The Revised Price Indexes

The 1950 Revision of the BAE Indexes of Prices Received by Farmers, and of Prices Paid by Farmers, Including Interest, Taxes, and Farm Wage Rates

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The following article endeavors to develop a technical but nevertheless relatively simple explanation of the revised price indexes of the Bureau of Agricultural Economics. These ind xes are widely used not only for general purposes but also in the administrative calculation of parity prices which current legislation provides are to be so determined as to give farm commodities generally the same purchasing power in terms of "articles and services that farmers buy, wages paid hired farm labor, interest on farm indebtedness secured by farm real estate, and taxes on farm real estate" as prevailed during the base period January 1910–December 1914. This means that the indexes must measure broad changes over something more than four decades. This requirement sets a most difficult task in constructing farm price indexes, especially the parity index covering prices and cost rates paid by farmers owing to the great shift in farm production methods and, equally, farm family living patterns since 1910. We believe that the new indexes are as good a basis for tracing these changes as can be devised from the available data and it is with considerable pride that they are presented, especially since the need for such revision has long been recognized.

—O. V. Wells.

IN JANUARY 1950 the Bureau of Agricultural Economics published revised indexes of prices paid by farmers and prices received by farmers.[1] This revision of the Index of Prices Paid by Farmers is the first to be adopted since 1935. The Index of Prices Received by Farmers, however, was revised in February 1944. The current revisions are significant in their own right, but in a larger sense they are merely another stage in the evolutionary development of these two indexes.

Amendments to the parity legislation included in the Agricultural Acts of 1948 and 1949 required the addition to the Parity Index of an allowance for cash wages paid to hired farm labor and the shifting of the base period for the Index of Prices Received by Farmers from August 1909—July 1914 to January 1910—December 1914. It was decided that these changes should be incorporated as part of the thoroughgoing revision that had

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[1] UNITED STATES BUREAU OF AGRICULTURAL ECONOMICS. AGRICULTURAL PRICES, JANUARY 1950, SUPPLEMENT I. [Processed.]

been recognized as necessary.[2]   It is believed that the revised Parity Index provides a more complete and more accurate measure than has heretofore been available of changes in prices and rates paid by farmers for all the groups of goods and services for which satisfactory data are available.

Some modifications were made in methods of calculating the indexes so that now the methods used in the calculation of both indexes are essentially similar.   The use of similar methods for compiling the two indexes is more appropriate now than ever before, since under the amended legislation both indexes enter into the computation of parity prices, instead of only the Parity Index, as heretofore.

Historical Development

Prices Received by Farmers

Before the current revisions are described, it seems worth while to summarize briefly the history of efforts to measure the fields represented by these indexes.   The earliest published attempt at an index number of prices received by farmers included prices of 10 crops.[3]   Average December

1 farm prices for the 43-year period 1866–1908 were used as a base for computing price relatives. These price relatives were averaged together, using values obtained by multiplying the base-period prices by quantