \frac{\Sigma r}{n} + \frac{\Sigma x_1 r}{\Sigma p_1} \tag{2}$$

The chain index is obtained by averaging the ratios of the individual prices of commodities and is expressed in the following manner:

$$Rc = \frac{\frac{p_2'}{p_1'} + \frac{p_2''}{p_1''} + \dots}{n}$$

$$Rc = \frac{\frac{p_1'(1+r')}{p_1'} + \frac{p_1''(1+r'')}{p_1''} + \dots}{n} = \frac{(1+r') + (1+r'') + \dots}{n}$$

$$Rc = \frac{n + \Sigma r}{n} = 1 + \frac{\Sigma r}{n} \tag{3}$$

by subtracting (3) from (2):

$$Rf - Rc = \frac{\Sigma x_1 r}{\Sigma p_1}$$

In other words the fixed-base index number will not equal the chain index number unless $\Sigma x_1 r = 0$ (which is true when r is constant). When $\Sigma x_1 r$ is negative the chain-index number will be larger and when positive the fixed-base index will be larger. $\Sigma x_1 r$ is positive when x (the size of the relative) is correlated (positively) with r (the percentage of increase), which is rarely if ever the case. The exact difference can be measured by $\frac{\Sigma x_1 r}{\Sigma p_1}$.

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 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 readily and without involving difficulties of interpretation.

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, with an explicit scheme of weights, can be thrown into the form of a series of relative prices on any base that is desired, with slight labor and with no ambiguity. Geometric means, of course, possess the same advantage.

Another problem in base periods has recently been developed by Prof. Fisher. Should the period to which the weights refer be the same as the period used as the base for computing relative prices, or should the weights be taken from a different period? Suppose that the index number is to be an arithmetic mean of relative prices weighted by the values of the commodities exchanged in some year. Then "if the weights used are the values of the *base* year (that is, the base year for the relative prices) they impart a *downward bias* to all the index numbers of any given year calculated thereby, while, on the other hand, if the weights used are the values of the *given* year itself, they impart an *upward bias*."

To understand this effect one must note that the commodities which have unusually high market prices in the base year will tend to have both high values (prices multiplied by quantities) in that year and low relative prices in other years. Vice versa, the commodities which have unusually low market prices in the base year will tend to have both low values in that year and high relatives in other years. Then the multiplication of the low relatives by the high values and of the high relatives by the low values will tend to reduce the index numbers for all other years in comparison with the base year. Changing the weights from values in the base year to values in any other year will tend to reverse these combinations. For commodities that have unusually low market prices in the base year and therefore high relatives in other years will tend to have higher values in the latter years, and the commodities with high market prices in the base year and low relatives in other years will tend to have lower values in the latter years. The index number with "given-year" weights will therefore tend to combine high relatives heavily weighted and low relatives lightly weighted, and so give figures that run high for all other years in comparison with the base year.

How considerable this "biasing" of the results by the choice of the period to which the weights refer will prove in practice depends upon

whether the prices and quantities of commodities usually fluctuate in the same or in opposite directions, for the influence of high and low prices on the values as weights may be offset, or more than offset, by contrary changes in the quantities. Little is positively known concerning the run of these facts. Prof. Fisher believes, however, that the quantity factor is almost as likely to influence the weights in one direction as in the other. If so, the price factor has a fair field to influence the values used as weights and the above argument holds good.

On this basis Prof. Fisher advises that in making arithmetic means of relative prices the weights be taken from the base year, in order that the downward bias of these weights may run counter to the upward bias of the arithmetic mean (caused by the greater influence exercised by high than by low relatives upon this form of average). Harmonic means, on the contrary, have a downward bias (are more influenced by low than by high relatives) and should therefore be weighted by values taken from some other year than the base. Geometric means, medians, and modes, which have no inherent bias, he holds, should be weighted by values both in the base and in the given year; for otherwise they will be affected by the bias of the weights.¹⁰

9. THE "IDEAL" FORMULA.

A more complicated formula for making index numbers than those heretofore discussed has recently been invented independently by three high authorities and recommended as the best for making general-purpose series. It may be written thus:

$$P_n = \sqrt{\frac{\sum p_n q_n}{\sum p_o q_n} \cdot \frac{\sum p_n q_o}{\sum p_o q_o}}$$

where Σ indicates "the sum of such terms as"

p_n = the price of any commodity in a given year (or period).

q_n = the quantity of that commodity in the given year.

p_o = the price of that commodity in the base year.

q_o = the quantity of that commodity in the base year.¹¹

To use this formula it is necessary to have data concerning the prices and the quantities of every commodity in every year covered by the index number. From these data four sets of aggregates of actual prices multiplied by quantities are made for each year: (1) Prices in the given year times quantities in the given year, (2) the same prices times quantities in the base year, (3) prices in the base

¹⁰ Irving Fisher: "The best form of index number." Quarterly Publication of the American Statistical Association, March, 1921, pp. 535, 536.

Prof. W. M. Persons has tested Prof. Fisher's contention that a geometric mean weighted by prices in the base year will have a downward bias. He finds that "Indices of quantity or of prices of agricultural products of the United States for the period 1890-1920 when measured relative to a fixed base (1910 in this case) show the same general movement whether the Fisher method or the geometric average is used . . . no cumulative divergence of the two indices is evident."—Review of Economic Statistics, May, 1921, p. 111.

¹¹ Mr. Walsh mentioned this formula in a footnote in his Measurements of General Exchange Value, 1901, but did not then exploit its merits. In 1912 Prof. A. C. Pigou published the same formula in *Wealth and Welfare* (p. 46); but failed to note that the square root of the product should be extracted. This oversight he remedied in his *Economics of Welfare*, 1920 (p. 78). In 1921 Prof. Irving Fisher having invented the formula in his turn, presented it before the American Statistical Association. Meanwhile Mr. Walsh in reviewing his earlier work had concluded that his footnote formula was perhaps the best of all. (See Quarterly Publication of the American Statistical Association, March, 1921, pp. 536, 539, and "The Problem of Estimation," p. 162.)

I have adopted Prof. Persons's notation as clearer than that of the inventors.—Review of Economic Statistics, May, 1921, p. 107, note.

year times quantities in the given year, and (4) the latter prices times quantities in the base year. Then the first and second aggregates (prices in the given year weighted in two ways) are reduced to relatives by dividing them respectively by the third and fourth aggregates (prices in the base year weighted in the same two ways). Finally these relatives are multiplied together and the square root of their product extracted.

What advantages does this formula possess to compensate for the great amount of labor it entails?

Prof. Pigou uses it in an index of changes in the volume of "real income." He finds it necessary to use weights for two periods because of "The root fact . . . that in the first period our group expends its purchasing power upon one collection of commodities, and in the second period it expends it on a second and different collection." The change in real income can not be accurately measured unless these alterations in the quantities of goods bought are represented in the index of prices used in reducing money income to real income.¹²

Prof. Fisher wants this formula for use in his equation of exchange. It serves admirably there, because an index number of prices made by it when multiplied by a similarly constructed index number of quantities will show the changes in the total values of goods exchanged.

Mr. Walsh's purpose is more general, "to measure variations in the exchange value or purchasing power of money," and his argument concerning its merits is more technical. The first of the two ratios included in the formula is equivalent to an harmonic mean of relative prices weighted by values in the given year, while the second ratio is equivalent to an arithmetic mean of price relatives weighted by values in the base year. By using imaginary examples covering four years, in which the last year has the same prices and quantities as the first year, Mr. Walsh tests arithmetic and harmonic means weighted in his way. He finds that they yield different results which "lie on opposite sides of the truth, and apparently equally above and below it proportionately." This result suggests the propriety of taking the geometric mean between the two averages. That step yields the "ideal" formula. Mr. Walsh adds: "Note that it involves the arithmetic average, the harmonic average, the weightings of the first and second periods, and the geometric mean. . . . It seems to contain everything that could be desired."¹³

We may agree with Prof. Pigou that this formula is well adapted to use in a measure of change in real income and with Prof. Fisher that it is well adapted to use in the equation of exchange. Can we agree with Mr. Walsh that it is the best formula for making general-purpose index numbers?¹⁴

If the end in view is to compare the change in prices between any two years, then this formula is more desirable than an aggregate of actual prices weighted by quantities in either year alone. That proposition holds true of every year-to-year comparison however far extended. Hence the "ideal" formula is admirably adapted for making chain index numbers, whenever it is possible to secure the

¹² Economics of Welfare, p. 72.

¹³ The Problem of Estimation, p. 102.

¹⁴ Mr. Walsh is explicit upon this point. (See The Problem of Estimation, p. 118.)

necessary annual data for quantities as well as prices and to meet the necessary expense of computation.

But can the separate links in such a chain index be welded together to make an equally admirable index covering long periods? Two objections lie against it on this score. (1) The ideal formula changes weights in each successive link in the chain. The quantities for 1920 and 1921 used in computing the link for that year are not likely to be the same as the quantities for 1921 and 1922 used in computing the latter link. As pointed out in section 6 above a change in the weights makes it uncertain what part of the net result is due to price fluctuations and what part to fluctuations in quantities. Whenever the purpose in view requires that the price factor shall be isolated, it is therefore undesirable to use the "ideal" formula for any comparisons except those between two specified years.¹⁵ (2) It has been shown in section 8 that an arithmetic mean of relatives on the preceding-year base when forged into a continuous chain drifts away upward from the corresponding fixed-base series made from the same data. Now the ideal formula does not use relative prices, but is made from aggregates of actuals which can not drift in this fashion, provided they are made with constant weights. Does the annual change of weights required by the "ideal" formula introduce errors that cumulate and so cause the chain index to part company from a fixed-base series? Prof. Persons has answered that question by an actual trial. Taking the prices and quantities of 12 leading crops of each year of the decade of 1910-1919, he has made first for the quantities and second for the prices two index numbers, one using the "ideal" formula computed directly to the fixed base 1910, another using the "ideal" formula chain fashion. Both of the chain indices are found to diverge from their fixed-base mates by a distance that is rather wide considering that the errors are cumulated for no more than nine years. The chain index for quantities drifts *upward* and the chain index for prices drifts *downward*. In both cases the discrepancies reach 4 per cent in 1919.¹⁶ Hence the "ideal" formula is ill-fitted for making index numbers covering a long period of years, when it is applied in the way which its logic strictly requires, namely, year-by-year comparisons. And a fixed-base series made by this formula—that is, one in which the index for each year is made by compounding the weights of that year with some base year (instead of the year before)—yields accurate comparisons only between the base year and any given year and not comparisons that are accurate as between any two given years. If it is desired to make possible comparisons between any two years of a period longer than two years aggregates of actual prices or geometric means, both made with constant weights, seem better than the "ideal" formula, as well as far easier to compute.¹⁷

¹⁵ This objection is reduced but not removed if the indices for each year are computed directly to a fixed base, say 1913. Then the prices for the year 1920 would be weighted by quantities in 1913 and 1920, the prices in 1921 by the quantities in 1913 and 1921, etc. The weights would still change, but not so much as in the chain index.

¹⁶ Review of Economic Statistics, May, 1921, pp. 113, 114.

¹⁷ Concerning the difference in labor of computing Prof. Persons gives an interesting note. The relative times required to compute the "ideal" index numbers and the geometric means in his test of the two were as follows:

	Relative times required.
Geometric means, constant weights.....	27
"Ideal" index number, fixed base.....	51
"Ideal" index number, chain series.....	100

Of course the difference would be much larger if the time were counted in that is spent in collecting yearly data concerning quantities called for by the "ideal" formula. A sum of actual prices made with fixed weights takes still less time for computation than a weighted geometric mean.

V.—A COMPARISON OF THE LEADING AMERICAN INDEX NUMBERS FOR THE YEARS 1890 TO 1918.

Many 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 Part I of this bulletin.

1. ANALYSIS OF THE SIMILARITIES AND DIFFERENCES BY YEARS, 1890 TO 1918.

Three general-purpose index numbers are available for the critical study proposed, the latest form of the Bureau of Labor Statistics series, Bradstreet's index, and Dun's index. It seems hardly worth while to include in the comparison index numbers made solely of the prices of foods, because they do not profess to measure changes in the commodity markets at large. It has been shown that these special indexes are not in close agreement with series containing not only foods but also minerals, forest products, textiles, chemicals, etc.; and that demonstration need not be repeated.¹⁸

The first step toward comparing index numbers is to throw them into similar form and establish them upon a common base. The new series of the Bureau of Labor Statistics is a weighted sum of actual prices, turned into relatives on the base, prices in 1913 = 100. This series can be shifted to any base desired without appreciable loss in accuracy. Dun's and Bradstreet's series are sums of actual prices, and have no base of their own. Accordingly they may be recast into relatives on the base, the average of the original figures for 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 average made from the Bureau's figures for these years—that is, to put \$6.7785 = 97.1—and then to apply the rule of three.¹⁹

These three series in comparable form are assembled in Table 19.²⁰

¹⁸ See subdivision 5, "The numbers and kinds of commodities included," especially pp. 52-56.
¹⁹ 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 slightly different results if they had been.

²⁰ The annual averages, made from the original figures published by Dun and Bradstreet's, run as follows:

Year.	Dun's.	Bradstreet's.	Year.	Dun's.	Bradstreet's.
1890.....	\$90.9	.....	1907.....	\$111.8	\$8.90
1891.....	92.2	.....	1908.....	109.9	8.01
1892.....	90.0	\$7.78	1909.....	117.8	8.52
1893.....	92.4	7.53	1910.....	119.2	8.99
1894.....	84.7	6.68	1911.....	116.8	8.71
1895.....	81.3	6.43	1912.....	124.4	9.19
1896.....	76.0	5.91	1913.....	120.9	9.21
1897.....	74.0	6.12	1914.....	122.2	8.90
1898.....	78.9	6.57	1915.....	126.4	9.85
1899.....	82.8	7.21	1916.....	148.8	11.83
1900.....	93.4	7.88	1917.....	204.1	15.66
1901.....	95.9	7.57	1918.....	229.2	18.73
1902.....	100.4	7.88	Averages:		
1903.....	99.0	7.94	1890-1899.....	84.3	6.78
1904.....	100.2	7.92	1900-1909.....	103.4	8.11
1905.....	100.6	8.10	1910-1914.....	120.7	9.00
1906.....	105.3	8.42	1915-1918.....	177.1	14.02

* Average of 1892-1899.

The second and third divisions of the table bring out certain differences among the figures, and the summaries in the latter part show the average or net movements in various periods.

TABLE 19.—A COMPARISON OF THE CHIEF AMERICAN INDEX NUMBERS FOR THE YEARS 1890 TO 1918.

Year.	The three index numbers shifted to the 1890-1899 base.			Percentage differences among the three index numbers.			Percentage by which each of the three index numbers rose (+) or fell (-) each year.		
	Bradstreet's.	Bureau of Labor Statistics.	Dun's.	Bradstreet's greater (+) or less (-) than Bureau of Labor Statistics.	Dun's greater (+) or less (-) than Bureau of Labor Statistics.	Bradstreet's greater (+) or less (-) than Dun's.	Bradstreet's.	Bureau of Labor Statistics.	Dun's.
<i>Period of decline.</i>									
1890.....		111	108		-2.7				
1891.....		111	109		-1.8				
1892.....	111	103	107	+7.8	+3.9	+3.7			
1893.....	108	106	110	+1.9	+3.8	-1.8	-2.7	+2.9	+2.8
1894.....	96	95	100	+1.1	+5.3	-4.0	-11.1	-10.4	-9.1
1895.....	92	95	96	-3.2	+1.1	-4.2	-4.2	± 0	-4.0
1896.....	85	90	90	-5.6	± 0	-5.6	-7.6	-5.3	-6.3
<i>Period of gradual rise.</i>									
1897.....	88	91	88	-3.3	-3.3	± 0	+3.5	+1.1	-2.2
1898.....	94	95	94	-1.1	-1.1	± 0	+6.8	+4.4	+6.8
1899.....	103	101	98	+2.0	-3.0	+5.1	+9.6	+6.3	+4.3
1900.....	113	109	111	+3.7	+1.8	+1.8	+9.7	+7.9	+13.3
1901.....	109	108	114	± 0	+5.6	-5.3	-4.4	-	+2.7
1902.....	113	116	119	-2.6	+2.6	-5.0	+4.6	+7.4	+4.4
1903.....	114	117	117	-2.6	± 0	-2.6	+ .9	+ .9	-
1904.....	113	117	119	-3.4	+1.7	-5.0	- .9	± 0	+1.7
1905.....	116	117	119	- .9	+1.7	-2.5	+2.7	± 0	± 0
1906.....	121	121	125	± 0	+3.3	-3.2	+4.3	+3.4	+5.0
1907.....	127	128	133	- .8	+3.9	-4.5	+5.0	+5.8	+6.4
1908.....	115	125	130	-8.0	+4.0	-11.5	-9.4	-2.3	-2.3
1909.....	122	133	140	-8.3	+5.3	-12.9	+6.1	+6.4	+7.7
1910.....	129	136	141	-5.1	+3.7	-8.5	+5.7	+2.3	+ .
1911.....	125	130	139	-3.8	+6.9	-10.1	-3.1	-4.4	-1.4
1912.....	132	138	148	-4.3	+7.2	-10.8	+5.6	+6.2	+6.5
1913.....	132	137	143	-3.6	+4.4	-7.7	± 0	- .7	-3.4
1914.....	128	136	145	-5.9	+6.6	-11.7	-3.0	- .7	+1.4
1915.....	141	139	150	+1.4	+7.9	-6.0	+10.2	+2.2	+3.4
<i>Period of accelerated rise due to war.</i>									
1916.....	169	170	176	- .6	+3.5	-4.0	+19.9	+22.3	+17.3
1917.....	224	241	242	-7.1	+ .4	-7.4	+32.5	+41.8	+37.5
1918.....	268	269	272	- .4	+1.1	-1.5	+19.6	+11.6	+12.4

TABLE 19.—A COMPARISON OF THE CHIEF AMERICAN INDEX NUMBERS FOR THE YEARS 1890 TO 1918—Concluded.

Item.	The three index numbers shifted to the 1890-1899 base.			Percentage variations among the three index numbers.			Percentage variations of the yearly rise and fall of each of the three index numbers.		
	Brad-street's.	Bureau of Labor Statistics.	Dun's.	Brad-street's compared with Bureau of Labor Statistics.	Dun's compared with Bureau of Labor Statistics.	Brad-street's compared with Dun's.	Brad-street's.	Bureau of Labor Statistics.	Dun's.
Averages by 5-year periods:									
1890-1894.....	105	105	107	3.6	3.5	3.2	6.9	5.1	3.7
1895-1899.....	92	94	93	3.0	1.7	3.0	6.3	3.4	4.7
1900-1904.....	112	113	116	2.5	2.3	3.9	4.1	3.4	4.8
1905-1909.....	120	125	129	3.6	3.6	6.9	5.5	3.6	4.3
1910-1914.....	129	135	143	9.5	5.8	10.0	3.5	2.9	2.7
1915-1918.....	201	205	210	2.4	3.2	4.7	20.6	19.5	17.7
Averages by 10-year periods:									
1890-1899.....	(100)	100	100	3.3	2.6	3.1	6.5	4.2	4.2
1900-1909.....	116	119	123	3.0	3.0	5.4	4.8	3.5	4.5
1910-1918.....	161	166	173	3.6	4.6	7.5	11.1	10.2	9.3
Maxima and minima:									
1890-1914—									
Maxima.....	132	138	148	8.3	7.2	12.9	11.1	10.4	13.3
Minima.....	85	90	88	0	0	0	0	0	0
Differences.....	47	48	60	8.3	7.2	12.9	11.1	10.4	13.3
1914-1918—									
Maxima.....	268	269	272	7.1	7.9	11.7	32.5	41.8	37.5
Minima.....	128	136	145	.4	.4	1.5	3.0	.7	1.4
Differences.....	140	133	127	6.7	7.5	10.2	29.5	41.1	36.1
Net rise (+) or fall (-):									
1890-1896.....	- 26	- 21	- 18						
1896-1907.....	+ 42	+ 38	+ 43						
1907-1908.....	- 12	- 3	- 3						
1908-1914.....	+ 13	+ 11	+ 15						
1914-1918.....	+140	+133	+127						
Algebraic averages:									
1890-1894.....				+3.6	+1.7	- .7	- 6.9	- 3.7	- 1.8
1895-1899.....				-2.2	-1.3	- .9	+ 1.6	+ 1.3	- .3
1900-1904.....				-1.0	-2.3	- 3.2	+ 2.0	+ 3.1	+ 4.1
1905-1909.....				-3.6	+3.6	6.9	+ 1.7	+ 2.7	+ 3.4
1910-1914.....				-4.5	+5.8	-10.0	+ 1.0	+ .5	+ .8
1915-1918.....				-1.7	+3.2	- 4.7	+20.6	+19.5	+17.7
1890-1914.....				-2.0	+2.4	- 4.6	+ .8	+ 1.0	+ 1.4
1890-1918.....				-2.0	+2.5	- 4.6	+ 3.9	+ 3.6	+ 3.7

A cursory examination of this table, or a glance at Chart 12, shows that these index numbers made by three independent organizations have a marked family resemblance. They all agree that prices fell heavily in 1890-1896, rose still more sharply in 1896-1900, wavered uncertainly in 1901-1904, rose rapidly again in 1905-1907, fell in 1908, more than recovered their lost ground in 1909-1910, dropped back in 1911, rose to a new high record in 1912, receded somewhat in 1912-1914, and finally shot up at an extraordinary rate during the war. Further, the three index numbers agree that the general level about which the yearly oscillations clustered was higher in 1910-1914 than in 1900-1909, and higher in 1900-1909 than in 1890-1899. About the major facts of price history, in short, the testimony of the leading American index numbers is unanimous.

On the other hand, Table 19 shows that the series differ in many details. For example, not once in the 29 years covered by the present record are all three index numbers identical, and in only six years

CHART 12.—INDEX NUMBERS OF THE BUREAU OF LABOR STATISTICS, DUN, AND BRADSTREET, 1890 TO 1918.

(Based on Table 19.)



are any two indexes precisely the same. On the average of the whole period the Bureau of Labor Statistics series varies from Bradstreet's by 3.3 per cent, from Dun's by 3.4 per cent, while Bradstreet's index varies from Dun's by 5.4 per cent. The maximum differences in any one year rise to 8.3 per cent between the bureau's index and Bradstreet's (1909), 7.9 per cent between the bureau's and Dun's (1915), and 12.9 per cent between Dun's and Bradstreet's (1909). Concerning the direction in which prices move from one year to the next, the bureau's series contradicts Bradstreet's in one year (1893) and Dun's series in four years, while Dun's and Bradstreet's indexes contradict each other in six years. If we count cases in which one index remains the same for two successive years while another series rises or falls, we find four years of partial contradiction when we compare the bureau's index with Bradstreet's, three years when we compare the bureau's index with Dun's, and two years when we set Bradstreet's against Dun's. In general, the bureau's index steers a middle course between the other two, averaging 2 per cent higher than Bradstreet's and 2.5 per cent lower than Dun's, while the margin by which Dun's index exceeds Bradstreet's averages 4.6 per cent.²¹

Most of the detailed differences among the annual figures of the three index numbers may be regarded as resulting from differences in respect to (1) secular trend and (2) degree of variability from one year to the next.

1. Chart 12 and the averages by decades in Table 19 show that on the whole Dun's index number has risen more than the bureau's, and the bureau's more than Bradstreet's. This long-period shifting of the level about which the monthly and yearly oscillations occur is technically called the secular trend. Graphically it may be represented by a straight line. Two turning points occur in the 29 years covered by the table. The great fall of prices which began in 1873 ended in 1896 or 1897, and a rise began. In 1915 the rate of this rise was violently accelerated by the war, so that the slope of the straight line representing the direction of the secular trend was suddenly made steeper. Of the three periods marked off by these turning points in the first half of Table 19, the middle one, 1896-1914, alone is long enough to make the computation of the secular trend significant.

The secular trends of the three index numbers during this period of 19 years, given in Table 20, are represented collectively on Chart 13 and are shown separately with their respective curves on Charts 14, 15, and 16. They are summarized in the following table:

TABLE 20.—SECULAR TRENDS OF INDEX NUMBERS OF BUREAU OF LABOR STATISTICS, BRADSTREET, AND DUN, 1896 TO 1914—SUMMARY.

Index numbers.	Annual geometric increment of secular trend in 1896-1914.	Geometric mean in 1896-1914.	Ratio of annual increment to geometric mean (per cent).	Terminal points of the straight line representing the secular trend.		Net per cent of rise in lines of secular trend, 1896-1914.
				1896	1914	
Bradstreet's.....	1. 0230	113. 7	0. 90	92. 7	139. 6	15. 1
Bureau of Labor Statistics.....	1. 0232	117. 1	. 87	95. 3	144. 0	15. 1
Dun's.....	1. 0269	120. 3	. 85	94. 7	152. 6	16. 1

²¹ These averages are made, of course, from algebraic sums of the yearly percentage differences.

It is primarily these differences in secular trend that make the bureau's index number follow a course intermediate between Bradstreet's and Dun's indexes.

CHART 13.—SECULAR TRENDS OF INDEX NUMBERS OF BUREAU OF LABOR STATISTICS, DUN, AND BRADSTREET, 1896-1914.

(Based on Table 21.)

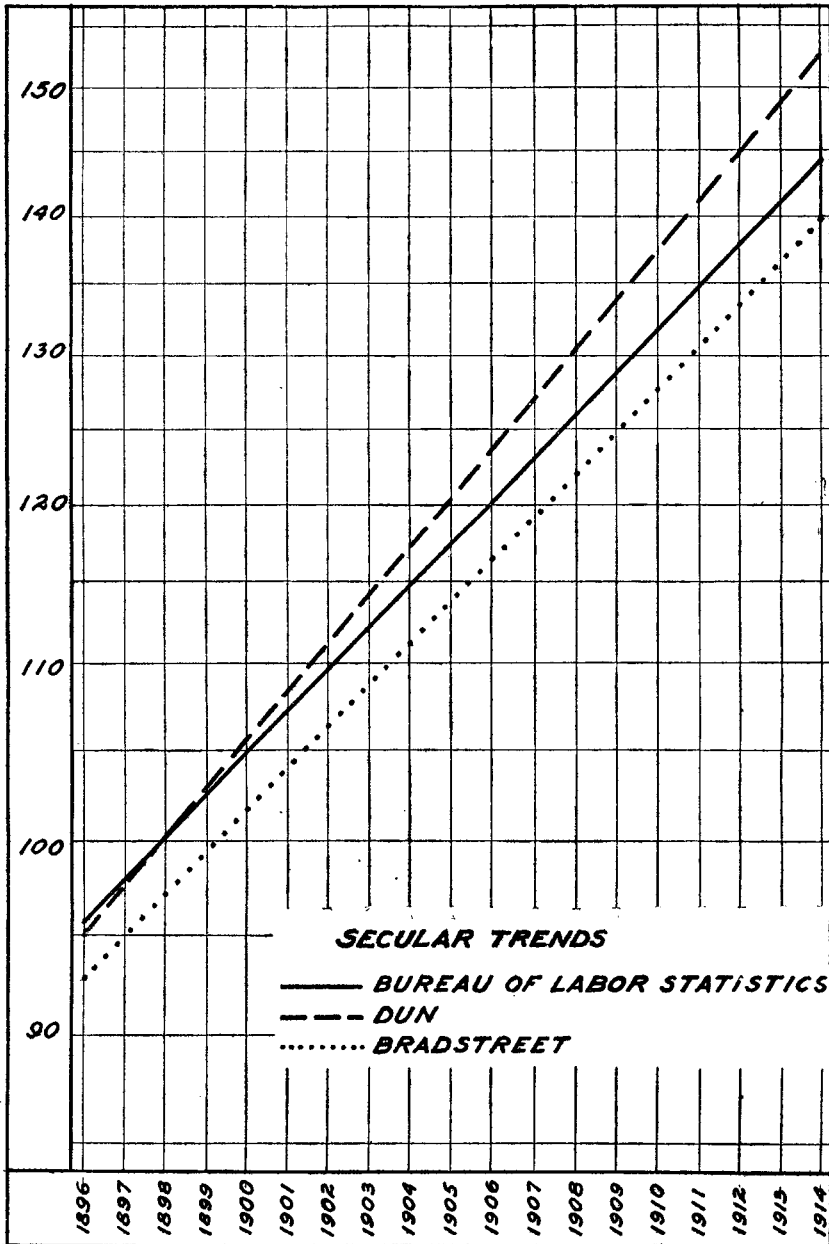


CHART 14.—INDEX NUMBERS OF BRADSTREET, COMPARED WITH THEIR SECULAR TREND, 1896-1914.

(Based on Table 21.)

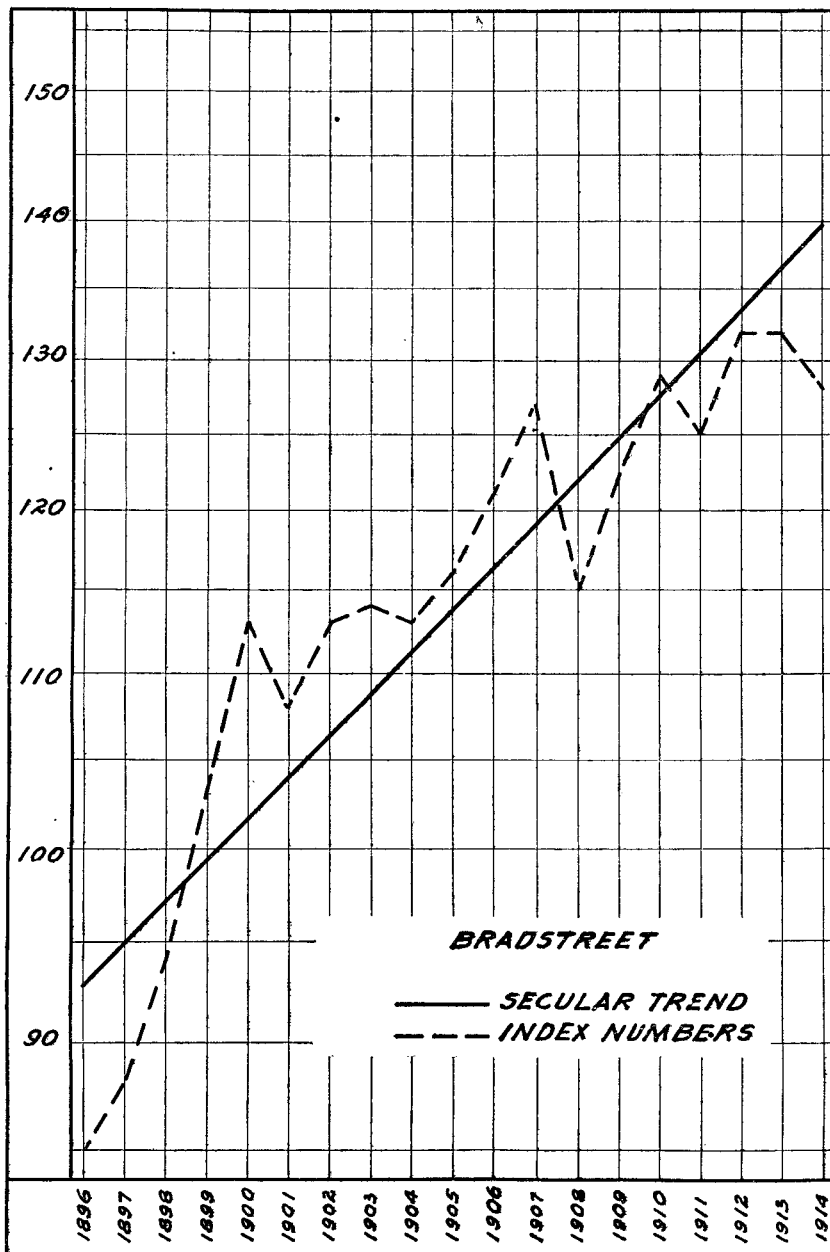


CHART 15.—INDEX NUMBERS OF BUREAU OF LABOR STATISTICS, COMPARED WITH THEIR SECULAR TREND, 1896-1914.

(Based on Table 21.)

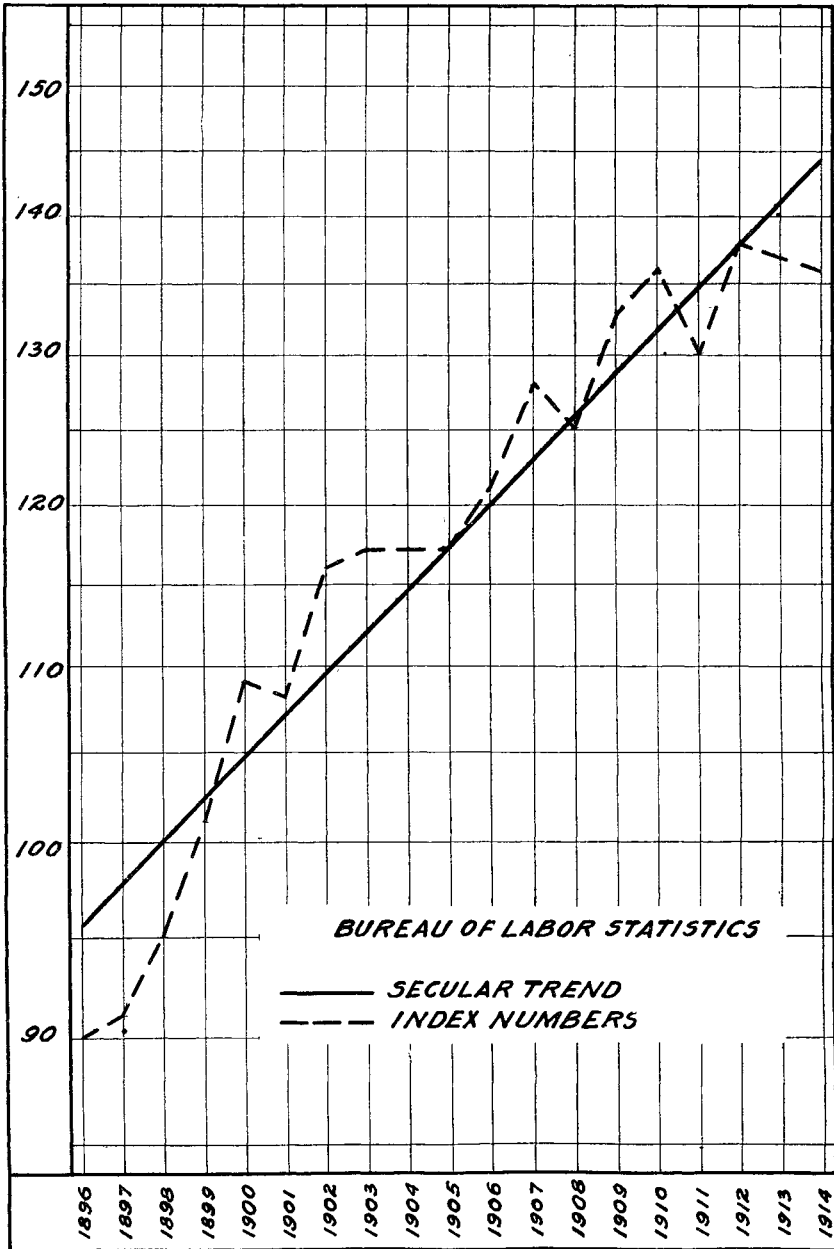


CHART 16.—INDEX NUMBERS OF DUN, COMPARED WITH THEIR SECULAR TREND, 1896-1914.

(Based on Table 21.)

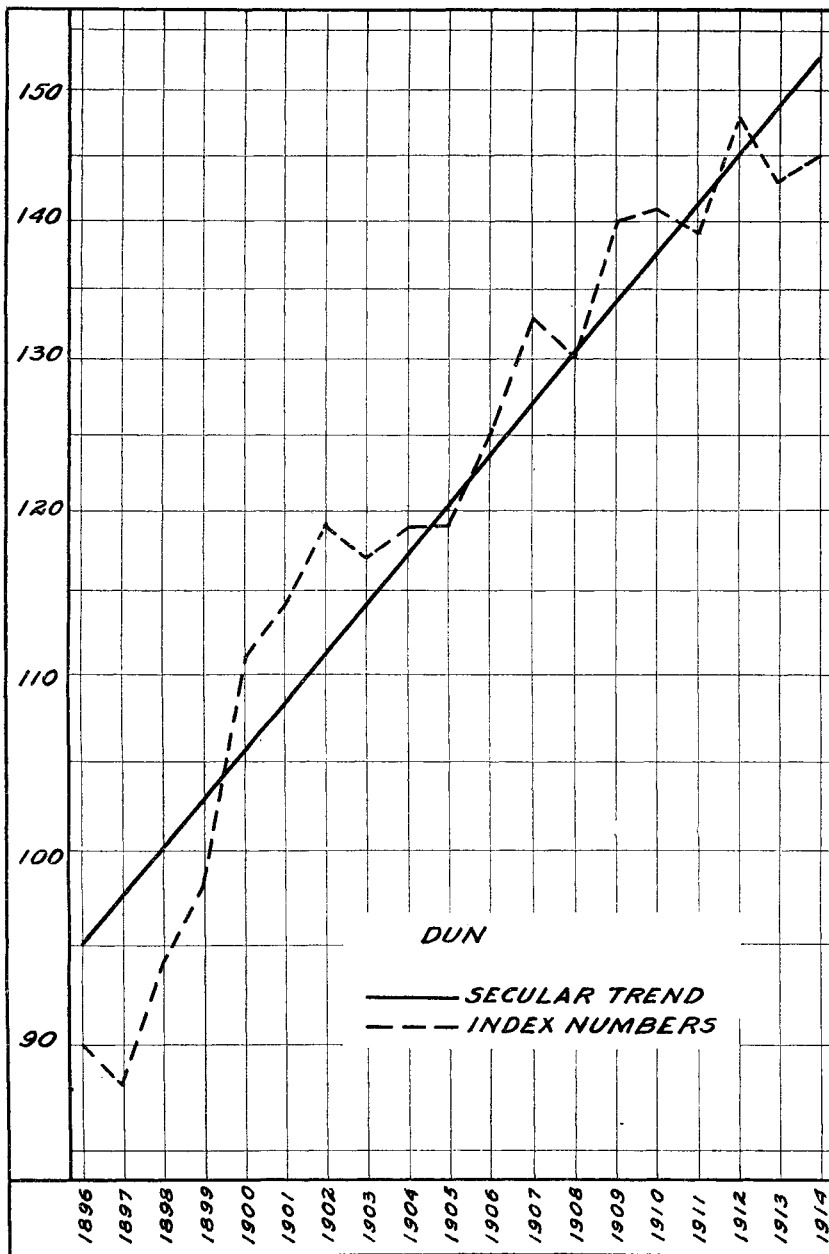


TABLE 21.—INDEX NUMBERS OF BRADSTREET, THE BUREAU OF LABOR STATISTICS, AND DUN, COMPARED WITH THEIR SECULAR TRENDS, BY YEARS, 1896 TO 1914.

Year.	Bradstreet's.				Bureau of Labor Statistics.				Dun's.				
	Secular trend.	Index number.	Excess of—		Secular trend.	Index number.	Excess of—		Secular trend.	Index number.	Excess of—		
			Secular trend over index number.	Index number over secular trend.			Secular trend over index number.	Index number over secular trend.			Secular trend over index number.	Index number over secular trend.	
			<i>Per ct.</i>	<i>Per ct.</i>			<i>Per ct.</i>	<i>Per ct.</i>			<i>Per ct.</i>	<i>Per ct.</i>	
1896.....	92.7	85	9.1	.....	95.3	90	5.8	.....	94.7	90	5.2	.....
1897.....	94.9	88	7.8	.....	97.5	91	7.1	.....	97.3	88	10.6	.....
1898.....	97.1	94	3.3	.....	99.7	95	5.0	.....	99.9	94	6.3	.....
1899.....	99.3	103	.....	3.7	102.0	101	1.0	.....	102.5	98	4.6	.....
1900.....	101.6	113	.....	11.3	104.4	109	.....	4.4	105.3	111	.....	5.4
1901.....	103.9	108	.....	3.9	106.8	108	.....	1.1	108.1	114	.....	5.5
1902.....	106.3	113	.....	6.3	109.3	116	.....	6.1	111.0	119	.....	7.2
1903.....	108.7	114	.....	4.8	111.9	117	.....	4.6	114.0	117	.....	2.6
1904.....	111.2	113	.....	1.6	114.5	117	.....	2.2	117.0	119	.....	1.7
1905.....	113.7	116	.....	2.0	117.1	117	.....	.1	120.3	119	.....	1.1
1906.....	116.3	121	.....	4.0	119.8	121	.....	1.0	123.5	125	.....	1.2
1907.....	119.0	127	.....	6.7	122.6	128	.....	4.4	126.8	133	.....	4.9
1908.....	121.8	115	.....	5.9	125.5	125	.....	.4	130.2	130	.....	.2
1909.....	124.6	122	2.1	128.4	133	3.6	133.7	140	4.7
1910.....	127.0	129	1.2	131.3	136	3.5	137.3	141	2.7
1911.....	130.4	125	.....	4.3	134.4	130	.....	3.4	141.0	139	.....	1.4
1912.....	133.4	132	1.0	137.5	1384	144.8	148	2.2
1913.....	136.4	132	.....	3.3	140.7	137	.....	2.7	148.6	143	.....	3.9
1914.....	139.6	128	.....	9.0	144.0	136	.....	5.9	152.6	145	.....	5.2

2. While steadier over a considerable period of time, Bradstreet's index changes more from one year to the next than does either the bureau's or Dun's series. Dun's index, further, is more variable than the bureau's.

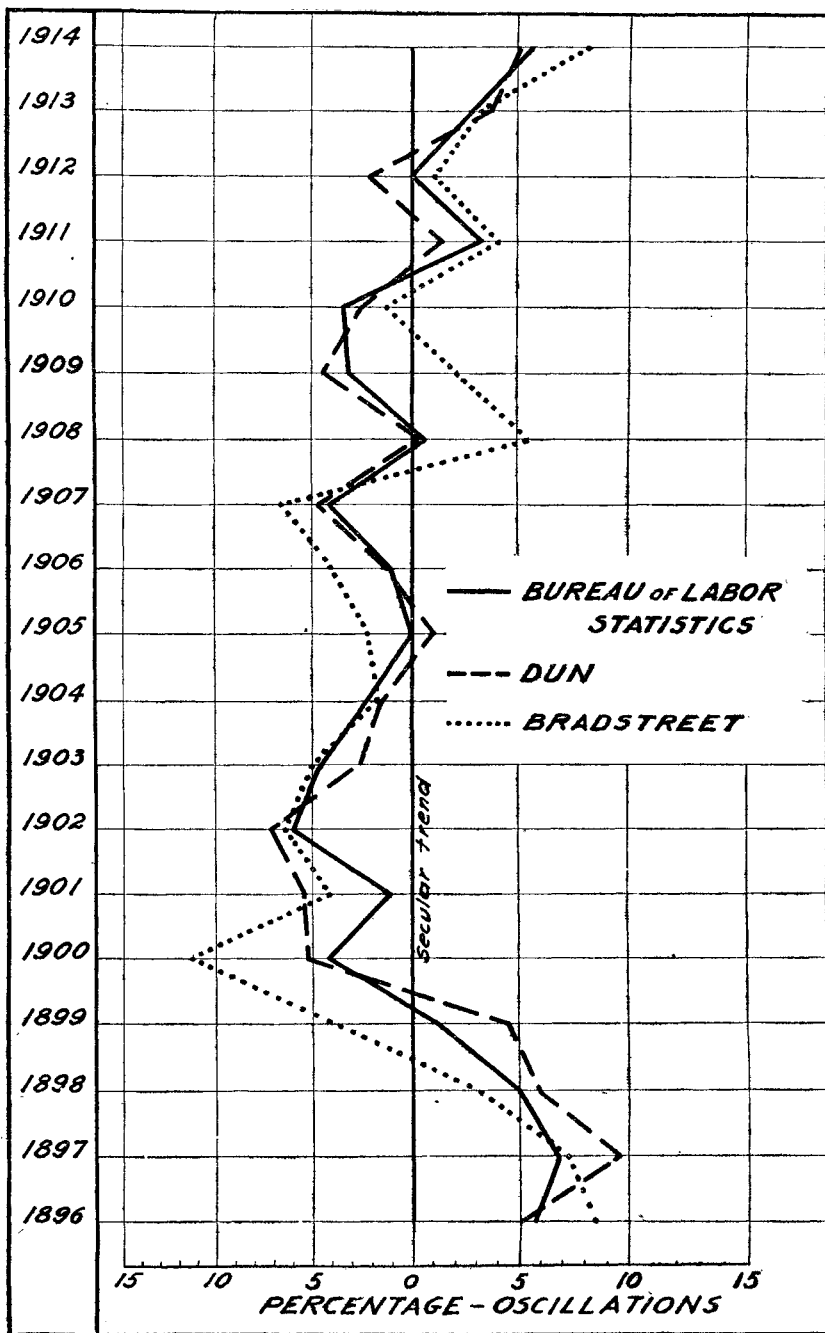
Several different ways of measuring year-to-year variations all support this conclusion: (1) If the "percentage by which each of the three index numbers rose or fell each year" as shown in Table 19 be averaged from 1892 to 1914, the results are Bradstreet's 5.15 per cent, Dun's 4.37 per cent, and the Bureau of Labor Statistics's 3.71 per cent. (2) The standard deviations of these annual percentages of rise and fall are, Bradstreet's 5.79, Dun's 5.06, and the bureau's 4.46. (3) If the figures showing the excess of the secular trend over the index number or the excess of the index number over the secular trend in Table 21 be averaged for 1896-1914, the results are, Bradstreet's 4.0 per cent, Dun's 4.0 per cent, the bureau's 3.3 per cent. (4) If the yearly deviations from the secular trend are plotted as in Chart 17, it appears that Bradstreet's fluctuates through the widest and the bureau's series through the narrowest range, Dun's index being intermediate.

To show that these index numbers differ in detail, 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 method of measurement in vogue, or to technical differences in the construction of the particular index numbers in question.

Unfortunately it is not possible to attack this problem effectively on the lines of analysis suggested in the preceding sections. For the compilers of Bradstreet's and Dun's index numbers do not give suffi-

CHART 17.—YEARLY DEVIATIONS FROM SECULAR TREND OF INDEX NUMBERS OF BUREAU OF LABOR STATISTICS, DUN, AND BRADSTREET, 1896-1914.

(Based on Table 21.)



cient data concerning the sources of information drawn upon for quotations, the commodities included and the weights employed for each commodity to make possible a close comparison with the bureau's series. Bradstreet's publishes quotations for 106 commodities, but bases its index number on the prices of 96, and does not say which 10 are omitted. Its prices per pound, which are added up to give the index number, were published for a short time in 1897, but are not disclosed in recent years. Dun's Review does not publish its list of commodities, to say nothing of their prices, and explains merely that it weights by per capita consumption, allowing 50 per cent of the total for foods, 18 per cent for textiles, 16 per cent for minerals, and 16 per cent for other commodities.²² With such scanty information about these two series, statements concerning the reasons for the relatively slight differences between each of them and the bureau's index number would be subject to a relatively wide margin of error.²³

After all, the important fact is that the three index numbers agree with one another very closely. The divergencies which do appear are smaller than those which result from most attempts to measure economic quantities. For example, two sets of experts employed upon a valuation case are likely to arrive at results farther apart than the maximum differences shown in Table 19. Again it is doubtful whether the margin of error in the average balance sheets of business enterprises, or in cost computations is as narrow as the average margin between Bradstreet's and Dun's index numbers, to say nothing of the narrower margins between the official series and either of these commercial indexes.

To sum up the comparisons in the most definite form the coefficient of correlation must be used. This coefficient is the standard statistical device for measuring the degree of agreement or difference between two variables. Its extreme limits are -1.0 and $+1.0$, the latter expressing perfect agreement.²⁴ When such coefficients are computed for the annual index numbers in 1892-1914, inclusive, the following results are obtained:

	Coefficients of correlation.
Bureau of Labor Statistics index number and Bradstreet's.....	+0.964
Bureau of Labor Statistics index number and Dun's.....	+ .992
Bradstreet's index number and Dun's.....	+ .959

High coefficients of correlation are to be expected, of course, when the variables compared are different measurements of the same quantity—in this case the general level of wholesale prices through a period of 23 years. To get such high coefficients as the preceding indicates that the measurements made by different hands are in close agreement and therefore presumably reliable.

A severer test may be applied by computing the coefficients of correlation between the percentage changes in the three index num-

²² Compare J. P. Norton's article in the Quarterly Journal of Economics, Aug., 1910, Vol. XXIV, p. 754.

²³ Most of the analytic comparisons among various American index numbers in Bulletin No. 173 dealt with series much more perfectly known than Dun's or Bradstreet's. The reader who turns back to that discussion will probably share the writer's belief that were all the necessary data available, the differences among the three series dealt with would be found to result primarily from differences in the lists of commodities and in the systems of weighting. But that belief will remain a mere probability so long as the construction of Bradstreet's and Dun's indexes is not fully disclosed.

²⁴ Most statistical text books explain the method of computing the coefficient of correlation in detail. See for example, G. Udney Yule, Introduction to the Theory of Statistics, 2d edition, 1912, chs. IX and X.

bers from one year to the next. The results of this operation are as follows:

	Coefficients of correlation.
Bureau of Labor Statistics index number and Bradstreet's.....	+0.882
Bureau of Labor Statistics index number and Dun's.....	+ .873
Bradstreet's index number and Dun's.....	+ .788

Here the coefficients, though less than in the preceding case, are still high. Bradstreet's agrees a bit better with the bureau's series than does Dun's, whereas in the former comparison Dun's had distinctly the higher correlation. In both comparisons, the bureau's series makes the best showing. Other things being equal, among different measures of a given quantity, that measure has the best claim to acceptance which is nearest the mean of all the measures. In the present case, however, other things are not equal. The bureau's series includes more commodities than either of its rivals, its system of weighting is better, and its method of construction from start to finish is disclosed with a fullness which justifies confidence. On these grounds its superiority is clear. The fact that it agrees better with both the commercial indexes than they agree with each other merely confirms the choice which would be made on a priori grounds.

2. COMPARISON OF FOUR LEADING AMERICAN INDEX NUMBERS, BY MONTHS, JULY, 1914, TO DECEMBER, 1918.

The peculiar interest attaching to the revolution in prices during the World War makes desirable a more detailed comparison of the leading American index numbers in 1914-1918. For this period, there are available besides the three series discussed in the preceding section, the index number compiled by the Price Section of the War Industries Board.

Table 22 and chart 18 present the four series on a common base—namely, average prices in the twelve months preceding the outbreak of war (July, 1913-June, 1914) = 100, giving by months first the index numbers themselves, and then the percentage by which each of the four index numbers rose or fell as compared with the month preceding.

Study of the table and of the chart based upon it shows at once a closeness of agreement for which even the results of the preceding comparison scarcely prepare one. And this impression of close agreement is abundantly justified when the coefficients of correlation are worked out. These coefficients, shown on page 108, approach even more closely to the limit of perfect agreement (+ 1.0) than the remarkably high coefficients we have found for the yearly index numbers in times of peace.

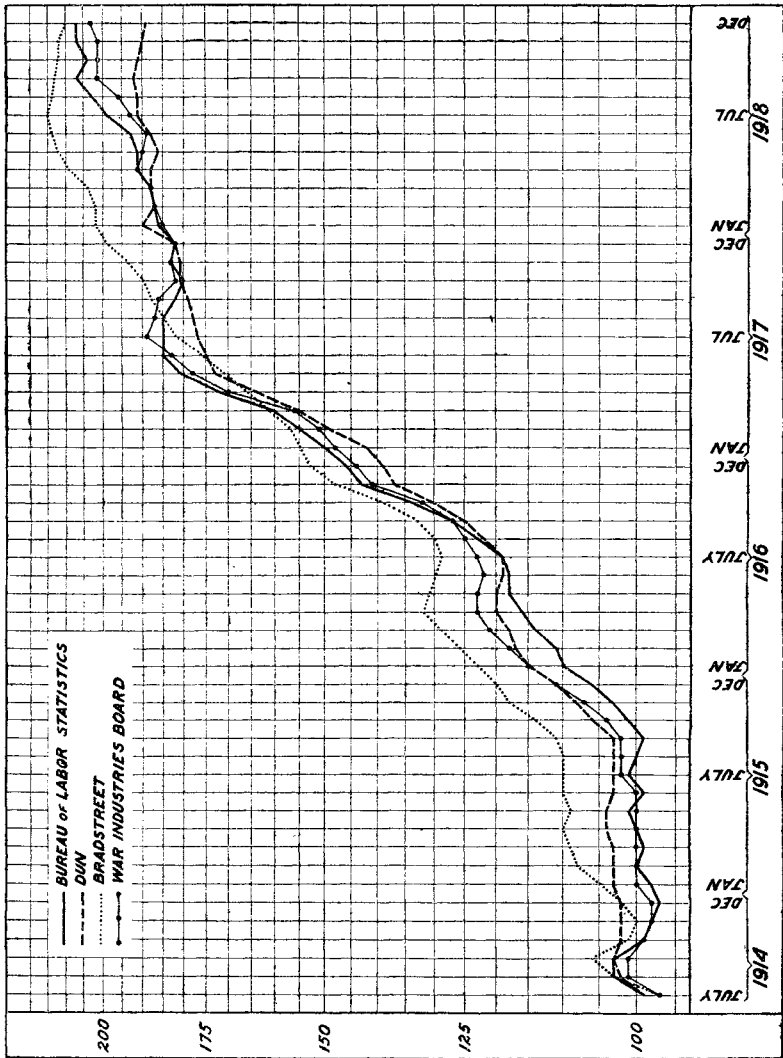
TABLE 22.—A COMPARISON OF FOUR LEADING AMERICAN INDEX NUMBERS, BY MONTHS, JULY, 1914, TO DECEMBER, 1918.

Year and month.	The four index numbers shifted to the base, July, 1913-June, 1914=100.				Percentage by which each of the four index numbers rose (+) or fell (-) each month.			
	War Industries Board.	Bureau of Labor Statistics.	Bradstreet's.	Dun's.	War Industries Board.	Bureau of Labor Statistics.	Bradstreet's.	Dun's.
1914.								
July.....	97	99	97	99	±0	+0.8	+0.5	-0.1
August.....	101	103	103	102	+4.1	+3.2	+6.3	+3.0
September.....	101	103	106	103	±0	+ .5	+2.9	+1.1
October.....	99	99	101	102	-2.0	-4.2	-4.7	-1.1
November.....	98	93	100	102	-1.0	- .9	-1.2	+ .3
December.....	98	97	102	102	±0	- .8	+1.6	- .1
1915.								
January.....	100	98	105	103	+2.0	+1.1	+3.5	+0.6
February.....	100	100	108	103	±0	+1.7	+2.5	±0
March.....	100	99	109	103	±0	-1.0	+ .6	+ .2
April.....	100	100	110	104	±0	+ .7	+ .9	+1.0
May.....	100	101	109	104	±0	+1.0	- .2	+ .4
June.....	100	99	110	103	±0	-1.6	+ .4	- .7
July.....	102	101	110	103	+2.0	+1.8	+ .4	- .4
August.....	102	100	110	103	±0	- .7	- .3	- .1
September.....	102	99	111	103	±0	-1.3	+ .8	+ .6
October.....	104	101	114	106	+2.0	+2.4	+2.9	+2.3
November.....	107	103	118	108	+2.9	+1.5	+3.3	+2.5
December.....	111	106	120	111	+3.7	+2.9	+2.6	+2.7
1916.								
January.....	115	110	123	115	+3.6	+4.2	+2.3	+3.4
February.....	118	111	126	117	+2.6	+1.2	+2.1	+1.6
March.....	121	114	129	118	+2.5	+2.3	+2.8	+1.2
April.....	123	116	132	120	+1.7	+2.0	+1.6	+1.4
May.....	123	118	131	120	±0	+1.6	- .3	- .1
June.....	122	118	130	119	- .8	+ .4	- .9	- .4
July.....	123	119	129	119	+ .8	+ .4	-1.1	- .5
August.....	125	123	130	122	+1.6	+3.5	+1.1	+2.4
September.....	127	127	133	125	+1.6	+3.3	+2.6	+2.8
October.....	132	134	139	130	+3.9	+5.0	+4.3	+4.2
November.....	141	143	148	137	+6.8	+7.2	+6.5	+5.0
December.....	144	146	153	139	+2.1	+2.0	+3.5	+1.4
1917.								
January.....	148	150	155	142	+2.8	+2.8	+1.0	+2.4
February.....	151	155	157	149	+2.0	+3.4	+1.5	+4.8
March.....	156	160	161	155	+3.3	+3.2	+2.3	+3.8
April.....	170	172	166	164	+9.0	+7.2	+3.4	+5.9
May.....	178	181	171	173	+4.7	+5.4	+3.0	+5.7
June.....	183	185	176	175	+2.8	+2.0	+3.1	+ .8
July.....	189	185	182	177	+3.3	+ .4	+3.0	+1.5
August.....	187	185	185	178	-1.1	- .4	+1.8	+ .7
September.....	186	182	188	179	- .5	-1.4	+1.6	+ .2
October.....	182	180	190	181	-2.2	-1.1	+1.3	+1.3
November.....	183	183	194	181	+ .5	+1.4	+2.0	+ .1
December.....	182	182	199	182	- .5	- .5	+2.6	+ .3
1918.								
January.....	185	186	202	190	+1.6	+2.2	+1.4	+4.3
February.....	187	187	202	187	+1.1	+ .7	+ .3	-1.4
March.....	188	188	204	188	+ .5	+ .4	+1.1	+ .7
April.....	191	191	209	188	+1.6	+1.9	+2.3	- .3
May.....	190	191	212	186	- .5	- .1	+1.5	-1.2
June.....	189	193	214	188	- .5	+1.0	+ .7	+1.3
July.....	193	199	215	191	+2.1	+2.9	+ .6	+1.6
August.....	196	203	214	191	+1.5	+2.2	- .6	+ .1
September.....	201	207	213	192	+2.5	+2.1	- .3	+ .3
October.....	201	204	212	191	±0	-1.5	- .4	- .5
November.....	201	207	212	190	±0	+1.3	+ .1	- .6
December.....	203	207	210	189	+1.0	±0	-1.0	- .1

Since both Bradstreet's and Dun's index numbers are computed from prices as of the first of the month while the Bureau of Labor Statistics and War Industries Board use average prices for the month or prices at various dates within the month, it is not quite accurate to compute coefficients of correlation from the figures as they stand

CHART 18.—INDEX NUMBERS OF THE BUREAU OF LABOR STATISTICS, DUN, BRADSTREET, AND THE WAR INDUSTRIES BOARD, JULY, 1914, TO DECEMBER, 1918.

(Average prices July, 1913, to June, 1914=100.)
(Based on Table 22.)



after shifting to a common base. To overcome this difficulty as well as may be, new monthly figures for Dun's and Bradstreet's have been made by averaging the index for July and August to get a new figure for July, then averaging the figures for August and September to get a new figure for August, and so on.

Coefficients of correlation among four American index numbers in the 54 months July, 1914, to December, 1918.

A. Coefficients of correlation computed from the monthly index numbers.

	Coefficients of correlation.
(1) Bureau of Labor Statistics' and War Industries Board's series.....	+0.997
(2) Bureau of Labor Statistics' and Bradstreet's series.....	+ .988
(3) Bureau of Labor Statistics' and Dun's series.....	+ .994
(4) War Industries Board's and Bradstreet's series.....	+ .986
(5) War Industries Board's and Dun's series.....	+ .995
(6) Bradstreet's and Dun's series.....	+ .991

B. Coefficients of correlation computed from the percentage change in prices from one month to the next.

(1) Bureau of Labor Statistics' and War Industries Board's series.....	+0.866
(2) Bureau of Labor Statistics' and Bradstreet's series.....	+ .633
(3) Bureau of Labor Statistics' and Dun's series.....	+ .801
(4) War Industries Board's and Bradstreet's series.....	+ .640
(5) War Industries Board's and Dun's series.....	+ .761
(6) Bradstreet's and Dun's series.....	+ .616

Taking both sets of coefficients into account, we find that the Bureau of Labor Statistics' index number has the closest agreement with the other three series. Then, in order, come the War Industries Board's series, Dun's, and Bradstreet's—which is the most divergent of the four. But there is a better test of reliability. In view of its very comprehensive list of commodities (1,366 in number) and its use of class in addition to commodity weights, the War Industries Board's series is probably the nearest approximation to a true measurement of the changes in the wholesale price level during the war. Accepting it as the standard, we may ask which of the three index numbers currently published is in closest agreement with it. Once more the answer is in favor of the bureau's series, when one considers the correlation either of the monthly index numbers themselves or of the monthly percentages of change. Dun's comes second and Bradstreet's again ranks lowest.

3. CRITICAL EVALUATION OF THE BUREAU OF LABOR STATISTICS', BRADSTREET'S, AND DUN'S INDEX NUMBERS.

A few additional remarks are called for on the relative merits of the three general-purpose index numbers now regularly published in the United States.

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 reputations of their series. They compromise these reputations still further when they fail to explain in full just what commodities they include, and just what methods of compilation they adopt. Bradstreet's index number suffers a bit in comparison because readers are not told which 96 commodities out of the 106 for 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.

The number of commodities now included in the three series is given as follows by the compilers: Bureau of Labor Statistics' 328, Dun's "about 300," Bradstreet's 96. Provided the commodities are equally well chosen, of course the longer the list of commodities included the better claim has an index number to acceptance as a measure of changes in the general level of commodity prices.

The preceding study of the relations among the leading American index numbers was made in the winter of 1919-20, just before the great fall in prices began. Early in the course of this fall marked discrepancies appeared between the Bureau's series and both the commercial indexes. These discrepancies presently became wider than any that had appeared in the preceding 30 years. By December, 1920, Bradstreet's index was 22.4 per cent lower than the Bureau's index and Dun's was 10.9 per cent lower.²⁵

²⁵ The following table continues, by months, from January, 1919, to May, 1921, the index numbers of the Bureau of Labor Statistics, Bradstreet, and Dun in the form given in Table 22:

Comparison of three American index numbers, by months, January, 1919, to May, 1921.

Year and month.	Bradstreet.	Dun.	Bureau of Labor Statistics.
1919:			
January.....	202.35	185.13	202.89
February.....	195.02	179.74	197.24
March.....	193.03	179.72	200.90
April.....	193.11	181.83	203.43
May.....	197.64	185.12	206.85
June.....	206.92	189.85	206.91
July.....	217.62	195.48	218.74
August.....	220.84	197.38	226.42
September.....	218.15	195.01	220.55
October.....	220.56	195.10	222.98
November.....	224.22	198.71	229.89
December.....	226.80	202.34	238.28
1920:			
January.....	230.68	206.08	248.59
February.....	233.09	208.39	249.19
March.....	232.22	210.10	253.97
April.....	231.87	214.34	268.80
May.....	227.19	216.09	272.14
June.....	219.46	214.89	268.62
July.....	213.60	214.95	263.20
August.....	205.89	209.95	249.80
September.....	195.16	199.69	241.93
October.....	182.30	191.03	225.36
November.....	163.93	180.45	207.33
December.....	147.08	168.70	189.44
1921:			
January.....	140.05	158.09	177.92
February.....	135.58	151.23	167.41
March.....	130.02	146.53	161.83
April.....	124.17	140.26	153.72
May.....	119.93	136.80	151.09

These wide discrepancies mean, not that the index numbers had become suddenly worse, but that the diversity among price fluctuations had become greater, so that differences among index numbers in respect to the number of commodities included and methods of weighting produced wider differences in the results. In other words, we have here the demonstration of a significant fact about price fluctuations: The great drop of prices in 1920-21 was characterized by much more irregularity in the promptness and degree of readjustment of different markets to the new situation than was the great rise of prices in 1915-1919. Presumably these great irregularities will prove to be a feature of the transition period only, and the three index numbers will approach one another again as the readjustments are gradually worked out in all markets.

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 made thus should give results in close agreement with the Bureau of Labor Statistics' series is really remarkable and proves that if prices, the raw materials from which index numbers are made, are accurate the particular method used in computing the index number is of secondary importance. Dun's system of weighting is distinctly better than Bradstreet's in theory. Whether the practice is as good as the theory is doubtful, for anyone familiar with the deficiencies of American statistics of consumption must wonder whence the compilers derive their estimates of the quantities of "about 300" 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 workingmen'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, and in 1918 it was found to be only 38.2 per cent.²⁶ The bureau's practice of weighting wholesale prices by the quantities of commodities that enter into trade is preferable to weighting by consumption. Moreover, the bureau publishes its weights, and shows each year the percentage which each weighted price makes of the total for the group in which the commodity is put, as well as of the total for all commodities.

²⁶ Eighteenth Annual Report of the Commissioner of Labor, 1903, p. 66. The data represented 25,400 families and 124,108 persons, both natives and immigrants. Also the Monthly Labor Review of the Bureau of Labor Statistics, August, 1919, p. 118. The data represented 12,096 white families in 92 industrial centers.

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 bureau's series shares this advantage, since it too is made by adding actual prices multiplied by weights; but it is presented in a form more convenient for comparison than the other two series. The relatives on the scale of 100, into which the bureau throws its figures in the last step of compilation, are easier to use than the awkward sums of dollars and cents which Dun's Review and Bradstreet's publish.

It is interesting, finally, to test the reliability of the several index numbers as "business barometers." Monthly figures would be better for this purpose than our yearly averages, but since they are not available for all three series in the 1890's, we must do the best we can with the rougher gauge. In 17 of the 26 years since 1892 (when Bradstreet's index in its present form begins), the three series agree concerning the direction in which prices were moving; they differ in nine years. In the following schedule these nine years are represented by columns in which each index number is credited with +1 when its change accords with the character of the alteration in business conditions, debited with -1 in case of disagreement, and marked ± 0 when it recognizes no appreciable change in the price level.²⁷ 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 quarter of a century.

Index number.	1893	1895	1897	1901	1903	1904	1905	1913	1914	Net score.
Bradstreet's.....	+1	-1	+1	+1	-1	+1	+1	± 0	+1	+4
Bureau of Labor Statistics.....	-1	± 0	+1	+1	-1	± 0	± 0	+1	+1	+2
Dun's.....	-1	-1	-1	-1	+1	-1	± 0	+1	-1	-4

Of the three indexes, Bradstreet's makes the best showing. Presumably the poor quality of Dun's index as a business barometer is due chiefly to the heavy weight (50 per cent) which it ascribes to foods. For foods are largely farm crops whose prices in a given year depend at least as much upon the weather as upon the condition of business. The bureau's series in this respect stands intermediate between the two commercial series, giving a lighter weight to foods than Dun's and a heavier weight than Bradstreet's. Probably that is why it is a better business barometer than the one and not so good as the other.

Of course this conclusion that Bradstreet's index number is a better business barometer than the bureau's series does not invalidate the preceding conclusion that the bureau's series is the best measure of changes in the general level of prices. For when farm crops are given their due weight in an index number, it is not to be expected that the index will always rise with business prosperity and decline

²⁷ For a summary of the changes in business conditions during these years, see *Business Cycles*, by Wesley C. Mitchell, p. 88.

with business depression. In making a wholesale price index number for use as a business barometer, indeed, one should exclude altogether commodities whose price fluctuations are determined largely by the weather. We have no such series at present, and it is high time that this lack should be supplied. But if some one does make a wholesale price index that is a nearly infallible business barometer, it will not be as reliable a measure of changes in the general level of prices as the present Bureau of Labor Statistics series.

VI.—CONCLUSIONS.

1. Variations in the level of wholesale prices from one year to the next are capable of being measured by a close approximation to accuracy, for these variations are highly concentrated about a central tendency. There are two American chain index numbers which for a quarter of a century never differ by more than 5 per cent, and differ on the average by only 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 covered a period of violent fluctuations.²⁸

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 become less accurate the greater the time over which they are extended. Nevertheless, the discrepancies observed between the two series just referred to (Dun's and the Bureau of Labor Statistics' new series of index numbers) do not reach 8 per cent in a period of 26 years, and average 3.4 per cent. The coefficient of correlation between these two series in 1892-1914 is +0.992, a close approach to +1.0, the expression of perfect agreement.

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

²⁸ These figures are computed from Table 19, by turning the percentages by which each index number rose or fell each year into relatives on the preceding-year base and computing the percentage differences between the resulting indexes. The results for three series are as follows:

Index numbers.	Average difference.	
	1893-1914.	1893-1918.
Bureau of Labor Statistics and Bradstreet's.....	<i>Per cent.</i> 2.25	<i>Per cent.</i> 2.82
Bureau of Labor Statistics and Dun's.....	1.95	2.00
Bradstreet's and Dun's.....	2.92	3.15

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 or a weighted geometric mean. The latter is preferable for measuring average ratios of change in prices; the former is preferable for measuring average change in the amount of money required to buy goods.

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. In making an aggregate of actual prices these weights should be applied directly to the quotations 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. Chain index numbers are best made by the "ideal" formula, when the chief aim is to attain the greatest possible accuracy in measuring fluctuations from one year to the next. But when the annual percentages of rise or fall in prices made in this way are forged into a continuous series, their errors cumulate and vitiate comparisons between the earlier and the later years. Such series are also faulty for some purposes in that one can not tell what part of the net results is due to changes in prices and what part to changes in the quantities used as weights. When the chief aim is to forge a chain which will yield reliable comparisons between prices in any two years it is best to use constant weights and make aggregates of actual prices or geometric means of price fluctuations, the choice turning once again upon the specific purpose in mind.

9. 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 COUNTRIES.

INTRODUCTION.

In the following pages the attempt has been made to present a brief though systematic description of all of the more important index numbers of wholesale prices that are known, either current or past. In the case of current series, the information has been brought up to the end of 1919, or the latest date for which complete data could be obtained. For discontinued series, the facts as published in Bulletin No. 173 of the Bureau of Labor Statistics are reprinted herewith. Owing to the situation brought about by war, several hitherto important series of index numbers have been allowed to lapse. This applies particularly to index numbers for Germany and Russia. In other countries the work of compiling and publishing the information has been interfered with to a greater or less extent by the exigencies of war. Several series of index numbers not in existence when the former bulletin was being prepared (in 1914) are described in the present bulletin.

UNITED STATES.

INDEX NUMBERS OF THE UNITED STATES BUREAU OF LABOR STATISTICS.

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 in bulletin form and appear annually.¹ Since June, 1918, the index number has been published currently in the Monthly Labor Review, the figures for a given month being shown in the issue for the second month thereafter.

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, 1900.² The purpose of this inquiry was to continue, so far as practicable, the investigation made for the Senate Committee of Finance for the years 1840 to 1891 under the direction of Roland P. Faulkner, statistician to the committee.³ In the report of the Department of

¹ Owing to the situation brought about by the war, the bulletins for the years 1917 to 1919 were published as one volume.

² Bulletin No. 27 of the Department of Labor.

³ Report from the Committee of Finance of the United States Senate on wholesale prices, wages, and transportation, Mar. 3, 1893, 52d Cong., 2d sess., Rept. No. 1394.

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,⁴ covered the 12 years from 1890 to 1901, inclusive. This series was continued in subsequent wholesale-price reports to 1914, such reports being contained in the March issue of the bimonthly bulletin of the bureau for the years from 1902 to 1911, inclusive, and published in separate form for 1912 and subsequent years.

Beginning with the report for 1914,⁵ the number of commodities included in the exhibit of wholesale prices was greatly increased and, in addition, a radical change in the method of calculating the index numbers from the money prices quoted was introduced. The new method is described in detail in the appendix to the 1914 bulletin,⁶ its predominant feature being the use of quantities denoting the total value in exchange of all commodities in each group in a given year or month, as compared with a similar quantity in the period selected as the base. This method of constructing group and general index numbers from the aggregate value of commodities exchanged year by year, thus producing a weighted index, superseded the former method of averaging the relative prices of individual commodities to obtain unweighted group and general index numbers. This method has been continued in subsequent reports.

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. Thus, for most grains, live stock, meats, etc., Chicago prices are quoted; for iron and steel products, Pittsburgh prices; for cotton and rice, New Orleans prices, etc. The prices for textiles are those prevailing in the general distributing markets, such as Boston, New York, and Philadelphia; and where no market is mentioned it should be understood that the prices are for the general market.

⁴ Bulletin No. 39, of the Department of Labor, March, 1902.

⁵ Bulletin No. 181, of the Bureau of Labor Statistics, pp. 252-256.

⁶ *Idem*.

BASE PERIOD.

In the reports issued during the period from 1902 to 1913, inclusive, the standard used for measuring price changes was the average price for the 10 years 1890 to 1899. This period, which embraced the first 10 years of the bureau's record of prices, was selected because it was believed 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. 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 covered by the data was chosen as the base.

In the 1914 report (Bulletin No. 181), issued in October, 1915, the base period was shifted from the decade 1890-1899 to the last completed year, 1914. This change was made for the purpose, first, of utilizing the latest and most trustworthy price quotations as the base from which price fluctuations were to be measured, and, second, to permit of the addition of new articles to those formerly included in the index number. For practically all articles which it was desired to add to the index in 1914 no prices were obtainable for the years 1890-1899.

In the reports for 1915 (Bulletin No. 200) and 1916 (Bulletin No. 226) the plan was continued of using the last completed year as the base. The abnormal conditions brought about by the war in Europe, however, made it advisable to provide a prewar standard for measuring price changes, and in the preparation of the bulletin covering the years 1917 to 1919 (Bulletin No. 269) the base period was shifted to the year 1913. This plan conformed to the one adopted by the bureau in its reports on retail prices and on union wages and hours of labor.

PRICES: HOW SHOWN AND COMPUTED.

For commodities of great importance, such as cattle, wheat, butter, eggs, milk, cotton, wool, pig iron, and lumber, more than one price series has been included in the index. In no case, however, is an article of a particular description represented by more than one series of quotations for the same market. Weekly prices have been secured for all articles subject to frequent fluctuations in price. In a large number of instances, particularly since the beginning of 1918, it has been possible to obtain average monthly prices based on daily fluctuations. For a few commodities whose prices are quite stable, as salt and plate glass, only first of the month prices are used.

The average price for the year is obtained by dividing the sum of the quotations for a given commodity by the number of quotations. For example, the sum of the 52 Tuesday prices of No. 1 northern spring wheat at Minneapolis for 1919 was \$133.43. This total, divided by 52, gives \$2.5660 as the average price per bushel for the year. When a range of prices is shown for a particular date, the mean of the high and low prices is found and this figure is used in computing the yearly average as above described.

Net cash prices are used for all articles whose list prices are subject to large and varying discounts. In the case of a few articles, the prices of which are subject to a small discount for cash, no deduction has been made.

NUMBER AND CLASS OF COMMODITIES.

Considerable variations have perforce occurred in the number of commodities included in the various reports on wholesale prices compiled by the Bureau. In earlier years the number varied from 250 to 260, increasing to 340 in 1914. In the detailed record of prices from 1890 to 1916 published in Bulletin No. 226 (issued in December, 1917) 342 series of quotations (including cases of substitution) were presented for the entire period or some part of the period. Of this number, 296 were weighted and used in computing the index number. In the report for 1917 to 1919 (Bulletin No. 269) the number of price series included in the weighted index was increased to 328, with 48 additional series for which satisfactory weighting factors could not be obtained. The number of commodities or price series in the weighted index classified into groups is as follows: Farm products, 32; food, etc., 91; cloths and clothing, 77; fuel and lighting, 21; metals and metal products, 25; lumber and building materials, 30; chemicals and drugs, 18; housefurnishing goods, 13; miscellaneous, 21; all commodities, 328.

DESCRIPTION AND GROUPING OF COMMODITIES.

The following list, compiled from the report for 1917 to 1919 (pp. 175 to 180), shows the grouping and description of the articles, those not included in the weighted index number being so noted.

Group I.—Farm products.

- Cotton, middling, upland:
 - New Orleans.
 - New York.
- Flaxseed, No. 1, cash.
- Grain:
 - Barley, fair to good, malting.
 - Corn, cash—
 - Contract grades.
 - No. 3, mixed.
 - Oats, contract grades, cash.
 - Rye, No. 2, cash.
 - Wheat, cash—
 - Chicago, No. 1 northern spring.
 - Chicago, No. 2 red winter.
 - Kansas City, No. 2 hard winter.
 - Minneapolis, No. 1 northern spring.
 - Portland, Oreg., bluestem.
- Hay:
 - Alfalfa, No. 1.
 - Timothy, No. 1.
- Hides:
 - Calfskins, No. 1.
 - Goatskins, Brazilian.
 - Green, salted, packers'—
 - Heavy, native steers.
 - Heavy, Texas steers.
- Hops:
 - New York State, prime to choice.
 - Pacific coast.
- Live stock (for food):
 - Cattle, steers—
 - Choice to prime heavy beefs.
 - Good to choice, corn fed.

Hogs:
 Heavy.
 Light.
 Sheep:
 Ewes, fed, poor to best.
 Lambs, good to prime.
 Wethers, fed, common to best.
 Peanuts, No. 1 grade.
 Poultry, live fowls:
 Chicago.
 New York, choice.
 Tobacco, burley, dark red, good leaf.

Group II.—Food, etc.

Beans, medium, choice.
 Bread:
 Crackers.
 Oysters.⁷
 Soda.⁷
 Loaf (before baking, per 16 oz.)—
 Chicago.⁷
 Cincinnati.⁷
 New Orleans.⁷
 New York.⁷
 San Francisco.⁷
 Butter:
 Boston—
 Creamery, extra.
 Creamery, firsts.
 Creamery, seconds.
 Chicago—
 Creamery, extra.
 Creamery, extra firsts.
 Creamery, firsts.
 Cincinnati—
 Creamery, extra.
 Creamery, centralized firsts.
 Creamery, centralized seconds.
 New Orleans.
 Creamery, fancy.
 Creamery, choice.
 New York—
 Creamery, extra.
 Creamery, firsts.
 Creamery, seconds.
 Philadelphia—
 Creamery, extra.
 Creamery, extra firsts.
 Creamery, firsts.
 St. Louis—
 Creamery, extra.
 San Francisco—
 Creamery, extra.
 Creamery, primary firsts.
 Canned goods:
 Corn, New York, standard.
 Peas, State and western, No. 5 sieve.
 Tomatoes, standard New Jersey, No. 3.
 Cheese:
 Chicago, whole milk, American twins.
 New York, whole milk, colored, average, fancy.
 San Francisco, California flats, fancy.
 Coffee, Rio, No. 7.

⁷Not weighted.

Eggs:

Boston, firsts, western.
 Chicago, firsts, fresh.
 Cincinnati, firsts, fresh.
 New Orleans, candled, western.
 New York, firsts, fresh gathered.
 Philadelphia, extra firsts, western.
 San Francisco, fresh, selected, pullets'.

Fish:

Cod, large, shore (pickled, cured).
 Herring, pickled, domestic, split, large, No. 1.
 Mackerel, salt, large, No. 3s.
 Salmon, canned, Alaska, red.

Flour:

Buckwheat.
 Rye, pure, medium straight.
 Wheat—
 Kansas City, winter patents. ⁸
 Kansas City, winter straights. ⁸
 Minneapolis, standard patents. ⁸
 Minneapolis, second patents. ⁸
 Portland, patents. ⁸
 St. Louis, first patents. ⁸
 St. Louis, second patents. ⁸
 Toledo, patents. ⁸
 Toledo, straights. ⁸

Fruit:

Apples—
 Evaporated, choice.
 Fresh, Baldwin.
 Bananas, Jamaica, 8s.
 Currants, uncleaned, in barrels.
 Lemons, California.
 Oranges, California.
 Prunes, California, 60s to 70s, in 25-pound boxes.
 Raisins, California, coast seeded (bulk).

Glucose, 42° mixing.

Lard, prime, contract.

Meal, corn:

White, Terre Haute.
 White, table, Philadelphia.

Meat:

Bacon—
 Rough sides.
 Short clear sides.
 Beef, fresh—
 Chicago:
 Carcass, good native steers.
 Steer, loin ends (hips). ⁷
 Steer, ribs, No. 2. ⁷
 Steer, rounds, No. 2. ⁷
 New York:
 Native sides.
 Loins, No. 2, city. ⁷
 Ribs, No. 2, city. ⁷
 Rounds, No. 2, city. ⁷
 Beef, salt, extra mess.
 Hams, smoked, loose.
 Lamb, dressed, round.
 Mutton, dressed.
 Pork, fresh—
 Chicago, loins. ⁷
 New York, loins, western. ⁷

⁷ Not weighted.

⁸ Only flour conforming to United States Food Administration standard was quoted in 1918.

Meat—Continued.
 Pork, salt, mess, old to new.
 Poultry, dressed fowls—
 Chicago, iced.
 New York, western, dry packed.
 Veal, city dressed, good to prime.
 Milk, fresh:
 Chicago (vicinity).
 New York (vicinity).
 San Francisco (vicinity).
 Molasses, New Orleans, open kettle.
 Oleomargarine, standard quality, uncolored.
 Oleo oil, extra.
 Olive oil, Spanish.
 Rice:
 Blue Rose, head.
 Honduras, head.
 Salt, American, medium.
 Soda, bicarbonate of, American. ⁷
 Spices: Pepper, black, Singapore.
 Starch, corn, for culinary purposes. ⁷
 Sugar:
 96° centrifugal.
 Granulated, in barrels.
 Tallow, packers' prime.
 Tea, Formosa, fine.
 Vegetables, fresh:
 Onions.
 Potatoes, white, range from good to choice.
 Vinegar, cider, 40-grain, in barrels.

Group III.—Cloths and clothing.

Boots and shoes:
 Children's, gun metal, button.
 Little boys', gun metal, blucher.
 Men's—
 Gun metal, Goodyear welt, blucher.
 Gun metal, Goodyear welt, button.
 Split seamless, Creedmore.
 Vici calf, blucher.
 Vici kid, Goodyear welt.
 Misses, vici kid, patent tip, button.
 Women's—
 Gun metal, Goodyear welt, button.
 Gun metal, McKay, sewed, button.
 Patent leather, pump, McKay, sewed.
 Youth's, gun metal, blucher.
 Carpets:
 Axminster, Lowell, 3-4.
 Brussels, 5-frame, Biglow.
 Wilton, 5-frame, Biglow.
 Cotton goods:
 Blankets, 2 pounds to the pair.
 Calico, American standard prints, 7 yards to the pound, in gray.⁷
 Denims, Massachusetts, 2.30 yards to the pound.
 Drillings—
 Brown, Pepperell, 2.85 yards to the pound, 29-inch.
 Massachusetts, D standard, 30-inch.
 Flannels—
 Colored, 2½ yards to the pound.
 Unbleached, 3½ yards to the pound.
 Gingham—
 Amoskeag, 6.37 yards to the pound.
 Lancaster, 6.50 yards to the pound.

⁷ Not weighted.

Cotton goods—Continued.

Hosiery—

Men's half hose, combed yarn, fast black.

Women's—

Full fashioned, combed peeler yarn, double sole.
Seamless, combed yarn, double sole, 220-needles.Percale, Scout, 36-inch, 5.35 yards to the pound.⁷

Print cloths, 27-inch, 7.60 yards to the pound.

Sheeting—

Bleached—

Pepperell, 10-4.

Wamsutta, 10-4.

Brown—

Indian Head, 4-4, 2.85 yards to the pound.

Pepperell, R. 4-4, 3.75 yards to the pound.

Ware Shoals, L. L., 4-4, 4 yards to the pound.

Shirting, bleached muslin, 4-4.

Fruit of the Loom.

Lonsdale.

Rough Rider.

Wamsutta, $\langle o \rangle$
xx

Thread, 6-cord, 200-yard spools, J. & P. Coats.

Ticking, Amoskeag, A. C. A., 2.05 yards to the pound.

Underwear—

Men's shirts and drawers.

Women's union suits.

Yarn, carded, white mulespun, northern, cones—

10-1.

22-1.

Yarn, twisted, carded, ordinary, for weaving—

20-2.

40-2.

Leather:

Calf, chrome, dull or bright finish, B grade.

Glazed kid, black, top grades, from Brazilian skins.

Harness, California oak, No. 1.

Side, black, chrome, tanned, B grade.

Sole—

Hemlock, middle, No. 1.

Oak, scoured backs, heavy.

Linen shoe thread, 10s, Barbour.

Silk, raw:

Japan—

Kansai, No. 1.

Special, extra, extra.

Woolen goods:

Blankets, 5 pounds to the pair.

Flannel, white, 4-4, Ballard Vale, No. 3.

Hosiery—

Men's seamless half hose—

Cashmere.

Wool.⁷

Overcoating, soft-faced, black, plain twill, 24-ounce.

Suitings—

Clay worsted, diagonal—

12-ounce.

16-ounce.

Middlesex, wool-dyed, blue.

Serge, 11-ounce.

Trousing, worsted, with silk decoration, 11 to 11½ ounces to the yard.

Underwear, merino—

Men's shirts and drawers, 50 per cent wool.

Union suits, 33½ per cent wool.

⁷ Not weighted.

Woolen goods—Continued.

Women's dress goods:

All wool—

Broadcloth, 53-54 inches.

French serge, 35-inch.

Storm serge, double-warp, 50-inch.

Cotton warp—

Cashmere, Hamilton Mills.

Poplar cloth, 36-inch.

Sicilian cloth, 50-inch.

Wool, Ohio, scoured, fleece—

Fine clothing.

Fine delaine.

Half-blood.

Medium ($\frac{1}{4}$ and $\frac{3}{8}$ grades).

Yarn—

2-32s, crossbred stock.

2-40s, half blood.

2-50s, fine domestic.

Group IV.—Fuel and lighting.

Alcohol, denatured, 180 proof.

Coal:

Anthracite—

Broken.

Chestnut.

Egg.

Stove.

Bituminous—

Chicago—

Mine run.

Prepared sizes.

Screenings.

Cincinnati, run-of-mine.

Pittsburgh, prepared sizes.

St. Louis, run-of-mine.

Semibituminous—

Cincinnati, New River smokeless, run-of-mine.

Norfolk, Pocahontas.

Coke, Connelsville, furnace.

Gasoline, motor.

Matches, average of Safe Home, Bird's Eye, and Searchlight brands.

Petroleum:

Crude—

California.

Kansas-Oklahoma.

Pennsylvania.

Refined—

Standard white 110° fire test, for export.

Water-white 150° fire test (jobbing lots).

*Group V.—Metals and metal products.*Augers, regular, 1-inch.⁷

Bar iron:

Best refined, Philadelphia.

Common, from mill, Pittsburgh.

Butts, loose-pin, wrought-steel, 3½ by 3½ inches.⁷Chisels, regular, socket firmer, 1-inch.⁷

Copper:

Ingot, electrolytic.

Sheet, hot-rolled (base sizes).⁷

Wire, bare, No. 8.

Door knobs, steel, bronze-plated.⁷Files, 8-inch, mill bastard.⁷Hammers, Maydole, No. 1½.⁷⁷ Not weighted.

Iron ore, Mesabi, Bessemer.

Lead:

Pig, desilverized.

Pipe.

Locks, common, mortise, knob-lock, 3½ inch.⁷

Nails, 8-penny, fence and common.

Cut.⁷

Wire.

Pig iron:

Basic.

Bessemer.

Foundry—

No. 2, northern

No. 2, southern.

Pipe, cast-iron, 6-inch.

Planes, jack planes.⁷

Quicksilver.⁷

Saws, Disston:

Cross-cut, No. 2, 6-inch.⁷

Hand, No. 8, skewback, 26-inch.⁷

Shovels, Ames, No. 2.⁷

Silver, bar, fine.

Steel:

Billets, Bessemer.

Plates, tank, ¼-inch wide.

Rails, standard—

Bessemer.

Open-hearth.

Sheets, box annealed, No. 27.⁷

Structural.

Tin:

Pig.

Plate, coke.

Trowels, Johnson's, brick, 10½-inches.⁷

Vises, solid box, 50-pound.⁷

Wire:

Barbed, galvanized.

Plain, annealed, Nos. 0 to 9.

Wood screws, 1-inch, No. 10, flathead.⁷

Zinc:

Sheet.

Spelter (pig zinc) western.

Group VI.—Lumber and building materials.

Brick, common:

Chicago, run-of-kiln, salmon.

Cincinnati, red, building.

New York, red, domestic, building.

Cement:

Portland, domestic.

Doors, western white pine.⁷

Glass:

Plate, polished, glazing—

Area 3 to 5 square feet.

Area 5 to 10 square feet.

Window, American single, 25-inch—

A grade.

B grade.

Lath, eastern spruce, 1½-inch slab.

Lime, eastern, common.

Lumber:

Douglas fir—

No. 1.

No. 2 and better

Hemlock.

Maple.

⁷Not weighted.

Lumber—Continued.

- Oak, white—
 - Plain.
 - Quartered.
- Pine—
 - White, boards, rough, No. 2, barn.
 - White, boards, rough, uppers.
 - Yellow, flooring.
 - Yellow, siding.
- Poplar, yellow.
- Spruce, eastern.
- Paint materials:
 - Lead, carbonate of (white lead), American, in oil.
 - Linseed oil, raw.
 - Turpentine, spirits of.
 - Zinc, oxide of (zinc white), American, extra dry.
- Putty.
- Rosin, common to good, strained.
- Shingles, 16 inches long:
 - Cypress.
 - Red cedar.
- Tar, pine.⁷

Group VII.—Drugs and chemicals.

- Acid:
 - Acetic, 28°.
 - Muriatic, 20°.
 - Nitric, 42°.
 - Sulphuric, 66°.
- Alcohol:
 - Grain, 190 proof, U. S. P.
 - Wood, refined, 95 per cent.
- Alum, lump.
- Ammonia, anhydrous.
- Borax, crystals and granulated, sacks.
- Copper sulphate, 99 per cent crystals (blue vitriol).
- Glycerine, refined, chemically pure.
- Opium, natural, in cases.
- Quinine, manufacturers' quotation.
- Soda:
 - Carbonate of (sal soda).
 - Caustic, 76 and 78 per cent, solid.
 - Nitrate of (Chile saltpeter), 95 per cent.
 - Soda ash, light, 58 per cent.
- Sulphur (brimstone), stick, crude.

Group VIII.—House-furnishing goods.

- Earthenware:
 - Plates, 7-inch, white granite.
 - Teacups and saucers, white, granite.
- Furniture:
 - Bedroom sets, 3 pieces.
 - Chairs—
 - Bedroom, rocker, oak.
 - Kitchen, hardwood.
 - Tables, kitchen, 2 by 3½ feet, with drawer.
- Glassware, common:
 - Nappies, 4-inch.
 - Pitchers, ½-gallon.
 - Tumblers, table, ½-pint.
- Table cutlery:
 - Carvers, stag handles.
 - Knives and forks, cocobolo handles, metal bolsters.
- Woodenware, oak-grained:
 - Pails, 3-hoop.
 - Tubs.

Group IX.—Miscellaneous.

- Beer, western, light or dark.⁷
- Bran.
- Cottonseed meal, prime.
- Cottonseed oil, prime, summer yellow.
- Jute, raw.
- Lubricating oil, paraffine.
- Malt, standard keg beer.
- Paper:
 - New, wood, roll, annual contracts.
 - Wrapping, manila, No. 1 jute.
- Phosphate rock, Florida land pebble, 68 per cent.
- Rope, pure manila, $\frac{5}{8}$ -inch (base size) and larger.
- Rubber, Para, island, fine.
- Soap, laundry:
 - 100 bars to a box of 68 $\frac{1}{2}$ pounds.
 - 100 bars to a box of 75 pounds.
- Starch, laundry.
- Tobacco:
 - Plug, Climax.
 - Smoking, granulated, Blackwell's Bull Durham.
- Whisky:
 - Bourbon—
 - 4 years in bond, 100 proof, in barrels, Kentucky.
 - Bottled in bond, Kentucky.
 - Proof spirits.¹
 - Rye—
 - 4 years in bond, 100 proof, in barrels, Pennsylvania.
 - Bottled in bond, Pennsylvania.
- Wood pulp, sulphate, domestic, unbleached.

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 list of 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. In making such substitutions articles were supplied corresponding as closely as possible to those which were previously used.

Additions to the number of articles included in the compilation have been made from time to time as circumstances demanded. For 1890 the number of articles in the weighted index (as shown in Bulletin No. 181, p. 160) was 192. In 1914 the number had increased to 297. In 1915 the number was 300. In 1916 it was reduced to 296, owing to the temporary dropping of 4 lines of children's shoes. In the report for 1917 to 1919, the 4 series of children's shoes were restored and 28 other series added, bringing the total to 328.

INTERPOLATION.

In a few instances during the years 1914 to 1917 interpolated figures were used in calculating the index numbers for months in which actual price quotations could not be obtained. For example, the closing of the New York and New Orleans cotton exchanges following the outbreak of war in 1914 made it impossible to secure satisfactory prices for this staple during a part of that year. Therefore, in computing the monthly index numbers for the farm products

⁷Not weighted.

group and for all commodities combined, the plan was followed of repeating for months in which quotations were lacking the figure for the last month prior to the closing of the exchange. A similar plan was followed in the cases of other articles for which prices were unobtainable in one or more months of the year. In computing yearly averages, however, the interpolated figures were not used, the averages in such cases being made from the actual prices available. In no case was a price interpolated for an entire year, or for more than a few months of the year.

Beginning with 1918, the plan was adopted of computing and publishing the index number from month to month, instead of after the close of the year as before. Under this plan of month-to-month comparison of weighted price aggregates it is the practice in cases where prices from correspondents are not received in time for use in computing the monthly index number, to interpolate the latest reported prices and issue the index number as a "preliminary" figure, revising the computation when the correct figures are received.

WEIGHTING.

Prior to 1914 weighting in its technical sense was not attempted in computing the index numbers shown in the wholesale price reports of the Bureau. Instead of this, the plan was followed of using simply a large number of representative staple articles, selected in such a manner as to make them a large to extent weight themselves.⁹ The actual money prices of the different commodities were converted into relatives of the average price in the base period 1890 to 1899, taken as 100, and these relatives were then combined into index numbers of groups of commodities and into a general index number of all commodities taken together. The simple arithmetic average of the relative prices in each group and in all commodities combined constituted the index numbers under this method.

Beginning with the 1914 report, the plan was adopted of constructing group and general index numbers from the aggregate values of commodities exchanged year by year. These aggregate values are obtained by multiplying the price in any given year or month by the physical quantity of the article placed on the market in a given year, 1909. The latter year was selected because in 1914 it represented the latest year in which a Federal census of agriculture and manufactures had been taken, and consequently it was the most recent period for which complete information was available.

To obtain the quantities of the various commodities marketed in 1909, recourse was had wherever possible to sources of an official character—particularly to reports of the Census Bureau, the Department of Agriculture, the Bureau of Foreign and Domestic Commerce, the Geological Survey, the Forest Service, and the Commissioner of Internal Revenue. In instances where satisfactory information from Government reports was lacking, data believed to be authoritative were obtained from nonofficial sources, such as the American Iron and Steel Institute, the National Association of Wool Manufacturers, produce exchanges, boards of trade, chambers of commerce, leading trade journals, etc.

⁹ See Bulletin No. 181, Wholesale Prices 1890 to 1914, pp. 239-252.

In the case of such articles as barley, corn, oats, hay, live poultry, apples, eggs, and milk, of which a considerable part of the quantity produced is consumed at home by the farmer, care was taken to include only that portion actually marketed. A similar plan was followed with regard to cotton and worsted yarns, coal, copper wire, pig iron, steel billets, and other manufactures used to a large extent in establishments where produced. Of cattle, hogs, and sheep, only the quantities consumed in the slaughtering and meat-packing industry were included, while the figures for the several kinds of meat products were restricted to the output of this industry, with the addition of the relatively small amount of imports.

For convenience in computation and to avoid the appearance of overrefinement of accuracy, the physical quantities used as weights for the prices of the different commodities have been expressed to the nearest thousands only. For example, it was found that the quantity of barley sold by growers in 1909, plus the imports, amounted to 75,300,538 bushels. This was written as 75,301. Similarly, the products representing value in exchange were expressed in thousands of dollars. Thus, the average price of barley in 1914 was \$0.6151 per bushel. This multiplied by 75,301 (000 omitted) produces \$46,318 (000 omitted) as the approximate value of barley marketed in 1914.

To illustrate the method followed in determining the weights for the different commodities, wheat is taken as an example. The Census Bureau reported the production of wheat in the United States in 1909 as 683,379,259 bushels. To this was added the imports during the fiscal year ending June 30, 1909, of 41,031 bushels, and from the sum was subtracted the reexports, amounting to 3,762 bushels, leaving 683,416,528 bushels as the quantity of wheat presumably marketed in 1909. From data furnished by the Department of Agriculture it was found that 269,843,000 bushels, or approximately 39.5 per cent, of this was spring wheat and 413,573,000 bushels, or 60.5 per cent, was winter wheat. In preparing the 1914 report, prices for both 1913 and 1914 were collected for spring wheat in Minneapolis and Chicago and for winter wheat in Kansas City, Chicago, and Portland, Oreg. By reference to reports of boards of trade, supplemented by information from other sources, the relative importance of each of these cities as a wheat market in 1909 was established with reasonable certainty. The total quantity of spring wheat marketed in the United States in 1909 was accordingly apportioned between Chicago and Minneapolis, and the total quantity of winter wheat was apportioned among Chicago, Kansas City, and Portland in proportion to their relative importance. As only one series of price quotations for wheat had been included in the Bureau's compilation for years prior to 1913, the prices for such years were weighted by the combined figures for spring and winter wheat stated above—683,416,000 bushels.

The physical quantities used as "weights" for the different series of price quotations in calculating the group and general index numbers are based, as has been stated, on the most careful estimates from official and nonofficial sources, and represent with approximate accuracy the quantities of the different commodities actually marketed in the census year 1909. These quantities, representing the

amount of each commodity exchanged in 1909, have been multiplied by the average prices for each month and year to obtain the value of the same quantity of the commodity at the price prevailing in the different months and years. The values of individual commodities were summed by groups and for all commodities to get the cost of the same bill of goods in the months and years for which an index number was to be calculated.

If, during any period of time under consideration, there were no changes in the list of commodities included in the index numbers, the percentage changes in the cost of the different groups of commodities would be accurately measured by dividing the aggregate for the base period into the corresponding aggregate for each month or year to be covered. In a number of years, however, the bureau's reports of wholesale prices have contained additions to the list of articles previously included, while numerous substitutions of one article for another at a different price have been made from time to time as circumstances demanded. Therefore, in carrying the index numbers over the period since 1890, a method had to be adopted that would allow for variations in the number and kind of commodities from year to year. This method, which is identical in principle with that employed by the bureau in its reports on retail prices and on wages, consists in computing two separate aggregates for any year or month in which an addition or a substitution occurs—the first aggregate being made from the list of articles before making additions or substitutions, and the second aggregate from the revised list of articles. In this way comparison between any two consecutive years or months is based on aggregates made up of identical commodities only. Table 1, relative to the farm products group, which was published on page 255 of Bulletin No. 181, will serve to illustrate the method employed.

TABLE 1.—INDEX NUMBERS BASED ON AGGREGATE VALUES IN EXCHANGE OF FARM PRODUCTS IN 1912, 1913, AND 1914.

Commodity.	Value in exchange (000 omitted) in—			
	1912	1913-A	1913-B	1914
Cotton, upland, middling:				
New Orleans.....			\$458, 026	\$406, 093
New York.....	\$622, 285	\$692, 016	230, 636	218, 194
Flaxseed, No. 1.....	38, 581	27, 123	27, 123	30, 664
Grain:				
Barley—				
Choice to fancy.....	76, 717	52, 266		
Fair to good, malting.....			47, 086	46, 318
Corn, cash—				
Contract grades.....	315, 863	288, 032	170, 165	188, 716
No. 3, mixed.....			115, 213	128, 151
Oats, cash.....	117, 323	100, 662	100, 662	112, 260
Rye, No. 2, cash.....	23, 567	18, 781	18, 781	22, 657
Wheat, cash.....	716, 903	651, 500		
Chicago, No. 1 northern spring.....			24, 639	28, 015
Chicago, No. 2 red winter.....			122, 372	124, 705
Kansas City, No. 2 hard winter.....			217, 548	233, 032
Minneapolis, No. 1 northern spring.....			212, 137	243, 612
Portland, Oreg., bluestem.....			38, 417	41, 717
Hay, timothy, No. 1.....	218, 106	171, 284	171, 284	168, 202
Hides:				
Calfskin, No. 1.....			24, 775	27, 573
Green, salted, packers'—				
Heavy, native steers.....	162, 315	169, 601	113, 067	120, 691
Heavy, Texas steers.....			55, 611	58, 870

TABLE 1.—INDEX NUMBERS BASED ON AGGREGATE VALUES IN EXCHANGE OF FARM PRODUCTS IN 1912, 1913, AND 1914—Concluded.

Commodity.	Value in exchange (000 omitted) in—			
	1912	1913-A	1913-B	1914
Hops:				
New York State, prime to choice.....	\$19,712	\$12,803	\$5,600	\$4,971
Pacific coast.....			4,128	6,143
Live stock (for food):				
Cattle, steers—				
Choice to prime.....	387,900	370,090	370,090	400,066
Good to choice.....	696,542	705,230	705,230	749,280
Hogs—				
Heavy.....	145,148	159,863	159,863	159,775
Light.....	432,931	484,665	484,665	480,509
Sheep—				
Ewes, fed, poor to best.....			10,780	11,600
Lambs, good to prime.....			62,736	65,319
Wethers, fed, common to best.....	9,448	10,250	6,149	6,705
Wethers, western.....	46,960	50,789		
Peanuts, No. 1 grade.....			15,470	17,518
Poultry, live fowls:				
Chicago.....			35,505	33,431
New York, choice.....	68,429	77,138	38,569	38,016
Tobacco, Burley, dark red.....	125,753	145,274	145,274	161,250
Total.....	4,224,483	4,187,367	4,191,601	4,334,063
Index number.....	98	97	97	100

Starting with the 1914 aggregate (\$4,334,063) as the base (100), \$4,191, divided by \$4,334,063 gives 96.7 as the index number for 1913. This is rounded off to 97, when published. The ratio of the aggregate in 1912 to the aggregate in 1913, based on quotations of identical articles, is \$4,224,483 to \$4,187,367 or 100.9 to 100. The index number for 1912 is obtained by multiplying the index for 1912 on the 1913 base (100.9) by the index for 1913 on the 1914 base (96.7) which gives 97.6, or 98, as the index number for 1912 on the 1914 base. By continuing this operation the index numbers for preceding years are obtained. Index numbers for the 8 remaining groups of commodities and for all commodities combined are found in similar manner.

TESTING.

Several comparisons have been made of the Bureau's weighted index number with the index numbers compiled by other agencies. Since March, 1918, the Monthly Labor Review has carried quarterly a table showing in parallel columns the index numbers of the Bureau of Labor Statistics, several series for foreign countries, all being reduced to percentages of the 1913 index number for purpose of direct comparison. The Federal Reserve Bulletin, published monthly by the Federal Reserve Board, has contained since October, 1918, a comparison of the Bureau's index with several series constructed by that board and designated by groups as farm products, animal products, forest products, mineral products, total raw materials, producers' goods, and consumers' goods, respectively. The year 1913 constitutes the base period in this comparison. In the summary to a History of Prices During the War, prepared by Wesley C. Mitchell and issued as War Industries Board Bulletin No. 1, by the War Industries Board in 1919, a comparison is made of the four series of index numbers compiled by the Price Section of the War Industries Board, the Bureau of Labor Statistics, Bradstreet's, and Dun's for

the six years from 1913 to 1918, inclusive. A second table compares the Bureau of Labor Statistics index with that of the Price Section for each quarter and month of the period 1913 to 1918. In both of these comparisons the base period used is the fiscal year, July, 1913, to June, 1914.¹⁰ Comparisons of the Bureau's index with other series is also contained in certain issues of the Monthly Labor Gazette of Canada, the quarterly Bulletin de la Statistique Générale of France, and other publications of foreign countries.

TABLES OF RESULTS.

Table 2, which has been reproduced from the Monthly Labor Review for February, 1921, page 45, shows the yearly movement in wholesale prices by groups of commodities for the period from 1890 to 1920, inclusive.

TABLE 2.—INDEX NUMBERS OF WHOLESALE PRICES, 1890 TO 1920, BY GROUPS OF COMMODITIES.

(Average prices in 1913=100.)

Year.	Farm products.	Food, etc.	Cloths and clothing.	Fuel and lighting.	Metals and metal products.	Building materials.	Chemicals and drugs.	House furnishing goods.	Miscellaneous.	All commodities.
1890.....	68	89	94	69	114	72	90	72	92	81
1891.....	73	89	91	68	102	70	92	72	92	82
1892.....	66	80	91	66	93	67	91	71	88	76
1893.....	67	87	88	66	85	68	90	68	91	77
1894.....	59	77	78	61	72	66	83	67	86	69
1895.....	60	74	78	67	77	64	88	62	82	70
1896.....	54	67	75	69	80	63	91	58	80	65
1897.....	58	71	75	62	71	62	89	56	80	67
1898.....	61	76	79	61	71	65	93	61	79	69
1899.....	62	75	82	71	108	71	96	62	82	74
1900.....	69	79	88	80	106	76	97	69	91	80
1901.....	73	80	82	78	98	73	98	69	90	79
1902.....	81	85	84	92	97	77	97	73	92	85
1903.....	75	82	88	105	96	80	96	74	94	85
1904.....	80	87	89	91	88	80	97	73	94	86
1905.....	77	86	91	87	98	85	96	71	95	85
1906.....	78	84	97	90	113	94	94	74	97	88
1907.....	85	89	104	93	120	97	96	80	101	94
1908.....	85	94	94	91	94	92	100	78	97	91
1909.....	97	99	98	88	92	92	101	77	109	97
1910.....	103	100	99	84	93	101	102	80	116	99
1911.....	93	99	96	82	89	101	103	85	104	95
1912.....	101	108	98	89	99	100	101	91	101	101
1913.....	100	100	100	100	100	100	100	100	100	100
1914.....	103	103	98	96	87	97	101	99	99	100
1915.....	105	104	100	93	97	94	114	99	99	101
1916.....	122	126	128	119	148	101	159	115	120	124
1917.....	189	176	181	175	208	124	198	144	155	176
1918.....	220	189	239	163	181	151	221	196	193	196
1919.....	234	210	261	173	161	192	179	236	217	212
1920.....	218	236	302	238	186	308	210	337	236	243

In Table 3 the index numbers are shown for each month from January, 1913, to March, 1921, inclusive.

¹⁰ See also pp. 105 to 108 of the present bulletin.

TABLE 3.—INDEX NUMBERS OF WHOLESALE PRICES BY GROUPS OF COMMODITIES AND BY MONTHS, 1913 TO MARCH, 1921.

(Average prices in 1913=100.)

Year and month.	Farm products.	Food, etc.	Cloths and clothing.	Fuel and lighting.	Metals and metal products.	Building materials.	Chemicals and drugs.	House furnishing goods.	Miscellaneous.	All commodities.
1913.										
Average for year...	100	100	100	100	100	100	100	100	100	100
January.....	97	99	100	103	107	100	101	100	100	100
February.....	97	98	101	103	105	101	101	100	100	100
March.....	99	97	100	102	102	101	101	100	99	99
April.....	97	96	100	98	102	101	101	100	98	98
May.....	98	95	100	98	102	101	100	100	98	98
June.....	99	99	99	100	100	101	100	100	100	100
July.....	101	102	100	99	98	101	99	100	101	100
August.....	101	104	100	100	99	99	99	100	102	101
September.....	104	105	100	100	99	99	99	100	102	102
October.....	103	102	100	100	99	98	100	100	100	101
November.....	101	105	100	99	96	98	100	100	100	101
December.....	101	101	99	99	92	98	100	100	100	99
1914.										
January.....	101	102	98	99	92	98	100	99	99	100
February.....	102	100	99	99	92	99	100	99	100	99
March.....	103	97	99	99	92	99	100	99	101	99
April.....	103	95	99	98	91	99	100	99	101	98
May.....	104	96	99	95	87	98	100	99	101	98
June.....	104	100	99	94	86	98	100	99	99	99
July.....	104	104	99	95	85	97	99	99	97	100
August.....	109	112	99	94	85	97	99	99	98	103
September.....	108	116	98	95	86	96	104	99	99	104
October.....	103	107	97	93	83	96	105	99	96	99
November.....	101	106	96	93	81	95	105	99	96	98
December.....	99	105	96	94	83	94	104	99	98	98
1915.										
January.....	102	106	96	93	83	94	103	99	100	99
February.....	105	108	97	92	87	95	102	99	100	101
March.....	105	104	97	92	89	94	102	99	99	99
April.....	107	105	99	89	91	94	102	99	99	100
May.....	109	105	99	89	96	94	102	99	98	101
June.....	105	102	99	89	100	93	104	99	97	99
July.....	108	104	99	90	102	93	108	99	98	101
August.....	107	102	99	92	100	92	112	99	97	100
September.....	103	100	100	94	100	92	116	99	97	99
October.....	105	103	103	96	100	93	124	99	99	101
November.....	102	107	105	98	104	94	142	99	100	103
December.....	103	111	107	100	114	97	153	99	103	106
1916.										
January.....	108	113	110	105	126	99	150	105	107	110
February.....	109	114	113	106	132	100	170	105	106	112
March.....	111	115	117	108	141	101	175	106	109	114
April.....	114	117	119	108	147	101	172	108	110	117
May.....	116	119	122	107	151	102	166	112	113	118
June.....	116	119	124	108	149	101	166	112	119	119
July.....	118	121	126	108	145	99	156	121	120	119
August.....	126	128	128	110	145	100	146	122	122	123
September.....	131	133	131	115	148	100	147	122	125	128
October.....	136	140	138	133	151	101	150	124	132	134
November.....	146	150	146	155	160	104	155	123	135	144
December.....	142	145	155	170	185	106	159	124	137	146
1917.										
January.....	148	150	161	176	183	106	159	132	138	151
February.....	151	159	162	185	190	108	160	132	141	156
March.....	163	160	164	188	199	110	165	132	143	161
April.....	181	182	169	184	208	114	170	139	149	172
May.....	197	190	173	194	217	117	179	139	150	182
June.....	197	187	179	201	239	127	180	144	152	185
July.....	199	181	187	192	257	132	198	152	153	186
August.....	205	180	193	165	249	133	209	152	156	185
September.....	204	178	193	160	226	134	223	152	155	183
October.....	208	183	193	146	182	134	252	152	163	181
November.....	212	184	198	155	174	134	240	155	166	183
December.....	205	185	202	158	174	135	238	155	170	182

TABLE 3.—INDEX NUMBERS OF WHOLESALE PRICES BY GROUPS OF COMMODITIES AND BY MONTHS, 1913, TO MARCH, 1921—Concluded.

Year and month.	Farm products.	Food, etc.	Cloths and clothing.	Fuel and lighting.	Metals and metal products.	Building materials.	Chemicals and drugs.	House furnishing goods.	Miscellaneous.	All commodities.
1918.	220	189	239	163	181	151	221	196	193	196
January	207	187	211	157	174	136	232	161	178	185
February	208	186	216	157	176	138	232	161	181	186
March	212	177	223	158	176	144	232	165	184	187
April	217	178	232	157	177	146	229	172	191	190
May	214	177	237	160	178	148	223	173	194	190
June	217	179	245	159	178	150	219	198	196	193
July	224	184	249	166	184	154	216	199	190	198
August	230	191	252	166	185	157	222	221	191	202
September	237	199	255	167	184	159	220	226	194	207
October	224	201	257	167	187	158	218	226	196	204
November	221	206	256	171	188	164	215	226	203	206
December	222	210	250	171	184	164	195	227	204	206
1919.	234	210	261	173	161	192	179	236	217	212
January	222	207	234	170	172	161	191	218	212	203
February	218	196	223	169	168	163	185	218	208	197
March	228	203	216	168	162	165	183	218	217	201
April	235	211	217	167	152	162	178	217	216	203
May	240	214	228	167	152	164	179	217	213	207
June	231	204	258	170	154	175	174	233	212	207
July	246	216	282	171	158	186	171	245	221	218
August	243	227	304	175	165	208	172	259	225	226
September	226	211	306	181	160	227	173	262	217	220
October	230	211	313	181	161	231	174	264	220	223
November	240	219	325	179	164	236	176	299	220	230
December	244	234	335	181	169	253	179	303	220	238
1920.										
January	246	253	350	184	177	268	189	324	227	248
February	237	244	356	187	189	300	197	329	227	249
March	239	246	356	192	192	325	205	329	230	253
April	246	270	353	213	195	341	212	331	238	265
May	244	287	347	235	193	341	215	339	240	272
June	243	279	335	246	190	337	218	362	247	269
July	236	268	317	252	191	333	217	362	243	262
August	222	235	299	268	193	328	216	363	240	250
September	210	223	278	284	192	318	222	371	239	242
October	182	204	237	282	184	313	216	371	229	225
November	165	195	234	258	170	274	207	369	220	207
December	144	172	220	236	157	266	188	346	205	189
1921.										
January	136	162	208	228	152	239	182	283	190	177
February	129	150	198	218	146	221	178	277	180	167
March	125	150	192	207	139	208	171	275	167	162

INDEX NUMBERS OF THE FEDERAL RESERVE BOARD.

PUBLICATION.

The Federal Reserve Bulletin, issued monthly by the Federal Reserve Board at Washington, contains a series of index numbers based on the wholesale price information collected by the United States Bureau of Labor Statistics. This publication is distributed without charge to member banks of the system and to officers and directors of Federal reserve banks. Others are charged a fee for subscription.

HISTORY.

It was announced in the September, 1918, issue of the Federal Reserve Bulletin that arrangements had been completed whereby the index number of wholesale prices computed by the Bureau of Labor Statistics, together with the data used in its construction,

would be placed at the disposal of the Federal Reserve Board for use each month in its bulletin. It was further explained that a regrouping of the commodities had been made in order to afford a more satisfactory basis for the study of business conditions. The series of index numbers, with the method of commodity grouping adopted, appeared for the first time in the Federal Reserve Bulletin for October, 1918, and has been continued in each subsequent issue.

SOURCE OF QUOTATIONS.

All price quotations used in the preparation of this series of index numbers are obtained directly from the Bureau of Labor Statistics and are identical with those used in computing that bureau's series.

BASE PERIOD.

The last prewar year, 1913, forms the base period from which changes in the price level are measured.

PRICES: HOW SHOWN AND COMPUTED.

To provide a more concrete illustration of actual price movements, there are presented each month tables of absolute and relative prices for certain commodities of a basic character. These are corn, cotton, wheat, cattle, hides, hogs, wool, hemlock and yellow-pine lumber, anthracite and bituminous coal, coke, copper, pig lead, crude petroleum, pig iron, cotton yarns, sole leather, steel billets, steel plates, steel rails, worsted yarns, carcass beef, coffee, wheat flour, hams, illuminating oils, and granulated sugar. In the October, 1918, number of the Federal Reserve Bulletin average prices were shown for each month from January, 1914, to August, 1918, inclusive. Yearly averages for 1914 to 1917 also were given. In subsequent issues a condensed statement for certain months in comparison with the latest available information is published.

NUMBER AND CLASS OF COMMODITIES.

The number of commodities included in the calculation of this series is identical with the number used in constructing the Bureau of Labor Statistics series and, like the latter, is revised from time to time as conditions make necessary. In 1920 this number was 327, including both raw materials and manufactured products.

DESCRIPTION AND GROUPING OF COMMODITIES.

The commodities are divided into three main groups, designated as raw materials, producers' goods, and consumers' goods, respectively. The group of raw materials is in turn divided into four subgroups, viz, farm products, animal products, forest products, and mineral products. Thus seven group index numbers, in addition to the general index of all commodities combined, are currently published.

SUBSTITUTIONS AND ADDITIONS.

Following the plan used by the Bureau of Labor Statistics, additions to the list of commodities and substitutions of one commodity for another have been made from time to time as circumstances demanded. The Federal Reserve Bulletin for October, 1918 (pp. 1006

to 1008), contains a complete list of the articles included at that time in each commodity group. Subsequent changes in the list have been announced as they were made. It is explained that the statistical methods employed insure continuity in the index number, so that figures from month to month are entirely comparable.

INTERPOLATION.

With respect to interpolation, the procedure followed has been that of the source from which the information is taken.

WEIGHTING.

The index numbers are constructed from the aggregates of weighted money prices in the same manner as the index numbers computed by the Bureau of Labor Statistics.

TESTING.

Comparison of the several group index numbers with the general index number of the Bureau of Labor Statistics is carried in each issue of the Federal Reserve Bulletin. No other means of testing is considered necessary.

TABLE OF RESULTS.

Table 4, taken from the Federal Reserve Bulletin for March, 1921, shows the manner in which the information is currently published:

TABLE 4.—INDEX NUMBERS OF WHOLESALE PRICES IN THE UNITED STATES FOR PRINCIPAL CLASSES OF COMMODITIES.

[Average prices in 1913=100.]

Year and month.	Raw materials.					Producers' goods.	Consumers' goods.	All commodities (Bureau of Labor Statistics index number).
	Farm products.	Animal products.	Forest products.	Mineral products.	Total raw materials.			
July, 1914.....	102	106	97	91	99	93	103	100
January, 1915.....	108	97	94	90	98	95	102	99
January, 1916.....	116	102	95	112	107	120	111	111
January, 1917.....	163	136	99	181	148	170	147	151
January, 1918.....	242	176	130	172	184	181	193	185
January, 1919.....	234	208	147	179	196	196	216	203
January, 1920.....	291	213	273	190	239	245	259	248
July, 1920.....	287	184	359	256	258	251	272	263
August, 1920.....	259	181	351	265	251	238	250	250
September, 1920.....	232	186	344	277	248	224	240	242
October, 1920.....	191	172	339	272	230	209	224	225
November, 1920.....	170	159	289	246	205	193	214	207
December, 1920.....	155	132	278	224	186	175	196	189
January, 1921.....	155	119	245	215	174	169	184	177

INTERNATIONAL PRICE INDEX.

It was stated in the January, 1920, issue of the Federal Reserve Bulletin that plans were being formulated for the construction of an international price index. In the May, 1920, issue it was announced that the technical details had been worked out and an index number constructed for the United States. The same method was to be employed in the case of foreign countries. Arrangements for the

cabling of prices each month from foreign countries had been made with the State Department, and the preliminary work of choosing commodities and determining quantity weights had been largely completed for England, France, and Italy.

It was explained that the proposed international index would not be a single index of world prices, but a group of index numbers for different countries, all constructed in the same fashion and with the same base year, the same type of quotations, and approximately the same number of commodities. The plans contemplated the inclusion in the index for each country of a certain number of commodities of special importance in its economic life, as well as the use of many staple articles in all the indexes.

Classification of commodities.—The system of classification of commodities adopted for the international index conforms in part to that used by the board for domestic wholesale prices, i. e., (1) raw materials, (2) producers' goods, and (3) consumers' goods. An additional classification was made in the case of the international index, viz, (1) goods produced, (2) goods imported, (3) goods consumed, and (4) goods exported.

Period covered and base year.—The index number for the United States covers the months of 1913 and all months since January, 1919. No effort was made to follow prices through the war period from 1914 to 1918. In computing the index number the prewar year 1913 was used as the base and prices in each month were measured in terms of that year.

Source of price quotations.—It is stated that quotations for the United States index have been obtained for the most part from trade journals, although a considerable number have been furnished by private firms. In general the sources are the same as those used by the Price Section of the War Industries Board in its study of prices during the war. In many cases the quotations are the same as those used by the Bureau of Labor Statistics and are supplied by that bureau. In all instances the effort is made to obtain the most representative quotations for each commodity line.

Number and kind of commodities included.—In constructing the index number for the United States about 60 different commodities were used. Repetition of commodities occurs in the classification according to source and use, but no duplications have been carried into the general index for all commodities. In choosing commodities to represent home production, it is explained that the effort was made to cover the most important agricultural, mineral, and forest products. Quotations were selected, as far as possible, to represent the most common types of the commodities in question. The same method was used also in the case of imported articles, prices of commodities received from leading foreign markets being allowed to stand for the prices of all imports of a particular class.

Weighting.—The system of weighting adopted for the index is said to be based upon the simple equation: The quantity of goods produced in a year plus the quantity imported equals the quantity consumed plus the quantity exported. Figures for the year 1913 were used for weighting purposes since, in most countries, that represents the most recent normal business year.

In applying the weights to the prices, the commodity quoted was allowed to represent other commodities in the same general class.

For example, the weight assigned to crude petroleum in the production index was the total production of petroleum in the United States, and not merely the production in the two fields for which prices were taken. A slightly different method was followed in the case of petroleum products and hides and skins, the quotations for which represented all but a small proportion of the total production of such commodities and were therefore weighted by the production of each kind instead of all kinds combined. It is stated that the production and consumption weights are only approximately correct, as it was necessary to resort to estimates in a large number of instances.

The method used for obtaining the weighted index number was that of multiplying the price of each commodity each month by its proper weight, adding the several results for each month together, and then converting the money aggregates into relatives or index numbers on the 1913 base. The all-commodities index was obtained by converting the sum of the aggregates of goods produced plus goods imported to index numbers in like manner.

Table 5 has been reproduced from the Federal Reserve Bulletin for March, 1921 (p. 330):

TABLE 5.—INDEX NUMBERS OF WHOLESALE PRICES IN UNITED STATES—CONSTRUCTED BY THE FEDERAL RESERVE BOARD FOR THE PURPOSE OF INTERNATIONAL COMPARISON.

(Average price for 1913=100.)

Date.	Goods produced.	Imported.	Exported.	Consumed.	Raw materials.	Producers' goods.	Consumers' goods.	All commodities.
1913								
Average for the year..	100	100	100	100	100	100	100	100
1919								
Average for the year..	209	174	214	206	209	198	207	206
1920								
January.....	244	212	255	240	245	236	240	242
February.....	244	216	252	242	242	247	240	242
March.....	250	218	256	247	246	263	241	248
April.....	265	242	264	263	263	274	257	263
May.....	266	246	262	264	263	274	261	264
June.....	260	226	256	257	258	265	255	258
July.....	253	208	248	249	249	251	250	250
August.....	238	182	229	234	237	235	229	234
September.....	231	164	211	227	233	225	218	226
October.....	213	142	181	211	211	209	203	208
November.....	195	127	163	193	192	190	187	190
December.....	178	112	146	176	176	171	171	173
1921								
January.....	168	114	142	166	164	166	163	164

INDEX NUMBERS OF WAR INDUSTRIES BOARD.

PUBLICATION.

An index number of wholesale prices in the United States from 1913 to 1918 was published by the Price Section of the War Industries Board in its series of 57 bulletins issued under the title of "History of Prices during the War."¹¹ These bulletins were prepared early in 1919 and given to the public as fast as they were received from the press. With the dissolution of the War Industries Board in 1919 its publications were suspended.

¹¹ History of Prices During the War, Buls. 1 to 57, Washington, Government Printing Office, 1919.

HISTORY.

In the preparation of the series of bulletins on prices during the war period it was recognized that a definite idea of the general trend of prices in an industry could not easily be gained from a study of the price quotations for individual commodities. Satisfactory comparisons of price fluctuations between two or more industries also could not be made from such data. For persons desiring summaries for an industry or comparisons for several industries index numbers were accordingly provided. These index numbers end with December, 1918, when the work of the War Industries Board was brought to a close.

SOURCE OF QUOTATIONS.

The chief sources drawn upon for price quotations were standard trade journals, newspapers making a specialty of price reporting, manufacturers or merchants, produce exchanges, boards of trade, trade associations, and Government bureaus. In general quotations from business houses of recognized standing were preferred to transcripts from periodicals. All sources used were scrutinized critically and no data were published that were not believed to reflect faithfully the trend of price fluctuations.

BASE PERIOD.

Since the whole inquiry centered about the effect of the war, the charts and index numbers were made to show the movements of prices away from their prewar levels. This was accomplished by using the 12 months from July, 1913, to June, 1914, as the base period in the computations.

PRICES: HOW SHOWN AND COMPUTED.

In the 50 bulletins of the series dealing with classes of closely related commodities average money prices for each commodity are shown for the base period July, 1913, to June, 1914, and for each year and quarter of the period covered. Money prices are also shown for each month, these being averages of weekly quotations in some instances and prices on a particular day of the month in other instances. Each price is the average of the high and low quotations on the day chosen. It is stated that variations in the method of compiling prices were necessary because of the diverse sources from which they were taken.¹²

In the several bulletins containing summaries for important groups of commodities, as foods, clothing, and building materials, as well as in the general summary, no absolute prices are shown, but the information is presented in the form of index numbers for each group, by years, quarters, and months.

NUMBER AND CLASS OF COMMODITIES.

It is stated in the introduction to the series of bulletins that in order to make the investigation widely serviceable it was desired to include as many industries and commodities as possible. The

¹² See Bulletin No. 8, Prices of Feed and Forage, p. 16.

plan adopted called for quotations on a much larger number of commodities than had been included in other price investigations. Table 6, taken from Bulletin No. 1 (page 5) shows the 50 classes of commodities treated and the number in each class. Each individual series of price quotations, not made by averaging other series shown in the price table, is counted as one "commodity." The consecutive numbers 8 to 57 assigned to the various classes shown in the table are those of the bulletins in which the classes are treated.

TABLE 6.—THE 50 CLASSES OF COMMODITIES COVERED BY THE "HISTORY OF PRICES DURING THE WAR" AND THE NUMBER OF COMMODITIES INCLUDED IN EACH CLASS.

Class.	Number of commodities.	Number of averages.	Class.	Number of commodities.	Number of averages.
<i>Food group.</i>			<i>Fuels group—Concluded.</i>		
(8) Feed and forage.....	23		(37) Matches.....	9	
(9) Wheat and wheat products.....	20		Total.....	65	1
(10) Corn and corn products.....	21		<i>Building materials group.</i>		
(11) Oats, rice, buckwheat, and their products.....	15		(38) Clay products.....	30	
(12) Barley, hops, rye, and their products.....	8		(39) Sand and gravel.....	10	
(13) Sugar and related products.....	10		(40) Quarry products.....	20	
(14) Vegetables and truck.....	21		(41) Cement.....	10	
(15) Edible vegetable oils.....	18		(42) Glass.....	10	
(16) Fruits, nuts, and wine.....	20		(43) Lumber.....	65	
(17) Spices and condiments.....	10		(44) Paints and varnishes.....	32	
(18) Tea, coffee, and cocoa.....	20		Total.....	177	
(19) Tobacco, and tobacco products.....	14	1	<i>Chemicals group.</i>		
(20) Live stock, meats, and fats.....	58		(45) Mineral acids.....	12	
(21) Poultry and dairy products.....	48		(46) Heavy chemicals.....	13	
(22) Fish and oysters.....	20		(47) Miscellaneous inorganic chemicals.....	20	
Total.....	332	1	(48) Fertilizers.....	28	
<i>Clothing group.</i>			(49) Soaps and glycerin.....	34	1
(23) Cotton and cotton products.....	91		(50) Essential oils, flavoring and perfumery materials.....	20	
(24) Wool and wool products.....	66		(51) Wood distillation products and naval stores.....	11	
(25) Silk and silk products.....	54	13	(52) Natural dyestuffs and tanning materials.....	19	
(26) Hides and skins and their products.....	157	32	(53) Coal-tar crudes, intermediates, and dyes.....	38	
(27) Hatter's fur and fur felt hats.....	10		(54) Drugs and pharmaceuticals.....	27	
(28) Hair, bristles, and feathers.....	22		(55) Proprietary preparations.....	24	
(29) Buttons.....	20		(56) Explosives.....	21	
Total.....	420	45	(57) Miscellaneous organic chemicals.....	14	
<i>Rubber, paper, and fibers group.</i>			Total.....	281	1
(30) Rubber and rubber products.....	34	4	<i>Recapitulation.</i>		
(31) Paper.....	25	5	Food group.....	332	1
(32) Fiber and fiber products.....	45	10	Clothing group.....	420	45
Total.....	104	19	Rubber, paper, and fibers group.....	104	19
<i>Metals group.</i>			Metals group.....	117	1
(33) Iron, steel, and their products.....	89		Fuels group.....	65	1
(34) Ferroalloys, nonferrous and rare metals.....	28	1	Building materials group.....	177	
Total.....	117	1	Chemicals group.....	281	1
<i>Fuels group.</i>			Total.....	1,496	68
(35) Coal and coke.....	26	1	Less duplications.....	22	
(36) Petroleum and petroleum products.....	30		Number of commodities quoted.....	1,474	

In addition to the 1,474 commodities included in the above table, a considerable number of American commodities are to be found in the bulletin on international price comparisons.¹³ These were not used in calculating the index numbers. Of the 1,474 commodities in the table, 108 were not included in the index numbers because they are not in the market at certain seasons of the year, or for other reasons.

DESCRIPTION AND GROUPING OF COMMODITIES.

The individual commodities making up the 50 classes shown in the table are described in more or less detail in the box heads over the tables of average prices in the various bulletins. The grouping adopted is seen in the foregoing table.

SUBSTITUTIONS AND ADDITIONS.

Owing to the comparatively short period of time covered by the index numbers, additions to the list of commodities or substitutions of one article for another were unnecessary. The ability to obtain continuous price quotations for the entire six-year period was a prerequisite in the selection of commodities.

INTERPOLATION.

In the preparation of the bulletins it was found necessary "to treat some of the series rather freely by interpolation to fill gaps, and occasionally splicing two series together, with allowance for a price differential. Attention is called to all such cases by footnotes in the tables. When a choice had to be made between omitting some important commodity altogether or working up quotations that are not perfectly regular, the latter course was chosen."¹⁴

WEIGHTING.

The method of weighting employed in the construction of the index numbers is explained as follows:¹⁵

The index numbers show the average fluctuations of all the commodities quoted to represent an industry. To make averages which fairly reflect business conditions, it is obviously necessary to give each commodity included in an index number an influence upon the result proportioned to its industrial importance. The meaning of the figures can best be grasped by noting the process by which they are made.

First, the monthly prices of all the commodities to be included in the industry were entered in parallel columns on large sheets. Second, an estimate was made for each commodity showing the quantity produced in the United States in 1917, plus the quantity imported in that calendar year. These estimates are technically called "Weights." Third, the price of each commodity each month was multiplied by its respective weight. Fourth, the products of the different commodity prices times commodity weights were cast up separately for each of the 72 months from January, 1913, to December, 1918. Finally, the resulting aggregates in dollars and cents were turned into relatives on the plan followed in converting actual commodity prices into relative price for charting. That is, the average of the aggregates for the industry in the 12 months July, 1913, to June, 1914, was called 100, and the aggregate for each month from January, 1913, to December, 1918, was turned into a relative figure on that scale.

One deviation from the standard practice should be noted. The materials bought by any industry were weighted, not by production plus imports, but by the estimated quantity consumed in that particular branch of trade.

The year 1917 was chosen as the base year for weighting because the inquiry aims to show prices under wartime conditions. Data for 1918 might have been still more ap-

¹³ See War Industries Board Price Bulletin No. 2.

¹⁴ War Industries Board Price Bulletin No. 1, p. 7.

¹⁵ Idem, No. 1, pp. 9, 10.

appropriate, but they could not be had for many commodities at the time these bulletins were being compiled. It was often difficult to find or make estimates of domestic production even for 1917, and many of the weights are subject to a wide margin of uncertainty. Whenever it was necessary to choose between guessing a weight or omitting a commodity, a guess was made and the commodity included.

There is an element of unreality in multiplying 1913 prices by quantities produced and imported in 1917. But it is clearly desirable to keep the weights constant for the whole period covered. If one desires to know how prices have changed, then prices must be the only variable admitted into his computations. If he changes the weights each year as well as the prices, then he can not tell what part of the results reached is due to alterations in production and imports and what part is due to price fluctuations. As matters stand, the results are unambiguous—they show the changes in prices and nothing but that.

Made in the fashion described, the index numbers for the 50 classes of commodities are strictly comparable not only among themselves but also with the relative prices of single commodities shown by the charts. The particular form of index adopted—the weighted aggregate of actual prices reduced to relatives at the end of the computation—is like the relative prices of single commodities even in this respect, that it can be shifted about from one base to another without a tacit alteration of the weights.¹⁶ Thus, the reader who so desires can make his comparisons in terms of prices in 1918 or any other year or month covered, by taking the relative figure for his desired base as 100 and converting the other figures into new relatives on the new base.¹⁷

The foregoing explanation relates to the manner in which the index numbers for the 50 classes of commodities were obtained. To obtain the index numbers for the 7 industry groups and for all commodities combined a further step was deemed necessary. It is explained that¹⁸—

The statistical materials available concerning the 50 classes of commodities included in this survey vary so much that strictly uniform treatment of all classes is impossible. In some industries one can obtain prices which represent nearly 100 per cent of the business; in other cases the available quotations represent less than 25 per cent. Sometimes a large part of the goods can be quoted first as raw materials, second as intermediate products, and third as finished goods; for example, raw cotton, cotton yarns, and cotton textiles, or coal-tar crudes, intermediates, and dyes. In other cases, for example, fertilizers, no satisfactory figures can be had except for the materials, and in still other cases the finished goods alone can be quoted. A further source of difficulty is that the "contract" prices at which the bulk of the business is done in certain industries are confidential and to use the market prices which are available gives these trades exaggerated importance in such a period as 1913-1918 when the market ran far ahead of the contract prices. The class of mineral acids is a case in point. Finally, in some industries most of the raw materials and even of the intermediate products are not sold but used by their producers in further manufacturing processes, while in other industries each stage of manufacture brings a transfer of goods to new owners. If an index number is to represent the average change in the prices that are actually paid and received, an effort should be made to differentiate between trades which call for the payment of several prices between the first producer and the final customer and highly integrated trades where the whole process of manufacture is performed by a single business concern.

To repeat, these differences among industries in respect to business organization, the abundance or scantiness of quotations, and the importance of confidential contract prices make it impossible to follow a uniform plan in collecting prices. In each industry the investigator must conform to the conditions which prevail and accept the quotations which are available. Yet if the data thus collected are simply added together, the industries for which quotations are abundant will be overweighted and others underweighted in the grand average.

The only way to overcome this difficulty is to use a second set of weights. Just as "commodity weights" were employed to secure each article quoted its due influence upon the index numbers of the class to which it belongs, so "class weights" can be employed to secure each class its due influence upon the index numbers for "all commodities."

¹⁶ For a discussion of this somewhat technical point see "The making and using of index numbers," in Bulletin No. 173 of the Bureau of Labor Statistics, pp. 33-44, 91.

¹⁷ Of the 1,474 different commodities quoted in the class bulletins, 108 are not included in the index numbers because they are not in the market at certain seasons of the year, or for other reasons. Attention is called to all such omissions in the appropriate places.

¹⁸ War Industries Board Price Bulletin No. 1, pp. 22-23.

The class weights were obtained by dividing the estimated value of the goods represented in each class by the class aggregate, i. e., the total found by adding the products of commodity prices times commodity weights. The quotients thus found were used to multiply the class aggregates in each month from January, 1913, to December, 1918, and the results were then added together to make totals for the 7 groups and for all commodities. The index numbers for the 7 groups and for all commodities combined were made like the index numbers for the 50 classes by treating the average totals for July, 1913, to June, 1914, as 100 and turning the totals for the 72 months covered into relatives on that scale. It is stated that ¹⁹—

A high degree of accuracy is not claimed for the result. Some of the values may be in error by a wide margin—there is no way of telling just how wide except by taking a census not only of manufactures, but also of farming, lumbering, mining, and fishing, with the classification here used as a base. All that is really required for the present purpose, however, is a ranking of the industries in the order of their importance, and the estimates made are believed to suffice for that. Rough as it is, the system of class weights is much more trustworthy than the haphazard weighting of classes which would result from merely adding class aggregates.

TESTING.

A comparison of the Price Section (War Industries Board) series with those of the Bureau of Labor Statistics, Bradstreet's, and Dun's for the years 1913 to 1918, is contained in Table 7, taken from page 28 of the summary bulletin.

TABLE 7.—COMPARISON OF FOUR AMERICAN INDEX NUMBERS, BY YEARS, 1913 TO 1918.
(Average prices in July, 1913, to June, 1914=100.)

Year.	The four index numbers on the 1913-14 base.				Rise (+) or fall (-) of prices as compared with year preceding.			
	Price Section index.	Bureau of Labor Statistics index.	Bradstreet's index.	Dun's index.	Price Section index.	Bureau of Labor Statistics index.	Bradstreet's index.	Dun's index.
1913.....	101	100	103	99				
1914.....	99	99	100	101	- 2	- 1	- 3	+ 2
1915.....	102	100	110	104	+ 3	+ 1	+10	+ 3
1916.....	126	123	132	122	+24	+23	+22	+18
1917.....	175	175	175	168	+49	+52	+43	+46
1918.....	194	197	209	189	+19	+22	+34	+21

Differences among the Series.

Index number.	Average differences.				Maximum differences.			
	Price Section from—	Bureau of Labor Statistics from—	Bradstreet's from—	Dun's from—	Price Section from—	Bureau of Labor Statistics from—	Bradstreet's from—	Dun's from—
Price Section.....	0.0	1.5	5.3	3.7	0.0	3.0	15.0	7.0
Bureau of Labor Statistics.....	1.5	.0	5.8	3.8	3.0	.0	12.0	8.0
Bradstreet's.....	5.3	5.8	.0	8.0	15.0	12.0	.0	20.0
Dun's.....	3.7	3.8	8.0	.0	7.0	8.0	20.0	.0
Averages of differences.....	3.5	3.7	6.4	5.2	8.3	7.7	15.7	11.7

¹⁹ War Industries Board Price Bulletin No. 1, p. 25.

Table 8, also taken from the summary bulletin (p. 30), the Bureau of Labor Statistics series and the Price Section series are compared by years, quarters, and months of the period 1913 to 1918.

TABLE 8.—COMPARISON OF THE INDEX NUMBERS OF ALL COMMODITIES COMPILED BY THE BUREAU OF LABOR STATISTICS AND BY THE PRICE SECTION OF THE WAR INDUSTRIES BOARD, BY MONTHS, QUARTERS, AND YEARS, 1913 TO 1918.

(Average prices in July, 1913, to June, 1914=100.)

Period.	1913		1914		1915		1916		1917		1918	
	Bureau of Labor Statistics.	Price Section.	Bureau of Labor Statistics.	Price Section.	Bureau of Labor Statistics.	Price Section.	Bureau of Labor Statistics.	Price Section.	Bureau of Labor Statistics.	Price Section.	Bureau of Labor Statistics.	Price Section.
Year.....	100	101	99	99	100	102	123	126	175	175	197	194
Quarter:												
First.....	99	102	99	100	99	100	112	118	155	152	186	187
Second.....	99	100	98	97	99	100	117	123	179	177	192	190
Third.....	101	101	101	100	100	102	123	125	184	187	202	197
Fourth.....	100	102	98	98	103	107	141	139	181	182	205	202
Month:												
January.....	99	103	100	100	98	100	110	115	150	148	185	185
February.....	100	102	99	100	100	100	111	118	155	151	187	187
March.....	99	102	99	99	99	100	114	121	160	156	187	188
April.....	98	101	98	98	99	100	116	123	171	170	191	191
May.....	98	100	98	97	100	100	118	123	181	178	191	190
June.....	100	100	98	97	99	100	118	122	184	183	193	189
July.....	101	100	99	97	101	102	119	123	185	189	198	193
August.....	101	101	102	101	100	102	123	125	184	197	202	196
September.....	102	102	103	101	98	102	127	127	182	186	207	201
October.....	101	102	99	99	101	104	133	132	180	182	204	201
November.....	101	102	98	98	102	107	143	141	182	183	206	201
December.....	99	101	97	98	105	111	146	144	181	182	206	203

Comparisons are also made with the Sauerbeck-Statist series for England, the General Statistical Office series for France, and the Department of Labor series for Canada.

TABLES OF RESULTS.

Table 9, taken from the summary bulletin,²⁰ shows the index numbers of all commodities combined and of the seven main industry groups, also index numbers of products used for the three purposes stated, for the period 1913 to 1918.

²⁰ War Industries Board Price Bulletin No. 1, pp. 52 and 53.

TABLE 9.—INDEX NUMBERS OF SEVEN GROUPS AND OF ALL COMMODITIES, BY MONTHS, QUARTERS, AND YEARS, 1913 TO 1918.

(Average prices in July, 1913, to June, 1914=100.)

Period.	All commodities.	Food group.	Clothing group.	Rubber, paper, fibers.	Metals group.	Fuels group.	Building materials group.	Chemicals group.	Products used for food.	Products used for clothing.	Products used for building.
<i>Year.</i>											
1913.....	101	99	101	106	110	101	103	102	99	101	104
1914.....	99	101	96	98	93	95	98	101	101	98	97
1915.....	102	102	97	91	108	89	96	145	100	99	98
1916.....	126	115	125	114	174	112	114	179	115	121	127
1917.....	175	162	177	145	262	158	148	176	159	169	168
1918.....	194	186	227	160	211	196	179	189	184	223	188
<i>Quarter.</i>											
1913, First.....	102	97	101	113	118	102	104	103	97	102	106
Second.....	100	96	100	106	113	101	105	103	95	101	107
Third.....	101	99	100	103	109	101	103	102	99	101	104
Fourth.....	102	103	101	101	100	101	100	100	103	101	100
1914, First.....	100	101	99	98	97	101	99	99	102	99	98
Second.....	97	98	99	98	94	96	98	99	96	99	97
Third.....	100	103	98	99	93	93	98	101	103	99	97
Fourth.....	98	104	89	99	89	91	95	105	105	96	93
1915, First.....	100	105	91	93	93	89	93	125	103	96	93
Second.....	100	102	95	90	102	85	94	134	98	98	95
Third.....	102	101	97	90	111	87	95	149	98	99	98
Fourth.....	107	101	105	93	125	96	102	171	102	103	107
1916, First.....	118	106	112	106	155	107	110	196	105	111	120
Second.....	123	109	118	112	171	113	113	190	107	116	128
Third.....	125	115	125	114	171	111	112	168	115	122	126
Fourth.....	139	128	145	124	199	118	118	162	131	135	134
1917, First.....	152	137	156	141	235	131	130	158	139	149	146
Second.....	177	162	168	147	266	170	148	170	161	160	172
Third.....	187	169	188	145	310	167	155	184	163	178	186
Fourth.....	182	178	198	146	215	167	158	192	175	188	168
1918, First.....	187	183	213	149	209	174	167	190	180	205	175
Second.....	190	177	227	161	209	202	179	190	173	223	188
Third.....	197	188	235	165	213	202	184	186	183	231	194
Fourth.....	202	197	234	163	214	207	185	189	200	231	193
<i>Month.</i>											
1913, January.....	103	98	102	114	120	102	104	103	99	102	105
February.....	102	96	102	113	118	101	104	104	97	102	106
March.....	102	97	101	112	116	101	105	104	96	102	107
April.....	101	97	100	107	114	101	105	103	97	101	107
May.....	100	95	100	105	113	101	105	103	94	101	107
June.....	100	96	99	105	111	101	105	102	95	101	107
July.....	100	96	99	104	110	101	102	102	96	101	104
August.....	101	100	100	104	110	102	102	101	99	101	104
September.....	102	102	100	103	108	102	103	101	101	101	104
October.....	102	102	103	102	105	102	100	100	102	101	101
November.....	102	103	102	101	100	102	100	100	104	101	100
December.....	101	102	100	99	96	101	100	101	104	101	99
1914, January.....	100	101	99	98	96	101	99	99	103	99	98
February.....	106	101	99	98	98	100	99	99	102	99	98
March.....	99	100	100	98	97	100	99	100	99	99	99
April.....	98	98	99	99	96	98	99	99	97	99	98
May.....	97	98	99	98	92	96	98	98	95	99	97
June.....	97	97	100	97	93	95	98	99	96	99	97
July.....	97	98	100	96	91	94	98	98	98	99	97
August.....	101	105	99	101	94	94	98	99	104	99	98
September.....	101	107	94	100	93	92	98	106	106	99	98
October.....	99	104	91	98	91	91	96	105	105	97	95
November.....	98	103	88	98	89	91	95	106	105	95	94
December.....	98	104	89	100	89	91	94	105	104	95	92

TABLE 9.—INDEX NUMBERS OF SEVEN GROUPS AND OF ALL COMMODITIES, BY MONTHS, QUARTERS, AND YEARS, 1913 TO 1918—Concluded.

Period.	All commodities.	Food group.	Clothing group.	Rubber, paper, fibers.	Metals group.	Fuels group.	Building materials group.	Chemicals group.	Products used for food.	Products used for clothing.	Products used for building.
<i>Month—Concluded.</i>											
1915, January.....	100	105	90	100	91	90	93	123	105	95	93
February.....	100	106	92	90	93	89	93	126	104	95	94
March.....	100	105	92	90	95	88	93	126	102	96	94
April.....	100	103	93	90	98	85	93	133	99	97	94
May.....	100	103	95	90	101	85	94	132	98	98	95
June.....	100	100	95	90	106	83	94	137	96	98	95
July.....	102	103	96	91	110	85	96	146	99	99	98
August.....	102	101	96	90	110	86	95	148	98	99	98
September.....	102	99	98	89	114	90	95	155	97	100	98
October.....	104	99	103	90	116	92	101	162	99	101	105
November.....	107	102	106	92	124	95	101	172	103	103	107
December.....	111	103	107	95	136	100	102	178	105	104	109
1916, January.....	115	105	110	103	147	106	109	189	105	109	117
February.....	118	106	113	104	154	107	111	200	105	111	120
March.....	121	106	115	109	168	109	112	201	106	113	123
April.....	123	109	116	112	174	112	113	198	107	114	127
May.....	123	109	118	112	171	113	113	188	107	116	128
June.....	122	109	120	111	169	113	113	185	107	117	128
July.....	123	111	122	112	167	113	112	175	111	119	126
August.....	125	115	125	114	170	110	112	166	115	123	126
September.....	127	118	129	117	172	109	112	162	119	125	127
October.....	132	125	135	120	176	111	116	162	127	130	131
November.....	141	130	146	123	202	120	118	163	133	136	134
December.....	144	129	154	129	218	122	119	162	133	139	137
1917, January.....	148	133	155	138	226	129	129	159	135	147	144
February.....	151	136	156	141	234	133	130	157	138	149	146
March.....	156	142	157	143	247	131	132	159	144	152	149
April.....	170	157	163	146	260	163	146	163	157	156	164
May.....	178	166	167	148	276	172	148	172	165	158	171
June.....	183	164	174	147	315	173	151	174	161	166	180
July.....	189	167	187	144	333	168	155	180	160	173	188
August.....	187	168	189	143	313	169	155	183	162	178	188
September.....	186	173	189	149	283	165	156	190	165	182	182
October.....	182	177	191	147	228	164	157	193	174	186	168
November.....	183	182	199	146	209	167	159	191	176	187	168
December.....	182	178	202	145	208	170	159	193	176	190	169
1918, January.....	185	152	209	148	208	173	165	186	182	200	173
February.....	187	184	212	148	209	174	165	192	182	204	174
March.....	188	182	218	150	209	175	169	192	178	210	178
April.....	191	180	218	155	208	200	176	192	176	220	186
May.....	190	177	226	162	209	204	179	190	173	223	188
June.....	189	175	228	165	210	202	181	189	169	226	190
July.....	193	182	233	164	212	201	182	184	176	231	192
August.....	196	187	234	166	214	202	184	186	183	235	194
September.....	201	194	237	166	214	204	186	188	190	229	196
October.....	201	195	238	165	216	204	185	190	195	230	193
November.....	201	194	234	163	216	207	186	193	200	231	193
December.....	203	202	230	162	211	207	185	183	205	231	192

INDEX NUMBERS OF THE UNITED STATES FOOD ADMINISTRATION.

PUBLICATION.

A series of index numbers of wholesale prices extending over a period of seven and a half years was published by the United States Food Administration in a pamphlet entitled "General Index Numbers of Food Prices on a Nutritive Value Base," issued in August, 1918.²¹ A comparable series of index numbers of producers' prices, based on figures from the Monthly Crop Reports of the United States

²¹ By Raymond Pearl, chief of the statistical division of the United States Food Administration.

Department of Agriculture, was also included in the publication. No subsequent presentation of either of these index number series has been made.

HISTORY.

In April, 1918, the Food Administration published in a preliminary way the results of certain computations in which food articles were assigned varying degrees of importance in accordance with their respective nutritive values. The pamphlet published in August contained a careful revision of the whole subject, with detailed data as to methods, weighting, etc.

SOURCE OF QUOTATIONS.

The price quotations used in calculating these index numbers were taken from the weekly report on wholesale prices of the Food Administration issued in manuscript to certain of its members, but not published. Most of the quotations used were obtained originally from trade journal sources, some being supplied by manufacturers or dealers.

BASE PERIOD.

The three years preceding the war, viz, 1911, 1912, and 1913, constitute the base period from which changes in the price level were measured.

PRICES: HOW SHOWN AND COMPUTED.

No actual money prices are published in connection with the tables of index numbers. It is stated, however, that a weekly range of prices was obtained for all the commodities on the list. In most cases Saturday quotations were used, because the majority of the weekly trade papers close their columns on that day. For the sake of uniformity quotations from daily papers were also taken on Saturday. The weekly quotations on each commodity were averaged for each month.

NUMBER AND CLASS OF COMMODITIES.

Twenty-six commodities were included in calculating the index number of wholesale prices. These represent for the most part manufactured rather than raw food products.

DESCRIPTION AND GROUPING OF COMMODITIES.

Table 10, which is reproduced as published, shows the principal facts concerning the data on which the index numbers are based.

TABLE 10.—QUOTATIONS, DESCRIPTIONS, AND SOURCES OF PRICES.

Commodity.	Description. ¹	Price.	Taken.	Source.	Unit.	Calculations.
Wheat flour..	100 per cent spring, in 98-pound cottons. ²	Mill price f. o. b. Minneapolis.	Saturday.	Northwestern Miller.	Bbl.	Weekly quotations averaged for the month.
Rye flour....	In jute, car lots.	Jobber's price f. o. b. New York.	...do....	...do.....	Bbl.	Do.
Oatmeal.....	Cartoad lots, in barrels.	Jobber's price to retailer f. o. b. New York.	Saturday issue.	New York Commercial.	Cwt.	Do.
Corn meal....	White, in bulk.	Mill price f. o. b. Terre Haute.	Saturday.	Furnished by the mill.	Cwt.	Do.

¹ All descriptions as written are for current quotations.

² Quotations were taken on "standard patent" until issue of Jan. 2, 1918; on "standard war flour" until issue of Mar. 27, 1918, and standard 100 per cent subsequently.

TABLE 10.—QUOTATIONS, DESCRIPTIONS, AND SOURCES OF PRICES—Concluded.

Commodity.	Description.	Price.	Taken.	Source.	Unit.	Calculations.
Sugar.....	Granulated, refined, in 100-pound bags.	Refiner's price, net, f. o. b. New York.	Saturday	Weekly Statistical Sugar Trade Journal.	Cwt.	Weekly quotations averaged for the month; current price fixed.
Potatoes, U. S. average.	White, bulk or sacked.	Wholesaler's price f. o. b. New York and Chicago. ³	Saturday issue.	Journal of Commerce and Daily Trade Bulletin.	Cwt.	Average of New York and Chicago weekly quotations averaged for the month.
Onions.....	Yellow, bulk or sacked.	.....do.....	.....do.....	Producer's Price Current and Daily Trade Bulletin.	Cwt.	Do.
Beans, navy or pea.	Michigan.....	Jobber's price f. o. b. Michigan.	Saturday.	Furnished by bean jobbers.	Cwt.	Weekly quotations averaged for the month.
Peanuts.....	No. 1 and No. 2. ⁴	F. o. b. Norfolk...	.....do.....	Virginian-Pilof...	Lb..	Weekly average of range of No. 1 and No. 2 averaged for the month.
Rice.....	Honduras, cleaned, domestic.	New Orleans.....	.....do.....	New Orleans Board of Trade.	Lb..	Weekly quotations averaged for the month.
Milk, evaporated.	In 48 16-ounce tins.	Manufacturer's price delivered New York.	.....do.....	Furnished by the manufacturer. ⁵	Case.	Do.
Milk, condensed.	Sweetened, in 48 14-ounce tins.	.....do.....	.....do.....	.....do.....	Case	Do.
Eggs.....	Fresh, firsts...	Wholesaler's price f. o. b. New York. ³	Saturday issue.	Producer's Price-Current (Urner-Barry.)	Doz.	Taken from Urner-Barry Statistical Review of New York Market.
Butter.....	Fresh, 92 score.	.....do.....	.....do.....	.....do.....	Lb..	Do.
Cheese.....	Fresh, flats, average run.	.....do.....	.....do.....	.....do.....	Lb..	Weekly quotations averaged for the month.
Margarine....	Standard high grade, in 60-pound tubs.	Manufacturer's price, net f. o. b. Chicago.	Saturday.	Furnished by the manufacturer.	Lb..	Do.
Lard.....	Leaf, in 100-pound cans.	Packer's price, f. o. b. Chicago or branch house.	.....do.....	National Provisioner.	Cwt.	Do.
Ham.....	Loose.....	.....do.....	Saturday issue.	Daily Trade Bulletin (Howard, Bartels).	Cwt.	Do.
Bacon.....	Breakfast, loose lots.	.....do.....	.....do.....	.....do.....	Lb..	Do.
Carcass beef..	Good native steers.	.....do.....	Saturday.	National Provisioner.	Lb..	Do.
Mutton.....	Legs.....	.....do.....	.....do.....	.....do.....	Lb..	Do.
Powl.....	Fresh, western, cornfed.	Wholesaler's price f. o. b. New York. ³	Saturday issue.	Producer's Price-Current (Urner-Barry).	Lb..	Taken from Urner-Barry Statistical Review of New York market.
Peas, canned.	Standard Early June No. 2, in case.	Canner's price f. o. b. Baltimore.	Saturday.	Canning trade.....	Doz.	Weekly quotations averaged for the month ⁶
Tomatoes....	Standard, No. 3, in case.	.....do.....	.....do.....	.....do.....	Doz.	Do.
Salmon.....	Alaska pink, tall No. 1, case.	Canner's price f. o. b. coast.	.....do.....	.....do.....	Doz.	Do.
Sardines.....	Oil keyless 100 1/4-inch case.	Canner's price f. o. b. Eastport.	.....do.....	New York Journal of Commerce.	Doz.	Do.

³ Wholesaler, i. e., the receiver of the country produce.

⁴ Previous to Jan. 25, 1913, peanuts No. 1 and No. 2 grades were called "strictly prime" and "prime," respectively.

⁵ Current prices fixed on competitive market conditions.

⁶ Based on the views of the Federal Trade Commission of reasonable profit and the Food Administration's valuation of reasonable crop-hazard insurance. United States Food Administration, Canned Goods Division. Bulletin No. 38.

SUBSTITUTIONS AND ADDITIONS.

It is stated that the prices are in most cases quoted from the same source and for the same grade of commodity throughout the entire period. In a few cases, where it was impossible to get consecutive prices on a particular grade, several quotations were spliced. No substitutions of one article for another was made, nor were there any additions to the list of articles during the period covered.

INTERPOLATION.

In a few instances the particular grade of a commodity on which prices were being secured was out of the market for one or two months of that period. In such cases, the quotations immediately preceding and following the gap were averaged to supply the deficiency.

WEIGHTING.

A distinguishing characteristic of these index numbers is the system of weighting adopted. The food value of the average production of each commodity during the base period 1911-1913 (except in a few cases where crop years were used) was expressed in calories and the value of wheat so expressed was taken as 100. The value of the other commodities was each in turn related to the value of wheat. The resulting relative figures were then divided by the number of pounds in the unit used for price quotations to obtain the weighting factor. For example, the relative food value of wheat flour as compared with wheat, based on calories, was found to be in the ratio of 61.69 to 100. Dividing 61.69 by 196 (the number of pounds of wheat flour in a barrel) yields 0.3147 as the weighting factor for the barrel price of that commodity. Similar weighting factors were worked out for the other commodities in the list. Each commodity price was then multiplied by its appropriate weighting factor, the several results added, and their sum divided by the sum of the weights to produce the absolute index number. The following formula illustrates the method employed:

$$I = \frac{(a_1 \times b_1) + (a_2 \times b_2) + \dots + (a_n \times b_n)}{b_1 + b_2 + \dots + b_n}$$

where I is the absolute index number, a is the quoted price in whatever unit given of a commodity denoted by the subscript 1, and b is the weighting factor for the same commodity. "In other words, the absolute wholesale index number is the weighted average price per pound of the several commodities entering into the index, when the weighting of each quoted commodity price is in proportion to the food value, expressed in calories, of the average production of that commodity in the three years preceding the war. The technical student in examining these indices critically should not forget that the necessary adjustment for difference in the units on which prices of different commodities are quoted (e. g., barrel, bushel, hundredweight, pound, etc.) is incorporated in the weighting factor, to the end of simplicity in computation."²² Most of the food values used were taken from *The Chemical Composition of American Food*

²² General Index Numbers of Food Prices on a Nutritive Value Base, p. 4. United States Food Administration, Washington, D. C., August, 1918.

Materials, by W. O. Atwater and A. P. Bryant. Absolute index numbers were reduced to relatives of the 1911-1913 base by dividing each absolute figure by the average of the absolute figures for the three years named.

TESTING.

No comparison of these index numbers with other wholesale price series is made in the publication, nor is any other form of testing employed. Index numbers of producer's prices are, however, published in connection with those of wholesale prices.

TABLES OF RESULTS.

Tables 11 and 12, showing the producer's and the wholesale price index numbers for each month from January, 1911, to May, 1918, are reproduced from page 8 of the pamphlet.

TABLE 11.—RELATIVE PRODUCER'S PRICE INDEX.

(Average prices in 1911-1913=100.)

Month.	1911	1912	1913	1914	1915	1916	1917	1918
January.....	92	103	90	106	115	108	149	217
February.....	89	101	92	106	115	108	157	218
March.....	88	107	93	106	114	114	171	218
April.....	88	116	96	106	117	114	210	219
May.....	88	117	96	107	116	110	216	218
June.....	92	113	99	106	111	113	212	.....
July.....	97	109	101	107	112	118	229	.....
August.....	99	106	108	115	107	126	215	.....
September.....	101	103	109	114	103	130	219	.....
October.....	100	99	106	108	101	136	206	.....
November.....	100	91	107	106	98	142	196	.....
December.....	100	90	106	108	102	141	204	.....

TABLE 12.—RELATIVE WHOLESALE PRICE INDEX.

(Average prices in 1911-1913=100.)

Month.	1911	1912	1913	1914	1915	1916	1917	1918
January.....	97	106	102	101	113	114	146	190
February.....	92	103	101	99	114	114	152	191
March.....	90	102	101	97	109	116	157	178
April.....	87	104	101	94	111	120	179	180
May.....	88	104	98	96	111	120	193	179
June.....	89	101	98	97	106	118	185	.....
July.....	93	99	99	99	106	120	177	.....
August.....	98	100	100	111	102	127	184	.....
September.....	101	103	102	116	99	132	188	.....
October.....	104	105	101	112	105	143	188	.....
November.....	105	105	104	113	109	149	188	.....
December.....	106	106	103	112	114	144	191	.....

INDEX NUMBERS OF THE UNITED STATES SENATE COMMITTEE ON FINANCE.²³

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

²³ 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.

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.²⁴

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 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."²⁵

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."²⁶ For this reason the year 1860, which would include most of the figures presented, was considered prefer-

²⁴ University of California Publications in Economics, vol. 1, Mar. 27, 1908.

²⁵ Report from the Committee on Finance of the United States Senate on Wholesale Prices, Wages, and Transportation, Pt. 1, p. 29

²⁶ *Idem*, p. 28.

able. 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."²⁶

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 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."²⁶

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 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).

²⁶ Report from the Committee on Finance of the United States Senate on Wholesale Prices, Wages, and Transportation, Pt. I, p. 28.

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 hogsheads.

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:
 Pig (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, 2 $\frac{3}{4}$ -inch, 1 blade.

Standard, blackhorn, brass G. S. handle, 3 $\frac{1}{2}$ -inch, pen, 2 blades.

Standard—

Cocoa, brass G. S. handle, 3 $\frac{1}{4}$ -inch, 2 blades.

Cocoa, brass G. S. handle, 3 $\frac{3}{4}$ -inch, 2 blades.

Cocoa, iron-lined handle, 2 $\frac{3}{4}$ -inch, 1 blade.

Cocoa, iron-lined handle, 3 $\frac{1}{4}$ -inch, 1 blade (two quotations).

Cocoa, iron-lined handle, 3 $\frac{1}{4}$ -inch, 2 blades.

Cocoa, iron-lined handle, 3 $\frac{3}{4}$ -inch, 2 blades.

Cocoa, iron-lined handle, 4-inch, 1 blade.

Ebony, brass G. S. handle, 3 $\frac{1}{4}$ -inch, 2 blades.

Ivory, brass G. S. handle, 3-inch, pen, 2 blades.

Ivory, brass G. S. handle, 3 $\frac{1}{2}$ -inch, pen, 2 blades.

Ivory, brass G. S. handle, 3 $\frac{1}{2}$ -inch, pen, 4 blades.

Ivory, brass G. S. handle, 3 $\frac{1}{2}$ -inch, pen, 3 blades.

Pearl, brass-lined handle, 3 $\frac{1}{4}$ -inch, pen, 3 blades.

Pearl, silver-lined handle, 3 $\frac{1}{4}$ -inch, pen, 3 blades.

Pearl, silver-lined handle, 3 $\frac{1}{4}$ -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, 4 $\frac{1}{2}$ -inch, 3 blades.

Stag, brass-lined handle, 3 $\frac{1}{4}$ -inch, pen, 3 blades.

Stag, brass-lined handle, 3 $\frac{3}{4}$ -inch, pen, 3 blades.

Stag, brass-lined handle, 3 $\frac{3}{4}$ -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, 1 $\frac{1}{4}$ 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.

Plate glass, polished—Concluded.
 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, 3½-foot.
 Glassware:
 Bowls, 8-inch.
 Goblets, common.
 Pitchers, ½-gallon.
 Sets, finished.
 Tumblers, ½-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 Table 13, showing the distribution of expenditure for 2,561 normal families.

TABLE 13.—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 repre-

sent 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.

Table 14 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:

TABLE 14.—RELATIVE PRICES OF ALL ARTICLES IN 1891, MEASURED BY CONSUMPTION.
(Average prices in 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	48.1	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.²⁷

²⁷ Report from the Committee on Finance of the United States Senate on Wholesale Prices, Wages, and Transportation, Pt. I, pp. 226, 227, and 256.

TABLES OF RESULTS.

The index numbers computed by 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 Table 15. The prices are in currency.²⁸

TABLE 15.—RELATIVE PRICES IN EACH YEAR, 1840 TO 1891, FOR ALL ARTICLES GROUPED BY DIFFERENT METHODS.

(Average prices in 1860=100.)

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	165.8
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	121.8	136.1
1846.....	106.4	96.7	95.2	1872.....	138.8	122.2	132.4
1847.....	106.5	96.7	95.2	1873.....	137.5	119.9	129.0
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	128.9
1850.....	102.3	92.6	89.2	1876.....	118.2	115.5	122.6
1851.....	105.9	99.1	93.6	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	96.6	95.0
1854.....	112.9	100.4	105.0	1880.....	106.9	103.4	108.4
1855.....	113.1	106.3	109.2	1881.....	105.7	105.8	104.9
1856.....	113.2	108.5	112.3	1882.....	108.5	106.3	109.1
1857.....	112.5	109.6	114.0	1883.....	106.0	104.5	105.6
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	93.3
1860.....	100.0	100.0	100.0	1886.....	91.9	95.5	93.4
1861.....	100.6	95.9	94.1	1887.....	92.6	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	190.7	232.2	1891.....	92.2	96.2	94.4

A convenient summary of the foregoing table, by periods of five years, is found in Table 16.²⁹

²⁸ Report from the Committee on Finance of the United States Senate on Wholesale Prices, Wages, and Transportation, Pt. I, p. 9.

²⁹ *Idem*, Pt. I, p. 10.

TABLE 16.—RELATIVE PRICES, BY 5-YEAR PERIODS, 1840 TO 1891, FOR ALL ARTICLES GROUPED BY DIFFERENT METHODS.

(Average prices in 1860=100.)

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	96.2
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 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 appears to have been 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 were 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 was 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 1920 and by months from January, 1917, to December, 1920, is shown in Tables 17 and 18 compiled from various issues of the Annalist. The monthly figures here shown have been obtained by averaging the weekly index numbers as published.

TABLE 17.—YEARLY INDEX NUMBERS, 1890 TO 1920.
(Average prices in 1890-1899=100.)

Year.	Index number.	Year.	Index number.	Year.	Index number.
1890.....	109.252	1901.....	104.656	1912.....	143.254
1891.....	119.488	1902.....	116.264	1913.....	139.980
1892.....	108.624	1903.....	107.516	1914.....	146.069
1893.....	116.100	1904.....	108.664	1915.....	148.055
1894.....	102.076	1905.....	110.652	1916.....	175.720
1895.....	94.604	1906.....	114.364	1917.....	261.796
1896.....	80.096	1907.....	117.940	1918.....	287.080
1897.....	84.092	1908.....	125.756	1919.....	295.607
1898.....	92.208	1909.....	133.952	1920.....	282.757
1899.....	93.348	1910.....	137.172		
1900.....	99.388	1911.....	131.068		

TABLE 18.—MONTHLY INDEX NUMBERS, JANUARY, 1917, TO DECEMBER, 1920.
(Average prices in 1890-1899=100.)

Month.	1917	1918	1919	1920
January.....	211.633	279.368	295.323	368.039
February.....	222.585	286.102	281.668	292.504
March.....	237.302	285.838	292.803	297.903
April.....	263.062	290.138	311.243	314.532
May.....	283.876	289.343	315.667	320.825
June.....	277.769	281.003	302.297	321.154
July.....	264.693	283.879	306.133	303.581
August.....	265.835	289.829	307.538	283.359
September.....	273.060	294.300	283.325	267.286
October.....	279.587	284.538	279.791	247.847
November.....	277.972	286.658	280.839	234.544
December.....	280.007	291.365	287.066	208.265

INDEX NUMBERS OF BRADSTREET.

PUBLICATION.

This "index" ³⁰ 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

³⁰ 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. See also pp. 108-112 of this bulletin.

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 100.³¹

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."³¹

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 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 gives 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,

³¹ Bradstreet's, Saturday, Sept. 21, 1895, p. 594.

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 of commodities 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.

- \$0. 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 Beeves, 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 Gingham.
- . 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 March 13, 1920.

Breadstuffs (6 articles).

Wheat, No. 2, red winter, elevator.	Barley, No. 2 (Milwaukee).
Corn, No. 2, mixed, elevator.	Rye, western.
Oats, No. 3, white, 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).	Codfish, large dried.
Milk (New York).	Coffee, Rio, No. 7.
Eggs, State, fresh (New York).	Sugar, standard, 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, choice marrow (New York).
Lard, western steam.	Peas, choice (New York).
Butter, creamery, State, best.	Potatoes, eastern.

Fresh and dried fruits (5 articles).

Apples (State).	Raisins, layer.
Peanuts, fancy, Virginia, in hull.	Currants, new, dried.
Lemons, choice, box.	

Hides and leather (4 articles).

Native steer hides, No. 1.	Union, middlebacks, tannery run.
Hemlock, packer, middle, No. 1.	Oak, scoured backs, No. 1.

Raw and manufactured textiles (11 articles).

Cotton, middling upland.	Silk, shinshiu No. 1, filature.
Wool, Ohio fine unwashed delaine (Boston).	Flax, New Zealand, spot.
Wool, Ohio half-blood unwashed, combed.	Print cloths, 64s (Boston).
Hemp, manila.	Standard sheetings, brown (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 Bessemer (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, beehive (Chattanooga).

Mineral and vegetable oils (6 articles).

Petroleum, crude, barrels (New York).	Cottonseed, crude, prime (New York).
Petroleum, refined, cases.	Castor, No. 1.
Linseed.	Olive, Italian, barrels.

Naval stores (3 articles).

Rosin, good, strained (Savannah).	Tar, regular (Wilmington, N. C.).
Turpentine, machine, regular (Savannah).	

Building materials (8 articles).

Brick, Hudson River, hard.	Glass, window, 10 by 15, box.
Lime, eastern common.	Pine, yellow, 12-inch and under.
Cement, domestic, Portland, spot.	Timber, eastern spruce, wide random.
Nails, wire, store, base prices.	Timber, hemlock, Pennsylvania, random.

Chemicals and drugs (11 articles).

Alum, potash, lump.	Sulphuric acid, 66 degrees.
Bicarbonate soda, American.	Phosphate rock, South Carolina, ground.
Borax, crystals.	Alcohol, 94 per cent.
Carbolic acid, drums.	Opium, cases.
Caustic soda, 76 per cent.	Quinine, sulphate, domestic.
Nitric acid, 42 degrees.	

Miscellaneous (7 articles).

Hops, Pacific, choice.	Paper, news, roll, transient.
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 of the numbers with those published by the London Economist, the Statist (Sauerbeck's), the Canadian Department of Labor, and the Oriental Economist (Tokio) for approximately the same dates.

TABLES OF RESULTS.

Table 19, appearing in Bradstreet's issue of March 13, 1920, illustrates the manner in which the group index numbers for different dates are shown.

TABLE 19.—BRADSTREET'S INDEX NUMBERS FOR SPECIFIED DATES.

Commodity group.	Mar. 1, 1919.	Jan. 1, 1920.	Feb. 1, 1920.	Mar. 1, 1920.
Breadstuffs.....	\$0. 1881	\$0. 2226	\$0. 2257	\$0. 2241
Livestock.....	. 6865	. 6685	. 6610	. 6575
Provisions.....	4. 5974	4. 5243	4. 4003	4. 3253
Fruits.....	. 3241	. 4506	. 4806	. 4556
Hides and leather.....	2. 1350	2. 8000	2. 7700	2. 7400
Textiles.....	4. 6317	6. 7085	7. 1913	7. 2598
Metals.....	1. 1240	1. 0634	1. 0714	1. 1207
Coal and coke.....	. 0117	. 0130	. 0130	. 0130
Oils.....	1. 0790	1. 0107	1. 0875	1. 0728
Naval stores.....	. 1335	. 2870	. 3272	. 3304
Building materials.....	. 2116	. 2147	. 2370	. 2313
Chemicals and drugs.....	1. 1363	1. 1825	1. 1855	1. 1915
Miscellaneous.....	. 9655	1. 2280	1. 2185	1. 1720
Total.....	17. 2244	20. 3638	20. 8690	20. 7950

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 statement, which is reproduced from Bradstreet's of April 9, 1921.

1921.....	³² \$12. 0679	1906.....	\$8. 4176
1920.....	18. 8095	1905.....	8. 0987
1919.....	18. 6642	1904.....	7. 9187
1918.....	18. 7117	1903.....	7. 9364
1917.....	15. 6385	1902.....	7. 8759
1916.....	11. 8237	1901.....	7. 5746
1915.....	9. 8530	1900.....	7. 8839
1914.....	8. 9034	1899.....	7. 2100
1913.....	9. 2115	1898.....	6. 5713
1912.....	9. 1867	1897.....	6. 1159
1911.....	8. 7129	1896.....	5. 9124
1910.....	8. 9881	1895.....	6. 4346
1909.....	8. 5153	1894.....	6. 6846
1908.....	8. 0096	1893.....	7. 5324
1907.....	8. 9045	1892.....	7. 7769

³² The index number for 1921 is an average of the numbers for the first four months of the year.

The index numbers computed from the wholesale prices of 96 articles on the first day of each month from January, 1912, to April, 1921, inclusive, are shown in Table 20, also compiled from Bradstreet's issue of April 9, 1921.

TABLE 20.—BRADSTREET'S INDEX NUMBERS (FIRST OF EACH MONTH), JANUARY, 1912, TO APRIL, 1921, INCLUSIVE.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1912.	\$8.9493	\$8.9578	\$8.9019	\$9.0978	\$9.2696	\$9.1017	\$9.1119	\$9.1595	\$9.2157	\$9.4515	\$9.4781	\$9.5462
1913.	9.4935	9.4592	9.4052	9.2976	9.1394	9.0721	8.9522	9.0115	9.1006	9.1526	9.2252	9.2290
1914.	8.8857	8.8619	8.8920	8.7562	8.6224	8.6220	8.6566	8.7087	9.7572	9.2416	8.8620	9.0354
1915.	9.1431	9.6621	9.6197	9.7753	9.7978	9.7428	9.8698	9.8213	9.8034	9.9774	10.3768	10.6473
1916.	10.9163	11.1415	11.3760	11.7598	11.7485	11.6887	11.5294	11.4414	11.7803	12.0399	12.7992	13.6628
1917.	13.7277	13.9427	14.1360	14.5769	15.1203	15.4680	16.0680	16.3985	16.6441	16.9135	17.0701	17.5966
1918.	17.9436	18.0506	18.0507	18.4431	18.8908	18.9818	19.1624	19.0937	19.0260	18.9942	18.8885	19.0151
1919.	18.5348	17.6344	17.2244	17.2795	17.2376	18.0900	18.8934	20.0017	19.4720	19.5215	19.9026	20.1756
1920.	20.3638	20.8690	20.7950	20.7124	20.7341	19.8752	19.3528	18.8273	17.9746	16.9094	15.6750	13.6263
1921.	12.6631	12.3689	11.8650	11.3749								

INDEX NUMBERS OF DUN.

PUBLICATION.

An "index"³³ 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.

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.

³³ 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. See also pp. 108-112 of this bulletin.

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 necessities 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, vegetable, 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. In Dun's Review of January 9, 1915, it is said that "about 200 products are taken." In a pamphlet entitled "Commodity prices, a record covering a period of over half a century, from Dun's Review, New York, January 1, 1919," it is said that "about 300 wholesale quotations 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,"³⁴ 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."³⁵

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, 1913, to April 1, 1921, have been compiled from Dun's Review of May 11, 1907, January 9, 1915, December 15, 1917, June 12, 1920, and April 9, 1921.

TABLE 21.—WHOLESALE PRICES OF SPECIFIED COMMODITIES, JAN. 1, 1913, TO APR. 1, 1921.

Date.	Bread-stuffs.	Meats.	Dairy and garden products.	Other foods.	Clothing.	Metals.	Miscellaneous.	Total.
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	10.877	20.835	17.850	22.428	119.728
Mar. 1.....	19.596	13.047	16.142	10.732	21.143	17.379	22.422	120.461
Apr. 1.....	19.966	13.478	15.319	10.165	20.938	16.924	22.427	119.217
May 1.....	20.673	13.183	15.112	10.120	20.807	16.753	21.676	118.324
June 1.....	21.277	12.963	16.525	10.250	20.705	16.760	21.570	120.050
July 1.....	21.192	13.090	13.039	10.213	20.534	16.512	21.739	116.319
Aug. 1.....	21.632	13.080	14.916	10.267	20.250	16.528	21.842	118.515
Sept. 1.....	22.975	12.786	16.604	10.571	20.507	16.742	21.868	122.053
Oct. 1.....	22.586	13.053	17.934	10.700	20.947	16.760	21.922	123.902
Nov. 1.....	22.610	12.211	19.978	11.068	21.074	16.758	21.804	125.503
Dec. 1.....	23.006	12.059	20.454	11.010	20.815	16.596	21.794	125.734
1914, Jan. 1.....	21.961	12.150	20.087	10.950	20.664	16.170	22.546	124.528
Feb. 1.....	20.962	12.625	18.056	11.002	20.241	16.185	22.570	121.641
Mar. 1.....	22.146	13.168	16.009	11.361	20.434	15.881	22.772	121.771
Apr. 1.....	21.402	12.868	15.872	10.684	20.641	15.784	22.540	119.791
May 1.....	21.544	12.813	16.437	10.467	19.969	15.599	21.441	118.230
June 1.....	23.162	13.068	16.114	10.610	20.686	15.655	21.761	121.096
July 1.....	21.086	12.979	17.244	10.449	20.834	15.691	21.425	119.708
Aug. 1.....	22.567	13.427	16.201	10.284	20.975	15.764	21.522	120.740
Sept. 1.....	26.253	12.839	17.432	11.729	20.398	16.126	22.198	126.975
Oct. 1.....	24.441	12.093	17.326	11.423	20.259	15.974	22.015	123.531
Nov. 1.....	25.300	11.907	18.586	10.880	19.970	15.849	21.848	124.340
Dec. 1.....	24.426	11.324	19.825	10.548	19.883	16.134	22.043	124.183

³⁴ Dun's Review, May 9, 1914, p. 23.

³⁵ 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."

TABLE 21.—WHOLESALE PRICES OF SPECIFIED COMMODITIES, JAN. 1, 1913, TO APR. 1, 1921—Concluded.

Date.	Bread-stuffs.	Meats.	Dairy and garden products.	Other foods.	Clothing.	Metals.	Miscellaneous.	Total.
1915, Jan. 1	\$25.891	\$10.705	\$19.289	\$10.602	\$19.724	\$16.163	\$21.794	\$124.168
Feb. 1	29.052	10.601	17.464	10.478	20.117	16.296	21.654	125.662
Mar. 1	28.606	10.731	15.580	10.822	20.221	16.343	21.855	124.158
Apr. 1	28.867	11.073	15.585	10.761	20.480	15.942	22.383	125.090
May 1	29.807	11.668	15.464	10.705	20.786	15.834	22.385	126.649
June 1	28.357	12.513	15.132	10.597	20.748	16.138	22.507	125.992
July 1	26.467	12.134	15.563	10.724	20.902	16.607	22.561	124.958
Aug. 1	25.999	11.988	16.030	10.970	21.400	16.616	22.676	125.079
Sept. 1	24.978	11.440	16.256	10.850	21.462	16.956	22.742	124.684
Oct. 1	23.540	11.469	18.769	10.717	21.926	17.065	23.177	126.663
Nov. 1	24.024	11.392	20.616	10.956	22.325	17.276	23.878	130.467
Dec. 1	25.164	10.551	20.971	11.224	22.808	18.328	24.100	133.146
1916, Jan. 1	27.318	11.494	20.509	11.212	23.420	18.893	24.820	137.666
Feb. 1	28.781	12.233	20.400	11.401	23.601	19.819	26.025	142.260
Mar. 1	26.273	13.222	20.812	11.527	23.783	20.387	26.101	142.110
Apr. 1	26.703	14.166	21.256	11.932	24.947	20.643	26.043	145.690
May 1	26.773	14.611	20.633	12.070	25.139	20.889	26.082	146.197
June 1	25.631	15.045	19.267	12.231	25.392	21.656	26.175	145.397
July 1	26.378	14.400	19.435	12.156	25.800	21.174	25.799	145.142
Aug. 1	28.660	13.655	17.366	12.016	25.899	21.057	25.277	143.930
Sept. 1	31.061	14.690	21.541	11.962	26.516	21.224	25.024	152.018
Oct. 1	31.821	13.691	20.702	12.616	26.826	21.326	25.373	152.355
Nov. 1	36.772	14.238	24.273	13.021	29.099	21.798	25.639	164.840
Dec. 1	36.090	14.248	25.403	12.923	30.234	23.390	25.802	168.090
1917, Jan. 1	36.152	15.020	25.167	12.928	30.082	24.451	25.762	169.562
Feb. 1	37.865	16.124	27.372	12.988	30.380	25.029	26.515	176.273
Mar. 1	40.955	17.031	31.509	13.166	30.389	25.977	27.217	186.244
Apr. 1	43.813	18.894	29.301	13.289	30.678	26.683	27.354	190.012
May 1	55.360	19.385	30.722	13.717	32.081	28.443	28.727	208.435
June 1	53.504	19.810	33.606	13.865	33.025	29.888	28.887	212.585
July 1	53.918	18.824	26.449	14.225	36.527	32.390	29.617	211.950
Aug. 1	64.071	17.746	21.247	15.213	36.917	32.575	31.010	218.779
Sept. 1	54.688	19.355	22.751	15.552	38.615	32.657	31.392	215.010
Oct. 1	55.518	19.127	25.802	16.086	39.436	31.159	32.551	219.679
Nov. 1	55.680	18.168	25.886	18.720	40.444	29.843	32.009	220.753
Dec. 1	53.996	19.008	27.021	18.767	40.745	28.413	32.222	220.172
1918, Jan. 1	54.276	19.292	27.416	18.744	40.880	29.273	32.294	222.175
Feb. 1	54.001	20.577	28.768	18.848	42.384	29.584	32.858	227.020
Mar. 1	55.498	20.917	27.123	19.194	42.213	29.914	33.118	227.977
Apr. 1	57.036	22.246	24.155	20.326	43.322	29.608	33.720	230.313
May 1	51.328	22.467	23.706	21.414	43.450	29.890	34.420	226.665
June 1	48.360	22.362	23.826	21.096	44.707	29.936	34.556	232.843
July 1	51.420	23.719	24.750	21.929	45.238	30.170	35.349	232.575
Aug. 1	50.314	23.085	24.681	22.307	44.285	30.345	35.785	232.058
Sept. 1	50.210	23.664	25.009	22.491	44.739	30.609	36.056	232.882
Oct. 1	49.196	22.901	26.439	23.010	44.533	30.677	36.471	233.227
Nov. 1	47.472	21.930	27.334	23.367	43.670	30.554	36.302	230.529
Dec. 1	47.947	21.556	27.631	23.407	43.157	30.394	36.283	230.375
1919, Jan. 1	48.599	22.192	27.138	23.962	43.194	28.762	36.299	230.146
Feb. 1	44.999	21.530	24.705	23.400	42.249	28.587	34.580	220.050
Mar. 1	44.633	22.027	22.937	23.847	40.464	28.217	34.912	217.037
Apr. 1	49.039	22.892	24.440	23.829	39.173	25.637	34.963	219.973
May 1	48.873	24.362	26.120	22.727	39.565	25.796	34.750	222.193
June 1	51.237	24.712	26.901	22.808	41.798	25.559	34.958	227.973
July 1	51.728	25.660	26.160	23.342	45.623	25.759	35.435	233.707
Aug. 1	54.757	25.105	26.877	23.695	48.558	26.606	36.052	241.550
Sept. 1	53.233	23.790	26.293	23.470	47.926	26.533	37.097	238.342
Oct. 1	48.009	20.084	27.983	23.382	49.852	26.578	39.979	235.867
Nov. 1	47.529	19.144	28.731	24.157	51.408	26.711	40.893	238.573
Dec. 1	48.281	20.007	30.094	24.630	52.285	27.727	41.615	244.639
1920, Jan. 1	48.943	19.955	29.077	24.944	52.778	28.963	42.734	247.394
Feb. 1	50.626	20.937	28.843	25.447	54.415	29.761	43.719	253.748
Mar. 1	49.874	19.937	28.727	25.364	54.102	30.400	44.612	253.016
Apr. 1	52.684	20.588	28.331	25.384	54.752	30.723	45.439	257.901
May 1	56.965	21.384	28.963	25.246	53.696	30.994	46.084	263.332
June 1	58.504	21.536	27.944	24.977	51.894	31.017	46.367	262.149
July 1	57.170	22.019	28.044	25.521	50.268	31.172	46.220	260.414
Aug. 1	49.871	22.124	26.450	25.593	49.538	32.046	46.666	262.288
Sept. 1	51.570	19.899	26.039	24.911	46.643	32.846	46.349	248.257
Oct. 1	42.713	19.896	26.721	23.589	44.838	33.381	45.203	237.341
Nov. 1	39.017	18.889	26.343	23.158	41.566	32.473	45.742	227.188
Dec. 1	32.969	16.935	27.205	21.651	38.471	29.871	44.526	211.628
1921, Jan. 1	32.697	15.240	25.176	20.690	34.108	28.149	42.540	198.600
Feb. 1	29.602	15.274	22.634	19.198	32.095	26.079	40.940	185.822
Mar. 1	31.059	16.451	20.121	19.013	29.541	25.109	40.627	181.921
Apr. 1	27.914	15.709	19.049	19.044	28.814	24.803	39.071	174.404

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.³⁶ 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.³⁷

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.

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.

³⁶ See also article by Prof. Norton in Quarterly Journal of Economics, August, 1910, pp. 750-759. Published by Harvard University, Cambridge, Mass.

³⁷ 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, 1909, to compute relative prices."

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:

TABLE 22.—ILLUSTRATIVE EXAMPLE OF CALCULATING GIBSON'S INDEX NUMBERS.

Commodity.	Total relatives of the groups.	Multipliers.	Weighted product.
Foods	2422.1	1.9159	46.4050
Textiles	1264.0	1.6860	21.3010
Minerals	1324.8	1.4987	19.8548
Other	1408.7	1.3488	19.0005
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	109.38	109.91
April, 1907	110.56	(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 Table 23 from figures appearing in Gibson's weekly market letter of April 15, 1921.

TABLE 23.—AVERAGE YEARLY INDEX NUMBERS, 1890 TO 1920.

Year.	Average yearly index number.	Year.	Average yearly index number.	Year.	Average yearly index number.
1890.....	43.4	1901.....	44.5	1912.....	62.6
1891.....	50.8	1902.....	53.5	1913.....	58.1
1892.....	45.3	1903.....	49.0	1914.....	60.8
1893.....	46.0	1904.....	48.3	1915.....	64.0
1894.....	43.4	1905.....	47.3	1916.....	74.9
1895.....	42.0	1906.....	49.8	1917.....	110.8
1896.....	34.0	1907.....	60.9	1918.....	122.8
1897.....	34.7	1908.....	51.2	1919.....	121.4
1898.....	38.7	1909.....	50.2	1920.....	127.0
1899.....	41.6	1910.....	53.3		
1900.....	44.2	1911.....	56.9		

Monthly averages from January, 1910, to March, 1921, also shown in the publication referred to above, are as follows:

TABLE 24.—AVERAGE MONTHLY INDEX NUMBERS, 1910 TO MARCH, 1921.

	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
January.....	60.8	54.3	62.3	55.5	58.2	64.7	65.6	87.4	118.9	119.7	130.4	81.9
February.....	61.2	52.9	61.7	57.0	58.2	68.0	68.2	90.5	121.9	116.7	127.3	78.8
March.....	63.6	53.3	63.8	57.8	57.8	68.7	69.5	96.4	126.1	122.9	133.8	80.8
April.....	62.6	53.1	67.8	59.0	57.7	67.8	71.3	109.2	130.5	129.8	147.4	.....
May.....	60.8	53.5	69.4	57.8	57.9	68.3	72.3	118.5	125.7	128.0	155.4	.....
June.....	59.0	52.9	66.6	57.3	59.7	64.3	70.8	114.2	122.7	122.9	154.7	.....
July.....	59.6	57.5	62.6	58.6	58.9	64.4	71.9	116.4	123.3	127.9	141.9	.....
August.....	59.8	60.1	61.1	59.3	64.9	63.1	76.1	117.9	122.2	126.7	125.8	.....
September.....	59.6	61.2	60.4	60.0	68.6	58.5	78.4	119.4	123.2	116.9	118.5	.....
October.....	56.9	62.0	59.8	58.4	62.9	60.0	82.2	120.1	119.0	111.2	106.9	.....
November.....	54.2	61.3	59.1	58.4	63.1	60.6	87.1	119.9	118.8	114.6	95.7	.....
December.....	53.8	60.3	56.8	58.2	62.3	62.1	85.1	121.4	120.9	119.4	86.0	.....

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 then 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, were among the subjects considered in the report.

This publication was the first of a series designed to include topics covering general industrial conditions as well as prices. Its main object, as stated in the preface, was "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, and in subsequent reports, numbered 5, 6, 7, 8, 9, and 10, issued in December, 1914, May, 1916, June, 1917, July, 1918, July, 1919, and

October, 1920, respectively. Quarterly index numbers, also, are shown in the Labor Bulletin, published quarterly up to June, 1917, by the Labor and Industrial Branch of the Australian Bureau of Census and Statistics.

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."

BASE PERIOD.

The basic period selected 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."

In the reports for the years 1916 and after, as well as in the quarterly Labor Bulletin after 1914, index numbers are also shown on the July, 1914, base as 1,000 in order that the variations in price levels since the outbreak of the war may be clearly seen.

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. Data for all of the 92 commodities, now included in the index numbers, are contained in the appendix to later reports.

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 opinion³⁸ 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 initial 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 and subsequent years 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.

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 92 commodities used in computing the index numbers for 1912 and subsequent years are divided into 8 groups, as follows:

- I. Metals and coal, 14 commodities.
- II. Textiles, leather, etc., 10 commodities.
- III. Agricultural produce, 16 commodities.
- IV. Dairy produce, 9 commodities.
- V. Groceries, 21 commodities.
- VI. Meat, 5 commodities.
- VII. Building materials, 10 commodities.
- VIII. Chemicals, 7 commodities.

The list of articles, with their description or brand, the unit upon which quoted, and the "mass unit"—i. e., the extent to which a commodity is used—are shown in Table 25.

³⁸ Source of this expert opinion not stated.

TABLE 25.—MELBOURNE WHOLESALE PRICES, COMMODITIES INCLUDED, UNITS OF MEASUREMENT, AND MASS UNITS.

[Commonwealth Bureau of Census and Statistics, Labor and Industrial Branch, October, 1920, Report No. 10, p. 67.]

Group I.—Metals and coal (14 commodities).

Commodity.	Brand.	Unit.	Mass unit.
Iron:			
Pig	Mixed numbers ..	Ton	6½
Rod and bar	Stafford	do	3½
Angle and T	do	do	3½
Plate	do	do	3
Hoop	do	do	½
Galvanized	26 gauge	do	5
Tinned plates:	I. C. coke	100 pounds	60
Fencing wire	No. 8	Ton	6
Zinc, sheet	do	do	1
Lead, sheet	do	do	½
Lead pipes	do	do	½
Copper, sheet	do	Pound	2,000
Quicksilver	do	do	12
Coal	Newcastle, on wharf ..	Tons	600
Total			2,702½

Group II.—Textiles, leather, etc. (10 commodities).

Bran bags		Dozen	110
Corn sacks		do	250
Woolpacks		Each	200
Leather:			
Waxed kip		Pound	600
Waxed split		do	600
Medium crop		do	600
Cotton	Raw	do	24,000
Wool	Greasy	do	12,200
Twine	Reaper and binder ..	do	150
Tallow	Mutton, prime	Ton	1½
Total			38,711½

Group III.—Agricultural produce (16 commodities).

Wheat		Bushel	500
Flour		Ton	48
Bran		do	14
Pollard		do	14
Oats	Feed	Bushel	1,200
Oatmeal	Colonial	Ton	1½
Barley	Malting	Bushel	150
Do	Feed	do	100
Maize	do	do	1,000
Hay	Best manger	Ton	135
Chaff	Good oaten	do	135
Straw	Victorian	do	25
Peas	do	Bushel	55
Potatoes	do	Ton	40
Malt	Victorian	Bushel	140
Onions	do	Ton	3
Total			3,560½

Group IV.—Dairy produce (9 commodities).

Ham		Pound	800
Bacon		do	3,200
Cheese		do	1,500
Butter		do	9,500
Lard	Best fresh	do	200
Eggs	In bladders	do	200
Honey	Ordinary	Dozen	1,800
Beeswax	do	Pound	600
Condensed milk	Bacchus Marsh	Dozen pounds	40
Total			17,800

TABLE 25.—MELBOURNE WHOLESALE PRICES, COMMODITIES INCLUDED, UNITS OF MEASUREMENT, AND MASS UNITS—Concluded.

Group V.—Groceries (21 commodities).

Commodity.	Brand.	Unit.	Mass unit.
Currants.....		Pound.....	1,400
Raisins.....	Sultanas.....	do.....	1,400
Herrings.....	1-pound, fresh.....	Dozen, 1-pound tins.....	50
Salmon.....	1 - pound, tall, Alaska.....	do.....	50
Sardines.....	Halves.....	Dozen halves.....	100
Coffee.....	Plantation.....	Pound.....	200
Cocoa.....	Taylor's.....	do.....	100
Sugar.....	No. 1A.....	Ton.....	22
Macaroni.....		Pound.....	200
Sago.....		100 pound.....	7
Rice.....	Patna.....	Ton.....	2
Salt.....	Liverpool fine.....	do.....	7
Do.....	Rock.....	do.....	1
Mustard.....	Coleman's.....	Dozen, 1-pound tins.....	6
Starch.....	Coleman's white.....	Pound.....	100
Blue.....	Keen's.....	do.....	50
Matches.....	Australian safety.....	Gross.....	90
Candles.....	Gouda.....	Pound.....	1,600
Tobacco.....	Two Seas, in pocket pieces.....	do.....	1,300
Tea.....		do.....	3,000
Kerosene.....		Gallon.....	1,700
Total.....			11,385

Group VI.—Meat (5 commodities).

Beef.....	Average quality.....	100 pounds.....	390
Mutton.....	do.....	Pound.....	33,000
Veal.....	do.....	do.....	2,000
Lamb.....	do.....	do.....	5,600
Pork.....	do.....	do.....	3,700
Total.....			44,690

Group VII.—Building materials (10 commodities).

Timber.....	Flooring:		
	6 x 1 1/2.....	100 feet linear.....	30
	6 x 2.....	do.....	30
	6 x 3.....	do.....	30
	6 x 4.....	do.....	30
	Weatherboards.....	do.....	200
Oregon.....	1,000 feet superficial.....		20
Cement.....	Shelving.....	do.....	10
White lead.....	Portland.....	Cask.....	30
Slates.....	Welsh, 20 x 10.....	Ton.....	3 1/2
Total.....			381 1/2

Group VIII.—Chemicals (7 commodities).

Cream of tartar.....	In kegs.....	Pound.....	400
Carbonate of soda.....		Ton.....	3 1/2
Salt peter.....	Refined.....	do.....	3 1/2
Sulphur.....		do.....	1 1/2
Caustic soda.....		100 pounds.....	7
Alum.....	Lump.....	Ton.....	1 1/2
Cyanide potassium.....		Pound.....	570
Total.....			978 1/2

In all 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 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 and later years 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 oaten 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.

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 for 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 consumption figures has been given by the author. 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 $6\frac{1}{2}$.

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.

Table 26 illustrates the system of weighted index numbers used:

TABLE 26.—COMPUTATION OF INDEX NUMBERS—ILLUSTRATIVE EXAMPLE OF AGGREGATE EXPENDITURES METHOD.

Article.	Unit.	Quantities consumed (in millions).	Prices.		Total expenditures (in millions).	
			1901	1911	1901	1911
Butter.....	Pound.....	90	<i>d.</i> 15	<i>d.</i> 18	<i>d.</i> 1,350	<i>d.</i> 1,620
Bread.....	2-pound loaf.....	470	3	4	1,410	1,880
Mutton.....	Pound.....	330	3	5	990	1,650
Milk.....	Quart.....	300	4	5	1,200	1,570
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. Table 27 illustrates this comparison:

TABLE 27.—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.

Table 28 contains the index numbers for each group and for all the groups as a whole for specified years from 1861 to 1919, inclusive.³⁹ No index numbers for meats are given in the original sources for years before 1884 or for the years 1886 to 1889.

TABLE 28.—MELBOURNE WHOLESALE-PRICE INDEX NUMBERS FOR SPECIFIED YEARS, 1861 TO 1919.

(Average prices in 1911=1000.)

Year.	Metals and coal.	Textiles, leather, etc.	Agricultural produce, etc.	Dairy produce.	Groceries.	Meat.	Building material.	Chemicals.	All commodities.
1861.....	1, 438	1, 381	1, 583	1, 008	1, 963	.....	1, 070	2, 030	1, 538
1871.....	1, 096	1, 257	1, 236	864	1, 586	.....	1, 044	1, 409	1, 229
1881.....	1, 178	1, 115	1, 012	935	1, 421	.....	1, 091	1, 587	1, 121
1891.....	895	847	1, 024	995	1, 032	888	780	1, 194	945
1901.....	1, 061	774	928	1, 029	1, 048	1, 345	841	917	974
1911.....	1, 000	1, 000	1, 000	1, 000	1, 000	1, 000	1, 000	1, 000	1, 000
1912.....	1, 021	991	1, 370	1, 206	1, 052	1, 357	1, 057	978	1, 170
1913.....	1, 046	1, 070	1, 097	1, 054	1, 024	1, 252	1, 128	995	1, 088
1914.....	1, 099	1, 032	1, 207	1, 137	1, 021	1, 507	1, 081	1, 253	1, 149
1915.....	1, 284	1, 017	2, 162	1, 530	1, 133	2, 435	1, 275	1, 528	1, 604
1916.....	1, 695	1, 423	1, 208	1, 485	1, 322	2, 515	1, 491	1, 760	1, 504
1917.....	2, 129	2, 008	1, 157	1, 423	1, 343	2, 403	1, 884	2, 171	1, 662
1918.....	2, 416	2, 360	1, 444	1, 454	1, 422	2, 385	2, 686	3, 225	1, 934
1919.....	2, 125	2, 363	1, 985	1, 651	1, 516	2, 348	2, 851	2, 898	2, 055

The variations in the index numbers of the separate commodity groups for the years 1915 to 1918, and for each month from January, 1918, to March, 1919, are shown in Table 29, taking July, 1914, the last month before the outbreak of the war, as the base (or 1,000) for each group.

³⁹ From Commonwealth Bureau of Census and Statistics, Labor and Industrial Branch, Report No. 10, p. 68.

TABLE 29.—MELBOURNE WHOLESALE-PRICE INDEX NUMBERS, BY YEARS, 1915 TO 1918, AND BY MONTHS, JANUARY, 1918, TO JUNE, 1920.

[Commonwealth Bureau of Census and Statistics, Labor and Industrial Branch, Report No. 9, July, 1919, p. 75, and No. 10, October, 1920, p. 69.]

(Average prices of July, 1914=1000.)

Year and month.	Metals and coal.	Textiles, leather, etc.	Agricultural produce, etc.	Dairy produce.	Groceries.	Meat.	Building materials.	Chemicals.	All commodities.
July, 1914..	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
1915.....	1,166	934	2,024	1,272	1,098	1,502	1,164	1,490	1,406
1916.....	1,539	1,307	1,130	1,235	1,266	1,551	1,361	1,716	1,318
1917.....	1,919	1,841	1,084	1,181	1,302	1,480	1,722	2,141	1,450
1918.....	2,197	2,324	1,351	1,210	1,378	1,469	2,448	3,085	1,695
Jan.....	2,132	2,432	1,185	1,144	1,331	1,540	2,046	2,685	1,635
Feb.....	2,157	2,365	1,191	1,155	1,336	1,532	2,069	3,180	1,633
Mar.....	2,161	2,463	1,232	1,188	1,324	1,556	2,107	3,275	1,668
Apr.....	2,161	2,430	1,261	1,209	1,385	1,517	2,156	3,275	1,677
May.....	2,192	2,309	1,382	1,288	1,366	1,452	2,596	3,001	1,711
June.....	2,195	2,331	1,359	1,272	1,355	1,469	2,593	3,207	1,709
July.....	2,206	2,249	1,356	1,250	1,409	1,463	2,636	3,462	1,700
Aug.....	2,225	2,392	1,358	1,217	1,414	1,408	2,656	3,363	1,721
Sept.....	2,232	2,410	1,357	1,180	1,408	1,426	2,616	3,271	1,720
Oct.....	2,234	2,310	1,417	1,163	1,402	1,490	2,616	3,188	1,727
Nov.....	2,229	2,074	1,573	1,182	1,394	1,403	2,624	2,995	1,716
Dec.....	2,237	2,122	1,639	1,271	1,397	1,370	2,663	2,916	1,722
1919:									
Jan.....	2,178	1,942	1,653	1,263	1,415	1,370	2,652	3,126	1,718
Feb.....	2,042	1,838	1,661	1,290	1,407	1,316	2,637	3,139	1,678
Mar.....	2,000	1,850	1,611	1,355	1,415	1,465	2,606	3,089	1,688
Apr.....	1,950	1,974	1,619	1,361	1,423	1,559	2,476	2,900	1,711
May.....	1,950	2,001	1,618	1,402	1,433	1,483	2,568	2,681	1,715
June.....	1,135	2,139	1,597	1,401	1,438	1,510	2,500	2,729	1,730
July.....	1,858	2,259	1,684	1,413	1,477	1,475	2,431	2,771	1,760
Aug.....	1,819	2,290	1,903	1,353	1,500	1,452	2,486	2,771	1,815
Sept.....	1,816	2,250	2,002	1,376	1,494	1,522	2,588	2,633	1,850
Oct.....	1,864	2,432	2,356	1,412	1,524	1,536	2,711	2,716	1,997
Nov.....	1,841	2,537	2,375	1,419	1,513	1,324	2,782	2,674	1,987
Dec.....	1,863	2,591	2,242	1,423	1,564	1,321	2,807	2,662	1,972
1920:									
Jan.....	1,889	2,729	2,265	1,432	1,555	1,466	2,820	2,678	2,026
Feb.....	1,919	2,832	2,269	1,490	1,608	1,486	2,867	2,717	2,063
Mar.....	2,051	2,805	2,256	1,615	1,602	1,456	2,977	2,797	2,089
Apr.....	2,051	2,733	2,339	1,690	1,924	1,600	2,977	2,797	2,173
May.....	2,135	2,648	2,519	1,765	1,965	1,695	3,074	2,972	2,250
June.....	2,135	2,597	2,613	1,870	1,951	2,075	3,074	2,972	2,330

In the initial report issued in 1912 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 1,000 and that for 1911 and 1912 is compared with this base. For instance, taking the average price level of 1871-1875 as 1,000, that for 1911-1912 has fallen to 806, and taking that of 1876-1880 as 1,000 that for 1911-1912 in comparison is 877. The other figures are to be read in the same manner.

TABLE 30.—INDEX NUMBERS FOR 1911-12, WITH AVERAGE EXPENDITURE IN EACH SUCCESSIVE QUINQUENNIAL PERIOD AS BASE.

Base period (prices=1,000).	I. Metals and coal.	II. Jute, leather, etc.	III. Agricultural produce.	IV. Dairy produce.	V. Groceries.	VI. Meat.	VII. Building materials.	VIII. Chemicals.	All groups together.
1871-1875..	672	792	841	1,037	678	.....	889	621	806
1876-1880..	746	926	895	957	731	.....	1,067	641	877
1881-1885..	821	1,012	946	957	775	.....	1,071	651	882
1886-1890..	854	1,172	934	974	928	.....	1,193	730	999
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	1,249	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	1,097	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 data as published originally 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. Comparison of the Australian index numbers with those for other countries is continued in somewhat different form in later reports.

INDEX NUMBERS OF THE BUREAU OF STATISTICS OF NEW SOUTH WALES.

The Bureau of Statistics of New South Wales is publishing a yearly index number of prices of the principal articles of domestic produce exported from New South Wales, calculated on the average f. o. b. prices at Sidney. The average prices prevailing in 1901 were adopted as the base, or 1,000.^a

TABLE 31.—INDEX NUMBERS OF PRINCIPAL EXPORTS FROM NEW SOUTH WALES, 1901 TO 1918.

[Official year book of New South Wales, 1915, p. 810, and 1918, p. 482.]

(Average prices in 1901=1,000.)

Year.	Pastoral products: Wool, tallow, hides, leather, etc.	Metals: Silver, lead, copper, tin.	All articles.	Year.	Pastoral products: Wool, tallow, hides, leather, etc.	Metals: Silver, lead, copper, tin.	All articles.
1901.....	1,000	1,000	1,000	1910.....	1,214	1,111	1,205
1902.....	1,096	935	1,065	1911.....	1,194	1,189	1,194
1903.....	1,125	992	1,065	1912.....	1,263	1,454	1,327
1904.....	1,112	1,011	1,071	1913.....	1,408	1,451	1,367
1905.....	1,192	1,149	1,150	1914.....	1,451	1,302	1,365
1906.....	1,316	1,432	1,277	1915.....	1,688	1,464	1,620
1907.....	1,354	1,461	1,343	1916.....	1,988	1,948	1,878
1908.....	1,122	1,073	1,164	1917.....	2,212	2,241	2,116
1909.....	1,137	1,066	1,188	1918.....	2,333	2,387	2,207

^a Since 1918, index numbers of wholesale prices in Sydney, including 100 commodities classified into 8 groups and based on prices in 1911 as 1,000, have been published by the Bureau of Statistics. See Official Yearbook of New South Wales, 1919, pp. 482-489.

AUSTRIA.

INDEX NUMBERS OF DR. BÉLA VON JANKOVICH.⁴⁰

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 Papiervaluta 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 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 semiofficial 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).

⁴⁰ 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.

TABLE OF RESULTS.

Table 32 summarizes the results of Dr. von Jankovich's compilations:

TABLE 32.—SUMMARY TABLE SHOWING INDEX NUMBERS FOR THE PRICES OF 45 ARTICLES IN THE WHOLESALE MARKETS OF AUSTRIA-HUNGARY.¹

[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).	Miscellaneous raw materials 35-45).	All raw materials (20-45).	Index number 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	98	96	98
1878.....	91	94	86	91	89	85	89	88	89
1879.....	89	90	82	88	81	82	82	82	83
1880.....	103	96	82	96	86	87	82	84	85
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	82	78	83	82	86
1884.....	93	101	64	90	77	78	85	81	85
1885.....	84	97	62	84	74	74	80	77	80
1886.....	82	93	61	82	74	73	74	74	77
1887.....	79	92	66	81	75	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	64	83	81	70	70	73	77
1891.....	89	96	64	86	82	67	70	72	78
1892.....	80	90	64	80	79	65	67	70	74
1893.....	75	91	68	79	78	69	71	72	75
1894.....	76	91	62	78	73	65	66	68	72
1895.....	76	97	58	80	72	64	66	67	72
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	75
1899.....	79	97	46	78	96	67	68	75	76
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	46	95	96	76	69	79	85
1906.....	89	129	44	94	112	85	74	88	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

¹ Numbers appearing in the box headings refer to the column numbers of the articles making up the six groups as they appear in the detailed table.

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 wholesale 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. The only exception seems to be a

table of index numbers computed for 28 articles of export, which was 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 depression économique et sociale et l'histoire des prix*), 1895,⁴¹ and the Index Numbers of Moral Phenomena (*Les index numbers—nombres indices—des phénomènes moraux*), 1911.⁴²

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 1893.⁴³ In the same publication the table appears a second time, but with data for each year from 1850 to 1910,⁴⁴ 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 based 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 the customs values. Of these Mr. Armand Julin⁴⁵ 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,

⁴¹ 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.

⁴² 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 1837-1877. A comparative table shows index numbers for the United States, Belgium, Germany, and England.

⁴³ This table is given on p. 189 of this bulletin.

⁴⁴ The general index computed for Belgium by Prof. Denis, which appears in this table, is printed on p. 189 of this bulletin for the years 1891-1910.

⁴⁵ "The economic progress of Belgium from 1880 to 1908," in the *Journal of the Royal Statistical Society*, 1911, p. 268.

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 remains 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.

TABLE 33.—COMPARISON OF GENERAL INDEX NUMBERS FOR FRANCE (PALGRAVE), GERMANY (SOETBEER), ENGLAND (SAUERBECK), UNITED STATES (FALKNER-HARDY), AND BELGIUM (DENIS), REDUCED TO A COMMON BASE.

(Average prices in 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.....		96.3	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	100	123	93.1
1868.....	97.6	95.5	99	115	95.8
1869.....	97.6	96.3	98	110	91.6
1870.....	94.6	96.3	96	102	91.8
1871.....	101.5	100	100	97.8	98.8
1872.....	108.3	106.4	109	99.8	109
1873.....	107.3	107.9	111	98.8	108.6
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	95	85	108.3
1877.....	99.5	100.1	94	79.7	103
1878.....	86.8	94.6	87	72.8	98.4
1879.....	83.9	91.5	83	69.5	95.8
1880.....	85.8	95.5	88	76.9	103.1
1881.....	82.9	94.6	85	76	97.8
1882.....	81.9	95.5	84	78	85
1883.....	80	95.5	82	76.2	85.7
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	70	67.7	75.6
1889.....		83.7	72	67.7	71.5
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.	Year.	Index numbers.
1894.....	59.0	1900.....	63.4	1906.....	64.8
1895.....	61.5	1901.....	63.1	1907.....	69.2
1896.....	61.0	1902.....	64.0	1908.....	67.7
1897.....	56.0	1903.....	60.6	1909.....	65.9
1898.....	58.5	1904.....	61.8	1910.....	64.7
1899.....	61.8	1905.....	60.9		

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.⁴⁶ 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.⁴⁷

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.⁴⁸ In a few instances, owing to special reasons, a period other than the decade 1890-1899 has been chosen as the base.

⁴⁶ Wholesale Prices in Canada, 1890-1909, p. 2.

⁴⁷ *Idem*, p. 9.

⁴⁸ Wholesale Prices in Canada, 1890-1909, p. 440. The base period used by the United States Department of Labor (Bureau of Labor Statistics) has since been changed.

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."⁴⁹ 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.⁵⁰ This plan was continued in the preparation of the wholesale-price data for 1913 and subsequent years.

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.⁵¹ 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.

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

⁴⁹ Wholesale Prices in Canada, 1890–1909, p. 439.

⁵⁰ *Idem*, 1912, p. 2.

⁵¹ *Idem*, 1890–1909, p. 439.

be made on the enlarged basis until the number of commodities is completed.⁵³

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 271 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 processes are present in about 40 per cent of the quotations."⁵³

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) and the Eighth Annual Report of Wholesale Prices in Canada, 1917 (pp. 87-92).

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, Manitoba.
Hay, Toronto.	Wheat, No. 2, white, Ontario.
Oats, No. 2, white, western.	

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, live.	

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.

Codfish, dry, f. o. b.	Lobster, canned.
Haddock, dry, f. o. b.	Mackerel, salted.
Halibut, fresh.	Salmon, B. C., canned.
Herring, salted.	Salmon trout, fresh.
Lobster, fresh.	Whitefish, fresh.

⁵² Wholesale Prices in Canada, 1912, p. 2.

⁵³ Idem, 1890-1909, p. 438.

V. Other foods.

(a) *Fruits and vegetables.*

- | | |
|---|---|
| <p>1. Fresh fruits.</p> <p>Native—</p> <p>Apples, good seasonable.</p> <p>Cherries.</p> <p>Grapes, blue.</p> <p>Peaches, Leno covers, No. 1 fruit.</p> <p>Pears, early, Bartletts and winter.</p> <p>Plums, early, Lombards, green-gages.</p> <p>Raspberries, red.</p> <p>Strawberries.</p> <p>Foreign—</p> <p>Bananas, yellow.</p> <p>Lemons, Messinas and Verdelis.</p> <p>Oranges, navels and Valencias.</p> | <p>2. Dried fruits.</p> <p>Apples, evaporated.</p> <p>Currants, Patras.</p> <p>Prunes, Bosnia.</p> <p>Raisins, Sultanas.</p> <p>3. Fresh vegetables.</p> <p>Beans, hand-picked.</p> <p>Onions, Canadian Red.</p> <p>Potatoes, Montreal.</p> <p>Potatoes, Toronto.</p> <p>Turnips.</p> <p>Tomatoes.</p> <p>4. Canned vegetables.</p> <p>Corn, standards, 2's.</p> <p>Peas, standards, 2's.</p> <p>Tomatoes, 3's.</p> |
|---|---|

(b) *Miscellaneous groceries and provisions.*

- | | |
|---|---|
| <p>1. Breadstuffs.</p> <p>Flour, straight rollers.</p> <p>Flour, strong bakers.</p> <p>Flour, winter wheat patents.</p> <p>Flour, Manitoba 1st patents.</p> <p>Bread, Toronto.</p> <p>Bread, Victoria, B. C.</p> <p>Biscuits, soda.</p> <p>Oatmeal, standard.</p> <p>Rice, Patna.</p> <p>Tapioca, medium pearl.</p> <p>2. Tea, coffee, and chocolate.</p> <p>Chocolate, Diamond.</p> <p>Coffee, Rio, No. 7.</p> <p>Coffee, Santos.</p> <p>Tea, good common Japan.</p> | <p>3. Sugar, etc.</p> <p>Glucose.</p> <p>Honey, strained.</p> <p>Maple sugar.</p> <p>Molasses, New Orleans.</p> <p>Sugar, Montreal granulated.</p> <p>Sugar, Montreal yellow.</p> <p>4. Condiments, etc.</p> <p>Pepper, black, pure.</p> <p>Cream of tartar.</p> <p>Salt, fine, dairy, cheese, and table.</p> <p>Soda, bicarbonate of.</p> <p>Vinegar, white wine, proofstrength.</p> |
|---|---|

VI. Textiles.

- | | |
|---|---|
| <p>(a) Woolens:</p> <p>Wool (Ontario), washed.</p> <p>Wool (Ontario), unwashed.</p> <p>Yarn.</p> <p>Woolen underwear.</p> <p>Beaver cloth.</p> <p>(b) Cotton:</p> <p>Cotton, upland middling.</p> <p>Gray cottons.</p> <p>Woven colored fabrics.</p> <p>Prints.</p> <p>(c) Silk:</p> <p>Silk, raw, Italian, classical.</p> <p>Silk, raw, Japan.</p> <p>Silk, spool.</p> <p>Silk, machine.</p> | <p>(d) Flax products:</p> <p>Flax sewing twine.</p> <p>Linen rope, white.</p> <p>Flax fiber.</p> <p>Tow, fine.</p> <p>(e) Jute:</p> <p>Jute, first marks.</p> <p>Hessian, 10½-ounce, 40-inch.</p> <p>(f) Oil cloths:</p> <p>Floor oilcloth, No. 3 quality.</p> <p>Table oilcloth, assorted patterns (5-4 wide).</p> |
|---|---|

VII. Hides and tallow, leathers, and boots and shoes.

Hides and tallow:	Leather—Concluded.
No. 1 beef hides.	Harness, No. 1, U. O.
No. 1 green calfskins.	Heavy upper.
Horsehides.	Boots and shoes:
Tallow rendered, No. 1 stock, in barrel.	Men's split blucher bal., pegged.
Leather:	Men's box calf blucher bal., G. W.
No. 1 Spanish sole, for jobbing.	Women's Dongola blucher bal., F. S.
No. 1 slaughter sole, heavy.	

VIII. Metals and implements.

(a) Metals:	(a) Metals—Concluded.
Antimony.	Spelter.
Brass.	Steel billets.
Copper.	Steel, cast.
Iron, pig, Summerlee.	Tin, ingots.
Iron, pig, No. 1 foundry, N. S.	Zinc, sheets.
Iron, common bar.	(b) Implements:
Iron, black sheets.	Anvils, Wrights', 80 pounds and over.
Iron, galvanized sheets.	Axes, standard.
Iron, tin-plate, charcoal.	Chains, coil.
Iron, tin-plate, coke.	Crowbars.
Iron, boiler-plate.	Grindstones, 40–200 pounds.
Wrought iron, No. 1.	Hammers, sledge.
Lead, imported.	Horseshoes.
Lead, domestic, Trail.	Mallets, carpenters' hickory.
Nickel.	Screws, bench wood.
Quicksilver.	Soldering irons.
Silver.	Vises, Wrights'.
Solder.	

IX. Fuel and lighting.

Coal, N. S., run of mines.	Gasoline.
Coal, Crow's Nest Pass.	Coal oil, prime white.
Coal, Pennsylvania anthracite.	Coal oil, water white.
Coke, Connellsville furnace.	Calcium carbide.
Coke, Crow's Nest Pass.	Matches.

X. Building materials.

(a) Lumber.

Pine, all grades, Ottawa.	Spruce, New Brunswick.
Pine, good sidings, Ottawa.	Shingles, New Brunswick.
Pine, No. 1 cuts, Toronto.	Birch, Toronto.
Laths, pine, Ottawa.	Maple, Toronto.
Pine, shipping, culls, Ottawa.	Oak, Toronto.
Pine, box boards, Ottawa.	British Columbia fir.
Hemlock, Ottawa.	British Columbia shingles.

(b) Miscellaneous building materials.

Brick, fire.	Plaster of Paris.
Brick, common building.	Red lead, dry.
Cement, Canadian Portland.	Sash cord.
Hinges.	Sash weights.
Iron pipe.	Soil pipe, medium.
Lead pipe.	Tar.
Lime.	Wire, copper.
Nails, cut.	Wire, iron.
Nails, wire.	Wire cloth.
Pitch.	Wire fencing.

(c) Paints, oil, and glass.

Benzine.	Rosin, white.
Glue.	Shellac.
Linseed oil (raw).	Turpentine.
Linseed oil (boiled).	Varnish.
Paris green.	Venetian red (dry color).
Prepared paints.	White lead.
Putty.	Window glass.

XI. House furnishings.

<i>(a) Furniture:</i>	<i>(b) Crockery and glassware—Concluded.</i>
Kitchen chairs (common spindle).	Earthenware: 10-piece printed to- let sets.
Kitchen tables (4-foot, with drawer).	Earthenware: 97-piece printed din- ner sets.
Dining tables (hardwood, exten- sion, 8-foot).	<i>(c) Table cutlery:</i>
Sideboards (hardwood, with mirror 16 by 28).	Knives, celluloid handle, medium size.
Bedroom sets (dresser and stand, hardwood).	Silver-plated knives and forks, 6 pennyweight, medium.
Iron beds, continuous pillars, 4-foot.	<i>(d) Kitchen furnishings:</i>
<i>(b) Crockery and glassware:</i>	Pails.
Tumblers, tank glass, $\frac{1}{2}$ -pint.	Tubs.
Earthenware: White cups and saucers.	Brooms.
	Sadirons, Mrs. Potts'.

XII. Drugs and chemicals.

Alcohol, 65 O. P.	Copperas.
Alcohol, wood.	Glycerin.
Alum.	Indigo.
Bleaching powder.	Muriatic acid.
Borax.	Opium.
Brimstone.	Quinine.
Carbolic acid.	Soda ash.
Caustic soda.	Sulphuric acid.

XIII. Miscellaneous.*(a) Furs.*

Mink, dark.	Raccoon.
Muskrat, best fall and winter.	Skunk, black Canadian.

(b) Liquors and tobacco.

Hops.	Ale and porter (draft).
Malt.	Tobacco, smoking.
Whisky (Can. Club 20-8 up).	Tobacco, raw leaf.

(c) Sundries.

Binder twine.	Rubber, Para Island.
Gunpowder.	Soap.
Paper, news print.	Starch.
Rope.	

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."⁵⁴ 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."⁵⁵

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.⁵⁶

⁵⁴ Wholesale Prices in Canada, 1890-1909, p. 447.

⁵⁵ Idem, 1913, pp. 129, 130.

⁵⁶ Idem, 1890-1909, p. 442.

TABLE 34.—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 (000,000 omitted).	Percentage of each amount to total.	Relative importance proposed for each article in index number reduced to percentage.
Breadstuffs:			
Wheat.....	£60	6.5	5
Barley.....	30	¹ 3.3	5
Oats.....	50	5.4	5
Potatoes, rice, etc.....	50	5.4	5
			20
Meat and dairy food:			
Meat.....	100	¹ 10.9	10
Fish.....	20	2.2	2 ¹ / ₂
Cheese.....			
Butter.....			
Milk.....	60	6.5	7 ¹ / ₂
			20
Mass luxuries:			
Sugar.....	30	3.3	2 ¹ / ₂
Tea.....	20	2.2	2 ¹ / ₂
Beer.....	100	¹ 10.9	9
Spirits.....	40	4.3	2 ¹ / ₂
Wine.....	10	¹ 1.1	1
Tobacco.....	10	¹ 1.1	2 ¹ / ₂
			20
Clothing:			
Cotton.....	20	2.2	2 ¹ / ₂
Wool.....	30	3.3	2 ¹ / ₂
Silk.....	20	2.2	2 ¹ / ₂
Leather.....	10	1.1	2 ¹ / ₂
			10
Metals and minerals:			
Coal.....	100	¹ 10.9	10
Iron.....	50	5.4	5
Copper.....	25	2.7	2 ¹ / ₂
Lead, tin, zinc, etc.....	25	2.7	2 ¹ / ₂
			20
Miscellaneous:			
Timber.....	30	3.3	3
Petroleum.....	5	1.5	1
Indigo.....	5	1.5	1
Flax and linseed.....	10	1.1	3
Palm oil.....	5	1.5	1
Caoutchouc.....	5	1.5	1
			10
Total.....	920	100.0	100

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:⁵⁷

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:	
(a) Lumber.....	6
(b) Miscellaneous building materials.....	2
(c) Paints, etc.....	1
House furnishings.....	2
Drugs and chemicals.....	2
Miscellaneous:	
(a) Furs.....	1
(b) Liquors and tobacco.....	2
(c) Sundry.....	2
Total.....	100

The results of the testing may be seen in Table 35 which gives both the weighted index numbers for each year from 1890 to 1917, inclusive,⁵⁸ and the unweighted index number, from 1890 to 1919, inclusive.

TABLE 35.—WEIGHTED AND UNWEIGHTED INDEX NUMBERS, 1890 TO 1919.

Year.	Weighted number.	Unweighted number.	Year.	Weighted number.	Unweighted number.
1890.....	112.0	110.3	1905.....	113.8	113.8
1891.....	111.3	108.5	1906.....	120.1	120.0
1892.....	104.9	102.8	1907.....	129.2	126.2
1893.....	103.9	102.5	1908.....	125.1	120.8
1894.....	97.2	97.2	1909.....	126.3	121.8
1895.....	95.6	95.6	1910.....	128.0	124.2
1896.....	90.6	92.5	1911.....	131.1	127.4
1897.....	89.9	92.2	1912.....	143.9	134.4
1898.....	95.5	96.1	1913.....	139.6	135.5
1899.....	99.0	100.1	1914.....	139.1	136.1
1900.....	105.8	108.2	1915.....	154.2	148.0
1901.....	106.0	107.0	1916.....	182.3	182.0
1902.....	109.6	109.0	1917.....	241.4	237.0
1903.....	109.7	110.5	1918.....	.....	278.3
1904.....	110.6	111.4	1919.....	.....	283.2

TABLE OF RESULTS.

Table 36, reproduced from various reports, shows by groups of commodities the index numbers for the 30 years, 1890-1919, inclusive.

⁵⁷ Wholesale Prices in Canada, 1890-1909, p. 12.

⁵⁸ Idem, 1918, p. 11.

TABLE 36.—INDEX NUMBERS, BY GROUPS OF COMMODITIES, 1890 TO 1919.¹
(Average prices in 1890-1899=100.)

Group.	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899
1. Grains and fodder	116.7	123.9	106.7	99.1	94.3	98.8	85.2	80.6	98.8	96.7
2. Animals and meats	111.2	101.7	108.5	117.7	98.7	92.2	82.4	90.4	97.9	95.1
3. Dairy products	103.0	106.2	105.8	110.4	104.6	94.8	90.1	90.1	92.9	101.4
4. Fish	103.3	97.3	90.6	99.7	96.4	101.4	102.6	98.6	99.6	110.0
5. Other foods	120.3	121.3	104.7	102.1	95.0	95.2	87.1	86.0	94.3	93.6
6. Textiles	111.4	104.2	102.2	101.2	97.3	93.6	96.9	98.0	95.2	99.8
7. Hides, leather, boots	100.6	102.6	99.8	101.8	89.9	98.6	92.9	100.1	105.0	109.4
8. Metals and implements:										
Metals	125.4	114.4	107.6	102.1	91.1	87.0	87.5	85.7	87.6	111.9
Implements	103.8	103.2	102.9	102.6	102.2	101.0	98.5	93.1	94.3	98.0
9. Fuel and lighting	107.4	106.7	106.6	102.9	97.5	97.0	98.9	96.4	93.5	96.9
10. Building materials:										
Lumber	103.5	102.7	104.4	103.7	104.6	102.8	97.1	93.9	90.8	95.8
Miscellaneous	117.6	110.4	106.8	103.7	98.7	95.2	93.9	87.7	87.4	97.2
Paints, oils, glass	109.5	103.8	98.2	98.6	95.5	96.1	96.2	95.5	100.0	107.6
11. House furnishings	100.2	100.5	100.9	101.1	101.3	97.9	97.5	99.8	99.0	100.2
12. Drugs and chemicals	110.5	110.3	104.4	104.4	103.1	100.3	99.8	96.5	96.8	93.3
13. Miscellaneous:										
Furs	86.5	99.7	103.7	123.6	113.5	80.5	80.7	88.0	111.1	111.8
Liquors and tobacco	94.9	99.0	99.7	99.4	98.7	99.4	98.0	103.9	103.9	102.3
Sundries	112.0	106.7	98.8	100.3	93.7	91.3	92.6	91.2	103.3	109.5
Total	110.3	108.5	102.8	102.5	97.2	95.6	92.5	92.2	96.1	100.1

Group.	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909
1. Grains and fodder	99.9	107.3	116.1	106.5	115.5	116.4	118.5	140.2	148.3	149.9
2. Animals and meats	103.4	111.3	122.2	117.9	111.3	120.7	130.1	133.8	129.6	148.6
3. Dairy products	109.0	102.5	106.9	108.9	107.2	115.1	120.2	131.5	136.3	133.6
4. Fish	106.4	113.2	110.2	116.2	119.5	115.7	121.8	129.5	120.5	134.0
5. Other foods	96.4	98.6	98.4	98.1	101.8	100.7	103.1	112.5	110.3	107.6
6. Textiles	100.0	103.6	101.0	105.9	110.4	114.6	123.4	126.1	111.0	108.3
7. Hides, leather, boots	113.8	112.8	118.2	115.7	113.6	119.6	128.1	125.5	120.0	135.4
8. Metals and implements:										
Metals	121.2	110.4	102.8	105.5	99.7	108.4	128.6	134.8	106.3	101.9
Implements	100.1	102.2	104.7	105.7	106.2	106.1	106.0	107.1	104.2	102.4
9. Fuel and lighting	100.8	98.1	104.9	111.0	103.0	104.1	106.4	108.8	102.2	103.8
10. Building materials:										
Lumber	114.0	114.6	122.0	128.8	131.3	134.1	152.7	165.2	162.6	154.6
Miscellaneous	111.8	106.0	104.6	107.7	107.2	106.8	104.7	108.7	107.5	105.7
Paints, oils, glass	125.9	121.9	128.1	126.3	122.4	125.3	135.3	141.2	136.8	135.2
11. House furnishings	110.2	107.9	109.2	109.6	112.7	107.3	113.0	112.7	112.8	110.4
12. Drugs and chemicals	101.5	99.8	102.2	105.5	109.6	106.4	106.3	108.5	107.1	103.9
13. Miscellaneous:										
Furs	147.3	140.9	145.2	168.1	171.3	217.4	229.2	239.2	231.8	227.2
Liquors and tobacco	103.3	103.3	103.7	107.0	107.8	108.1	108.1	125.5	118.0	117.5
Sundries	113.0	110.9	116.8	115.9	119.1	121.1	120.9	123.0	117.6	121.6
Total	108.2	107.0	109.0	110.5	111.4	113.8	120.0	126.2	120.8	121.2

Group.	1910	1911	1912	1913	1914	1915	1916	1917	* 1918	* 1919
1. Grains and fodder	140.7	148.4	167.3	136.8	156.5	186.9	195.2	281.5	316.2	310.9
2. Animals and meats	163.6	146.6	160.8	180.8	192.3	187.2	217.7	288.1	354.5	357.8
3. Dairy products	135.7	136.2	159.0	151.7	154.4	161.4	183.5	230.5	259.4	296.5
4. Fish	145.1	143.6	155.7	158.0	156.0	149.7	184.8	205.8	247.0	236.6
5. Other foods	111.3	118.7	126.0	117.4	118.8	125.5	156.2	220.6	250.5	251.5
6. Textiles	114.6	119.2	120.7	130.8	133.5	149.2	193.4	263.4	356.9	373.1
7. Hides, leather, boots	135.4	139.6	152.4	163.9	171.8	180.5	233.4	275.1	276.5	349.5
8. Metals and implements:										
Metals	97.6	108.3	117.4	119.1	113.9	152.4	198.9	259.1	273.1	206.0
Implements	104.5	104.5	104.7	105.6	103.8	112.1	135.2	181.6	241.4	240.4
9. Fuel and lighting	103.0	100.5	113.3	118.2	110.9	108.8	132.6	193.0	221.8	237.1
10. Building materials:										
Lumber	158.5	165.4	166.5	181.3	182.1	175.7	182.1	214.5	267.1	310.8
Miscellaneous	109.2	102.6	105.4	112.7	111.4	115.9	154.9	203.5	223.4	224.5
Paints, oils, glass	145.5	154.5	148.6	144.8	140.7	157.1	200.5	222.4	310.8	379.0
11. House furnishings	110.6	110.4	114.5	128.2	129.5	136.5	157.1	203.7	250.9	321.2
12. Drugs and chemicals	109.5	112.1	115.5	113.3	121.6	181.3	252.2	267.9	283.2	232.0
13. Miscellaneous:										
Furs	234.5	252.9	297.3	307.9	205.4	161.9	299.8	411.6	602.4	1009.2
Liquors and tobacco	132.9	151.2	155.2	134.7	136.9	135.6	142.4	167.8	216.6	275.8
Sundries	118.0	100.3	104.3	113.1	108.5	116.6	143.0	188.8	219.5	211.6
Total	124.2	127.4	134.4	135.5	136.1	148.0	182.0	237.0	278.3	293.2

¹ 230 commodities, 1890-1909; 272 commodities, 1910-1914; 271 commodities, 1915-1919, one line of spelter having been dropped in 1915.

² Preliminary figures.

Table 37 showing the course of wholesale prices, classified into commodity groups, in Canada during the years 1914 to 1920, has been reproduced from the January, 1921, Labor Gazette, published by the Department of Labor of Canada. The figures are in certain instances preliminary and are therefore to be regarded as subject to possible revision.

TABLE 37.—INDEX NUMBERS OF WHOLESALE PRICES BY GROUPS OF COMMODITIES, 1914 TO 1920.

(Average prices, 1890-1899=100.)

Commodity group.	1914		1915		1916		1917		1918		1919		1920											
	Jan.	July.	Jan.	July.	Jan.	July.	Jan.	July.	Jan.	July.	Jan.	July.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Grains and fodder.....	140.9	150.4	191.7	191.2	181.0	179.0	238.1	296.3	319.8	314.2	272.3	330.0	368.4	377.7	384.0	399.0	412.6	413.9	401.1	372.4	348.1	313.9	275.3	261.1
Animals and meats.....	191.2	195.7	177.9	195.0	196.3	231.7	249.2	293.4	325.0	369.4	343.7	389.7	350.0	350.7	356.5	359.9	371.8	378.8	378.9	366.2	363.4	348.4	331.0	320.8
Dairy products.....	179.9	131.3	177.5	141.2	186.7	160.5	242.6	210.3	259.0	251.0	294.4	286.4	352.3	333.1	317.9	302.6	292.2	282.0	299.6	305.5	311.1	318.7	322.1	340.0
Fish.....	153.9	148.9	160.0	137.9	163.7	155.9	183.8	201.5	236.3	240.9	268.3	223.3	245.1	244.7	240.6	239.2	286.6	248.2	244.4	241.3	249.5	.....	243.2	236.5
Other foods:																								
Fruits and vegetables..	125.2	131.2	115.1	103.5	169.6	170.5	234.9	308.2	258.4	280.2	246.1	239.7	317.0	347.1	352.7	377.8	428.5	404.3	352.9	258.8	227.6	211.2	242.5	226.1
Miscellaneous.....	112.9	112.5	133.4	138.8	143.2	153.6	177.7	215.9	225.3	246.0	257.7	251.2	282.3	288.6	293.1	304.6	316.6	316.2	325.9	319.3	300.8	287.3	271.3	256.5
Textiles.....	135.2	132.8	126.1	153.4	174.2	192.7	215.7	268.5	326.9	370.4	383.6	364.3	414.0	419.4	420.9	428.7	422.0	410.5	398.3	392.8	387.4	382.4	357.5	328.6
Hides, leather, and boots..	168.1	173.6	178.1	176.3	193.5	240.2	285.9	277.4	261.8	283.5	280.7	385.3	387.6	400.8	363.2	391.8	344.6	297.9	292.2	282.8	264.1	255.8	250.7	231.8
Metals and implements:																								
Metals.....	114.7	109.2	112.6	176.5	198.4	191.9	210.6	274.4	259.7	283.8	242.8	197.6	227.4	236.7	250.2	254.2	253.2	247.0	248.7	249.0	246.1	242.2	231.9	211.8
Implements.....	106.6	106.6	107.5	113.2	116.6	136.7	161.4	194.5	199.0	223.8	241.4	238.4	248.4	243.7	250.3	250.3	251.7	255.4	256.8	273.4	273.2	273.2	273.2	273.2
Fuel and lighting.....	113.6	109.0	108.9	106.2	122.0	125.6	180.9	229.7	188.1	242.4	246.8	229.8	251.1	254.4	254.7	289.3	304.1	330.1	348.0	352.7	349.9	349.2	319.3	317.6
Building materials:																								
Lumber.....	183.5	183.2	178.0	174.1	178.1	182.2	189.6	222.3	238.6	273.0	279.9	304.6	419.9	439.9	485.0	485.0	533.0	533.9	512.0	516.2	494.5	480.5	480.5	457.0
Miscellaneous.....	114.0	110.8	108.2	120.3	132.4	153.6	178.4	215.3	209.4	227.7	233.8	218.5	232.4	235.8	250.5	256.7	250.6	251.6	267.7	273.3	273.3	273.8	271.5	266.8
Paints, oils, and glass..	140.2	140.6	142.9	162.1	193.9	197.4	227.5	261.7	263.2	312.6	339.5	404.9	433.3	447.9	471.1	473.5	489.8	472.9	467.4	443.3	437.3	415.3	395.4	382.7
House furnishings.....	128.8	128.8	131.9	138.7	146.7	152.6	179.5	212.8	222.4	250.9	298.1	325.0	363.5	363.4	364.5	371.8	389.2	389.2	389.2	383.2	387.6	390.2	390.2	390.2
Drugs and chemicals.....	111.1	111.6	135.0	174.2	250.4	249.0	258.5	263.1	289.2	293.1	272.3	221.2	215.3	214.2	219.5	227.2	230.2	233.0	247.1	247.1	245.4	238.6	232.5	228.1
Miscellaneous:																								
Raw furs.....	226.5	235.0	121.8	144.0	269.6	292.3	399.5	396.7	511.5	583.1	742.3	945.6	1785.3	1851.4	1851.4	1779.7	1072.1	900.3	915.9	868.2	868.2	868.2	450.4	364.6
Liquors and tobacco....	138.8	128.3	137.9	134.7	136.7	136.7	161.3	164.1	202.2	222.9	258.7	274.1	317.3	314.0	316.3	316.3	316.8	320.8	315.1	315.1	307.8	303.7	303.7	298.0
Sundries.....	109.3	106.2	113.6	116.3	135.1	142.1	165.8	194.5	200.8	218.9	207.4	214.2	248.1	212.0	205.3	207.5	212.2	216.5	215.8	215.2	214.4	215.7	208.9	210.3
All commodities.....	136.5	134.6	138.9	150.2	172.1	180.9	212.7	248.7	258.7	284.0	286.5	294.0	336.4	343.5	349.0	353.1	355.6	349.3	346.8	330.2	325.6	317.6	304.2	290.5

Table 38, taken from the Labor Gazette, June, 1920 (p. 738), and March, 1921 (p. 439), gives the general index number, by months, from January, 1919, to February, 1921, inclusive.

TABLE 38.—GENERAL INDEX NUMBERS OF WHOLESALE PRICES BY MONTHS, 1919 TO FEBRUARY, 1921.

Year and month.	Index number.	Year and month.	Index number.	Year and month.	Index number.
1919.		1920.		1921.	
January.....	286.5	January.....	338.4	January.....	281.3
February.....	279.8	February.....	343.5	February.....	270.1
March.....	277.6	March.....	349.0		
April.....	279.6	April.....	353.1		
May.....	284.1	May.....	356.6		
June.....	284.1	June.....	349.3		
July.....	294.0	July.....	346.8		
August.....	301.1	August.....	330.2		
September.....	301.5	September.....	326.6		
October.....	299.6	October.....	317.6		
November.....	307.7	November.....	304.2		
December.....	322.7	December.....	290.5		

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 was published annually in the trade statistics of that country,⁵⁹ with a brief advance statement of it appearing in the journal of the statistical office.⁶⁰ Data for late years have been published in the Statistical Yearbook (*Statistisk Aarbog*). It covers a period extending from 1876 down to recent years.

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

⁵⁹ Danmarks vareindførselsg-udførsel i aaret 1906–1912. Udgivet af det Statistiske departementet. Copenhagen, 1907–1913. (Danmarks Statistisk Tabelværk. 5. række, Litra D.)

⁶⁰ Statistiske efterretninger, udgivet af det Statistiske departementet. Copenhagen, 1909–1914.

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), cocoa 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, and 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.

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:

TABLE 39.—INDEX NUMBER OF WHOLESALE PRICES OF 38 IMPORTANT ARTICLES ENTERING INTO THE IMPORT AND EXPORT TRADE OF DENMARK, 1876 TO 1917.

[Danmarks vareindførselsog-udførsel i aaret 1912. Udgivet af det Statistiske departementet. Copenhagen, 1913: Pt. 2, p. 7*, and Statistisk Aarboeg 1920.]

(Average prices for 1891-1900=100.)

Year.	Index number.	Year.	Index number.	Year.	Index number.	Year.	Index number.
1876.....	145	1887.....	99	1898.....	99	1909.....	115
1877.....	135	1888.....	105	1899.....	105	1910.....	120
1878.....	122	1889.....	109	1900.....	110	1911.....	123
1879.....	120	1890.....	109	1901.....	106	1912.....	130
1880.....	128	1891.....	112	1902.....	108	1913.....	¹ 129
1881.....	129	1892.....	101	1903.....	105	1914.....	¹ 145
1882.....	127	1893.....	100	1904.....	107	1915.....	¹ 184
1883.....	126	1894.....	94	1905.....	110	1916.....	¹ 244
1884.....	120	1895.....	92	1906.....	114	1917.....	¹ 322
1885.....	109	1896.....	93	1907.....	118	1918.....	¹ 392
1886.....	101	1897.....	95	1908.....	113	1919.....	¹ 421

¹ Figures taken from the Statistisk Aarboeg, 1920.

FRANCE.

INDEX NUMBERS OF ANNUAIRE STATISTIQUE DE LA FRANCE.

PUBLICATION.

The Statistical Annual (*Annuaire Statistique de la France*) published until 1918 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 all years since 1857.

In addition to these there are shown in certain of the reports, for purpose of comparison, Sauerbeck's index number for the United Kingdom, as published in the Journal of the Royal Statistical Society, the former index number for Hamburg, Germany, based on import values, the index numbers for the United States, published by the Senate Committee on Finance in 1893 and by the Bureau of Labor Statistics in later years, 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 (p. 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.⁶¹ 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.⁶²

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.⁶³

⁶¹ *Annuaire Statistique de la France*, 1907, p. vii.

⁶² *Idem*, 1912, p. 223*.

⁶³ *Idem*, pp. 38*, 59*.

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. In the report for the years 1916, 1917, and 1918 the base was again changed to 1901-1910 and recomputations for the previous years 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.

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 1913 (pp. 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 1913 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.⁶⁴ As previously stated, the

⁶⁴ See, however, page 206 of this bulletin for list of articles published in the *Bulletin de la Statistique Générale de la France*, October, 1912.

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 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.

Table 40, showing the variation in the index number by years from 1857 to 1918, inclusive, is reproduced in condensed form from the *Annuaire Statistique* of 1916, 1917, and 1918 (Vol. XXXV, p. 312*).

TABLE 40.—FLUCTUATIONS IN WHOLESALE PRICES, BY YEARS, 1857 TO 1918.

(Average prices in 1901-1910=100.)

Year.	Food.	Miscellaneous commodities.	Total.	Year.	Food.	Miscellaneous commodities.	Total.	Year.	Food.	Miscellaneous commodities.	Total.
1857.....	133	166	152	1878....	132	112	120	1899....	92	93	93
1858.....	114	153	137	1879....	134	106	117	1900....	93	103	99
1859.....	118	150	137	1880....	133	110	120	1901....	96	94	95
1860.....	127	155	144	1881....	130	108	117	1902....	95	92	94
1861.....	137	145	142	1882....	126	106	114	1903....	96	95	96
1862.....	127	152	142	1883....	119	104	110	1904....	94	95	94
1863.....	122	157	143	1884....	106	97	101	1905....	99	97	98
1864.....	119	156	141	1885....	107	93	99	1906....	98	109	104
1865.....	115	144	132	1886....	102	90	95	1907....	105	112	109
1866.....	124	142	134	1887....	98	88	92	1908....	104	98	101
1867.....	128	133	131	1888....	101	93	96	1909....	104	99	101
1868.....	133	131	132	1889....	105	96	100	1910....	109	108	108
1869.....	129	130	130	1890....	103	97	100	1911....	119	109	113
1870.....	133	133	133	1891....	106	93	98	1912....	124	114	118
1871.....	144	134	138	1892....	106	88	95	1913....	116	115	116
1872.....	135	149	144	1893....	108	84	94	1914....	120	116	118
1873.....	138	147	144	1894....	101	77	87	1915....	151	107	162
1874.....	133	131	132	1895....	94	79	85	1916....	193	238	218
1875.....	127	130	129	1896....	88	77	82	1917....	261	336	302
1876.....	131	128	130	1897....	91	76	83	1918....	325	416	392
1877.....	140	124	131	1898....	95	79	86				

INDEX NUMBERS OF THE STATISTIQUE GÉNÉRALE DE LA FRANCE.

HISTORY.

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 issued by the General Statistical Office of France. The publication of this index number began with the April, 1912, issue of the bulletin and has been continued in each subsequent issue.

SOURCE OF QUOTATIONS.

The prices used in computing these index numbers are compiled from various sources, among which are reports of trade bodies, price-regulating agencies, and commercial periodicals.

BASE PERIOD.

The base period from which price changes are measured is the average of the years 1901-1910, represented by 100.

PRICES: HOW SHOWN AND COMPUTED.

Each number of the *Bulletin de la Statistique Générale* contains a considerable amount of price data. Market quotations for most of the articles included in the index, and covering a period of several months, are shown for Paris or some other city of France in comparison with similar information for leading cities of other countries. Current market prices, by weeks or months, also are published for a large number of commodities. In most instances the prices relate to a particular day of the week or month. Relative prices for each of the 45 articles in the index, dating back to 1901 and computed on prices in 1901-1910 as the base, are published in the issues of January, 1919, and January, 1920.

NUMBER AND CLASS OF COMMODITIES.

The index numbers of the *Statistique Générale* are based on prices of 45 commodities, divided into two groups, as follows:

Twenty food products.—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, and cocoa.

Twenty-five industrial products.—Cast iron, wrought iron, copper, tin, lead, zinc, coal, cotton, flax, hemp, jute, wool, silk, salted hides, skins, tallow, rapeseed oil, linseed oil, alcohol (90°), petroleum, soda carbonate, soda nitrate, indigo, lumber, and rubber.

WEIGHTING.

No system of weighting the commodity prices is employed in the construction of these index numbers.

TABLES OF RESULTS.

Tables 41 and 42 taken from the January, 1921, issue of the *Bulletin de la Statistique Générale de la France* (pages 109, 110), give the index numbers since 1913 and also offer a comparison with certain index numbers of Great Britain, Italy, and the United States.

TABLE 41.—INDEX NUMBERS, BY GROUPS OF COMMODITIES, BY YEARS, 1913 TO 1920, AND BY MONTHS, OCTOBER TO DECEMBER, 1920.

(Average prices in 1901-1910=100.)

Date.	General index numbers (43).	Food products.				Industrial products.			
		Vegetable food (8).	Animal food (8).	Sugar, coffee, cocoa (4).	Total (20).	Minerals and metals (7).	Textiles (6).	Miscellaneous (12).	Total (25).
1913.....	115	120	118	106	116	120	117	110	115
1914.....	118	123	122	112	120	117	127	109	116
1915.....	162	151	149	160	152	197	154	160	169
1916.....	218	204	191	174	193	278	210	219	234
1917.....	302	291	254	213	260	325	354	332	336
1918.....	392	358	338	235	325	340	538	461	446
1919.....	412	376	463	268	389	326	520	445	430
1920.....	589	512	593	446	532	538	863	577	635
October.....	580	504.8	629.4	447.8	543.2	544.1	745	579.6	609.3
November.....	532.6	468.5	612.3	400	512.3	509.1	597.1	547.8	548.8
December.....	502.6	431.4	607.8	376.4	490.9	462.4	556.3	518.6	512

¹ This number does not agree with that given in Table 42, but both are as shown in the Bulletin de la Statistique Générale.

TABLE 42.—COMPARISON OF INDEX NUMBERS FOR FRANCE, ENGLAND, ITALY, AND THE UNITED STATES.

(Average prices in 1901-1910=100.)

Date.	France.			England.		Italy.	United States.
	Statistique générale.			Sauerbeck (45).	Economist (44).	Prof. Bachi (44).	Dun (200).
	Food products (30).	Industrial products (25).	Total (45).				
1913.....	116.4	114.7	115.4	115.9	114.8	119.9	111.4
1914.....	120.2	116.1	117.9	116.3	113.3	114	114.8
1915.....	150.9	166.9	161.6	145.1	141.2	159.1	119
1916.....	192.7	237.6	217.6	184.7	184.3	239.3	139.8
1917.....	260.6	335.8	302.4	238	234.2	367.1	191.4
1918.....	325.2	445.6	392.1	262.1	258.1	490	215.4
1919.....	389.2	429.9	411.8	280	269.9	438.5	216.9
1920.....	531.7	634.6	588.9	337.8	325	.....	232.9
First quarter.....	545	648.2	602.3	348.2	345.1	671	236.2
Second quarter.....	545.2	694.7	628.2	354.8	344.9	790.1	245.4
Third quarter.....	521.2	639.1	586.7	343.6	330.5	761.3	238.4
Fourth quarter.....	515.5	556.7	538.4	304.5	279.7	781.4	211.8
October.....	543.2	609.3	580	328.6	305.7	798.8	223
November.....	512.3	548.8	532.6	301.7	281	788.8	213.5
December.....	490.9	512	502.6	282.1	252.5	761.7	190

In 1911 the General Statistical Office published a volume devoted exclusively to the subject of wages and the cost of living in France at different epochs.⁶⁵ 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.

In Table 43, 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

⁶⁵ Salaires et Coût de l'Existence à diverses Époques, jusqu'en 1910. Paris. Imprimerie Nationale.

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. The average of the prices for 1891-1900, taken as 100, constitutes the base.

TABLE 43.—RELATIVE PRICES OF COMMODITIES, 1880 TO 1909.

(Average prices in 1891-1900=100.)

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	133	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	97
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	93	123
1892.....	101	100	100	83	125	138	111	101	93	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	67	100	105	122	95	88	91
1896.....	100	107	98	83	82	88	98	96	90	103
1897.....	120	96	98	117	93	78	92	92	95	100
1898.....	121	102	99	100	90	73	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	113	150	82	121	78	91	111	104
1903.....	107	100	104	167	75	128	109	78	101	90
1904.....	110	102	106	150	80	128	65	50	93	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	105	128	199	100	192	70	60	128	106

Table 44, 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 preceding 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.

TABLE 44.—THREE SERIES OF INDEX NUMBERS COMPUTED FOR 10 ARTICLES, 1880 TO 1909.

(Average prices in 1891-1900=100.)

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	1895.....	94	96	96
1881.....	139	121	111	1896.....	94	96	93
1882.....	126	125	117	1897.....	98	99	93
1883.....	125	120	105	1898.....	99	98	99
1884.....	122	116	106	1899.....	98	99	100
1885.....	109	109	101	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	104	103	1905.....	102	85	94
1891.....	110	108	104	1906.....	109	89	95
1892.....	105	106	108	1907.....	115	95	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 of wholesale prices in France formerly was published weekly in *La Réforme Économique*, a journal of social and political economy, Jules Domergue, editor. Since the beginning of the war period, only certain information for a limited number of individual commodities has been continued, no general index number being calculated.

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 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. Owing to the situation brought about by war, only fragmentary information has been published since 1913.

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.⁶⁶ 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.

⁶⁶ *Annuaire Statistique de la France*, 1912, p. 223*.

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*),⁶⁷ 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) agricultural 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.

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 were 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),

⁶⁷ The French term "fécule" includes such articles as potato flour, tapioca, sago, arrowroot flour, etc.

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 of index numbers has been compiled from the numbers of *La Réforme Économique* published during the years 1892–1913:

TABLE 45.—INDEX NUMBERS COMPUTED FROM AVERAGE ANNUAL PRICES, 1891 TO 1913.

[Data from *La Réforme Économique*.]

(Average prices in 1890=100.)

Year.	Index number.	Year.	Index number.	Year.	Index number.
1891	99.6	1899	95.6	1907	112.2
1892	94.2	1900	102.4	1908	101.2
1893	97.6	1901	95.8	1909	101.8
1894	89.4	1902	94.2	1910	108.2
1895	84.4	1903	95.8	1911	113.8
1896	82.2	1904	95.2	1912	117.8
1897	83.4	1905	95.8	1913	116.0
1898	87.6	1906	105.4		

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*.⁶⁸

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.

⁶⁸ *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.

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:

Year.	Index. number.	Year.	Index. number.
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		

DESCRIPTION OF COMMODITIES.

The articles selected for which Mr. 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.
Beer. ⁶⁹	Codfish.
Cider. ⁷⁰	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*

⁶⁹ Included in the calculation of index numbers in 1 instance only.

⁷⁰ Included in the calculation of index numbers in 3 instances only.

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 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."⁷¹

TABLES OF RESULTS.

Table 46, 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:

TABLE 46.—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 prices in 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	95	96	98	99
Environs of Paris....	114	106	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	101
Small schools....	111	100	106	100	100	98	100	101	102	99	102	104	109
North:													
Large schools....	111	98	102	100	100	100	98	99	98	97	96	99	102
Small schools....	114	99	97	105	95	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	103
Small schools....			106	102	98	99	99	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	96	96	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	98	98
Other schools:													
Large schools (37)	110	103	100	100	99	99	98	100	99	96	97	101	105
Small schools (30)	113	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 Table 47, the figures being given separately for Paris, its suburbs, and the large and small schools, respectively, of the 9 agricultural sections of France.⁷²

⁷¹ Le coût de la vie, p. 11.

⁷² Idem, pp. 22 and 23.

TABLE 47.—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 prices in 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
Environs of Paris.....	120.2	174.4	135.6	99.9	62.2	102.1	.....	.....	112.1	.....	123.3
Northwest:											
Large schools.....	117.6	166.0	164.1	111.7	65.1	64.7	.....	169.5	110.5	104.4	105.3
Small schools.....	121.6	114.2	113.2	124.0	57.9	.....	.....	154.2	109.9	.....	110.3
North:											
Large schools.....	113.3	113.1	189.6	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	138.5	105.5
Small schools.....	119.8	106.1	116.8	106.2	69.3	72.9	.....	.....	113.8	.....	109.0
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	.....	118.8
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	107.7	134.7	63.7	103.6	.....	.....	104.4	150.6	109.3
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	109.2
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	105.2
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	120.3	110.7

Sections.	Oil (table).	Eggs.	Milk.	Cheese.	Sugar.	Fresh fish.	Salted fish.	Cod-fish.	Pota-toes.	Coal.
Paris.....	91.3	110.3	95.6	103.0	59.3	71.0	.....	81.6	108.1	113.5
Environs of Paris.....	112.2	107.5	100.0	108.9	60.7	98.4	.....	.....	125.8	110.3
Northwest:										
Large schools.....	108.3	116.1	112.4	116.2	61.0	98.5	.....	103.8	98.9	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.....	93.4	108.2	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	105.0	116.3	59.1	91.4	130.8	.....	109.7	124.7
Southeast:										
Large schools.....	102.9	115.3	100.4	120.6	62.5	93.9	106.0	125.2	.....	119.9
Small schools.....	109.3	123.7	125.0	125.0	58.2	100.0	117.0	111.1	.....	121.2
South:										
Large schools.....	74.2	115.6	121.7	104.8	56.8	75.9	109.6	.....	106.5	107.1
Small schools.....	111.6	134.0	111.6	113.0	62.6	78.2	143.2	105.8	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	84.3	99.5	82.6	156.0
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 FORMER IMPERIAL STATISTICAL OFFICE.

PUBLICATION.

This series of index numbers, which represents wholesale prices of commodities in German markets, formerly was published yearly in the *Vierteljahrshäfte zur Statistik des Deutschen Reichs*, a publication of the Imperial Statistical Office, and appeared 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 later reports regularly covered the 10-year period ending with the date of the publication of the report. Since the dissolution of the German Imperial Government in 1918 the publication of the *Vierteljahrshäfte* has been continued by the Statistical Office (*Statistischen Reichsamt*) but only fragmentary price data have been included.

HISTORY.

Beginning with 1879 the German Imperial Statistical Office 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 for later years 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 was extended back only as far as the year 1899.

SOURCES OF QUOTATIONS.

The number of markets represented in this study was 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 1917: 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), 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 f. o. b. 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 Harburg on the Elbe (for the raw jute f. o. b. Hamburg), the Merchants' Association at Lindau, the Royal Administration of Mines at Saarbrücken, the Imperial Grain Office at Berlin, the Imperial Meat Office at Berlin, the German Green Hides Corporation at Berlin, the Statistical Office of the city of Leipzig, and the Bureau of Trade Statistics at Hamburg.

From the beginning ordinary published market quotations were avoided as representing fluctuations in quality and as not being scientifically constructed. The study was restricted to prices secured currently from the above-named or similar sources.

BASE PERIOD.

The 10-year period 1889 to 1898 was taken as the base period. No reasons were 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) 44 series of index numbers were given. Of this number three series represented iron and two each represented coal and petroleum. Each of the other commodities was represented by a single series. The actual number of commodities was therefore 40. No index number for the total of the 44 series of index numbers was published, nor were index numbers shown for groups of commodities.

The index numbers for the 40 articles represented 235 series 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 also 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 as published in 1917 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*).
 Frankfurt 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.
 Frankfurt on the Main, minimum 75 kilograms per hectoliter [58.3 pounds per bushel].
 Hamburg, Holstein, Mecklenburg.
 Königsberg, 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.
 Frankfurt on the Main, good, native.
 Königsberg, 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 Baden, from Württemberg, 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.
 Frankfurt on the Main, brewing.
 Königsberg, 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].
 Madgeburg, Chevalier, good medium. (Not after 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, mountain.
 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.
 Madgeburg, Saxon, for food.
 Madgeburg, distilling.
 Stettin, sorted, red, for food.
 Stettin, sorted, white, for food.

Live stock for slaughter.

Cattle (100 kilograms [220.5 pounds]) Berlin, slaughter weight.⁷³
 Hogs (100 kilograms [220.5 pounds]) Berlin, slaughter weight.⁷³
 Calves (100 kilograms [220.5 pounds]) Berlin, slaughter weight.⁷³
 Sheep (100 kilograms [220.5 pounds]) Berlin, slaughter weight.⁷³

Rye flour (100 kilograms with sack).

Berlin, No. 0/1, good average grade.
 Danzig, No. 0/1, domestic price (*Inlands preis*).
 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).⁷⁴

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).⁷⁴

Brunswick, without container in paper.
 Magdeburg, I loaf (*Brot*), without container, in paper.
 Stettin, I loaf (*Brot*), without container, in paper.

⁷³ 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 8½ per cent higher than on dressed weight.

⁷⁴ Descriptions from table of actual prices. Article not included in table of relative prices.

Molasses (100 kilograms, net weight).⁷⁴

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.

Frankfort on the Main, with container.

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, standard quality, 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, Campinas.

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.

Frankfort on the Main, with sack, Santos choice.

Frankfort on the Main, with sack, blue Java or Central American.

Cocoa (100 kilograms, in bond).⁷⁴

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.

⁷⁴ 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.
Bremen, with packings, in bond, Brazil, 6 months' time.
Bremen, with packings, in bond, Virginia, stems, 6 months' time.
Hamburg, in bond, Domingo, wrapper and filler leaves, 6 months' time or 2½ per cent discount.
Hamburg, in bond, Brazil, 6 months' time or 2½ per cent discount.
Mannheim, in bond, wrapper leaves, Palatinate, 6 months' time or 1 per cent discount.
Mannheim, in bond, wrapper leaves, and filler leaves, Palatinate, 6 months' time or 1 per cent discount.
Mannheim, in bond, cut, Palatinate, 6 months' time or 1 per cent discount.

Hides and skins.

Bremen, 100 kilograms, ox hides, best dry, Buenos Aires, 6 months' time.
Bremen, 100 kilograms, ox hides, 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).⁷⁶

Berlin, North German sheep, medium.
Bremen, washed, Buenos Aires, I.
Munich, South German, medium.
Leipzig, top, Australian, A.
Leipzig, top, La Plata, choice.
Leipzig, top, La Plata, half blood.
Leipzig, top, La Plata, quarter blood.
Leipzig, noil, Australian, current.
Leipzig, noil, La Plata, medium.

Cotton (100 kilograms).

Bremen, middling upland.
Bremen, good Oomrawuttee, 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, cash, 6 per cent discount.
Krefeld, English Nos., 130-200, twofold, singed, cash, 6 per cent discount.
Mülhausen, in Alsace, metric Nos., warp No. 16, 30 days, 2 per cent discount.
Mülhausen, in Alsace, metric Nos., warp No. 28, 30 days, 2 per cent discount.
Mülhausen, in Alsace, metric Nos., card. Maco No. 40, 30 days, 2 per cent discount.

⁷⁶ Descriptions for quotations at Munich and Leipzig taken from actual prices. Wool quoted in these two markets is not included in the table of relative prices.

Mülhausen, in Alsace, metric Nos., woof No. 16, 30 days, 2 per cent discount.
 Mülhausen, in Alsace, metric Nos., woof No. 37, 30 days, 2 per cent discount.
 Mülhausen, in Alsace, metric Nos., card. Maco No. 50, 30 days, 2 per cent discount.
 Munich-Gladbach, Mule No. 8, f. o. b. factory, 3 months' time.
 Munich-Gladbach, Water No. 12, f. o. b. factory, 3 months' time.
 Munich-Gladbach, Water No. 20, f. o. b. factory, 3 months' time.

Calico (1 meter).

Mülhausen, in Alsace, 90 centimeters [35.4 inches] wide, 20/20 thread.
 Munich-Gladbach, 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 organzine, 18-20, 9 months' time, or cash 5 per cent discount.
 Krefeld, Italian tram, 24-26, 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 organzine, 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 ^{R F}
 C

Hamburg, Good I, native brands.

Hamburg, Good II, native brands.

Rubber, crude (1 kilogram).⁷⁴

Hamburg, South Kamerun.
 Hamburg, Benguela II.
 Hamburg, Upper Kongo I.
 Hamburg, Kassai I, red.
 Hamburg, Massai.
 Hamburg, Mozambique I.
 Hamburg, fine Para, hard.
 Hamburg, Manáos, 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.
 Düsseldorf, at the foundry, puddle.
 Düsseldorf, at the foundry, foundry pig.
 Düsseldorf, at the foundry, Luxemburg No. 3.

⁷⁴ Descriptions from table of actual prices. Articles not included in table of relative prices.

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.

Hard 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.

Dusseldorf, at the mine, open-burning.

Dusseldorf, at the mine, anthracite.

Dusseldorf, at the mine, uninflamable.

Dusseldorf, at the mine, gas.

Essen, at the mine, open-burning.

Essen, at the mine, anthracite.

Essen, at the mine, uninflamable.

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, tare 20 per cent,

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.

Lubeck, "Nobel."

SUBSTITUTIONS, ADDITIONS, AND OMISSIONS.

Within the period of years covered by the 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 was assigned for the substitution of the new series and no explanation was 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.

Only two new commodities, cocoa and rubber, have been added in the period covered by the index numbers. In these cases only actual prices are shown.

TABLE OF RESULTS.

As has been stated on a preceding page, index numbers made by averaging the different series of relative prices for a particular commodity were published in former years. Beginning with 1913, however, this practice was discontinued by the German Statistical Office. Therefore, in order to bring the information up to the latest possible date it has been necessary, in the preparation of the present bulletin, to compute such index numbers for the years 1913 to 1917 by adding the several series of relative prices shown for a commodity and dividing the sum so obtained by the number of price series.

It should be noted, moreover, that during the war most of the commodities for which prices formerly were collected by the German Statistical Office were under Government control and all free trading in them was prohibited. In a number of instances commodities imported from abroad or manufactured from imported raw materials disappeared entirely from the markets. For these reasons prices for a considerable number of commodities could not be obtained after 1914 and many of the series of index numbers were in consequence interrupted.

Table 48 is taken from more than one report, because no table of relatives as published covers more than 10 years. In cases where the earlier and later series do not agree, both sets of figures have been copied.

TABLE 48.—RELATIVE PRICES OF

[Data from Vierteljahreshette zur Statistik des

(Average prices in 1889-1898=100.)

Commodity.	1899	1900	1901	1902	1903	1904	1905	1906
Rye.....	100	97	96	97	91	90	98	107
Wheat.....	91	88	94	94	90	98	98	100
Oats.....	98	96	101	108	93	92	102	114
Corn (maize).....	91	103	106	116	108	108	115	119
Barley.....	99	96	98	95	92	94	101	103
Hops.....	118	90	81	88	138	166	107	72
Potatoes.....	93	103	87	81	102	133	126	83
Cattle.....	101	104	102	106	113	115	120	129
Hogs.....	91	92	107	114	96	94	123	128
Calves.....	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Sheep.....	106	108	109	117	128	123	134	146
Rye flour.....	97	95	94	95	89	87	91	101
Wheat flour.....	91	86	92	92	89	94	94	97
Butter.....	100	100	105	101	105	107	112	115
Potato alcohol.....	102	97	81	71	86	127	107	91
Rapeseed oil.....	90	109	107	100	90	85	87	105
Herrings.....	129	144	116	128	106	99	136	146
Coffee.....	53	63	56	55	51	60	62	62
Tea.....	93	92	84	83	87	90	81	87
Rice.....	106	104	104	95	104	101	100	103
Pepper.....	147	168	164	161	167	159	155	143
Lard.....	82	105	127	152	126	105	100	130
Leaf tobacco.....	103	108	108	101	93	91	92	103
Hides and skins.....	{ (1) 3 107	{ 2 113 3 110	{ 2 113 3 167	{ 2 117 3 118	{ 2 117 3 115	{ 2 121 3 118	{ 2 132 3 129	{ 2 146 3 142
Wool.....	127	117	94	104	117	118	123	134
Cotton.....	79	120	102	105	128	144	114	130
Cotton yarn.....	{ 4 92 5 91 6 86	{ 4 117 5 116 6 107	{ 4 105 5 104 6 89	{ 4 105 5 104 6 94	{ 4 121 5 121 6 110	{ 4 131 5 131 6 118	{ 4 108 5 117 6 108	{ 4 134 5 117 6 108
Calico.....	{ 5 88	{ 5 108	{ 5 89	{ 5 94	{ 5 111	{ 5 118	{ 5 109	{ 5 127
Linen yarn.....	96	118	120	102	110	120	116	130
Raw silk.....	109	102	91	99	107	93	99	107
Hemp.....	112	124	135	128	121	114	114	125
Mexican fiber.....	105	112	97	98	117	128	122	121
Raw jute.....	98	114	107	103	111	113	149	194
Iron, German, pig.....	122	153	115	106	105	104	104	119
Iron, English, pig.....	128	145	113	115	108	102	108	117
Iron, Swedish, bar.....	120	148	118	115	113	112	114	118
Lead.....	130	149	112	97	100	102	118	149
Copper.....	149	148	141	108	120	119	141	176
Zinc.....	131	108	91	98	110	118	133	141
Tin.....	153	166	148	150	158	158	180	225
Coal, anthracite, German.....	106	120	123	116	112	111	113	118
Coal, anthracite, English.....	113	159	125	118	114	108	108	113
Petroleum, American.....	106	110	106	103	110	104	99	106
Petroleum, Russian.....	102	106	97	91	99	98	96	102

1 No index number published.

2 New series occasioned by substitution in Frankfort quotation for German and Russian hare skins.

3 Old series.

ARTICLES OF WHOLESALE TRADE.

Deutschen Reichs: 1917 and preceding years.]

(Average prices in 1889-1898=100.)

1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917
127	123	115	101	113	125	110	119			
116	118	130	116	114	121	112	122			
125	114	119	107	120	134	113	127			
131	140	139	127	127	147	126				
114	118	112	103	121	129	107				
178	54	97	142	195	184	147	137	54	59	94
122	121	115	98	146	165	111	129	228	286	372
128	121	115	127	134	145	151	145	193		
106	112	128	127	110	141	140	119			
(¹)	(¹)	(¹)	(¹)	167	181	195	174	236		
144	136	137	143	146	160	176	177	255		
122	120	110	97	106	115	107	121	151	149	143
112	115	126	113	111	115	111	125	167	153	171
114	119	120	123	129	134	127	128	173	183	207
119	143	108	107	104	141	151	152			
135	129	107	107	118	123	122	134	308		
115	92	107	121	124	145	157	190	298	645	751
59	60	62	74	97	107	93	89	132		
94	88	87	94	102	102	105	138	210		
115	113	107	105	116	142	121				
123	87	90	103	122	143	134	144	123	2,300	7,283
135	113	171	183	136	156	166	157			
121	118	112	129	141	123	127	127	209	455	
² 137	² 125	143	156	144	180	197	181	148	229	208
³ 134	³ 122									
138	121	132	135	129	131	144	185	273		
135	122	137	172	159	142	150	141			
159	137	131	149	142	136	134	139	234	351	320
145	119	113	121	119	123	124	121	190		
157	132	110	124	134	134	145	150	211	239	337
133	96	99	96	95	93	98	103	116	194	316
132	128	130	138	145	167	169	180			
117	113	100	104	114	113	115				
185	152	125	131	180	191	233	259			
136	119	101	107	108	123	130	123	155	180	256
126	112	110	112	110	129	132	122			
118	115	115	124	123	123	124	124	133		
165	116	112	111	120	154	160	172	247	268	268
179	121	119	116	114	148	139	141		194	194
126	107	119	124	135	141	124	120	158	175	196
216	168	169	193	238	259	255	206			293
127	133	129	127	125	130	139	137	159	172	227
137	129	118	120	118	139	146	134			
108	113	110	105	105	125	126	126	152	161	155
106	112	106	103	104	120	125	126			

⁴ New series including Stuttgart quotations.⁵ Old series including Stuttgart quotation.⁶ 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 former issues of the *Jahrbücher für Nationalökonomie und Statistik*, published monthly at Jena, Germany. They are 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 appeared in published form 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. From 1887 to 1914, however, presentation of the figures at some time during the year was made. Each issue of the *Jahrbücher* reproduced the figures from the beginning, though those for the earlier years were grouped by periods in the later issues. No index numbers appear to have been published in the *Jahrbücher* since 1914.

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 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 Borgh, now Prof. van der Borgh, 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 seaborne 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 Warenpreise 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 Warenpreis 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*, volume 3, third series, 1892, pages 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 Schiffahrt—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 were made after Dr. Conrad's article was written. An average actual quotation was carried for each of 171 articles and subdesignations of articles for all years up to 1912, when publication of the index numbers was discontinued.

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 238 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 presented annually in the *Jahrbücher* up to 1914.

Index numbers computed from prices of 39 selected articles.

The first series contains relatives for each of 39 articles from 1871 to 1912 and appeared in current issues of the *Jahrbücher*. No general relative was computed for this group. This is the table used in the Report from the Committee on Finance of the United States Senate, 1893.⁷⁸

BASE PERIOD.

This table appears in the first study of this series, volume 3 of the *Jahrbücher*, 1864, by Dr. E. Laspeyres in practically its latest 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 no general relative for this table was made.

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 Borgh, by whom the work was continued in 1882, did not print this table at all. Its publication was resumed,

⁷⁸ Report from the Committee on Finance of the United States Senate on Wholesale Prices, Wages, and Transportation. Mar. 3, 1893. 52d Cong., 2d sess., Report No. 1394. Pt. I, pp. 297–301.

however, by Dr. Conrad in volume 1, third series, of the *Jahrbücher*, 1891, with 1847-1870 as the base. This base remained unaltered from 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, third series, 1891, it is possible to get the decennial relative for each article since 1851-1860 and the yearly relative from 1886 to 1912, on the latest 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 new 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 1912 the actual prices of the table under consideration are those of Hamburgs Handel und Schiffahrt as 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 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.⁷⁶

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.

⁷⁶ 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.

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, 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 has been 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 Schiffahrt 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 the "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 issues of the *Jahrbücher* up to 1914. 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 236-238 of this bulletin.

BASE PERIOD.

The weighted relative as 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 Borghet 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 was published up to 1912, 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 after 1905. By the use of preceding issues a yearly relative for the 19 articles is made 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 appeared for 1912 it contained 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 appeared for sugar, silk, or unforged zinc after 1891. The table, however, was preserved in its original form until volume 31 of the *Jahrbücher*, 1906 (containing the relative for 1904), when the table was recast to include only the 19 articles. No explanation of the reason for the omission of the three articles noted above was made, but since they were later not 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 *Hamburgs* 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 issues of the *Jahrbücher* up to June, 1914, 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 equals.....	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 Borgh't 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 Borgh't's method of weighting each year separately. Dr. Conrad continued to weight this table according to the consumption statistics of 1880 up to 1912, the latest year for which figures were shown.

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 1912, however, the general relative was 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. In 1912 it included only 157 articles. Dr. Conrad also included in his periodical price studies after 1889 a relative based on the official imperial quotations (*Reichsstatistik*), and in addition reprinted Sauerbeck's index as found in the *Journal of the Royal Statistical Society*, London. These various relatives he utilized for comparison with his own work.

Index numbers computed from prices of 157 articles.

Beginning with volume 1, third 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 1912 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 issue of the *Jahrbücher* for 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 printed in its latest form 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 later basis of 157 articles is available only from 1902 to 1912. This is occasioned by the fact that when the relative was recomputed on its later 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 now is 95, and on the base 1871-1880 was 72 and is now 85 plus. The year 1892, 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.

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 1912 appear in "Hamburgs Handel und Schifffahrt." 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. Aloes. | *44. Casings (i. e., for sausages). |
| 2. Antimony. | 45. Yellow metal and brass. |
| 3. Oranges. | 46. Gin. |
| 4. Arrack. | 47. Barley. |
| 5. Asphalt. | 48. Plate glass. |
| 6. Balsam of copaiba. | 49. Natural guano. |
| 7. Peruvian balsam. | 50. Gum arabic. |
| 8. Cotton and cotton waste. | *51. Gum benzoin. |
| 9. Bay leaves. | *52. Dammar. |
| 10. Tin plate. | 53. Raw rubber. |
| 11. Sheet iron. | 54. Copal. |
| 12. Lead. | 55. Gutta-percha and chicle. |
| 13. White lead. | 56. India-rubber shoes. |
| 14. Borax. | 57. Dried and salted hides. |
| 15. Bristles. | 58. Oats. |
| 16. Cinchona bark. | 59. Hemp. |
| 17. Cochineal. | 60. Resin and galipot. |
| 18. Divi-divi. | 61. Herring. |
| 19. Iron wire. | 62. Logwood. |
| 20. Pig and cast iron. | 63. Yellowwood. |
| 21. Bar iron from all sources (<i>im Ganzen</i>). | 64. Redwood. |
| 22. Strap iron, English. | 65. Ebony wood. |
| 23. Sheet billets, Swedish. | 66. Rosewood (<i>Jacaranda</i>). |
| 24. Iron rails and fishplates. | 67. Corkwood. |
| *25. Elephant's tusks and ivory. | 68. Mahogany. |
| 26. Peas. | *69. Walnut wood. |
| 27. Extract of logwood. | 70. Cedar wood. |
| *28. Extract of redwood. | 71. Honey. |
| *29. Extract of yellowwood. | 72. Ox and cow horns. |
| *30. Extract of quercitin (dyer's oak). | 73. Indigo, natural and manufactured. |
| 31. Figs. | 74. Raw ginger (zinziber). |
| 32. Deerskins, doeskins, and reindeer skins. | 75. Iodine and iodine preparations. |
| 33. Calfskins. | *76. Jute. |
| 34. Sheep and goat skins. | 77. Cheese. |
| 35. Dried fish. | 78. Coffee, raw, without designation of kind (<i>im Ganzen</i>). |
| 36. Meats, fresh and cured. | 79. Coffee, raw, Brazil. |
| *37. Meat extracts. | 80. Coffee, raw, San Domingo. |
| *38. Nutgalls. | 81. Coffee, raw, Java. |
| 39. Cotton yarn. | 82. Coffee, raw, La Guaira. |
| *40. Coconut fiber yarn. | 83. Coffee, raw, Porto Rico. |
| *41. Jute and manila hemp yarn. | 84. Cocoa. |
| 42. Linen yarn. | *85. Potassium monochromate. |
| 43. Woolen and half-woolen yarn. | 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.⁷⁷
 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. Caster 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 Undrubaat*).
 *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.

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 number 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 included 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

⁷⁷ 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.

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 latest year for which information is shown, 1912, it was 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 issued for 1912 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 last published ⁷⁸ 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 made available from 1888 to 1912, excepting for 1889 and 1902. For these years relatives were not computed, although the actual prices were available.

On the base 1879-1889 the table shows relatives by five-year periods from 1889 to 1913 and annual relatives from 1908 to date. By the use of preceding issues an annual relative is made available from 1890 to date, except for 1889 and 1902, as noted above.

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 price series each for sugar, coffee, tobacco, and cotton yarn. However, for the years after 1909 the quotation on herring is lacking, while from 1907 to 1912 no quotation on copper is shown. Therefore the relative as printed is actually based on 33 articles from 1884 to 1906, 32 articles from 1907 to 1909, and 31 articles from 1909 to 1912.

⁷⁸ *Jahrbücher für Nationalökonomie und Statistik*, 102, Band (III. Folge, 47. Band), Heft 6. Juni, 1914, p. 800.

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 issue of the *Jahrbücher* for June, 1914:⁷⁹

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).
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, Lubeck.
22. Raw silk, Milan organzine Krefeld.
23. Cotton yarn, Nos. 40-120, Krefeld.
24. Cotton yarn, warp 16, Mülhausen, in Alsace.
25. Cotton cloth, Mülhausen, 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).

⁷⁹*Jahrbücher für Nationalökonomie und Statistik*, 102, Band (III. Folge, 47. Band), Heft 6. Juni, 1914, pp. 799-801.

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.

Tables 49, 50, and 51, compiled mainly from the issue of the Jahrbücher for June, 1914, show the principal index numbers computed by Dr. Conrad:

TABLE 49.—RELATIVE PRICES OF 39 SELECTED ARTICLES (BASED ON HAMBURG TRADE STATISTICS), BY SPECIFIED PERIODS, 1871 TO 1910, AND BY YEARS, 1906 TO 1912.¹

(Average prices in 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	84.55	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	52.96	53.98	58.83	60.86	59.90	51.04	61.75	60.48	63.50	57.56
Currants	89.50	80.33	63.44	79.07	96.39	90.88	97.40	95.50	94.32	104.34	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	104.65	162.61	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	78.08	72.83
Palm oil	100.46	71.04	57.61	62.71	74.67	69.47	78.41	66.63	69.15	85.31	83.16	81.78
Indigo	111.41	93.36	77.48	54.23	40.85	47.15	51.89	38.24	33.75	34.58	43.95	35.94
Mahogany	92.56	83.14	68.59	56.97	42.86	43.53	44.29	44.13	37.11	43.28	57.06	27.78
Cotton	81.06	62.53	45.95	48.24	49.70	48.57	48.87	50.52	45.23	55.55	29.43	51.85
Hemp	98.01	85.55	80.37	90.13	91.69	83.95	81.88	97.46	96.73	101.17	97.15	53.27
Rice	81.43	68.15	59.36	57.78	65.39	62.24	68.46	69.84	64.47	62.62	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	106.26	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	89.95	57.76	51.34	67.84	63.35	74.15	71.36	69.90	62.62	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	103.69
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 rape-seed	97.88	84.99	72.13	68.52	74.68	86.16	78.00	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	96.50	115.13	102.08
Calfskins	103.00	74.42	59.58	70.38	87.89	94.10	82.66	86.48	87.31	86.77	88.76	85.20
Bristles	155.22	145.76	88.75	74.42	81.07	82.12	78.52	77.91	80.76	85.73	93.92	98.92
Wax	76.98	54.12	60.99	74.41	75.45	81.98	83.06	74.42	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	78.67	84.69
Fish oil	82.17	66.65	49.24	52.95	55.64	49.77	57.55	51.97	54.30	62.10	65.61	56.68
Lard	86.92	78.25	62.50	75.88	87.92	76.23	83.36	84.71	98.89	108.59	89.45	99.65
Herrings	121.94	109.15	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	108.85	105.33	111.65	100.27	107.18	118.15	143.34	153.85
Copper	88.02	63.91	57.20	67.35	68.90	70.80	81.95	65.36	65.77	63.89	63.46	72.31
Lead	112.19	83.77	86.44	95.06	102.94	112.18	116.76	102.59	96.23	91.14	86.49	98.24
Quicksilver	129.54	83.40	87.16	102.43	91.37	87.74	84.08	92.43	94.67	95.65	98.04	92.25
Coal and coke	109.88	77.78	85.85	87.65	87.65	83.95	93.83	92.59	83.95	86.42	82.72	95.06
Saltpeter	96.71	73.71	56.30	65.62	69.05	75.14	75.70	68.98	65.90	62.11	67.37	74.58
Bar iron (English)	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	105.39	87.32	95.66	113.48	114.12	109.64	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
Linen yarn	80.55	98.17	109.91	116.56	117.10	116.30	121.75	117.93	111.49	117.35	121.11	125.60

¹ Jahrbücher für Nationalökonomie und Statistik, 102. Band (III. Folge, 47. Band), Heft 6. Juni, 1914, p. 796.

² These figures appear thus in the original.

TABLE 50.—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 1912.¹

(Average prices in 1847-1880=100.)

Article.	Prices 1871- 1880 (based on 1847- 1887= 100).	1881- 1890	1891- 1900	1901- 1905	1906- 1910	1906	1907	1908	1909	1910	1911	1912
I.												
Coffee, Brazil.....	} 141.66	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.....												
II.												
Cotton.....	81.84	66.28	48.70	51.07	52.68	51.78	51.79	53.54	47.93	58.88	62.98	54.95
III.												
Indigo.....	} 101.65	78.87	61.65	61.15	42.73	63.36	42.57	39.91	36.26	38.09	46.26	39.06
Saltpeter.....												
Fish oil.....												
Palm oil.....												
IV.												
Pig iron.....	} 111.80	72.97	73.26	79.51	94.48	89.50	102.72	88.69	91.68	96.96	107.71	117.90
Tin.....												
Copper.....												
Lead.....												
V.												
Coal.....	109.88	75.90	83.74	86.03	85.54	81.93	91.57	90.36	81.93	84.34	80.72	92.77
VI.												
Wheat.....	} 112.51	78.01	63.90	63.40	69.88	67.06	72.52	72.60	76.02	67.14	69.59	79.29
Rye.....												
Barley.....												
Oats.....												
Average..	105.54	77.43	68.44	67.93	71.31	70.55	76.42	70.10	68.52	70.79	76.04	79.38
Arithmetical mean, com- puted from 157 Hamburg average prices	111.31	91.70	84.10	76.37	83.03	80.52	89.47	82.07	80.22	82.87	84.80	² 86.51

¹ Jahrbücher für Nationalökonomie und Statistik, 102. Band (III. Folge, 47. Band) Heft 6. Juni, 1914, p. 798.

² 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.

TABLE 50.—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.

(Average prices in 1871=100.)

Article.	Prices 1871-1880 (based on 1817-1867=100).	1881-1890	1891-1900	1901-1905	1906-1910	1906	1907	1908	1909	1910	1911	1912
I.												
Coffee, Brazil.....	} 79.43	88.23	52.62	74.09	57.16	81.21	70.16	71.87	74.76	82.72	85.82	
Cocoa.....												
Tea.....												
Pepper.....												
Rice.....												
II.												
Cotton.....	79.63	56.69	59.44	61.39	59.92	60.29	62.32	55.79	68.61	73.40	64.04	
III.												
Indigo.....	} 78.97	61.69	61.22	40.28	93.43	49.57	37.64	34.19	35.91	43.63	36.83	
Salt peter.....												
Fish oil.....												
Palm oil.....												
IV.												
Pig iron.....	} 67.19	67.48	73.21	96.76	82.49	105.18	90.83	93.90	99.30	110.31	120.74	
Tin.....												
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.....	} 76.37	62.65	62.07	68.88	65.65	75.48	71.56	74.94	66.18	68.60	78.16	
Rye.....												
Barley.....												
Oats.....												
Average Arithmetical mean, computed from 157Hamburg average prices.....	74.86	66.19	65.56	70.30	68.12	75.52	69.46	67.85	70.57	75.66	78.69	
	85.18	78.47	71.07	77.30	74.87	83.19	76.51	74.74	77.21	78.88	* 80.47	

* 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.

TABLE 51.—RELATIVE PRICES OF SELECTED ARTICLES 1890 TO 1913 (BASED ON CUSTOMS

[Jahrbücher für Nationalökonomie und Statistik,

(Average prices in

Marginal number.	Article.	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899
1	Wheat—14 ¹ quotations.....	102.59	118.95	99.73	82.70	72.61	75.78	83.37	92.24	104.15	93.88
2	Rye—14 ¹ quotations.....	110.27	136.65	117.35	89.88	77.95	79.09	80.01	85.35	97.77	106.26
3	Barley—15 ¹ quotations.....	113.03	112.12	104.26	101.41	93.95	89.15	95.43	99.96	107.92	107.54
4	Maize—5 ¹ quotations.....	91.53	116.60	96.35	88.40	82.50	84.84	69.69	68.09	76.98	83.24
5	Oats—13 ¹ quotations.....	116.57	115.49	105.43	121.49	98.84	88.61	94.01	101.85	110.00	109.27
6	Wheat flour—6 ¹ quotations.....	100.60	115.14	94.33	78.98	70.54	74.62	78.98	88.20	96.88	89.71
7	Rye flour, Berlin ³	112.95	140.41	128.56	85.50	74.77	79.75	78.78	.....	.....	92.68
8	Rapeseed oil, Berlin.....	120.15	110.99	95.63	89.51	78.32	79.99	89.28	.....	.....	104.59
9	Potato alcohol, Hamburg ⁴	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	72.98	66.49	72.69	69.74	70.36	84.84
12	Coffee, Rio, ⁵ good ordinary, Bremen.....	153.66	140.79	124.89	141.96	140.79	139.07	124.39	96.73	70.19	62.01
13	Coffee, plantation, Ceylon, ⁶ medium, Frankfurt on Main.....	120.70	120.37	115.75	120.03	112.78	108.38	105.20	98.87	85.33	81.04
14	Rice, Rangoon, table, Bremen.....	103.13	102.01	95.58	86.51	83.56	76.85	79.76	86.73	104.47	105.29
15	Pepper, Bremen.....	88.57	68.61	52.92	49.07	39.90	39.90	40.20	54.04	73.26	71.79
16	Herring, Norwegian, Hamburg.....	84.82	111.70	86.46	61.16	77.64	107.30	76.28	96.85	92.94	128.70
17	Leaf tobacco, Kentucky, ordinary, Bremen.....	68.78	75.69	85.62	101.31	89.93	76.98	67.64	66.34	81.16	76.43
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.....	99.64	76.99	107.38	76.76	63.15	63.64	71.44	65.55	54.78	63.27
20	Wool, Berlin.....	94.37	89.50	81.30	76.14	70.81	73.16	77.04	72.34	76.88	108.79
21	Hemp, Lübeck.....	91.67	85.61	83.43	95.08	106.58	107.66	105.72	101.53	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	76.73	98.88
24	Cotton yarn, warp, 16, Mülhausen, in Alsace.....	90.50	81.56	78.21	84.92	78.77	77.90	81.56	75.20	64.80	60.33
25	Calico, Mülhausen, in Alsace.....	110.13	86.96	89.56	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	100.57	85.31	84.55	82.84	82.84	87.38
27	Lead—6 ¹ 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	89.18	139.02
29	Zinc—5 ¹ quotations.....	143.22	143.32	130.50	107.19	96.05	91.04	101.25	108.20	127.04	167.46
30	Tin—3 ¹ 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	106.08	95.04	96.82	98.09	94.32	94.04	92.64	.....	.....
32	Petroleum, Hamburg, in bond.....	89.76	84.86	79.02	62.93	64.12	88.92	82.00	70.32	79.88	97.95
33	Coal, Westphalian, Berlin.....	132.60	129.40	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	81.75	81.82	82.65	84.04	99.60

¹ Present number has varied from time to time.² Relative not computed for this year.

ACTUAL AVERAGE PRICES AS SHOWN BY OFFICIAL STATISTICS OF THE GERMAN UNION).

3. Folge, 1, 5, 11, 17, 24, 31, 34, 44, 46, and 47.]

1879-1889=100.)

1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	Marginal number.
85.51	90.04	(2)	85.55	92.55	89.92	95.04	110.62	112.99	124.32	111.66	108.85	115.66	108.33	1
93.13	96.12	(2)	89.70	90.31	93.85	102.16	124.08	121.16	113.67	99.61	110.41	112.20	108.47	2
104.48	106.36	(2)	96.69	100.96	102.97	105.99	111.52	113.57	109.11	99.63	116.25	126.23	106.13	3
89.67	91.84	(2)	91.99	94.35	97.26	103.14	113.08	133.93	125.37	111.12	110.82	127.72	110.40	4
102.30	107.34	(2)	97.71	97.68	105.57	119.44	132.77	120.34	126.51	113.67	137.02	142.78	120.96	5
76.57	81.32	(2)	79.30	83.66	82.02	85.68	99.15	102.10	111.52	100.32	98.90	100.04	98.58	6
93.33	91.16	(2)	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	(2)	87.63	82.45	85.45	103.85	133.95	126.60	103.54	104.98	117.13	120.94	121.67	8
96.71	80.99	(2)	.....	.....	.....	.....	55.89	66.90	50.50	50.12	48.85	65.92	70.94	9
41.71	35.94	(2)	33.90	37.40	40.26	31.33	31.63	38.70	39.79	46.27	47.34	46.21	34.83	10
78.55	85.57	(2)	78.74	58.72	63.01	54.42	56.51	60.30	61.56	69.97	63.37	71.41	57.73	11
78.54	58.70	(2)	51.62	66.55	69.55	70.56	63.83	62.61	66.60	78.95	110.59	128.14	109.97	12
83.89	76.30	(2)	72.90	75.93	75.81	76.85	76.34	77.41	73.33	82.15	96.35	104.64	99.83	13
94.59	96.38	(2)	99.46	93.07	94.62	95.98	104.96	104.46	97.01	97.94	110.63	129.71	114.66	14
104.88	102.41	(2)	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	(2)	109.75	97.71	116.43	148.26	112.83	101.11	128.38	.....	.....	.....	.....	16
99.34	104.59	(2)	112.54	93.82	92.86	109.51	136.56	156.13	124.47	145.62	155.41	153.98	141.31	17
125.75	100.09	(2)	84.28	89.81	98.86	109.99	137.73	133.58	108.65	108.49	141.08	146.98	151.24	18
89.89	77.19	(2)	100.20	108.47	85.61	99.15	106.08	93.57	104.51	132.41	117.66	104.94	113.00	19
92.10	75.84	(2)	98.11	97.56	102.23	114.23	114.78	103.71	114.23	110.41	108.22	112.87	121.20	20
121.33	132.05	(2)	118.53	111.54	113.29	122.07	129.57	124.83	126.85	135.31	141.93	163.20	164.99	21
83.40	73.24	(2)	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	(2)	108.39	112.37	107.34	129.77	163.10	126.62	128.09	151.36	141.51	131.45	138.57	23
75.42	65.92	(2)	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	(2)	103.91	107.39	113.86	118.70	132.61	109.56	104.35	106.52	107.40	113.91	110.87	25
105.92	109.43	(2)	96.87	106.35	104.73	115.16	139.57	115.92	99.38	111.23	122.56	119.29	121.04	26
131.94	98.55	(2)	89.64	90.42	105.08	131.45	146.12	102.51	82.79	98.30	98.55	159.56	166.13	27
125.26	121.12	(2)	102.07	99.63	118.29	147.42	.....	.....	.....	.....	.....	.....	.....	28
126.86	106.55	(2)	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	(2)	129.78	129.21	145.10	184.41	177.16	137.42	138.28	157.32	194.08	212.03	207.38	30
.....	.....	(2)	105.30	98.11	100.57	110.17	120.02	105.42	103.18	104.64	103.44	119.23	125.60	31
97.76	.....	(2)	97.89	89.58	84.44	92.88	94.33	102.64	93.21	81.20	.....	116.89	116.62	32
127.72	134.51	(2)	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	(2)	93.82	94.05	96.46	108.01	113.56	104.94	102.13	104.17	112.20	120.31	115.83	

² From 1892 to 1894 No. 00 with sack; from 1895 to date, No. 0/1. ⁵ Coffee, Sabanilla from 1896 to date.
⁴ Berlin, 1879-1903, Hamburg, raw, 1904 to date. ⁶ Java, 1879-1890.

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 1903.⁸⁰ "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 1879 to 1886.
From 1858 to 1870.	From 1886 to 1895.
From 1870 to 1879.	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.⁸¹ 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 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."⁸²

The later index number (1879-1902) is based on data of the Imperial Statistical Office, which published for each of the more important commodities several series of quotations representing a number of important markets and varieties. From these the author selected as a basis for his index number a single series from a representative

⁸⁰ 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.

⁸¹ In regard to Hamburg Bureau of Trade Statistics see also pp. 229 and 230.

⁸² Bimetallism in Europe, by Edward Atkinson, p. 226.

market, and in connection with the detailed description of the article stated the manner in which prices were 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.

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 1879–1902.⁸³ 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 1.—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 publications 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.

⁸³ No detailed description is available after 1902.

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 descrip-

tion 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 ascertained 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 $8\frac{1}{2}$ 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 mark $\frac{1}{2}$.

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. 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, hogshead duty amounting to about 0.95 marks per 100 kilograms net was charged. After the lifting of the hogshead 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.	Schmitz.
1851-1855.....	117. 18	117. 32
1856-1860.....	123. 35	122. 06
1861-1865.....	121. 46	120. 58
1866-1870.....	120. 98	119. 62
1871-1875.....	135. 56	130. 75

TABLES OF RESULTS.

Table 52 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.

TABLE 52.—INDEX NUMBERS OF WHOLESALE PRICES IN GERMANY, 1851 TO 1913, 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.	Year.	Total index number: 1879-1888 equals 100.
1851	100.60	1860	118.73	1869	120.14	1878	110.62	1887	90.98	1896	83.91	1905	103.50
1852	108.33	1861	117.24	1870	117.32	1879	100.87	1888	96.07	1897	85.79	1906	112.08
1853	118.91	1862	120.31	1871	123.02	1880	111.71	1889	100.87	1898	90.65	1907	119.43
1854	131.79	1863	122.68	1872	136.12	1881	109.26	1890	107.54	1899	98.43	1908	112.87
1855	131.96	1864	125.28	1873	141.56	1882	106.52	1891	104.75	1900	106.49	1909	111.65
1856	132.59	1865	117.37	1874	130.60	1883	104.06	1892	95.46	1901	100.11	1910	113.65
1857	132.76	1866	119.88	1875	122.41	1884	99.62	1893	92.21	1902	99.19	1911	118.95
1858	112.08	1867	120.69	1876	119.52	1885	92.88	1894	83.79	1903	100.64	1912	130.41
1859	114.16	1868	120.09	1877	119.86	1886	88.00	1895	83.55	1904	100.22	1913	127.07

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	109.26
1882.....	106.21	106.52
1883.....	104.52	104.06
1884.....	98.31	99.62
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. The index numbers are as follows:

1851-1855.....	117.32	1876-1880.....	112.52	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.....	99.34	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 1858,⁸⁴ 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, 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 Hamburg's *Handel und Schifffahrt*, by the bureau of trade statistics of Hamburg and those of Prof. Conrad, of Halle, published in the *Jahrbücher für Nationalökonomie und Statistik*.⁸⁵

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.

⁸⁴ Beiträge zur Statistik der Preise: I. Uebersicht der Durchschnitts-Preise verschiedener Handelsartikel nach den Angaben im Hamburger Börsen-Preiscourante 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.

⁸⁵ For a description of these index numbers see pp. 228-238 of the present bulletin.

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 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.	Linsced 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.	Red wood.
Cassia bark.	Mahogany.
Rice.	Cane.
Sago.	Palm oil.
Arrack.	Ivory.
Rum.	

V. Minerals and metals (14 articles).

Coal.	Copper.
Pig iron.	Quicksilver.
Bar iron.	Sulphur, raw.
Steel.	Salt peter, 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.	Worsted.
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 ⁸⁶ 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 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 ⁸⁷ 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 Statis-

⁸⁶ U. S. Senate Ex. Doc. No. 34 (p. 226), 50th Cong., 1st sess., 1887.

⁸⁷ See pp. 276-278 of this bulletin.

tical Office. For this comparison the base period 1881 of the bureau is used.

TABLE OF RESULTS.

In his article on "The course of prices from 1886 to 1890"⁸⁸ Dr. Soetbeer presents his last published table, which gives his computations of index numbers for the 114 articles by groups, as follows:

TABLE 53.—SUMMARY OF RELATIVE PRICES OF COMMODITIES FOR THE YEARS 1847-1890.

(Average prices in 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	128.21	114.13	118.64	102.11	131.83	144.33	127.56	123.59
1866-1870..	137.74	136.35	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	156.72	132.15	134.32	140.60	119.58	119.14	128.52	138.28
1874.....	150.99	157.76	145.02	136.74	116.70	112.80	112.21	126.06	136.20
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	140.35	130.29	98.87	108.33	99.80	114.04	127.70
1878.....	132.50	141.53	134.34	125.61	94.14	102.33	97.24	111.03	120.60
1879.....	132.92	137.60	139.10	125.34	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	146.76	138.91	126.38	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	99.10	104.72	122.14
1883.....	143.93	156.40	142.38	130.17	82.93	95.93	95.38	104.72	122.24
1884.....	129.85	150.28	120.16	117.90	78.69	97.02	84.82	103.36	114.25
1885.....	110.75	140.45	123.78	118.39	74.23	95.89	81.35	100.48	108.72
1881-1885..	130.77	150.65	134.41	119.01	81.55	96.65	91.11	103.28	117.68
1886.....	101.31	133.53	122.44	115.45	70.52	80.76	78.75	97.03	103.99
1887.....	96.28	129.93	121.81	118.59	72.50	81.42	77.30	95.98	102.02
1888.....	98.18	128.97	120.09	116.41	75.57	82.17	74.31	94.91	102.04
1889.....	102.06	130.95	127.57	118.82	78.55	80.65	86.41	96.60	106.13
1890.....	107.53	129.85	138.61	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 Ministry of Labor for years prior to 1902.⁸⁹ From that year until 1920 an annual report on the subject was published in the January issue of The Labor Gazette, London. Since 1920 the index numbers have been published in one of the January issues of the weekly Board of Trade Journal and Commercial Gazette.

HISTORY.

The inquiry concerning the subject of prices had occupied the Ministry of Labor 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

⁸⁸ Jahrbücher für Nationalökonomie und Statistik, 1892, p. 593.⁸⁹ 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, the number later being stated as 47. 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."⁹⁰ 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.⁹¹

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 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. From 1906 until 1920 the year 1900 has been used as the base period.

⁹⁰ Report on Wholesale and Retail Prices, 1902, p. 427. Great Britain. Board of Trade.

⁹¹ *Idem*, p. 439.

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. After 1905 no price data other than the general index number were shown until the publication of index numbers for the four groups was resumed in the January issue of the Labor Gazette.

NUMBER AND CLASS OF COMMODITIES.

The list of articles covered by the reports includes principally raw materials or materials at an early stage of manufacture. The January, 1914, and subsequent issues of the Labor Gazette state that, in compiling the general index number, the index numbers for 47 separate articles have been weighted in accordance with their estimated consumption in 1881-1890. 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 47 articles included in the group and general index, the weight allotted to each article, and the source of the quotations.⁹²

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.....	59½	

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	

⁹² Report on Wholesale and Retail Prices, 1902, pp. xxxv-xxxvii. Great Britain. Board of Trade.

*Group III.—Food and drink (25 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's 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 Bethlam 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.....	$\frac{1}{2}$	Import values of cocoa.
Rum.....	$1\frac{1}{2}$	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.....	$\frac{1}{2}$	Import values of palm oil.
Paraffin.....	$\frac{1}{2}$	Import values of paraffin.
Petroleum.....	2	Import values of petroleum.
Bricks.....	3	Price of stocks at Glasgow.
Hewn fir.....	20	Import values of hewn fir.
Caoutchouc.....	$1\frac{1}{2}$	Import values of caoutchouc.
Hides.....	8	Import values of hides.
Total.....	43 $\frac{1}{2}$	
Grand total.....	568	

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.⁹³

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 in the period 1881-90. 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."⁹⁴ 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 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 in the base period. 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 9,173.2, 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 47 commodities is computed in like manner.

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.

⁹³ Report on Wholesale and Retail Prices, 1902, p. 426. Great Britain. Board of Trade.

⁹⁴ *Idem*, p. 432.

TABLE 54.—COMPARISON OF A SPECIALLY WEIGHTED NUMBER FROM THE BOARD OF TRADE AND SAUERBECK'S NUMBER.¹

Year.	Specially weighted number.	Sauerbeck's number.
1867.....	100	100
1868.....	100	99
1869.....	96	98
1870.....	94	96
1871.....	96	100
1872.....	107	109
1873.....	113	111
1874.....	104	102
1875.....	97	96
1876.....	96	95
1896.....	62	61

¹ 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 commodities.⁹⁵ 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.

TABLE 55.—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.]

(Average prices in 1871=100.)

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.	
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	109.7	109.3	98.1	108.2	109.4
1874.....	113.6	158.8	102.6	110.8	110.1	94.9	108.6	108.4
1875.....	107.8	126.3	100.2	99.9	116.6	93.9	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	96.9	110.3	97.3
1878.....	99.3	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	94.9	88.6	98.0	106.6	86.2	100.8	89.2
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.....	96.5	90.3	82.0	93.9	113.7	80.9	102.1	87.5
1884.....	88.3	86.4	79.8	81.1	104.7	70.7	91.4	82.2
1885.....	83.0	82.1	75.7	76.7	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	78.3	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	113.6	72.9	72.0	91.7	63.8	80.6	72.9
1891.....	84.1	106.6	72.1	73.2	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	63.1	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	84.6	54.9	72.4	63.9
1898.....	73.6	92.7	54.8	73.1	81.8	54.2	75.1	66.5
1899.....	74.5	107.5	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	89.8	50.1	75.3	71.7
1902.....	78.8	114.9	65.0	63.7	94.4	46.1	76.7	69.2
1903.....	78.6	111.2	71.3	63.8	92.1	47.0	75.7	68.4
1904.....	78.7	106.1	78.7	66.7	89.0	48.2	75.5	66.0
1905.....	77.7	105.6	73.5	64.8	88.4	52.1	74.8	68.7

⁹⁵ Report on Wholesale and Retail Prices, 1902, p. 34. Great Britain. Board of Trade.

A second table, reproduced below, shows the index as published up to the end of 1920, the price in 1900 being used as the base, or 100. 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."⁹⁶ It is presumed that the calculation was made in the same way as in the original report.

TABLE 56.—BOARD OF TRADE INDEX NUMBERS, 1871 TO 1920.

[The Board of Trade Journal and Commercial Gazette, London, January 13, 1921, p. 34.]

(Average prices in 1900=100.)

Year.	Index number.	Year.	Index number.	Year.	Index number.	Year.	Index number.	Year.	Index number.
1871.....	135.6	1882.....	127.7	1893.....	99.4	1904.....	98.2	1914:	
1872.....	145.2	1883.....	125.9	1894.....	93.5	1905.....	97.6	Jan.-July	113.6
1873.....	151.9	1884.....	114.1	1895.....	90.7	1906.....	100.8	Aug.-Dec	122.6
1874.....	146.9	1885.....	107.0	1896.....	88.2	1907.....	106.0	1914.....	117.2
1875.....	140.4	1886.....	101.0	1897.....	90.1	1908.....	103.0	1915.....	143.9
1876.....	137.1	1887.....	98.8	1898.....	93.2	1909.....	104.1	1916.....	186.5
1877.....	140.4	1888.....	101.8	1899.....	92.2	1910.....	108.8	1917.....	243.0
1878.....	131.1	1889.....	103.4	1900.....	100.0	1911.....	109.4	1918.....	267.4
1879.....	125.0	1890.....	103.3	1901.....	96.7	1912.....	114.9	1919.....	296.3
1880.....	129.0	1891.....	106.9	1902.....	96.4	1913.....	116.5	1920 ¹	371.4
1881.....	126.6	1892.....	101.1	1903.....	96.9				

¹ Preliminary.

In Table 57 are shown the index numbers of the 47 articles since 1900, classified into four groups.

TABLE 57.—INDEX NUMBERS OF 47 ARTICLES, CLASSIFIED BY GROUPS, 1900 TO 1920.

[The Board of Trade Journal and Commercial Gazette, London, January 13, 1921, p. 34.]

(Average prices in 1900=100.)

Year.	Coal and metals.	Textiles (raw materials).	Food, drink, and tobacco.	Miscellaneous.	All articles combined.
1900.....	100.0	100.0	100.0	100.0	100.0
1901.....	82.2	93.3	100.1	96.3	96.7
1902.....	76.1	92.3	101.4	92.5	96.4
1903.....	74.1	101.7	100.6	91.7	96.9
1904.....	70.9	112.9	101.2	88.3	98.2
1905.....	71.3	106.7	101.2	91.1	97.6
1906.....	78.3	121.1	101.0	95.6	100.8
1907.....	86.9	127.4	105.5	99.7	106.0
1908.....	78.5	109.8	107.0	94.8	103.0
1909.....	73.6	112.4	108.7	96.5	104.1
1910.....	76.6	136.2	109.2	104.3	108.8
1911.....	74.7	128.9	111.6	105.5	109.4
1912.....	84.9	119.6	119.9	110.1	114.9
1913.....	92.5	135.0	117.7	109.4	116.5
1914 (January to July).....	86.2	135.1	114.8	106.2	113.6
1914 (August to December) ^a	88.8	116.8	130.4	119.1	122.6
1914 (year).....	86.7	128.8	120.9	111.3	117.2
1915.....	116.7	119.8	154.1	143.8	143.9
1916.....	165.8	180.1	189.4	204.0	186.5
1917.....	182.0	270.4	246.2	256.3	243.0
1918.....	204.9	354.4	259.3	268.6	267.4
1919.....	280.2	373.3	279.7	317.8	296.5
1920.....	419.3	538.1	335.1	352.2	371.4

^a First five months of the war.^b Preliminary.⁹⁶ The Board of Trade Labour Gazette, vol. 15, 1907, p. 4.

CHANGE IN METHOD OF COMPILING WHOLESALE PRICE INDEX NUMBERS OF THE BOARD OF TRADE.

In the issue of the Board of Trade Journal and Commercial Gazette of January 13, 1921, it was stated that the index numbers for 1920 were the last to be calculated according to the method adopted for the series given in the foregoing table, and that an account of the method to be followed in compiling the index numbers for 1921 and succeeding years would appear in the next issue of the journal. In the issue of January 20, 1921, the following explanation was given:

For a number of reasons it has been decided to revise the basis of calculation, beginning with the present year. Several changes of considerable importance are being made in the nature of the material used in the compilation and also in the manner in which the different elements of the calculation are combined. The average import or export values hitherto used are to be replaced by market values. In a few special cases, as in the past, so also in the future, reliance will be placed on values furnished to the board by experts in the absence of a satisfactory published quotation of the prices of the articles concerned. A further point of importance is that, instead of multiplying the price percentages by suitable factors, the number of separate prices used will be increased, so that articles of special importance, such as wheat, coal, iron, and cotton, will be represented by several quotations. The number of quotations to be used in each case has been determined on the same general principles as the multipliers in the old number, but the results of the census of production have rendered possible a complete revision, based on the values of goods made in many cases in which the value of raw materials worked up were alone ascertainable prior to that census. The total number of series of commodity prices which it is proposed to use at present is 150, or three times the number hitherto employed. The quotations will relate in numerous instances to standard manufactured commodities, in others to raw or semimanufactured materials.

To avoid various inconveniences resulting from the use of prices based on those of a fixed year, the calculation to be made in the first place will be the percentage movement of prices over a period of one year, each month's figure showing the increase or decrease compared with the corresponding month a year earlier. This procedure will avoid the difficulties which occur when, owing to changes in business, commodities once serving as standards of comparison are superseded by other commodities or other grades. The extension of the list of commodities, when necessary, will also be facilitated in the same way, the calculations forward from any date not being hampered by the necessity of securing comparisons with prices at a past date from which the calculations have started. The combination of the series of yearly comparisons so as to yield continuous record can be easily made. The results will not be dependent on the initial date of the series, as is generally the case when the procedure described above as used in the old index number is followed.

The 150 series of quotations are to be arranged in eight groups of approximately equal importance, three for foodstuffs and five for industrial products. The foodstuffs groups comprise cereals, meat and fish, and other foods; the industrial products are grouped as iron and steel, other metals and minerals, cotton, other textiles, and miscellaneous industrial products. The separate index numbers for

the eight groups will be prepared, and the aggregate index number will be the average of these eight numbers. Finally, the geometric mean of the individual items is to be used in place of the more commonly employed arithmetic mean, this course being adopted for various technical reasons. It is anticipated that the new series of numbers will reflect more closely than has been the case with the older series in the recent past the movements of the wholesale markets, the special conditions of trade during and since the war having had the effect of diminishing in this respect the value of the index number as hitherto calculated.

The Board of Trade Journal and Commercial Gazette for March 17, 1921, contains the following table of new index numbers for the period from January, 1920, to February, 1921:

Percentages of prices to the average prices of 1920.

Groups.	1920												1921	
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
Cereals.....	89.3	88.8	97.7	101.6	102.5	104.3	103.0	102.2	103.3	106.7	106.3	96.2	90.5	78.4
Meat and fish.....	98.5	91.9	88.6	93.6	91.8	92.9	102.4	106.0	106.9	109.1	111.4	110.6	108.0	100.8
Other food.....	91.9	101.3	106.5	108.2	106.7	108.5	101.4	96.1	91.2	97.2	94.5	92.3	88.0	81.6
Total food.....	94.2	94.2	97.7	101.3	100.4	102.0	102.2	101.2	101.0	104.0	103.4	99.1	94.8	86.2
Iron and steel.....	82.7	90.2	96.4	100.4	105.4	109.1	108.2	107.0	107.0	104.2	99.2	93.8	8.6	79.0
Other metals and minerals.....	96.7	101.8	100.3	97.0	101.0	101.0	101.6	102.8	103.6	102.3	100.1	92.3	85.5	80.7
Cotton.....	112.4	127.0	127.4	127.9	123.9	115.7	108.0	105.3	96.1	78.9	65.8	52.9	46.7	40.6
Other textiles.....	113.6	120.6	121.7	123.4	117.7	108.7	99.2	94.6	93.9	84.2	76.3	67.0	61.1	55.6
Other articles.....	99.0	104.0	107.1	108.0	104.9	100.2	99.9	98.2	100.8	99.5	94.3	85.9	80.4	78.6
Total not food.....	98.3	105.7	108.0	108.9	109.0	106.4	103.5	101.9	100.9	94.9	88.2	79.2	73.1	67.3
All articles.....	96.8	101.5	104.2	106.1	105.9	104.8	103.0	101.6	101.9	98.0	93.3	85.7	80.1	73.4

NOTE.—In this table the aggregate index number is the geometric average of the 150 separate index numbers for individual commodities.

INDEX NUMBERS OF THE ECONOMIST.

PUBLICATION.

This index represents the course of wholesale prices of commodities in the United Kingdom.

It is compiled and published each month in the Economist, London, a summary being given also for the period since January 1, 1914.

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 periodical 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 three 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 2, thus reducing it to that of 22 articles as used formerly.

The chief change made was in respect of the coal and iron trades, which were formerly represented by one quotation only, but were now given a weight of 5 quotations out of 44. Quotations were added, for the first time, for barley, oats, potatoes, rice, pork, and butter among foodstuffs; Egyptian cotton and jute among textiles; iron bars, steel rails, and coal among minerals; and petroleum, oilseeds, 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 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. A review of price changes among the selected articles is 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.

Table 58, which appeared in the *Economist* of November 18, 1911, shows the number of quotations for each commodity, comparing the old with the new base period:

TABLE 58.—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	1
Beef.....	1	1	Tin.....	1	1
Mutton.....	1	2	Lead.....	1	1
Pork.....	1	1	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 until recently includes 38 articles. These are arranged in five groups as follows: ⁹⁷

Cereals and meats.

Wheat, Gazette averages (English grain).
 Barley, Gazette averages (English grain).
 Oats, Gazette averages (English grain).
 Flour, town made, households.
 Beef, inferior.
 Beef, prime.
 Mutton, prime.
 Potatoes, good English.
 Rice, Rangoon.

Other foodstuffs.

Sugar, granulated.
 Tea, Indian and Ceylon, broken and fannings.
 Tea, Indian and Ceylon, broken Pekoes, common.
 Coffee, Santos, good average.
 Butter, Danish.
 Tobacco, mean price Virginia leaf, common to fine.

Textiles.

Cotton, middling, American.
 Cotton, yarn, 32's, twist.
 Wool, Victoria, scoured, good.
 Wool, Southdown ewes and wethers.
 Silk, Canton.
 Hemp, manila.
 Jute, native firsts.

⁹⁷ *Economist*, Jan. 6, 1917, p. 5.

Minerals.

Iron and steel, Cleveland, No. 3, G. M. B.
 Iron and steel, common, bars.
 Iron and steel, steel rails.
 Coal, pit-head prices, best steam, Newcastle.
 Coal, pit-head prices, best Yorkshire (silkstone), house.
 Copper, standard.
 Tin, standard.
 Lead, English pig.

Miscellaneous.

Timber, pitch pine.
 Timber, yellow pine, large.
 Leather, mixed tannage, butts or bends.
 Petroleum.
 Rubber, fine, hard, Para.
 Seeds, linseed.
 Tallow, town.
 Indigo, Bengal, good red violet.

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.

Table 59 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.⁹⁸ The decade 1891 to 1900 is considered as the base or 100.

TABLE 59.—INDEX NUMBERS OF THE LEVEL OF PRICES IN THE UNITED KINGDOM, BY DECADES, 1861 TO 1910.

(Average prices in 1891-1900=100.)

Decade.	Economist.		Sauerbeck.	Board of Trade.
	Weighted.	Unweighted.		
1861-1870.....	146	152	151	138
1871-1880.....	131	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, presented 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.

TABLE 60.—COMPARISON OF WHOLESALE AND RETAIL PRICES, 1895 TO 1910.

(Average prices in 1900=100.)

Year.	Economist index number on Jan. 1 of each year.	Board of Trade index number of retail prices in London.
1895.....	89	93.2
1896.....	93	92.0
1897.....	91	95.2
1898.....	88	100.3
1899.....	89	96.4
1900.....	100	100.0
1901.....	99	101.9
1902.....	91	101.6
1903.....	93	103.2
1904.....	103	104.3
1905.....	99	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.

Table 61, 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.

⁹⁸ The Economist, Aug. 26, 1911, pp. 422, 423.

TABLE 61.—THE ECONOMIST INDEX (ORIGINAL).¹

(Average prices in 1845-1850=2200.)

1845-50: Average.....	2200	1875: January....	2778	1887: January....	2059	1899: January....	1918
1851: January....	2310	July.....	2692	July.....	2116	July.....	2028
1853: July.....	2463	1876: January....	2711	1888: January....	2239	1900: January....	2145
1857: July.....	3059	July.....	2531	July.....	2121	July.....	2211
1858: January....	2667	1877: January....	2715	1889: January....	2187	1901: January....	2126
1859: January....	2556	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.....	1995
1862: January....	2878	1879: January....	2225	1891: January....	2224	1903: January....	2003
1863: January....	3492	July.....	2299	July.....	2190	July.....	2111
1864: January....	3787	1880: January....	2577	1892: January....	2133	1904: January....	2197
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.....	2105	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.....	(?)	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						
July.....	2914						
1874: January....	2891						
July.....	2779						

¹ The Economist, Sept. 2, 1911, pp. 490 and 491.

² 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 Table 62:

TABLE 62.—COMPARISON OF ECONOMIST INDEX NUMBERS COMPUTED ON OLD AND NEW BASES.¹

Date.	Old basis (1845-1850= 100).	New basis (1901-1905= 100).	Date.	Old basis (1845-1850= 100).	New basis (1901-1905= 100).
1896:			1904:		
January 1.....	91	90	January 1.....	100	102
July 1.....	88½	88	July 1.....	97	99
1897:			1905:		
January 1.....	89	89	January.....	97	104
July 1.....	86	90	July 1.....	98	102½
1898:			1906:		
January 1.....	86	89	January 1.....	106	109
July 1.....	87	95	July 1.....	107	110
1899:			1907:		
January 1.....	87	93	January 1.....	114	115
July 1.....	92	98½	July 1.....	118	121
1900:			1908:		
January 1.....	97½	110	January 1.....	105	111½
July 1.....	100½	111	July 1.....	100	106½
1901:			1909:		
January 1.....	97	106	January 1.....	100	104
July 1.....	91	103	July 1.....	102	110
1902:			1910:		
January 1.....	89	98	January 1.....	109	113½
July 1.....	91	101	July 1.....	107	113
1903:			1911:		
January 1.....	91	99½	January 1.....	114	114
July 1.....	96	104½			

¹ These data are taken from the Economist of Nov. 18, 1911, p. 1035.

Table 63, reproduced from the Economist of January 8, 1921, shows the manner in which the information relative to the index number is now presented.

TABLE 63.—INDEX NUMBERS OF WHOLESALE PRICES IN GREAT BRITAIN, IN SPECIFIED MONTHS, 1914 TO 1920.

[The Economist, Jan. 8, 1921, p. 44.]

Date.	Cereals and meat.	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	2200	100.0
January 1, 1914.....	563	355	642	491	572	2623	119.2
April 1, 1914.....	560	350½	626½	493	567	2597	118.0
July 1, 1914.....	565½	345	616	471½	551	2549	115.9
End July, 1914.....	579	352	616½	464½	553	2565	116.6
End December, 1914.....	714	414½	509	476	686½	2800	127.3
End December, 1915.....	897	446	731	711½	848½	3634	165.1
End December, 1916.....	1294	553	1124½	824½	1112	4908	223.0
End December, 1917.....	1286½	686	1684½	839½	1348½	5845	263.2
End October, 1918.....	1271	780	1889	878½	1391½	6210	282.6
End November, 1918.....	1289	782½	1848	905	1389½	6212	282.6
End December, 1918.....	1303	782½	1805½	866	1337	6094	277.0
End January, 1919.....	1287	782½	1618½	828	1335	5851	265.9
End February, 1919.....	1288½	782½	1596½	818	1310½	5736	263.8
End March, 1919.....	1285	782½	1502	844½	1294	5708	259.4
End April, 1919.....	1306½	752	1512½	912½	1290½	5774	262.4
End May, 1919.....	1310½	776½	1643	931	1327	5988	272.2
End June, 1919.....	1338	800	1741½	937	1371½	6188	281.3
End July, 1919.....	1339½	805½	1854½	1033½	1417	6450	293.2
End August, 1919.....	1380	822½	1877½	1040	1383	6503	295.9
End September, 1919.....	1399	817½	1979½	1047	1344	6587	299.4
End October, 1919.....	1412	838	2123	1064	1358	6795	308.9
End November, 1919.....	1427½	866	2202	1093	1396	6985	317.5
End December, 1919.....	1441½	881½	2442½	1145	1453½	7344	334.7
End January, 1920.....	1461	857½	2702½	1211½	1535½	7788	353.1
End February, 1920.....	1454	866½	2951½	1253½	1614½	8190	370.9
End March, 1920.....	1508	914	2974½	1246	1709½	8352	379.6
End April, 1920.....	1498½	908	2938½	1232½	1654½	8232	374.2
End May, 1920.....	1484	981½	2819	1295½	1619	8199	372.7
End June, 1920.....	1511	929½	2562	1289	1555½	7847	356.7
End July, 1920.....	1499	934	2594	1308	1541	7876	358.0
End August, 1920.....	1438	927	2521	1302½	1554½	7743	352.0
End September, 1920.....	1504	928	2362½	1311	1539½	7645	347.5
End October, 1920.....	1560½	900½	1951½	1316½	1446	7175	326.1
End November, 1920.....	1478	869½	1651	1259½	1336	6594	299.7
End December, 1920.....	1344	805	1284	1216	1275	5924	269.3

How each group has moved from the beginning of the war to the end of 1919 may be seen from Table 64, in which the changes in each half year are compared with July, 1914, as 100:

TABLE 64.—ECONOMIST INDEX NUMBERS FOR DECEMBER AND JUNE EACH YEAR 1914 TO 1919.¹

(Average prices in July, 1914=100.)

End of—	Cereals and meat.	Other food products.	Textiles.	Minerals.	Miscellaneous.	Total.
July, 1914.....	100	100	100	100	100	100
December, 1914.....	124	117	82	103	124	109
June, 1915.....	141	122	90	135	141	127
December, 1915.....	155	126	119	154	153	142
June, 1916.....	172	143	129	193	183	164
December, 1916.....	224	157	183	178	201	192
June, 1917.....	248	185	239	182	230	220
December, 1917.....	222	194	274	181	244	228
June, 1918.....	220	220	294	186	250	238
December, 1918.....	226	222	293	186	241	236
June, 1919.....	231	227	284	202	247	241
December, 1919.....	249	250	396	247	263	287

¹ From the Economist, Jan. 10, 1920, p. 54.

INDEX NUMBERS OF AUGUSTUS SAUERBECK (STATIST).

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. A general discussion of the results for each year is now also published in 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*.⁹⁹ 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."¹

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."² 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

⁹⁹ *Journal of the Royal Statistical Society*, September, 1886, vol. 49, p. 531.

¹ *Idem*, p. 532.

² *Idem*, p. 632.

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 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 Table 65, 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.

TABLE 65.—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			
Rice.....	1	1	Total minerals.....	10	7
Total vegetable food.....	8	8	Cotton.....	2	2
Beef.....	2	2	Flax.....	2	1
Mutton.....	2	2	Hemp.....	2	1
Pork.....	1	1	Jute.....	1	1
Bacon.....	1	1	Wool.....	3	2
Butter.....	1	1	Silk.....	1	1
Total animal food.....	7	7	Total textiles.....	11	8
Sugar.....	3	2	Hides.....	3	1
Coffee.....	2	1	Leather.....	2	1
Tea.....	3	1	Tallow.....	1	1
Total sugar, coffee, and tea.....	8	4	Oil.....	2	2
Total food.....	23	19	Linseed oil and linseed (flaxseed).....	2	1
			Petroleum.....	1	1
			Soda crystals.....	1	1
			Nitrate of soda.....	1	1
			Indigo.....	1	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:³

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. Coffee, Ceylon plantation, low middling. | 19c. Tea, Indian, good medium. |

³ Journal of the Royal Statistical Society, March, 1918, pp. 344, 345.

Minerals (10 price series).

- | | |
|---|---|
| 20a. Iron, Scotch pig. | 23. Tin, Straits. |
| 20b. Iron, Cleveland (Middlesbrough) 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 Dholera. | 32b. Wool, merino, Adelaide, average grease. |
| 29a. Flax, Petrograd. | 33. Wool, English, Lincoln half hogs. |
| 29b. Flax, Russian average import. | 34. Silk, Tsatlee. |
| 30a. Hemp, Manila fair roping. | |
| 30b. Hemp, Petrograd, 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 1892⁴ two tests were applied, the one consisting of weighting the relative prices according to the "money-values" of the commodities in accordance

⁴ Journal of the Royal Statistical Society, June, 1893, pp. 215-247, 254.

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 1895⁵ Mr. Sauerbeck used the geometric average⁶ 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 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*.⁷

⁵ *Journal of the Royal Statistical Society*, March, 1896, pp. 193, 194.

⁶ 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.)

⁷ September, 1886, p. 643; March, 1891, p. 128; March, 1911, p. 403; April, 1914, p. 556; March, 1917, p. 289; March, 1921, p. 255.

TABLE 66.—SUMMARY OF INDEX NUMBERS, 1846 TO 1920.

(Average prices in 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	81	98	95	92	77	86	85	89
1847	129	88	87	105	94	78	86	86	95
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	88	109	104	102
1855	120	87	89	101	109	84	109	101	101
1856	109	88	97	99	110	89	109	102	101
1857	105	89	119	102	108	92	119	107	105
1858	87	83	97	88	96	81	102	94	91
1859	85	85	102	89	98	88	107	98	94
1860	99	91	107	98	97	90	111	100	99
1861	102	91	96	97	91	92	109	99	98
1862	98	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	84	97	97	91	91	134	97	108	101
1866	95	96	94	95	91	130	99	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	96
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	116	92	96	100	102
1875	93	108	100	100	101	88	92	93	96
1876	92	108	98	99	90	85	95	91	95
1877	100	101	103	101	84	85	94	89	94
1878	95	101	90	96	74	78	88	81	87
1879	87	94	87	90	73	74	85	78	83
1880	89	101	88	94	79	81	89	84	88
1881	84	101	84	91	77	77	86	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	63	79	68	68	81	73	76
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	78	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	59	69	68	72
1892	65	84	69	73	71	57	67	65	68
1893	59	85	75	72	68	59	68	65	68
1894	55	80	65	66	64	53	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	52	65	66	51	62	59	62
1898	67	77	51	68	70	51	63	61	64
1899	60	79	53	65	92	58	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	87	41	67	82	61	71	71	69
1903	62	84	44	66	82	66	69	72	69
1904	63	83	50	68	81	71	67	72	70
1905	63	87	52	69	87	72	68	75	72
1906	62	89	46	69	101	80	74	83	77
1907	69	88	48	72	107	77	78	86	80
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	85
1914	75	100	58	81	99	81	87	88	85
1915	108	126	70	107	126	92	109	108	108
1916	133	152	86	130	158	129	136	140	136
1917	177	192	113	169	172	192	174	179	175
1918	168	207	130	174	192	222	202	206	192

TABLE 66.—SUMMARY OF INDEX NUMBERS, 1846 TO 1920—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.	
1919.....	179	213	147	185	220	228	219	222	206
1920.....	227	263	198	234	295	262	244	264	251
Average:									
1904-1913...	68	91	53	73	95	74	76	81	77
1890-1899...	61	80	63	68	71	56	66	64	66
1878-1887...	79	95	76	81	73	71	81	76	79
1818-1827...	109	90	151	111	128	105	106	112	111

INDIA.

INDEX NUMBERS OF THE DEPARTMENT OF STATISTICS.

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.

Atkinson's work was continued by the Commercial Intelligence Department of India, and, in addition, a series of index numbers of prices in India for the years 1861 to 1904 was constructed by Mr. J. A. Robertson, director general of statistics, and published in August, 1905. The series and the charts were republished in 1910, with figures brought up to 1909, and again in 1911, 1912, and 1913, with the figures brought up to date. These publications appeared under the title of "Variations in Indian Price Levels." In 1919 the Department of Statistics of India, which had superseded the Commercial Intelligence Department, published the sixth volume of the new series, with a few additional tables and with figures brought up to 1918, under the title of "Index Numbers of Indian 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.⁸

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 in 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.

In later publications by the Department of Statistics the same sources of price quotations were utilized.

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 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. In 1910 the base year was changed to 1873 in reports of the Commercial Intelligence Department. This year was considered to have been of normal character, and it was the year when silver began to fall consequent on the general demonetization of silver by Germany and other countries.

PRICES: HOW SHOWN AND COMPUTED.

The yearly volume on "Prices and Wages in India" which has been published by the Government since 1878 contains numerous tables on wholesale prices in Calcutta, the prices of certain staple articles at Calcutta and Bombay, and prices of articles of export at Calcutta, Bombay, Madras, and Rangoon. Each table of actual prices is followed by one showing relative prices, or index numbers, of individual commodities from a given basic period. A separate table gives the actual prices, through a number of years, of 25 articles among the

⁸ See *Journal of the Royal Statistical Society*, March, 1897, Vol. LX, pp. 124, 125.

grains used for food, together with a comparison of prices in India with those in the United Kingdom. Yearly relative prices are also shown for articles of consumption by troops at 16 stations in India. Other tables in the appendix give average yearly prices of rice, wheat, cotton, and jute.

NUMBER AND CLASS OF COMMODITIES.

In the volume entitled "Index Numbers of Indian Prices, 1861-1918" (p. 22), published by the Department of Statistics in 1919, the number of articles included in Atkinson's index number is given as 37. In this count, however, several related articles are in some instances counted as one article, due allowance being made in the weighted index number. A straight count of the articles or kinds of articles, arbitrarily made, gives the number as 60. Both raw and manufactured commodities are included in the list, the raw commodities predominating. The index number of the Department of Statistics, as shown by page 19 of the report referred to above, includes 39 articles, of which 28 represent exported articles and 11 imported articles. A majority of these consists of raw materials.

DESCRIPTION AND GROUPING OF COMMODITIES.

The individual commodities included in the general index numbers of both systems and the markets in which the prices were obtained are given separately. The Atkinson commodities are the following. The numerals at the beginning of each paragraph refer to the order of arrangement of the articles in the total of 100 price series.

1-30. *Rice* (15 prices).⁹—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, central provinces, Nagpur; common, central provinces, Jubbulpore; 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. *Jawari*¹⁰ (3 prices).—Bombay; Madras, Salem; and Hyderabad, Bolaram.

39-40. *Raggee*¹¹ (2 prices).—Madras, southeast coast division; and Mysore.

41-42. *Gram*¹² (2 prices).—Punjab, central division; and northwest provinces, central division.

43-44. *Bajra*¹³ (2 prices).—Bombay, Deccan division; and Madras, Salem.

45. *Maize* (1 price).—Chota, Magpur.

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 (*Ervum lens*) and chenna (*Cicer arietinum*), were supplied by the

⁹ 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.

¹⁰ A cheap Indian grain used in making a kind of unleavened bread.

¹¹ A cereal grass (*Eleusine Carocana*) largely cultivated for food.

¹² The chick-pea (*Cicer arietinum*) of East Indies, there extensively used as food for men, horses, and cattle.

¹³ The spiked or pearl millet (*Panicillaria spicata*) one of the commonest food cereals of southeastern Asia.

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.¹⁴

57. *Spices (1 price)*.—Ginger, export accounts. Prices taken from the export accounts.

58. *Ghee*¹⁵ (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.

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,¹⁶ Rangoon; myrobalans;¹⁷ 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.

Manufactures.

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, 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.

¹⁴ Journal of the Royal Statistical Society, March, 1897, Vol. LX, p. 90.

¹⁵ Butter clarified by boiling or heating and skimming or straining until it becomes a liquid or semiliquid oil, capable of being kept for many years. It enters into the composition of nearly everything eaten by the Brahmans.

¹⁶ An extract from the bark of the mangrove used in tanning and dyeing.

¹⁷ Prune-like fruits of several tropical plants of the genus terminalia, used for tanning and calico printing.

A list of the commodities included in the index number of the Department of Statistics of India follows:¹⁸

Exported articles.—Rice—average of Moonghy and Ballam; wheat; jawari; bajra; gram; barley; ragee; sugar; tea—average of Pekoe Souchong and Congou; ghee; linseed; rapeseed; sesamum (til or jinjili seed); poppy seed; castor oil; jute, raw—average of picked and ordinary; jute—gunny bags; cotton, raw; cotton yarn; T cloth; silk, raw; wool, raw; hides, raw; skins, dressed—average of goat and sheep; coal; shellac—average; saltpeter; indigo.

Imported articles.—Sugar—Mauritius; salt; gray shirtings; gray yarn; colored yarn; silk, raw; iron; copper; spelter; coal; kerosene oil.

Retail prices were used in the case of certain cereals—jawari, bajra, barley, ragee, and gram—wholesale prices of these articles not being available before 1897, and the difference between wholesale and retail prices being very small.

WEIGHTING.

Briefly, the procedure adopted in preparing the Atkinson series of 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. 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, jawari 3, ragee, 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, saltpeter, 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

No weights are used in constructing the index numbers of exported and imported articles published by the Department of Statistics.

TABLES OF RESULTS.

The Department of Statistics has published a table on page 1 of its report, "Index Numbers of Indian Prices, 1861-1918," containing the unweighted index numbers of 28 articles of export, 11 articles of import, in all 39 articles, and a continuation of the Atkinson series of weighted index numbers to 1918.

¹⁸ See Index numbers of Indian Prices, 1861-1918, p. 19.

TABLE 67.—INDEX NUMBERS OF PRICES IN INDIA, 1861 TO 1918.¹

(Average prices in 1873=100.)

Year.	Exported articles (28—unweighted).	Imported articles (11—unweighted).	General index number for all articles (39—unweighted).	Weighted index number (100 price series) equated to 100 for 1873.
1861.....	88	95	90	93
1862.....	88	95	90	93
1863.....	93	113	98	97
1864.....	103	132	111	105
1865.....	100	125	107	109
1866.....	110	126	115	124
1867.....	102	124	108	118
1868.....	94	107	98	107
1869.....	108	97	105	118
1870.....	105	95	102	107
1871.....	95	88	93	93
1872.....	101	91	98	98
1873.....	100	100	100	100
1874.....	102	99	101	108
1875.....	95	90	94	96
1876.....	90	91	90	100
1877.....	110	88	104	129
1878.....	114	84	106	138
1879.....	112	83	104	126
1880.....	110	88	104	109
1881.....	99	86	96	99
1882.....	95	85	92	98
1883.....	93	79	89	99
1884.....	96	78	91	107
1885.....	91	75	87	106
1886.....	93	80	89	103
1887.....	94	83	91	104
1888.....	98	92	96	111
1889.....	104	91	101	117
1890.....	104	91	100	117
1891.....	103	84	98	120
1892.....	109	84	102	132
1893.....	112	89	105	129
1894.....	110	84	102	122
1895.....	111	87	104	120
1896.....	117	94	110	131
1897.....	124	86	113	153
1898.....	102	80	96	125
1899.....	100	87	96	121
1900.....	124	96	116	143
1901.....	116	96	110	139
1902.....	113	86	106	128
1903.....	103	88	99	122
1904.....	104	93	101	121
1905.....	116	96	110	135
1906.....	139	105	129	158
1907.....	145	116	137	167
1908.....	151	106	138	179
1909.....	133	99	124	160
1910.....	127	109	122	150
1911.....	136	113	129	155
1912.....	145	117	137	174
1913.....	154	117	143	182
1914.....	160	114	147	187
1915.....	155	146	152	182
1916.....	163	236	184	185
1917.....	170	262	196	186
1918.....	199	289	225	215

¹ These index numbers are for wholesale prices except in the case of the cereals jawari, bajra, barley, raggee, and gram, wholesale prices of these articles not being available before 1897.

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 taken from the data published by the Department of Statistics. 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.

TABLE 68.—INDEX NUMBERS OF PRICES IN INDIA, 1870 TO 1908.

[Journal of the Royal Statistical Society, September, 1909, Vol. LXXII, pp. 500-502.]

Year.	Index numbers (percentages) of rupee prices in India (average of 1868-1876=100).				Index numbers of 11 articles of import.	Index numbers, 111 articles, including 11 articles of import.	Sauerbeck's gold prices (average, 1867-1877 =100).	Gold price of silver (60.34d. per ounce =100).	Gold price of rupee (23.34d. =100).	Index number of articles of export (1868-1876 =100).
	Food (60 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	99	97
1872.....	91	103	105	95	96	95	109	99	99	101
1873.....	96	99	100	97	105	98	111	99	99	102
1874.....	107	103	105	105	104	105	102	96	96	103
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	30	125	93	122	94	90	90	105
1878.....	155	102	93	135	88	130	97	86	85	107
1879.....	137	104	95	123	87	119	83	84	84	109
1880.....	108	108	103	106	93	105	88	86	86	106
1881.....	93	103	102	96	90	95	85	85	85	100
1882.....	93	100	97	95	89	94	84	85	85	96
1883.....	96	100	97	96	83	95	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	75	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	73	73	103
1891.....	123	106	100	116	88	113	72	74	74	105
1892.....	138	115	103	128	88	124	68	65	65	115
1893.....	131	117	113	125	94	122	68	58	58	116
1894.....	121	118	116	119	88	116	63	48	48	122
1895.....	113	125	118	116	91	114	62	49	49	57
1896.....	133	120	111	127	99	124	61	50	61	113
1897.....	171	114	103	149	90	143	62	45	45	115
1898.....	131	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	40	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	136
1908.....	202	127	122	174	113	168	73	40	68	131

More recent index numbers of wholesale prices compiled by the Department of Statistics of India are based on prices at the end of July, 1914, as 100 and include 75 commodities. Available figures for this series follow.

INDEX NUMBERS OF THE DEPARTMENT OF STATISTICS, CALCUTTA, INDIA.

[Source: Federal Reserve Bulletin, May, 1921, p 604.]

Date.	Building materials.	Manufactured articles.	Metals.	Hides and skins.	Cotton manufactures.	Raw cotton.	Jute manufactures.	Other textiles.	Oils, mustard.	Raw jute.	Oil seeds.	Tea.	Sugar.	Pulses.	Cereals.	Other foods.
End of July, 1914.	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
1920.																
Average for the year.....	138	231	238	147	354	153	149	162	128	104	173	78	407	166	154	184
March.....	127	218	222	211	351	179	150	159	135	118	166	87	321	160	151	192
April.....	114	201	219	209	357	158	170	161	116	119	163	90	377	159	156	185
May.....	128	215	248	160	365	135	142	164	123	120	169	90	511	150	157	183
June.....	131	233	244	116	364	144	147	164	119	83	171	73	482	149	156	180
July.....	139	235	249	100	364	132	151	168	119	89	169	74	503	159	151	188
August.....	142	235	257	99	360	139	163	168	115	91	167	72	477	160	154	185
September.....	158	237	245	105	347	154	163	164	115	105	179	65	456	170	154	186
October.....	154	282	245	96	343	142	136	164	132	104	184	64	392	169	155	178
November.....	161	246	243	89	341	133	118	164	118	90	163	62	348	168	150	173
December.....	161	229	242	90	333	116	107	156	124	83	152	69	273	149	139	160
1921.																
January.....	158	238	247	81	324	107	104	149	116	85	130	77	314	135	139	139
February.....	147	226	243	80	306	104	101	149	97	80	124	70	352	119	129	148
March.....	147	242	255	97	311	119	97	123	110	85	131	76	354	147	141	150

Index numbers for all of the 75 commodities combined are as follows:

INDEX NUMBERS OF THE DEPARTMENT OF STATISTICS, CALCUTTA, INDIA.

[Source: Federal Reserve Bulletin, March, 1921, p. 317, and May, 1921, p. 601.]

Year and month.	Index number.
End of July, 1914.....	100
Year 1920.....	204
1920.	
January.....	218
February.....	209
March.....	198
April.....	200
May.....	210
June.....	206
July.....	209
August.....	209
September.....	208
October.....	206
November.....	194
December.....	180
1921.	
January.....	178
February.....	174
March.....	183

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 Minister of Industry, Commerce and Labor (*Ministro per l'Industria, il Commercio e il 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. The latter series of index numbers has been continued in the reports for subsequent years.

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.

Table 69 contains the index numbers for the 13 commodities furnished to boarding schools during the period 1890 to 1916, inclusive.

TABLE 69.—INDEX NUMBERS BASED ON PRICES PAID BY THE NATIONAL SCHOOLS (CONVITTI NAZIONALI) FOR COMMODITIES NECESSARY FOR THE NOURISHMENT OF THE PUPILS, 1890 TO 1916.

[Annuario Statistico Italiano, 1912, p. 138, and 1916, p. 197.]

(Average prices in 1890-1894=100.)

Commodity.	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902	1903
Bread.....	99.7	101.1	107.6	99.2	92.1	95.5	92.4	94.1	103.9	103.1	102.8	100.0	96.9	95.5
Italian paste.....	102.1	101.2	103.1	99.6	94.2	91.8	91.7	97.9	99.8	100.0	99.0	98.1	95.7	91.7
Rice.....	102.1	101.7	103.1	96.5	96.3	97.5	96.1	101.3	99.1	98.5	95.7	93.9	93.7	93.7
Beef.....	99.4	104.7	100.5	98.8	96.4	97.0	95.2	93.8	91.4	90.7	90.6	93.5	93.8	92.6
Sausage.....	99.8	98.9	101.1	101.1	98.8	100.3	101.3	101.5	102.2	98.2	104.2	104.8	104.3	107.6
Fish (in oil).....	100.0	101.0	101.7	98.5	98.5	100.0	101.4	102.0	102.6	100.8	103.1	100.2	103.6	115.0
Eggs.....	101.1	99.3	100.4	99.0	100.3	99.7	100.7	100.9	101.7	100.2	107.8	108.9	111.0	111.2
Butter.....	99.5	97.4	101.0	100.2	101.7	101.0	100.2	102.4	98.8	97.4	98.4	102.0	99.9	101.3
Oil.....	99.3	99.4	102.1	101.1	98.3	97.6	92.8	91.5	105.0	100.7	110.8	111.1	103.8	102.7
Milk.....	103.8	102.1	97.2	100.6	96.5	97.5	95.4	91.6	93.0	93.7	89.2	89.9	92.7	92.0
Coffee.....	98.8	98.1	96.5	99.5	106.0	105.1	102.7	98.9	93.9	85.3	83.8	82.4	78.5	75.6
Sugar.....	97.4	96.2	98.6	100.1	107.5	100.9	101.7	100.3	99.8	101.0	101.1	100.9	96.6	93.8
Wine.....	115.5	110.0	90.7	90.7	93.2	94.6	102.8	91.3	94.3	95.2	94.9	93.8	87.3	89.3
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	96.8	97.1

Commodity.	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916
Bread.....	91.3	91.3	93.8	93.0	97.2	103.7	106.8	104.8	108.2	109.6	106.5	129.5	134.6
Italian paste.....	89.7	90.5	91.8	94.4	100.6	102.5	102.1	99.2	103.5	106.4	106.4	127.9	154.3
Rice.....	93.3	92.1	93.7	94.3	96.0	98.4	100.5	95.5	95.3	100.3	97.1	104.1	113.1
Beef ¹	96.6	101.4	102.6	102.8	102.6	111.2	112.0	124.7	132.6	123.6	122.4	143.5	195.1
Sausage.....	109.1	111.6	109.4	111.7	118.9	118.4	130.6	139.1	138.3	143.6	142.6	150.8	193.9
Fish (in oil).....	104.2	102.4	104.8	106.9	117.3	127.5	133.6	140.1	134.6	145.5	154.1	167.4	223.3
Eggs.....	110.9	114.9	115.9	121.4	126.2	131.5	133.4	140.0	140.9	142.3	149.3	164.5	225.7
Butter.....	101.7	100.6	103.1	104.9	107.4	111.0	112.4	113.9	118.1	119.9	119.3	129.6	156.8
Oil.....	95.2	100.0	94.3	101.0	105.1	145.3	135.8	146.6	138.1	139.0	137.9	143.6	180.1
Milk.....	89.9	91.6	93.4	98.6	99.6	103.8	109.3	112.5	114.9	113.5	118.0	121.1	137.1
Coffee.....	74.6	74.5	75.7	75.6	77.4	76.4	76.1	84.2	92.9	94.5	90.5	93.5	106.6
Sugar.....	92.2	97.4	96.0	96.7	96.8	96.4	97.8	100.1	104.8	100.2	92.5	98.5	138.7
Wine.....	89.6	89.3	92.1	93.3	84.5	71.7	77.5	123.5	133.8	118.4	93.0	110.3	215.6
General index number	95.3	96.7	97.4	100.0	102.3	107.5	109.8	117.2	119.7	119.7	117.7	129.6	167.3

¹ The prices used represent the average prices paid for beef (steers) and veal in one school. *Annuario Statistico Italiano*, 1912, p. 138; 1913, p. 134; 1916, p. 197.

INDEX NUMBERS OF PROF. RICCARDO BACHI.

PUBLICATION.

This series of index numbers is published annually in *l'Italia Economica*, a yearbook of economics edited by Prof. Riccardo Bachi, a distinguished economist of Italy. The series is also carried in current issues of the quarterly bulletin of the French General Statistical Office (*Bulletin de la Statistique Générale de la France*), in the monthly bulletin of the International Institute of Statistics (*Bulletin Mensuel de l'Office Permanent, Institut International de Statistique*) published at The Hague, Netherlands, and in the monthly bulletin of the Federal Reserve Board, Washington.

HISTORY.

The publication of these index numbers was begun in 1915, and has been continued to date in the publications mentioned above.

SOURCE OF QUOTATIONS.

It is stated that the prices are for the most part taken from the published reports of the Genoa bourse, the most important market of Italy. For some articles recourse has been had to official prices established by the cities of Milan, Rome, Naples, and Palermo.

BASE PERIOD.

The years 1901–1905 comprise the base period used in computing the index numbers up to the end of 1920. In that year a new series was constructed with the average end of month prices for the year as the basis for the calculations. The new series was, however, shifted to the old base by the compiler to preserve the continuity of the data.

NUMBER AND CLASS OF COMMODITIES.

Until 1920 Prof. Bachi based his original index numbers on the prices of 40 articles, divided into 5 groups:

1. Cereals and meats.
2. Other foodstuffs.
3. Textiles.
4. Metals and minerals.
5. Miscellaneous.

The following 40 articles were included in the index: Hard wheat, soft wheat, rice, oats, maize, flour, paste, beef, pork, codfish, olive oil, butter, cheese, coffee, sugar, lemons, almonds, Latium wine, Apulian wine, American cotton, Indian cotton, wool, hemp, raw silk, thrown silk, Cardiff coal, bar iron, cast iron, copper, zinc, lead, sulphur, petroleum, lumber, brick, lime, copper sulphate, hay, leather. Two of these, flour and lemons, were later left out of the reckoning because their prices could not be ascertained with any assurance so that only 38 commodities have been included in recent months. In 1920 the number of commodities was increased to 76.¹⁹

¹⁹ Vegetable foodstuffs: Wheat, soft. Wheat, hard. Rice. Oats. Rye. Maize. Macaroni. Potatoes. Almonds. Tomato preserve. Wine, Latium. Wine, Emilia. Wine, Sicily. Olive oil. Seed oil. Dried beans. Coffee. Sugar. Cocoa. Animal foodstuffs: Salt codfish. Tunny. Butter. Cheese. Honey. Eggs. Beeves. Calves.	Animal foodstuffs: Hogs. Bacon. Chemical products: Copper sulphate. Sodium nitrate. Ammonium sulphate. Calcium carbide. Sulphuric acid. Caustic soda. Citric acid. Tartaric acid. Textile materials: Cotton, American. Cotton, Indian. Cotton yarn. Wool, Sardinia. Wool, Aleppo. Hemp. Raw silk. Thrown silk. Cocoons. Minerals and metals: Coal, Cardiff. Coal, Newport. Coal, American. Iron, wrought. Iron, sheet. Tin plate.	Minerals and metals: Zinc. Tin. Copper. Lead. Antimony. Sulphur. Building materials: Bricks. Lime. Cement. Lumber, fir. Lumber, pitch pine. Miscellaneous vegetable products: Hay. Wheat straw. Wood charcoal. Firewood. Miscellaneous industrial materials: Alcohol. Tobacco. Illuminating gas. Electric power. Hides, raw. Hides, tanned. Kerosene. Paper. Soap.
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WEIGHTING.

As far as the published information shows, no weights were used in computing the older indexes. In the new series the geometric mean is employed.

TABLES OF RESULTS.

The 1916 volume of the Italia Economica gives two tables of index numbers. The first one is a monthly index number, by groups, for the years 1914 to 1916, and the second is a yearly index, by groups, for the years 1913 to 1916. In Table 70 the monthly figures for the years 1917-1919 have been taken from the monthly bulletin of the International Institute of Statistics.

TABLE 70.—MONTHLY INDEX NUMBERS, BY GROUPS OF COMMODITIES, JANUARY, 1914, TO DECEMBER, 1920.

[Data from Italia Economica and Bulletin Mensuel de l'Office Permanent, Institut International de Statistique.]

(Average prices in 1901-1905=100.)

Year and month.	All commodities.	Cereals and meats.	Other food-stuffs.	Textiles.	Metals and minerals.	Miscellaneous.
1914.						
January	128.6	117.0	135.1	118.7	114.2	117.9
February	119.7	116.3	133.7	117.4	112.6	118.1
March	117.9	116.0	130.7	114.1	112.4	115.2
April	116.5	115.1	129.8	113.7	110.7	115.5
May	118.2	115.7	137.4	114.4	110.8	111.2
June	117.0	115.9	132.7	115.6	111.7	107.7
July	115.6	114.0	127.2	116.9	111.6	108.1
August	122.0	114.6	117.0	123.4	148.7	115.5
September	119.4	119.6	115.6	103.8	141.5	111.2
October	123.3	135.4	115.7	97.8	129.6	115.3
November	127.2	139.5	120.0	104.7	138.0	114.3
December	127.1	136.0	119.8	102.2	142.1	120.9
1915.						
January	132.7	142.9	116.0	103.5	167.0	126.4
February	140.7	148.4	115.1	124.9	186.7	129.0
March	146.5	152.3	116.8	125.0	207.9	134.2
April	152.3	157.1	129.7	115.8	217.8	132.7
May	159.0	155.0	126.7	116.3	241.3	147.7
June	161.3	149.5	124.6	126.3	260.3	154.5
July	164.4	156.9	133.4	127.0	253.3	155.8
August	170.0	158.0	141.4	140.2	253.0	162.1
September	177.8	168.2	151.1	151.8	254.8	165.8
October	186.4	173.5	157.4	157.2	276.1	175.7
November	200.4	168.5	164.3	171.1	316.0	193.0
December	214.8	178.2	166.2	170.3	371.1	206.2
1916.						
January	232.3	179.9	177.9	189.1	434.3	212.0
February	240.5	183.5	181.7	201.1	448.7	223.3
March	247.8	187.9	186.8	204.6	469.7	227.3
April	252.7	185.7	192.9	198.8	482.8	231.9
May	254.5	184.3	195.8	190.7	491.9	236.2
June	242.8	184.8	194.7	194.1	459.7	232.8
July	242.8	186.2	202.2	208.9	402.8	236.5
August	248.1	187.3	213.0	224.2	398.4	236.7
September	256.7	186.2	212.2	246.3	423.7	238.7
October	260.2	176.3	208.4	248.3	453.0	240.1
November	269.5	195.5	203.5	275.7	465.7	248.1
December	294.6	205.7	198.7	278.8	594.2	243.7
1917.						
January	288.1	210.4	219.6	289.0	506.1	247.6
February	303.0	221.8	226.7	299.0	543.4	257.7
March	328.1	226.0	231.2	330.3	625.4	271.0
April	333.5	227.0	231.2	320.5	645.8	286.0
May	350.1	227.2	244.2	339.4	716.7	271.6
June	362.9	229.8	245.4	371.0	722.5	297.1
July	383.1	249.2	252.1	398.1	738.1	336.9
August	391.9	255.1	254.6	411.8	762.7	337.0
September	416.8	283.6	257.1	438.7	831.2	337.3
October	441.6	320.5	267.6	498.4	829.7	359.4
November	458.8	322.1	288.8	514.7	860.8	378.7
December	459.3	322.9	276.5	515.5	870.7	384.0

TABLE 70.—MONTHLY INDEX NUMBERS, BY GROUPS OF COMMODITIES, JANUARY, 1914, TO DECEMBER, 1920—Concluded.

Year and month.	All commodities.	Cereals and meats.	Other food-stuffs.	Textiles.	Metals and minerals.	Miscellaneous.
1918.						
January.....	457.6	326.0	264.3	513.8	869.4	388.1
February.....	478.8	336.4	265.2	540.6	939.1	392.5
March.....	496.8	353.8	274.1	562.4	954.6	421.1
April.....	505.6	360.9	288.9	575.6	949.6	435.2
May.....	515.4	347.9	299.4	577.6	950.8	454.3
June.....	523.5	335.5	326.0	589.6	975.1	468.1
July.....	540.6	391.7	338.7	590.0	992.8	468.1
August.....	544.1	403.9	348.0	582.7	978.2	481.4
September.....	545.8	413.5	360.3	585.8	942.0	499.8
October.....	556.4	413.9	407.3	584.3	939.8	502.9
November.....	550.7	414.5	416.8	584.3	891.7	509.1
December.....	467.9	360.8	418.4	584.3	520.9	509.5
1919.						
January.....	410.1	370.8	438.7	398.4	357.3	496.9
February.....	403.9	371.3	449.7	395.2	357.3	453.2
March.....	410.1	356.7	455.1	399.3	418.2	425.6
April.....	417.9	365.8	482.1	401.7	428.2	411.4
May.....	426.3	365.1	491.2	452.8	435.4	401.4
June.....	451.0	396.6	501.8	455.9	506.6	396.0
July.....	456.6	408.7	484.9	483.2	511.8	403.7
August.....	465.5	405.8	513.0	509.7	512.8	402.4
September.....	468.3	385.3	521.2	517.9	535.3	402.7
October.....	492.0	407.2	534.7	601.9	555.0	412.0
November.....	552.9	410.2	542.4	764.0	687.1	414.1
December.....	576.2	420.4	544.9	793.5	706.4	477.1
1920.						
January.....	63.7	436.5	578.1	937.4	811.9	492.3
February.....	701.0	438.6	582.2	1013.2	1036.7	522.7
March.....	780.0	458.5	610.4	1159.6	1205.2	576.0
April.....	855.7	475.2	712.6	1283.9	1302.5	630.8
May.....	830.3	530.2	728.4	1012.8	1317.3	619.4
June.....	774.7	535.0	746.7	895.3	1109.9	628.4
July.....	772.4	521.9	742.7	915.4	1093.0	639.5
August.....	795.9	534.8	745.6	957.3	1157.9	637.0
September.....	832.2	551.7	759.7	1009.0	1257.8	637.9
October.....	834.3	536.0	733.2	976.3	1303.4	674.1
November.....	829.1	570.6	781.8	920.0	1220.8	689.6
December.....	800.6	577.8	775.6	813.8	1123.1	735.6

TABLE 71.—YEARLY INDEX NUMBERS, BY GROUPS OF COMMODITIES, 1913 TO 1916.

[Data from Italia Economica.]

(Average prices in 1901-1905=100.)

Year.	All commodities.	Cereals and meats.	Other food-stuffs.	Textiles.	Metals and minerals.	Miscellaneous.
1913.....	126.0	120.2	146.1	120.6	121.6	117.9
1914.....	119.8	122.6	122.6	116.1	121.8	113.4
1915.....	167.2	159.5	136.4	139.1	250.1	157.8
1916.....	251.8	188.3	195.5	219.4	460.4	224.9

The following index numbers for 1920 and to February, 1921, have been supplied by the American trade commissioner at Rome:

BACH'S INDEX NUMBERS COMPUTED ACCORDING TO NEW SYSTEM OF GEOMETRIC AVERAGES.

(76 commodities; average prices for months of 1920=100.)

Year and month.	Index number.
1920.	
January.....	81.25
February.....	89.13
March.....	96.41
April.....	106.30
May.....	105.73
June.....	101.18
July.....	97.77
August.....	100.13
September.....	104.98
October.....	105.47
November.....	107.33
December.....	104.97
1921.	
January.....	102.89
February.....	98.23

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 1910,²⁰ 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 was 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 were supplied. The issue of *La Riforma Sociale* for September-October, 1920, pages 341-355, brings the information up to the end of 1918.

SOURCE OF QUOTATIONS.

The data used in computing the index numbers were those formulated by the Central Commission for Customs Valuation (*Commissione Centrale dei Valori per le Dogane*) 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

²⁰ Societa Tipografia-Editrice Nazionale (gia Roux e Viarenga), Torino. The same information also was published as a supplement to *La Riforma Sociale*, Vol. XXI, September-October, 1910.

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.
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 weighing 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 pro-

visional 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 work²¹ are given the following index numbers for imports and exports, respectively, for the years from 1881 to 1909. 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 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

²¹ *La Curva dei Prezzi della Merci in Italia negli Anni 1881-1909.*

the "Prezzi della Merci in Italia nel 1912," published in 1914, while those for years subsequent to 1912 have been taken from *La Riforma Sociale*, September–October, 1920, pages 353 and 354.

TABLE 72.—INDEX NUMBERS OF ITALIAN IMPORTS AND EXPORTS.

(Average prices in 1881=100.)

Year.	Imports.			Exports.		
	Necco.	Pantaleoni.	Benini.	Necco.	Pantaleoni.	Benini.
1881.....	100.00	100.00	100.00	100.00	100.00	100.00
1882.....	96.86	98.98	98.43	96.84	92.71	94.44
1883.....	93.01	94.90	94.06	91.96	86.46	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	76.73	69.79	74.40
1889.....	82.58	73.47	81.58	80.49	78.12	76.89
1890.....	83.23	78.47	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	76.18	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	62.50	67.72
1897.....	70.42	60.20	69.30	67.80	62.50	66.40
1898.....	74.49	62.24	73.23	69.09	64.57	67.79
1899.....	79.77	66.33	76.81	75.55	79.17	74.02
1900.....	86.47	66.33	83.17	75.10	72.92	73.58
1901.....	79.65	65.31	77.37	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.....	79.52	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	.....	.....
1913.....	90.05	.....	.....	83.80	.....	.....
1914.....	91.34	.....	.....	83.52	.....	.....
1915.....	128.96	.....	.....	95.46	.....	.....
1916.....	198.24	.....	.....	128.58	.....	.....
1917.....	358.68	.....	.....	188.32	.....	.....
1918.....	407.96	.....	.....	253.63	.....	.....

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. ²²	Sugar.
Flour N. O. (national).	Wine, Dalmatian, in transit.
Paste (macaroni, etc.), national,	Vinegar. ²²
fine.	Soap. ²²
Rice, fine, in transit.	Fresh butter.
Kidney beans.	Coffee, Santos, in transit.
Potatoes.	Milk.
Oil, fine, in transit.	Lard.
Cheese, Parma, in transit.	Eggs.
Beef (cow).	Meal, yellow.

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

²² Prices are average prices paid by the Istituto dei Poveri.

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.

Table 73 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.

Table 74 shows the indexes, both simple and weighted, for the 14 articles taken as a whole, in yearly periods from 1885 to 1911, inclusive.

Table 75 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.

TABLE 73.—INDEX NUMBERS BASED ON PRICES OF ISTITUTO DEI POVERI.¹

Name of article.	Price in base period, 1885.	Coefficient.	1910			1911		
			Price.	Simple index.	Weighted index.	Price.	Simple index.	Weighted index.
Bread.....	32.00	26	38.17	119.28	3,101.28	37.54	117.31	3,050.06
Flour, wheat.....	25.52	1	35.69	139.85	139.85	34.19	133.97	133.97
Paste (macaroni, etc.)	36.00	4	48.47	134.64	538.56	49.97	138.81	555.24
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	88.92	177.84
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	46.50	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
Soap.....	52.00	1	56.90	109.42	109.42	59.33	114.10	114.10
				1,650	15,535		1,823	17,415

¹ Mario Alberti, Il movimento dei prezzi e dei salari nell' anno 1911 a Trieste, pp. 24 and 25.

TABLE 74.—INDEX NUMBERS BASED ON PRICES OF ISTITUTO DEI POVERI, FOR EACH YEAR, 1885 TO 1911, INCLUSIVE.¹

(Average prices in 1885=100.)

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	88.96
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	90.79
1897.....	96.93	97.40
1898.....	99.57	99.99
1899.....	99.87	102.43
1900.....	101.21	114.95
1901.....	101.73	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	117.55
1909.....	117.14	112.33
1910.....	117.86	108.41
1911.....	130.21	121.53

¹ Mario Alberti, Il movimento dei prezzi e dei salari nell' anno 1911 a Trieste, pp. 24 and 25.

TABLE 75.—INDEX NUMBERS BASED ON PRICES OBTAINED FROM THE AUSTRIAN LLOYD STEAMSHIP CO.¹

Name of article.	Price in base period, 1892-1896.	Coefficient.	1910			1911		
			Price.	Simple index.	Weighted index.	Price.	Simple index.	Weighted index.
Bread ²	27.916	26.00	38.17	136.73	3,554.98	37.54	134.48	3,496.48
Flour, N. O., national.....	25.952	1.00	40.61	156.48	156.48	35.22	135.71	135.71
Paste (macaroni, etc.), national, fine.....	35.920	4.00	45.46	126.56	506.24	47.86	133.24	532.96
Rice, fine, in transit.....	36.880	2.50	43.95	119.17	297.94	45.11	122.32	305.79
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	9.86	154.25	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	252.08	138.70	27.74	240.52	132.34	26.47
Beef (cow) ²	94.300	20.00	105.00	111.34	2,226.80	138.00	146.35	2,927.00
Sugar.....	64.996	4.00	80.99	124.61	498.44	83.66	128.72	514.88
Wine, Dalmatian, in transit.....	23.322	20.00	22.53	96.61	1,932.20	44.06	188.92	3,778.40
Vinegar ²	12.896	.60	6.00	46.52	27.91	6.03	46.76	28.06
Soap ²	50.092	1.00	56.90	113.59	113.59	59.33	118.44	118.44
Fresh butter.....	224.992	2.00	231.68	102.98	205.96	259.96	115.55	231.10
Coffee, Santos, in transit.....	193.300	1.00	108.87	56.37	56.37	154.38	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	365.80	160.65	156.56	313.12
Eggs.....	6.232	50.00	6.60	105.90	5,295.00	7.18	115.05	5,752.50
Meal, yellow.....	17.364	1.00	23.68	136.37	136.37	22.68	130.62	130.62
				2,256	20,431		2,446	24,060

¹ Mario Alberti, *Il movimento dei prezzi e dei salari nell'anno 1911 a Trieste*.

² Index numbers based on prices paid by the Istituto dei Poveri.

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.²³ The latest available report, issued in March, 1920, is the thirty-fifth 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.

²³ Bulletin de l'Institut International de Statistique, tome XIX, 3^e livraison, p. 237.

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 report issued in 1914 comprises index numbers for the years 1904 to 1912 only, 1900 being still retained as the base or 100. In the thirty-fifth statistical report, the latest issued, the year 1912 is used as base.

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.

In the thirty-fifth statistical report, covering the years 1912 to 1919, only 39 articles are quoted. They are:

Rice, superior.	Hemp.
Barley.	Bleached cotton fabric, domestic.
Naked barley.	Calico.
Wheat.	Silk tissue, for lining.
Soy beans.	Kaiki silk.
Small red beans.	Petroleum.
Salt.	Coal.
Soy (sauce).	Firewood.
Miso (sauce, soy beans, rice, water).	Charcoal.
White sugar, domestic.	Rapeseed oil.
Sake (rice liquor).	Hanshi paper.
Tea.	Balk (beam) sugi.
Bonito (fish), dried.	Plank, sugi, 4 bu. (0.477 inch) thick.
Beef.	Sleeper, chestnut.
Eggs.	Pig iron, domestic.
Milk.	Nails, foreign.
Cut tobacco.	Dried sardines (for manure).
Ginned cotton, domestic.	Herring (for manure).
Cotton yarns, domestic.	Rapeseed cake.
Raw silk, superior.	

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, umeboshi (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.

In the thirty-fifth annual report the 39 commodities quoted are divided into 5 groups.

The grouping is as follows:

Grain.

Rice.	Wheat.
Barley.	Soy beans.
Naked barley.	Small red beans.

Food, etc.

Salt.	Bonito, smoked, dried.
Soy.	Beef.
Miso.	Eggs.
White sugar.	Milk.
Sake.	Cut tobacco.
Tea.	

Clothing.

Ginned cotton.	Bleached cotton fabric.
Cotton yarns.	Calico.
Raw silk.	Silk tissue, for lining.
Hemp.	Kaiki silk.

Material.

Balk sugi.	Pig iron.
Plank, sugi, 4 bu (0.477 inch) thick.	Nails (foreign).
Sleeper, chestnut.	

Others.

Petroleum.	Hanshi paper.
Coal.	Dried sardines (for manure).
Firewood	Herring (for manure).
Charcoal.	Rapeseed cake.
Rapeseed oil.	

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 ²⁴) 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,²⁵ from 1881 to 1909, inclusive, are shown in the following table published in the bulletin of the international statistical institute.²⁶ 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.

²⁴ A genus of evergreen trees of the pine family.

²⁵ A native beer made from rice.

²⁶ Bulletin de l'Institut International de Statistique, tome XIX, 3^e livraison, p. 239.

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TABLE 76.—INDEX NUMBERS FOR FOUR PRINCIPAL COMMODITIES, 1881 TO 1909.

(Average prices in 1881=100.)

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	73	64
1885.....	64	64	64	94	77
1886.....	56	55	57	80	66
1887.....	52	45	58	83	66
1888.....	48	41	57	76	61
1889.....	61	47	71	80	69
1890.....	90	72	78	85	83
1891.....	75	70	74	84	78
1892.....	77	64	73	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.....	125	84	115	192	147
1901.....	127	72	108	201	149
1902.....	132	81	104	201	150
1903.....	153	113	116	205	164
1904.....	143	137	147	208	172
1905.....	137	123	146	223	175
1906.....	155	85	139	239	180
1907.....	173	106	149	240	189
1908.....	167	115	134	252	192
1909.....	139	103	117	251	180

Table 77, compiled from the 28th, 29th, and 34th statistical reports of the Japanese Department of Agriculture and Commerce, shows the index numbers for each of the three groups²⁷—food, clothing, and materials—and for the three groups combined, by years, from 1900 to 1917. 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.

TABLE 77.—INDEX NUMBERS FOR THE THREE PRINCIPAL GROUPS OF COMMODITIES, 1900 TO 1917.

(Average prices in 1900=100.)

Year.	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	116
1906.....	129	122	101	114
1907.....	135	129	110	122
1908.....	136	120	113	122
1909.....	133	119	107	118
1910.....	132	124	110	120
1911.....	139	133	114	126
1912.....	154	130	119	133
1913.....	155	132	121	135
1914.....	148	120	118	129
1915.....	139	113	122	127
1916.....	147	146	138	143
1917.....	180	216	183	188

²⁷ For index numbers of the separate commodities of each group see the statistical reports of Department of Agriculture and Commerce for 1911, 1912, and 1919.

Table 78, taken from the thirty-fifth statistical report (p. 159), gives index numbers for the five groups for the years 1912-1919.

TABLE 78.—INDEX NUMBERS BY GROUPS OF COMMODITIES, 1912 TO 1919.

(Average prices in 1912=100.)

Year.	Grains.	Food.	Clothing.	Material.	Others.	Grand average.
1912.....	100	100	100	100	100	100
1913.....	102	100	100	100	103	101
1914.....	86	101	92	99	99	96
1915.....	74	97	89	117	96	94
1916.....	77	100	111	162	111	109
1917.....	108	116	156	229	151	145
1918.....	169	146	205	314	219	200
1919.....	211	190	272	281	262	238

INDEX NUMBERS OF THE BANK OF JAPAN.

PUBLICATION AND HISTORY.

Since 1897 the Bank of Japan has published index numbers of wholesale prices in Tokyo. These index numbers are published in monthly bulletins and in yearbooks.

BASE PERIOD.

The year 1887 was used as a base period until February, 1913. The base was then changed to October 1900.

SOURCES.

The prices are taken from private sources, being supplied by merchants and associations in Tokyo and Yokohama.

NUMBER AND CLASS OF COMMODITIES.

Before 1900 the index numbers were based on the prices of 41 commodities. In 1900 this number was increased to 56 and has not been changed since. For a short time in 1904 the commodities were divided into the three following classes:

1. Commodities the prices of which were influenced by domestic economic conditions.
2. Commodities the prices of which were influenced by export conditions.
3. Commodities the prices of which were influenced by import conditions.

This method proved to be too cumbersome for the prompt issuance of index numbers and was very soon abandoned. Later on another group subdivision was adopted as follows: Cotton cloth, building materials, papers, metals, fuels, silks (raw and waste), silk cloth, foodstuffs, fertilizers, cereals, tobacco, and other goods. This group plan was also abandoned later, since which relative prices for the 56 commodities have been given individually.

DESCRIPTION OF COMMODITIES.

The following is the list of commodities on which the latest index numbers of the Bank of Japan are based:

Rice.	Floss silk.
Barley.	Cotton yarns.
Rye (hadakamugi).	Imitation nankeens.
Wheat.	Cotton shirtings.
Soy beans.	Cotton.
Red or white beans (azuki).	Ramie and China grass.
Wheat flour.	Flannel.
Rice bran (fertilizer).	Muslin.
Fish fertilizer.	Italian cloth.
Oil cake.	Fuel.
Sugar.	Indigo.
Tea.	Timber.
Salt.	Steel, bars and rods.
Miso.	Nails.
Soy.	Copper.
Sake.	Stone.
Dried bonito (<i>katsuobushi</i>).	Bricks.
Kerosene oil.	Tiles for roofing.
Charcoal.	Portland cement.
Eggs.	Mattings.
Oils.	Glass plates.
Tobacco.	Kami (Japanese paper).
Cigarettes.	Paper.
Raw silk.	Lacquer.
Habutai silk.	Vegetable wax.
Silk handkerchiefs.	Leather.
Kaiki silk.	Matches.
Silk for lining.	Coal.

WEIGHTING.

The index numbers are unweighted, being the simple arithmetic averages of the relative prices of individual commodities.

TABLES OF RESULTS.

The information now issued by the Bank of Japan in the form of monthly sheets shows, besides the general index numbers for a period of ten years, relative prices of principal articles for the preceding 12 months. Relative prices of individual commodities for the month in question, the month immediately preceding it and the same month of the previous year are also given.

In the yearbook the relative prices of all commodities are given individually by months for the years 1900 to date; also the monthly general index numbers are given for the same period, as well as the Economist figures. In addition a table showing the increase in the cost of commodities during the war in Tokyo and in London is presented.

Table 79, taken from the June, 1920, issue of the statement showing "Index numbers of average monthly wholesale prices in Tokyo," published by the Bank of Japan, gives index numbers by months from January, 1911, to June, 1920.

TABLE 79.—INDEX NUMBERS OF WHOLESALE PRICES IN TOKYO, JANUARY, 1911, TO DECEMBER, 1920.

(Average prices in October, 1900=100.)

Month.	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
January.....	123	129	134	130	120	145	168	224	277	398
February.....	123	130	133	128	123	153	166	232	275	414
March.....	123	131	132	128	125	154	167	238	267	425
April.....	123	132	132	127	127	153	173	243	267	397
May.....	123	133	131	125	128	150	182	242	278	359
June.....	122	131	132	125	127	147	190	245	295	327
July.....	122	133	130	125	125	147	206	252	319	1 317
August.....	124	131	130	127	126	151	221	267	324	1 311
September.....	128	130	132	129	126	153	214	274	332	1 305
October.....	127	132	133	125	127	157	214	280	352	1 299
November.....	126	133	132	121	133	168	212	278	370	1 293
December.....	127	134	131	119	141	172	216	277	381	1 272

¹ From Bulletin of Supreme Economic Council, London, vol. 2, No. 4, 1921, p. 10.

Table 80, showing the trend of wholesale prices in Tokyo during the war, is taken from the January, 1920, yearbook, page 45.

TABLE 80.—INDEX NUMBERS OF WHOLESALE PRICES IN TOKYO, JULY, 1914, TO DECEMBER, 1919.

(Average prices in July, 1914=100.)

Month.	1914	1915	1916	1917	1918	1919
January.....	.....	96	116	132	178	221
February.....	.....	98	122	132	185	219
March.....	.....	100	123	133	190	213
April.....	.....	101	122	138	194	213
May.....	.....	102	120	145	193	221
June.....	.....	101	117	151	195	235
July.....	100	100	117	164	201	254
August.....	101	100	120	176	213	258
September.....	103	100	122	170	219	265
October.....	100	101	125	170	223	280
November.....	97	106	134	170	221	294
December.....	95	113	137	173	221	303
Average.....	.....	100	112	132	180	218

NETHERLANDS.

INDEX NUMBERS OF THE NETHERLANDS STATISTICAL OFFICE.

HISTORY AND PUBLICATION.

An index of wholesale prices prepared by the Netherlands Statistical Office appeared for the first time in the monthly journal of that office in June, 1914.²⁸ 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 was continued through 1918, in the monthly journal of the same office, after which its publication was discontinued. A new series was begun in the monthly journal for August, 1920, and has been continued in subsequent issues.

SOURCE OF QUOTATIONS.

Price quotations were obtained from the different wholesale markets, the number and place of these markets not being specifically mentioned. Monthly price quotations were averaged annually.

²⁸ Maandschrift van het Centraal Bureau voor de Statistiek. The Hague, 1914, vol. 9, No. 6 (June) pp. 461-466.

BASE PERIOD.

The base period used for the original series was 1893, the average price of that year representing 100. In the more recent series the years 1901–1910 form the base period.

NUMBER AND DESCRIPTION OF COMMODITIES.

There were 12 commodities for which separate index numbers, or relative prices, were given; in the first published series no general index for all commodities combined was presented. In the new series published since August, 1920, the number of commodities has varied from 48 to 50, relative prices being shown for individual commodities and a general index for all articles combined. Both raw and manufactured commodities are included.

WEIGHTING.

A simple arithmetical average apparently has been employed no, mention being made of any kind of weighting.

TABLE OF RESULTS.

The following table shows the index numbers of wholesale prices for the Netherlands as now published in the monthly journal of the Central Bureau of Statistics:

TABLE 81.—INDEX NUMBERS OF WHOLESALE PRICES, BY YEARS, 1911 TO 1920, AND BY MONTHS, JANUARY TO DECEMBER, 1920.

[Source: Maandschrift van het Centraal Bureau voor de Statistiek, Jan. 31, 1921, p. 128.]

(Average prices in 1901–1910=100.)

Year.	General index (49 articles).	Index of foods (31 articles).	Year and month.	General index (49 articles).	Index of foods (31 articles).
1901–1910.....	100	100	1920.		
1911.....	116	117	January.....	334	296
1912.....	120	120	February.....	329	285
1913.....	114	112	March.....	331	283
1914.....	121	122	April.....	338	291
1915.....	170	171	May.....	339	293
1916.....	266	263	June.....	339	301
1917.....	340	313	July.....	343	307
1918.....	454	338	August.....	330	297
1919.....	349	333	September.....	328	292
1920.....	325	290	October.....	323	290
			November.....	297	283
			December.....	266	260

NEW ZEALAND.

INDEX NUMBERS OF THE CENSUS AND STATISTICS OFFICE.

PUBLICATION AND HISTORY.

During the year 1917 a system for the regular collection of information regarding wholesale prices was put into operation by the Census and Statistics office of New Zealand. A considerable volume of data was obtained from merchants and traders by means of retrospective investigations covering the years 1891 to 1917, and it was found possible to obtain sufficient information upon which to calculate index numbers of wholesale prices over the period from 1891 on.

These index numbers first appeared in the November, 1919, issue of the Monthly Abstract of Statistics, and since then have been published in every issue of this periodical. The yearly figures are reproduced in the New Zealand Official Yearbook and go back as far as 1891.

BASE PERIOD.

The base for the computation of index numbers is the average of the period 1909-1913, which is taken as 1,000.

SOURCE OF QUOTATIONS.

The wholesale prices quoted are obtained from private sources—merchants, traders, millers, live-stock brokers, etc., in various localities. The index numbers, however, are based only on the prices in the four chief centers: Auckland, Wellington, Christchurch, and Dunedin. These cities include one-third of the Dominion's entire population and about 70 per cent of the urban population.

PRICES: HOW SHOWN AND COMPUTED.

Average wholesale prices of commodities are given in the Monthly Abstract of Statistics. These are shown in very great detail, by localities. The official yearbook gives quarterly prices as well as the average yearly prices, by commodities.

NUMBER AND CLASS OF COMMODITIES.

The general index number, covering all years since 1891, is based upon the prices of 106 commodities. From 1909 on, more detailed information was available and the group index numbers now computed represent the fluctuations of 140 articles or grades of commodities. Both raw and manufactured commodities are included.

DESCRIPTION AND GROUPING OF COMMODITIES.

The 140 commodities used for the computation of the group index numbers are divided as follows:

- I. Agricultural produce.
- II. Flour, bran, pollard, and oatmeal.
- III. Wool, hides, tallow, butter, and cheese.
- IV. General merchandise and crockery.
- V. Building materials.
- VI. Leather.
- VII. Chemicals and manures.
- VIII. Coal.

The following is the list of articles:

Agricultural produce.

Wheat: Tuscan, Hunters, velvet, fowl.
 Oats: Garton's A; Garton's B; Sparrowbills.
 Barley: Malting; feed.
 Cocksfoot (M. D.).
 Rye grass: Italian (M. D.); perennial (M. D.).
 Potatoes.
 Onions.
 Maize.

Milling products.

Flour.
 Bran.
 Pollard.
 Oatmeal.

Wool, hides, tallow, etc.

Wool:
 Merino, medium to good; merino, inferior.
 Half-bred, medium to good; half-bred, inferior.
 Crossbred, medium to good; crossbred, inferior.
 Hides:
 Ox, heavy; ox, medium; ox, light.
 Cow, heavy, medium and light, yearling.
 Calf.
 Tallow.
 Butter.
 Cheese.

General merchandise.

Tinned fruits: Apricots, 2½-pound tins; peaches, 2½-pound tins; pears, 2½-pound tins.
 Dried fruits: Currants, sultanas, prunes.
 Herrings; salmon; sardines; coffee; cocoa; tea; sugar, No. 1A; golden syrup, 2-pound tins; treacle; sago; tapioca; rice; salt, common; table, 7-pound bags; cream of tartar; carbonate of soda; vinegar; mustard; pepper; starch; soap (New Zealand); bluing; candles, wax; tobacco, plug (duty paid); kerosene; ham; bacon; lard; honey; bran bags; corn sacks; wool packs.

Ironmongery.

Iron: Pig; bar; angle and T; plate; hoop; corrugated galvanized.
 Fencing wire, No. 8, galvanized; black.
 Nails, 4-inch wire.
 Zinc, sheet.
 Lead, sheet.
 Tinned plates, I. C. coke.
 Copper, sheet.
 Lime (Auckland and Wellington prices are for hydraulic lime; Christchurch and Dunedin for white lime).
 White lead.
 Linseed oil, raw.
 Bricks, ordinary building.

Textiles.

Fox's No. 4 serge; blankets, colonial all wool (quality most sold), size 10/4; S. S. S. galatea shirting (Prestwick's), 30-inch; Finlay's F. T. sheeting, 80-inch; Crewdson's No. 2 calico, 36-inch; Nairn's linoleum, second quality, 6 feet wide; Williamson's linoleums, third quality, 6 feet wide.

Leather.

Sole: New Zealand—Crop, 18-20 lb.; bends, first quality. Sole, imported.
 Kip, New Zealand; kip, imported; split kip, New Zealand.
 Chrome calf, New Zealand; chrome calf, imported (E. or A.).
 Chrome sides, New Zealand; chrome sides, imported.
 Glace kid, New Zealand; glace kid, imported (European or American; Australian).

Crockery.

English china cups and saucers:
 London W. & G.
 Norwich W. & G.
 Worcester shape, gold edge, London size.
 Worcester shape, gold edge, Irish size.
 Worcester shape, gold edge, breakfast size.
 White granite and semiporcelain dinnerware, 10-in. plate.
 White granite toilet sets, six pieces, size 9.
 Tumblers, ¾ quart, plain heavy bottom.

Fresh fruit, etc.

Apples: Eating; cooking.
 Oranges: Fiji and Island; Sydney.
 Peaches: Eating; cooking.
 Pears: Eating; cooking.
 Bananas.
 Appricots: Eating; cooking.
 Cabbage; cauliflower; onions; eggs, fresh, preserved.

Coal (at wharf).

New Zealand: Screened; unscreened; small.
 New Castle: Screened.

Timber.

New Zealand timbers:
 Kauri, heart, first grade.
 Kauri, heart, second grade.
 Kauri, heart, third grade.
 Rimu: Clean heart; heart (bridge quality); ordinary building; second class.
 Matai: Heart; ordinary building.
 Totara: Clean heart; heart (bridge quality); ordinary building; second class.
 Southland beech or birch: Black birch or beech (*fagus fusca*); white pine (*kahikatea*).
 Imported timbers:
 Oregon, merchantable, sawn; Oregon, select, sawn; Jarrah, sawn; Jarrah, hewn.
 Tasmanian hardwoods, sawn.
 Ironbark; hewn; sawn.
 Tasmanian palings, split, 6 ft.; sawn, 6 ft.
 Jarrah palings, sawn, 6 ft.

Chemicals.

Acid: Boracic (20-Mule Team); carbolic, crude; tartaric.
 Alum, bluestone (Macclesfield); borax.
 Bottles: Glass, empty, quart beers; 8-oz. dispensing. Caustic soda; Cod-liver oil, Norwegian, nonfreezing; cottonseed oil; cotton wool, cheap English; Eno's fruit salts; Epsom salts; glycerin (1.260 S. G.); Jeyes's fluid; naphtha, wood; rectified spirit, 90 per cent (65 O. P.); resin; saltpeter; soda bicarbonate, B. M.; soda hyposulphite; sugar of milk, B. P.; sulphide of sodium, solid (concentrated); sulphur, ground; washing soda.

Manures.

Superphosphate, 39-43 per cent; superphosphate, 36-38 per cent.
 Guano: 60 per cent analysis; 40 per cent analysis.
 Basic slag.
 Kainit; pure bone dust; nitrate of soda; nitrate of lime; sulphate of ammonia; sulphate of potash.

WEIGHTING.

The system of weighting is the one known as the "aggregate-expenditure" method. Each article has been given a weight corresponding to its average annual prewar consumption in the Dominion and, further, to its price.

TABLE OF RESULTS.

The monthly, quarterly, and yearly figures appear in every issue of the Monthly Abstract of Statistics. The Official Year Book gives, in addition to the above, a table for yearly index numbers for the period from 1891 on.

Tables 82, 83, and 84 are taken from the May, 1920, and February, 1921, issues of the Monthly Abstract of Statistics and Table 85 from the Official Yearbook, 1919, page 806.

TABLE 82.—MONTHLY INDEX NUMBERS OF WHOLESALE PRICES IN NEW ZEALAND (AVERAGE OF THE FOUR CHIEF CENTERS) BY GROUPS OF COMMODITIES, JANUARY, 1918, TO DECEMBER, 1920.

(Average annual aggregate expenditure of the four chief centers, 1909-1913=1,000.)

Month.	Group I: Agricultural produce.	Group II: Flour, bran, pollard, and oatmeal.	Group III: Wool, hides, tallow, butter, and cheese.	Group IV: General merchandise and crockery.	Group V: Building materials.	Group VI: Leather.	Group VII: Chemicals and manures.	Group VIII: Coal.	All groups combined.
1918.									
January	1,585	1,456	1,468	1,574	2,011	1,895	1,757	1,460	1,677
February	1,556	1,464	1,471	1,587	1,992	1,891	1,822	1,463	1,676
March	1,604	1,504	1,471	1,605	2,019	1,912	1,873	1,462	1,697
April	1,702	1,553	1,466	1,642	2,044	1,909	1,901	1,462	1,741
May	1,720	1,558	1,459	1,663	2,076	1,906	1,988	1,463	1,759
June	1,726	1,561	1,461	1,690	2,111	1,907	2,006	1,463	1,775
July	1,784	1,566	1,462	1,718	2,158	1,891	2,031	1,463	1,808
August	1,931	1,574	1,462	1,729	2,221	1,885	2,089	1,463	1,860
September	1,992	1,580	1,464	1,731	2,247	1,897	2,088	1,463	1,879
October	2,077	1,588	1,465	1,750	2,277	1,884	2,098	1,516	1,917
November	2,197	1,587	1,468	1,760	2,324	1,910	2,052	1,529	1,955
December	2,269	1,586	1,467	1,757	2,299	1,916	2,052	1,529	1,961
1919.									
January	1,996	1,585	1,468	1,747	2,240	1,886	1,986	1,529	1,888
February	1,903	1,584	1,467	1,736	2,186	1,883	1,988	1,529	1,848
March	1,719	1,550	1,463	1,722	2,119	1,892	1,957	1,546	1,789
April	1,698	1,534	1,462	1,713	2,094	1,902	1,938	1,546	1,770
May	1,732	1,524	1,476	1,705	2,041	1,902	1,931	1,551	1,760
June	1,754	1,517	1,502	1,711	2,018	1,941	1,888	1,574	1,762
July	1,812	1,519	1,537	1,756	1,989	2,027	1,899	1,649	1,788
August	1,923	1,517	1,552	1,797	1,996	2,128	1,924	1,664	1,828
September	1,961	1,512	1,542	1,869	2,016	2,196	1,925	1,750	1,868
October	1,975	1,509	1,567	1,890	2,022	2,282	1,968	1,807	1,886
November	1,961	1,519	1,570	1,930	2,034	2,345	2,042	1,809	1,899
December	1,986	1,533	1,576	1,979	2,050	2,405	2,053	1,809	1,925
1920.									
January	2,185	1,548	1,586	2,083	2,078	2,441	2,152	1,818	1,999
February	2,130	1,560	1,634	2,174	2,181	2,538	2,164	1,849	2,039
March	2,083	1,718	1,688	2,224	2,310	3,279	2,176	1,935	2,123
April	2,100	1,722	1,650	2,243	2,338	3,476	2,229	1,995	2,153
May	2,055	1,724	1,610	2,227	2,391	3,437	1,435	2,066	2,167
June	2,015	1,736	1,546	2,206	2,405	3,368	2,463	2,092	2,158
July	1,983	1,746	1,532	2,470	2,584	3,145	2,528	2,096	2,264
August	1,939	1,756	1,560	2,498	2,587	2,901	2,489	2,108	2,261
September	1,931	1,764	1,582	2,493	2,585	2,890	2,501	2,153	2,267
October	1,855	1,761	1,907	2,509	2,605	2,897	2,494	2,158	2,291
November	1,740	1,755	1,770	2,494	2,603	2,716	2,426	2,170	2,247
December	1,828	1,747	1,750	2,459	2,612	2,592	2,368	2,178	2,249

TABLE 83.—QUARTERLY INDEX NUMBERS OF WHOLESALE PRICES IN NEW ZEALAND (AVERAGE OF THE FOUR CHIEF CENTERS), BY GROUPS OF COMMODITIES, JANUARY, 1914, TO DECEMBER, 1920.

(Average annual aggregate expenditure of the four chief centers, 1909-1913=1,000.)

Quarter ending—	Group I: Agri-cultural produce.	Group II: Flour, bran, pollard, and oat-meal.	Group III: Wool, hides, tallow, butter, and cheese.	Group IV: General merchandise and crockery.	Group V: Building materials.	Group VI: Leather.	Group VII: Chemicals and manures.	Group VIII: Coal.	All groups combined.
1914.									
March.....	907	990	1,123	1,078	1,103	1,172	1,064	1,003	1,045
June.....	969	1,031	1,159	1,077	1,109	1,180	1,077	1,003	1,067
September.....	1,033	1,131	1,115	1,077	1,123	1,187	1,080	1,003	1,073
December.....	1,176	1,326	1,067	1,125	1,144	1,198	1,082	1,008	1,123
1915.									
March.....	1,542	1,589	1,196	1,175	1,148	1,286	1,160	1,016	1,221
June.....	1,621	1,727	1,305	1,186	1,192	1,349	1,195	1,014	1,237
September.....	1,641	1,605	1,371	1,216	1,256	1,368	1,244	1,014	1,304
December.....	1,517	1,298	1,315	1,229	1,273	1,388	1,272	1,031	1,284
1916.									
March.....	1,480	1,361	1,337	1,271	1,334	1,440	1,375	1,082	1,323
June.....	1,305	1,273	1,402	1,312	1,418	1,458	1,417	1,118	1,314
September.....	1,461	1,306	1,436	1,340	1,485	1,472	1,494	1,175	1,403
December.....	1,702	1,300	1,430	1,345	1,508	1,510	1,495	1,204	1,449
1917.									
March.....	1,499	1,410	1,431	1,367	1,564	1,676	1,574	1,267	1,450
June.....	1,508	1,447	1,452	1,407	1,676	1,795	1,650	1,330	1,510
September.....	1,535	1,459	1,468	1,463	1,838	1,853	1,719	1,432	1,593
December.....	1,529	1,436	1,512	1,551	2,009	1,901	1,753	1,445	1,665
1918.									
March.....	1,582	1,475	1,470	1,592	2,007	1,899	1,817	1,461	1,684
June.....	1,716	1,557	1,462	1,665	2,077	1,907	1,965	1,462	1,759
September.....	1,902	1,573	1,463	1,727	2,209	1,891	2,070	1,463	1,849
December.....	2,181	1,587	1,467	1,756	2,300	1,903	2,071	1,525	1,944
1919.									
March.....	1,873	1,573	1,466	1,735	2,181	1,887	1,977	1,535	1,842
June.....	1,727	1,525	1,480	1,709	2,050	1,915	1,919	1,557	1,764
September.....	1,898	1,516	1,544	1,808	2,000	2,117	1,916	1,688	1,828
December.....	1,974	1,521	1,571	1,933	2,035	2,344	2,021	1,809	1,903
1920.									
March.....	2,132	1,609	1,636	2,160	2,190	2,753	2,164	1,867	2,054
June.....	2,057	1,727	1,602	2,225	2,379	3,427	2,376	2,051	2,160
September.....	1,951	1,755	1,558	2,487	2,585	2,979	2,506	2,119	2,264
December.....	1,808	1,754	1,809	2,487	2,607	2,735	2,429	2,169	2,262

TABLE 84.—INDEX NUMBERS, OF WHOLESALE PRICES IN NEW ZEALAND (AVERAGE OF THE FOUR CHIEF CENTERS), BY GROUPS OF COMMODITIES, 1910 TO 1919.

(Average annual aggregate expenditure of the four chief centers, 1909-1913=1,000.)

Year.	Group I: Agri-cultural produce.	Group II: Flour, bran, pollard, and oat-meal.	Group III: Wool, hides, tallow, butter, and cheese.	Group IV: General merchandise and crockery.	Group V: Building materials.	Group VI: Leather.	Group VII: Chemicals and manures.	Group VIII: Coal.	All groups combined.
1910.....	1,021	989	981	969	957	986	994	985	983
1911.....	991	972	1,008	993	995	982	986	985	994
1912.....	1,089	970	1,029	1,032	1,037	993	1,024	1,011	1,041
1913.....	967	981	1,047	1,055	1,063	1,126	1,035	1,038	1,032
1914.....	1,021	1,120	1,116	1,089	1,120	1,184	1,076	1,004	1,077
1915.....	1,580	1,555	1,297	1,202	1,217	1,348	1,218	1,019	1,269
1916.....	1,487	1,310	1,401	1,317	1,444	1,470	1,445	1,145	1,390
1917.....	1,517	1,440	1,466	1,447	1,772	1,806	1,674	1,369	1,555
1918.....	1,845	1,548	1,466	1,685	2,148	1,900	1,981	1,478	1,809
1919.....	1,868	1,534	1,515	1,796	2,067	2,066	1,958	1,647	1,834
1920.....	1,987	1,711	1,651	2,340	2,440	2,974	2,369	2,052	2,185

TABLE 85.—GENERAL INDEX NUMBERS OF WHOLESALE PRICES IN NEW ZEALAND (AVERAGE OF THE FOUR CHIEF CENTERS), 1891 TO 1920.

(Average aggregate annual expenditure, four chief centers, 1909-1913=1,000.)

Year.	Index number.	Year.	Index number.	Year.	Index number.
1891.....	991	1901.....	931	1911.....	994
1892.....	937	1902.....	975	1912.....	1,011
1893.....	925	1903.....	954	1913.....	1,051
1894.....	927	1904.....	922	1914.....	1,077
1895.....	920	1905.....	994	1915.....	1,209
1896.....	943	1906.....	1,028	1916.....	1,380
1897.....	1,005	1907.....	1,016	1917.....	1,555
1898.....	962	1908.....	1,006	1918.....	1,809
1899.....	893	1909.....	949	1919.....	1,834
1900.....	917	1910.....	984	1920.....	1,2,185

¹ From Monthly Abstract of Statistics, Wellington, February, 1921, p. 39.

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."²⁹

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."³⁰

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

²⁹ An examination of the yearbooks for 1911, 1912, 1913, and 1919, however, fails to disclose any data bearing on this subject.

³⁰ The Course of Prices in New Zealand, James W. McIlraith, p. 3.

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 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.	Oatmeal, first-class New Zealand manufacture.
Barley, best on Christchurch market.	

Pastoral products (8 articles).

Wool, best merino, greasy. ³¹	|	Lamb, carcasses exported. ³²
Wool, best half-bred, greasy. ³¹		Bacon, best New Zealand product.
Beef, best quality, Addington (Christ-church) sales yard.		Cheese, best New Zealand product..
Mutton. carcasses exported. ³²		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	|	Cocoa, 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). ³³
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. ³⁴	|	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 substitutions 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.

³¹ 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.

³² Prices are deduced from estimated values of carcasses exported, as published in the "Statistics of New Zealand."

³³ This kind is quoted in later decades; Kentish is quoted in earlier periods.

³⁴ Best imported sugar was quoted prior to the opening of the Auckland refinery.

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)." ³⁵

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." ³⁶

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.

³⁵ The Course of Prices in New Zealand, James W. McIlraith, p. 29.

³⁶ Idem, p. 23.

TABLES 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 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 means, is reproduced herewith as Table 86.

TABLE 86.—COMPARISONS OF INDEX NUMBERS COMPUTED UPON THE SAME BASE PERIOD.

Year.	New Zealand, 1890-1899 =100.0.	"Economist," 1890-1899 =100.0.	Sauerbeck, 1890-1899 =100.0.	New Zealand (by median).	Year.	New Zealand, 1890-1899 =100.0.	"Economist," 1890-1899 =100.0.	Sauerbeck, 1890-1899 =100.0.	New Zealand (by median).
1861.....	184	133	149	172	1886.....	108	99	105	107
1862.....	186	141	153	172	1887.....	103	101	103	102
1863.....	193	171	156	176	1888.....	103	109	106	101
1864.....	195	185	159	185	1889.....	111	106	109	111
1865.....	189	175	153	183	1890.....	107	110	109	104
1866.....	200	174	155	187	1891.....	108	110	109	108
1867.....	187	149	152	192	1892.....	104	104	103	102
1868.....	184	131	150	189	1893.....	100	103	96	100
1869.....	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	96
1875.....	148	135	146	148	1900.....	101	104	114	99
1876.....	140	132	144	134	1901.....	98	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	116	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 ³⁷ No. 9-10 of that year. It covers a period from 1880 to 1910, but whether or not it has since been continued is not known, although the prices on which it is based are found for later years in the annual summary of commercial statistics issued by the Norwegian office of general statistics.³⁸

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 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),

³⁷ Sociale meddelelser (fortsaettelse av maanedsskrift for socialstatistik) utgit av Socialavdelingen under er Departementet for sociale saker, handel, industri og fiskeri. Christiania. 1ste aargang, Nr. 9-10, 1911, pp. 136-149.

³⁸ Norges handel, 1908—(Statistique du commerce de la Norvege pendant l'annee 1908—) Utgit av det Statistiske centralbureau. (Norges officielle statistik, V, 87, 116.)

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.

Table 87, which appears in the journal of the Norwegian Labor Office for September and October, 1911 (No. 9-10)³⁹ shows in detail the main results of this series of index numbers, as published.

TABLE 87.—INDEX NUMBERS OF WHOLESALE PRICES.

(Based on 7 food commodities imported into Norway, 1880-1910. Average prices in 1891-1900=100.)

Year.	Beef	Pork.	Cheese.	Butter.	Oleo- marga- rine.	Eggs.	Pota- toes.	All 7 com- modi- ties.
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	.....	.....	86	100	97
1888.....	90	122	96	98	96	91	100	99
1889.....	90	107	100	98	101	91	100	98
1890.....	90	97	104	98	101	91	100	97
1891.....	95	98	109	105	112	91	100	101
1892.....	92	112	104	101	112	97	100	103
1893.....	100	136	104	105	112	97	100	108
1894.....	95	115	96	98	107	97	100	101
1895.....	95	95	91	97	96	97	100	96
1896.....	92	75	96	91	90	102	100	92
1897.....	95	76	96	91	84	102	100	92
1898.....	105	93	100	105	92	102	100	100
1899.....	108	86	100	105	96	102	100	100
1900.....	113	115	100	105	96	108	100	105
1901.....	113	131	100	105	96	108	83	105
1902.....	118	153	104	105	96	108	83	110
1903.....	110	132	104	105	96	108	83	105
1904.....	103	114	104	105	96	108	92	103
1905.....	115	119	104	108	96	108	88	105
1906.....	128	136	113	105	101	108	72	109
1907.....	133	136	122	108	101	108	88	114
1908.....	123	132	113	115	112	108	111	116
1909.....	123	166	113	115	112	108	97	119
1910.....	131	180	113	129	112	108	83	122

³⁹ Maanedsskrift for socialstatistik. Udgitt av det Statistiske Centralbyraa, 1ste aargang, Nr. 9-10, 1911, pp. 141-148.

TABLE 87.—INDEX NUMBERS OF WHOLESALE PRICES—Continued.

(Based on 10 grains and flours imported into Norway, 1880-1910. Average prices in 1891-1900=100.)

Year.	Barley.	Oats.	Wheat.	Rye.	Pot or pearl barley.	Hulled oats.	Barley flour.	Rye flour.	Oat-meal.	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	149
1882.....	137	126	140	130	133	112	146	153	108	144	133
1883.....	134	110	156	124	146	112	138	143	102	139	130
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	123	107	114	127	92	110	108
1887.....	97	84	106	84	113	79	98	103	83	107	95
1888.....	102	89	109	84	119	84	106	90	86	111	98
1889.....	109	110	113	94	119	90	114	101	98	108	106
1890.....	114	99	113	102	119	96	114	109	105	113	108
1891.....	134	115	132	143	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	89	78	79	80	88	83	81	95	81	83
1895.....	86	76	82	78	83	87	89	82	89	85	84
1896.....	87	89	89	86	90	87	85	71	95	90	87
1897.....	87	103	105	86	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	105	98	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	106	101	108	96	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	109	127	118
1910.....	111	105	111	100	91	106	106	92	102	117	104

(Based on 6 commodities imported into Norway from the East, 1880-1910. Average prices in 1891-1900=100.)

Year.	Coffee.	Tea.	Sugar.		Tobacco.	Rice.	All 6 commodities.
			Loaf.	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	126	123	119	107	90	105
1886.....	72	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.....	129	106	116	119	103	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.....	122	101	94	92	99	86	99
1896.....	112	98	94	88	99	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	95	74	69	99	95	81
1903.....	51	95	77	73	99	100	83
1904.....	56	95	90	89	96	100	88
1905.....	63	95	97	100	96	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	96	105	98

TABLE 87.—INDEX NUMBERS OF WHOLESALE PRICES—Continued.

(Based on wool and cotton yarns and cotton goods (7 articles) imported into Norway, 1880-1910. Average prices in 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.....	128	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.....	109	106			101	102	107	105
1892.....	106	103			98	100	103	102
1893.....	106	106			97	100	103	102
1894.....	103	101			91	94	99	98
1895.....	103	101			99	94	99	99
1896.....	101	98			99	94	99	98
1897.....	86	93	97	100	103	98	96	96
1898.....	86	93	93	93	99	98	92	93
1899.....	92	95	93	93	103	102	92	90
1900.....	106	106	117	113	108	112	110	110
1901.....	101	103	109	120	103	102	99	105
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.....	109	122	113	133	124	132	142	125
1910.....	118	127	144	147	125	134	145	134

(Based on 6 metals, and leather, fuels, and petroleum imported into Norway, 1880-1910. Average prices in 1891-1900=100.)

Year.	Leather.	Petroleum.	Pig iron.	Steel.	Bar and hoop iron.	Zinc.	Lead.	Tin.	Coal, coke, etc.	All 9 commodities.
1880.....	157	188	109	148	112	103	144	101	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.....	116	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	100
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	126	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	91	86	100	107	98	94
1894.....	89	94	87	90	86	86	96	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	103	118	129	104	113	111	112
1900.....	110	94	154	121	142	114	128	145	158	130
1901.....	113	85	104	103	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	108	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

TABLE 87.—INDEX NUMBERS OF WHOLESALE PRICES—Concluded.

(Based on 39 articles imported into Norway, 1880-1910, by groups of commodities. Average prices in 1891-1900=100.)

Year.	I. Food products.	II. Flour and grain.	III. Articles imported from the East.	IV. Manufactured articles (cot- ton and woolen yarn and goods).	V. Miscellane- ous (metals princi- pally).	All com- modities.
1880.....	107	144	138	139	135	133
1881.....	115	149	136	139	116	131
1882.....	129	133	124	129	110	125
1883.....	124	130	121	125	107	121
1884.....	115	117	111	122	99	113
1885.....	105	115	105	116	99	108
1886.....	95	108	102	114	98	103
1887.....	97	95	108	112	100	102
1888.....	99	98	106	113	101	103
1889.....	98	106	113	112	105	107
1890.....	97	108	112	111	111	108
1891.....	101	131	110	105	105	110
1892.....	103	120	111	102	98	107
1893.....	108	100	118	102	94	104
1894.....	101	83	105	98	90	95
1895.....	96	84	99	99	92	94
1896.....	92	87	97	98	91	93
1897.....	92	92	89	96	90	92
1898.....	100	101	89	93	98	96
1899.....	100	103	89	96	112	100
1900.....	105	100	91	110	130	107
1901.....	105	98	87	105	110	101
1902.....	110	102	81	105	103	100
1903.....	105	98	83	112	101	100
1904.....	103	100	88	116	100	101
1905.....	105	101	92	118	104	104
1906.....	109	104	85	127	116	108
1907.....	114	123	86	134	119	115
1908.....	116	123	88	125	103	111
1909.....	119	118	90	125	102	111
1910.....	122	104	98	134	106	113

RUSSIA.**INDEX NUMBERS OF THE FORMER IMPERIAL MINISTRY OF
COMMERCE AND INDUSTRY, PETROGRAD.****PUBLICATION.**

The former imperial Ministry of Commerce and Industry of Russia published annually a "Summary of Prices for Commodities in Representative Russian and Foreign Markets," in which was included an index number based on the average annual prices of the various articles under consideration. Wholesale prices were 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 were used as the original material for compilation. In the absence of exchange quotations for some of the articles, information was 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, were 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 were 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 there 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 with custom duties included.

BASE PERIOD.

The average price for the 10-year period, 1890–1899, taken as 100, was used as a base in computing the index number.

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.
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 vershok ⁴⁰ wide by 585 arshin ⁴¹ long, 80 funt ⁴² in weight.
Wool.....	Moscow, medium quality.

⁴⁰ 1 vershok equals 1.75 inches.

⁴¹ 1 arshin equals 0.77 yard.

⁴² 1 funt equals 0.9 pound.

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.

6. *Drugs and chemicals.*

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.....	Rybinsk.
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 Table 88, compiled from the 1912 report:

TABLE 88.—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.
1890-1899.....	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1890.....	108.2	99.3	102.6	100.9	109.8	103.6	113.3	105.4
1891.....	128.8	93.9	108.3	93.7	99.3	100.8	105.5	104.2
1892.....	126.4	96.7	104.5	94.1	89.6	102.7	97.5	101.6
1893.....	103.1	104.6	109.3	108.0	96.1	106.5	104.7	104.6
1894.....	78.6	102.5	103.8	105.1	91.0	100.6	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	96.4	95.2	94.9
1898.....	106.3	104.0	110.4	96.1	102.7	96.0	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	121.9	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	115.8	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

SOUTH AFRICA.

INDEX NUMBERS OF THE OFFICE OF CENSUS AND STATISTICS.

A report of 120 pages dealing with retail and wholesale prices, rents, and cost of living was published by the Office of Census and Statistics of the Union of South Africa in August, 1919.⁴³ Appendix B of this report contains a table of index numbers of wholesale prices, arranged by groups of commodities and based on prices in January of each year from 1914 to 1919 and in April and July, also, of 1919. Subsequent information is contained in the Quarterly Abstract of Union Statistics, also published by the Office of Census and Statistics.

HISTORY.

An economic commission in 1913 advised the Government to establish a section of statistical work covering the subjects of prices, rents, cost of living, and wages, as having a vital interest for the workers of the country. This and subsequent commissions appointed

⁴³ Social Statistics. Statistics of Retail and Wholesale Prices, Rents, and Cost of Living (1895-1919). Office of the Census and Statistics, Pretoria, Union of South Africa, 1919.

in 1916 and 1917 found themselves at a disadvantage in their study of economic conditions, owing to the absence of statistical data. It was not found possible, however, to give effect to the recommendations of these commissions until the latter part of 1918, when a section of the Office of Census and Statistics was constituted for the purpose of maintaining a regular service of social statistics. It is stated in the preface to the report that "it may be expected that future developments will show the results of the experience now for the first time being obtained in South Africa, and that the measurement of price movements in their bearing upon the economic conditions of this country will gradually be rendered possible in a more precise and certain way than can be expected in the first stages."

SOURCE OF QUOTATIONS.

The report states that, except for a few articles of South African produce, there has been no systematic publication of prices by trade journals. A limited amount of information as to values of imports and exports is shown by the figures in the customs returns, but this was found unsatisfactory for the present purpose. Records of commercial establishments form the principal source from which price quotations were obtained. While the task of compiling suitable data from such sources involves considerable labor, it is stated that "the value of the results will scarcely be questioned and, apart from the use to which the statistics can be put in the immediate present, the foundations are being laid for a system of record of wholesale prices which should prove of increasing usefulness as comparisons become more comprehensive and trustworthy."⁴⁴

BASE PERIOD.

In calculating the index numbers for this report the prices in January, 1914, were taken as the basis for comparison (1,000). It was anticipated that further investigations will secure price quotations as far back as 1910, the year in which the Union was constituted, and that such year will thereafter be used as the base year.

PRICES: HOW SHOWN AND COMPUTED.

A table in the appendix to the report contains average money prices of each commodity for the Union, for January of the years 1914 to 1919 and for April and July of the last-named year. In a second table these average money prices are shown as relatives of the January, 1914, price. The method of calculating the average price for the Union is explained as follows:

As regards each town separately, the predominant price or, if there was no predominant price, the actual price nearest to the average of all quotations was taken as the base price; the arithmetical average of the base prices for the coast towns was then calculated; finally the Union price was obtained by taking the mean between the Johannesburg base price and the average of the base prices for the coast towns.

NUMBER AND CLASS OF COMMODITIES.

It was the original intention to confine the list of commodities to be considered in the record and study of wholesale prices to 97 items, based closely on the list adopted by the Commonwealth of Australia.

⁴⁴ Social Statistics. Statistics of Retail and Wholesale Prices, Rents, and Cost of Living (1895-1919). Office of the Census and Statistics, Pretoria, Union of South Africa, 1919.

However, in view of the greater general utility of a more comprehensive list, the number was enlarged to 188 articles. It is planned to extend the list still further, should this be found expedient. In a number of cases it was found impracticable to arrive at the approximate consumption and it was, therefore, necessary to omit such articles in computing the index numbers. These however, are included in the table of average and relative prices.

In the selection of articles due consideration was given to their relative importance in the economy of the country. Only staple commodities were dealt with, and it was further recognized as essential that a brand, grade, or standard sufficiently definite to make comparison reasonably certain be secured.

DESCRIPTION AND GROUPING OF COMMODITIES.

The articles are grouped as follows:

I. Metals.

Iron and steel, including pig iron, common bar iron, angle and T, channel and H, $\frac{1}{4}$ -inch plate, tinned plate (30 w. g.), hoop, galvanized corrugated (24 w. g.), galvanized flat (26 w. g.), No. 8 fencing wire, fencing standards (14 lbs.), baling wire (16 w. g.), sheet copper, insulated copper wire, sheet lead, lead pipe, tin plate, quick-silver, sheet zinc.

II. Jute, leather, hides, and skins.

Grain bags (2 $\frac{1}{2}$ -lb.), wool bags (10-lb.), sugar pockets, sail twine, binding twine, kip leather, basils leather, wet salted hides, dry salted hides, merino sheepskins, other sheepskins, goatskins.

III. Grains, meal, etc.

S. A. milling wheat, domestic white flour, imported white flour, sifted wheaten meal, unsifted wheaten meal, domestic oatmeal, imported oatmeal, domestic breakfast oats, imported breakfast oats, bran, feed oats, feed barley, flat white maize, mixed maize, maize meal, kaffir corn, potatoes, onions, oat hay, Lucerne hay, teff hay.

IV. Dairy produce.

Bacon, butter, Cheddar cheese, gonda cheese, S. A. lard.

V. Groceries.

Baking powder, bicarbonate of soda, blueing, cocoa, coffee, beans, cream of tartar, dried apples, dried apricots, dried peaches, dried pears, prunes, currants, raisins, tinned fruit, glucose, hops, domestic jam, macaroni, condensed milk, mustard, white pepper, rice, sago, salmon, fine salt, blue mottled household soap, yellow household soap, starch, refined white sugar, domestic golden sirup, imported sirup, tapioca, tartaric acid, domestic tea, imported tea, manufactured tea, tobacco, domestic wine, vinegar.

VI. Meat.

Beef, mutton, veal, lamb, pork.

VII. Building materials.

Teak, timber, deals, Oregon lumber, pitch pine, flooring boards, ceiling boards, skirting, shelving, doors, windows, frames, cement, lime, brick, mixed paints, copal varnish, turpentine, white lead, raw linseed oil, dry red oxide, dry red lead, glue, rosin, coal tar, putty, window glass, plate glass, wire nails, flooring boards.

VIII. Chemicals.

Carbonate of soda, caustic soda, saltpeter, sulphur (flowers), rock sulphur, cyanide of sodium, arsenate of soda, superphosphates, basic slag, nitrate of soda, borax, refined glycerin, methylated spirits, nitric acid, crude opium.

IX. Fuel and light.

Coal (local consumption), pithead, paraffin, petrol, candles, matches, calcium carbide.

X. Soft goods.

Bleached calico, flannelette, white flannel, woolen blankets, black merino, black cotton cashmere, cotton shirting, prints, cotton gabardine, cretonne, dress drill, sewing cotton, single sheets, ticking.

XI. Miscellaneous.

Anti-friction grease, detonators, fuse, heavy lubricating oil, light lubricating oil, cotton waste, manila rope, iron bedsteads, bent-wood chairs, cups and saucers, white dinner plates, glass tumblers, newspapers, wrapping paper.

SUBSTITUTIONS AND ADDITIONS.

No additions or substitutions are shown for the limited period covered by the price series.

INTERPOLATION.

Interpolation has not been resorted to, so far as the published report shows.

WEIGHTING.

In computing the index numbers for the several groups of commodities in the report the average prices of the individual articles were weighted in proportion to the quantities consumed in the Union in 1917. In the great majority of cases the estimates of consumption were based on the quantities given in the annual statement of imports and exports and in the report of the census of manufactures. In a few cases, e. g., beef, mutton, etc., the quantities adopted in the typical family budget shown in the section of the report devoted to cost of living formed the basis of the estimate. With respect to the articles included in the groups designated as "soft goods" and "miscellaneous" it is stated that satisfactory estimates of consumption were not obtainable and that the index figures for these groups were arrived at by taking the arithmetic average of the price relatives for individual commodities.

Owing to war conditions the consumption of many articles, particularly metals and chemicals, was below normal in 1917. For this reason, it is explained, when the conditions return to normal the advisability of adopting an alternative course for future years may be considered.

TESTING.

No method of testing the accuracy of the results obtained appears to have been adopted, so far as the published information reveals.

TABLES OF RESULTS.

Table 89 is reproduced from the report of the Office of Census and Statistics, published in 1919.

TABLE 89.—INDEX NUMBERS OF WHOLESALE PRICES IN SOUTH AFRICA, BY GROUP 7 OF COMMODITIES, JANUARY, 1914, TO 1919, AND SPECIFIED MONTHS IN 1919.

[Statistics of Retail and Wholesale Prices, Rents and Cost of Living, 1895 to 1919, p. 102.]

(Average prices in January, 1914=1000.)

Date.	Metals.	Jute leather, etc.	Grain, meal, etc.	Dairy produce.	Groceries.	Meat.	Building materials.	Chemicals.	Fuel and light.	Soft goods.	Miscellaneous.	All groups.
1914, January	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
1915, January	1,417	1,073	1,124	1,108	1,073	1,013	1,087	1,155	1,047	1,180	1,189	1,109
1916, January	1,926	1,198	1,147	1,136	1,127	1,066	1,201	1,282	1,146	1,480	1,602	1,229
1917, January	2,929	1,400	1,393	1,163	1,275	1,155	1,464	1,446	1,409	1,960	1,904	1,470
1918, January	4,130	1,769	1,376	1,259	1,396	1,296	1,832	1,591	1,602	2,506	2,291	1,663
1919:												
January	3,838	1,773	1,454	1,281	1,433	1,373	2,067	1,661	1,697	3,147	2,524	1,799
April	2,770	1,694	1,479	1,421	1,448	1,311	1,944	1,627	1,696	3,099	2,362	1,758
July	2,797	1,663	1,609	1,686	1,672	1,365	1,866	1,493	1,690	3,069	2,407	1,831

Table 90 shows the index numbers as published in the Quarterly Abstract of Union Statistics, No. 6, April, 1921, page 28.

TABLE 90.—INDEX NUMBERS OF WHOLESALE PRICES IN SOUTH AFRICA, BY GROUPS OF COMMODITIES, 1915 TO JANUARY, 1921.

(Index number for 1914=1000.)

Group.	1915	1916	1917	1918	1919	1920	January, 1921.
Metals.....	1669	2256	3193	3836	3147	3286	3162
Jute, leather, etc.....	1160	1335	1577	1739	1790	2077	1520
Grain, meal, etc.....	1166	1304	1408	1432	1659	2619	1670
Dairy produce.....	1129	1162	1216	1276	1592	2013	1693
Groceries.....	1,28	1,229	1,322	1,387	1,529	2,073	2,134
Meat.....	1033	1098	1206	1310	1368	1680	1579
Building materials.....	1149	1348	1686	1905	2005	2353	2265
Chemicals.....	1480	1809	2169	2124	1650	1473	1488
Fuel and light.....	1089	1264	1485	1619	1662	1826	2081
Soft goods.....	1330	1720	2233	2827	3185	4322	4190
Miscellaneous.....	1303	1706	2226	2629	2530	3244	3430
All groups.....	1174	1345	1542	1679	1808	2449	2064

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 all that I have, but I am aware these need to be corrected and made more complete."⁴⁵ 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.

⁴⁵ *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:⁴⁶

	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.

Table 91 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 in the last two columns:

TABLE 91.—VARIATIONS IN WEIGHTED RELATIVE PRICES OF FOOD COMMODITIES IN SPAIN, 1891 TO 1908, BY YEARS.^a

(Average prices in 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.....	77.8	96.3	120.0	102.3	76.5	85.3	90.9	96.1
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.....	85.0	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	83.9
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	101.8	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	103.7	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	114.5
1905.....	131.7	112.3	96.8	111.9	109.1	105.5	100.7	106.2
1906.....	111.6	97.2	98.3	109.3	118.7	114.6	100.7	106.2
1907.....	115.0	96.3	98.1	105.8	115.2	108.9	100.7	106.2
1908.....	119.8	108.5	100.6	105.5	104.3	83.1	100.7	103.9

⁴⁶ 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.

^a El Problema de las Subsistencias, Francisco Bernis, p. 58.

TABLE 91.—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	108.9	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.....	91.5	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	95.6	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	112.3	106.0	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 1914⁴⁷ 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 three index numbers are as follows:⁴⁸

⁴⁷ Estudios estadísticos. Contribucion a la investigacion de la situacion economica de los trabajadores en España. Barcelona, Tipografia "La Academica" de Serra Hnos y Russell, Ronda Universidad, 6.

⁴⁸ Idem, pp. 10-13.

(Average prices in 1901=100.)

Year.	Arithmetic mean.	Geometric mean.	Weighted index.
1892.....	88.6	88.07	84.8
1893.....	92.5	91.75	90.2
1894.....	97.9	95.59	90.9
1895.....	91.8	91.23	91.6
1896.....	87.9	87.32	86.8
1897.....	92.7	92.09	94.3
1898.....	96.6	96.15	98.5
1899.....	97.3	96.88	95.8
1900.....	96.8	96.55	96.7
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.....	106.4	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

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."⁴⁹

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.

⁴⁹ 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^e année 1910. 2^e 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.

China: Shanghai. Index numbers of the Treasury Department's Bureau of Markets.

These index numbers of wholesale prices include 147 articles and are calculated on prices in September, 1919, as the base, or 100. The commodities are classified into 6 groups, viz, cereals, other foods, textiles, metals, combustibles, and miscellaneous articles. Data are available for each month since January, 1920.

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, Ellsworth. 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.

Denmark. Index numbers of the *Finanstidende*.

These are computed from the first of the month prices of 33 commodities at wholesale. The commodities are divided into two groups, foodstuffs and other articles, with a general index for all articles combined. The index numbers are roughly weighted according to consumption and are based on prices in the period from July 1, 1912, to June 30, 1914, as 100. Figures are available for January and July of each year from 1915 to 1920 and for all months since July, 1920.

Drobisch, Moritz Wilhelm. Ueber die Berechnung der Veränderung der Waarenpreise und des Geldwerthes. (Published in the *Jahrbücher für Nationökonomie 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.

Egypt. Index numbers of wholesale prices in Cairo and Alexandria. (Published in *Monthly Agricultural Statistics of the Ministry of Finance*, Cairo.)

The average price of each commodity during the period from January 1, 1913, to July 31, 1914, has been determined and the prices for other months are expressed as percentages of such averages. The index number is the average of these percentages, without reference to the relative importance of the different articles. The number of commodities included in the index numbers is 24, of which 21 are foods, the remaining three being soap, unrefined spirit, and petroleum. The figures cover the years from 1915 to 1920, separate figures being shown for Cairo and Alexandria.

*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.

Federal Reserve Bank of New York. Index numbers of wholesale prices of 12 basic commodities. (Published in *Monthly Review of Credit and Business Conditions in the Second Federal Reserve District*.)

The 12 basic commodities included in the index number are wheat, corn, cotton, hogs, sugar, lumber, petroleum, pig iron, copper, lead, rubber, and hides. The sources of information are such trade papers and daily news quotations as make it possible to compile the index on any day of the week. All prices used are for New York except those for hogs and hides, which are quoted as of Chicago. The index is made up regularly each Monday, using Saturday's prices. Equal weight is given to the several commodities, the average of prices between October, 1918, and January, 1920, being taken as the 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.

France: Alsace and Lorraine. Index numbers of the Office Statistique d'Alsace et Lorraine.

The Statistical Office of Alsace and Lorraine has compiled a series of index numbers of wholesale prices for 55 commodities, divided into two groups, viz. food products and industrial materials. Prices on July 1, 1914, are taken as the base, or 100. Data are available for July, 1919, and for each month since January, 1920.

Germany. Index numbers of the *Frankfurter Zeitung*.

The *Frankfurter Zeitung* has constructed a series of index numbers for Germany by averaging from month to month the relative prices of 77 commodities, using prices in January, 1920, as the base, or 100. The commodities are divided into four groups, viz. agricultural products, textiles and leather, minerals, and miscellaneous articles, and include those whose prices are subject to Government control, or are fixed periodically by the great combines, as well as those which fluctuate with the natural movements of an unhampered market. Most kinds of manufactures are excluded from the index. All four groups are given equal weight in the general index. Data are available for months since January, 1920. For purpose of comparison a "peace index" based on prices at the middle of 1914 is also shown.

Great Britain. Index numbers of the *Times*.

Index numbers calculated from the wholesale prices of 40 commodities are published by the *Times* of London. The commodities are divided into two equal groups, food products and industrial materials, with prices on December 31, 1913, as the base, or 100. Data are available for the years 1919 and 1920 and for each month since December, 1919.

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. Dénrées et salaires. Paris. 1878.

The average of 10 articles purchasable with 1 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, 1890-1899, 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 Kön. ungarische statistische Zentralamt 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 Rückgang der Waarenpreise und die oesterreichisch-ungarische Handelsbilanz, 1875-1888. (Published by the k. k. Statistische Zentral-Kommission in the "Statistische Monatsschrift." 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 "Beiträge 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 1873.

*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. 1835.

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 50 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.

Mitchell, H. *Index numbers of wholesale prices in Canada*. (Published in the *Labor Gazette of the Department of Labor*, Ottawa.)

Prof. H. Mitchell, of McMaster University, Toronto, Canada, has compiled a series of index numbers of wholesale prices, including 40 commodities and based on average prices in the decade 1900-1909, equals 100. His results for the years 1914 to 1920, by months, are published in the *Labor Gazette* for January, 1921, page 118. In subsequent issues Mitchell's figures are shown alongside those of the Department of Labor in the tables comparing price movements in Canada with those in other countries.

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.⁵⁰

———. *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.

Norway. *Index numbers of the Økonomisk Revue*.

A series of index numbers of wholesale prices, with the period December 31, 1913, to June 30, 1914, as the base, or 100, has been compiled by the *Økonomisk Revue* of Christiania, Norway. The commodities are divided into 12 groups: Animal food, vegetable food, foodstuffs and fertilizers, coal and coke, petroleum and benzine, iron, metals, building materials, textiles, hides and leather, pulp wood, and paper. Data are available for December of each year 1914 to 1918; January, June, and December, 1919, and for each month since January, 1920.

Ottolenghi, Costantino. *Index numbers of wholesale prices in Italy during the Great War*. (Published in the *Journal of the Royal Statistical Society*, May and July, 1920.)

In an article published in the *Journal of the Royal Statistical Society* for May, 1920, the author presents a table of weighted index numbers, computed from the prices of 19 commodities arranged into 5 groups and covering the years from 1910-1912 to 1918. The three years from 1910 to 1912 constitute the base period. A second article in the July, 1920, number of the *Journal* gives further details concerning the construction of the index number series.

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.)

⁵⁰ Compare pp. 308 and 309 of this bulletin.

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 3 groups) from 1870 to 1884 for the same base 1865-1869.

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.

Roumania. 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 semimonthly, monthly, quarterly, semiannually, and annually from 1908 to 1911 for five grains.

Sweden. Svensk Handelstidning, Stockholm.

An unofficial series of index numbers of wholesale prices in Sweden is published monthly in this periodical. The index numbers are built on 47 series of market quotations, comprising raw materials or goods in the first stages of manufacture. As some commodities are represented by more than one grade or quality, the actual number of articles included is less than 47. These are classified into 11 groups: All commodities, vegetable foodstuffs, animal foodstuffs, agricultural materials, coal, oils, metals, building materials, textiles, hides and leather, and wood pulp. The base period selected is the prewar year July, 1913, to June, 1914.

The monthly data shown for vegetable and animal foodstuffs are from averages of weekly quotations, while for the remaining articles prices at the fifteenth of the month form the basis of the computations. In calculating the index numbers the prices are weighted according to the value of the goods consumed during a period of one year immediately preceding the outbreak of the war.

These index numbers are currently reproduced in the Federal Reserve Bulletin, published by the Federal Reserve Board, Washington, D. C., the monthly bulletin of the International Institute of Statistics, published at the Hague, Netherlands, the quarterly bulletin of the General Statistical Office of France, and other publications.

Tyszka, Carl von. Die Bewegung der Preise einiger wichtiger Lebensmittel, insonderheit 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 crop prices and prices of meat animals. (Published by the Bureau of Crop Estimates, Department of Agriculture, Washington.)

These index numbers are published from time to time in the *Monthly Crop Reporter*. The July, 1920, issue of this publication (p. 62) contains a table showing index numbers of prices of 10 leading crops of the United States, representing about 75 per cent of the value of all crops, the average value for the 5 years 1910-1914 being denoted by 100. The figures cover all months of the period from January, 1908, to July, 1920, with yearly averages from 1908 to 1919. Page 72 of the same issue gives monthly index numbers of prices to producers of meat animals for the period from 1913 to June 15, 1920, with yearly averages for 1913 to 1919. Each number of the *Monthly Crop Reporter* contains a table showing the average prices received by producers of the United States for a large number of important farm products. Prices of certain articles quoted for first of month are averages of reports of county crop reporters, weighted according to the relative importance of county and State. Prices quoted for fifteenth of month are averages of returns from a list of about 7,000 country buyers. State averages are weighted according to their relative importance to obtain the United States averages.

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 "Ueber 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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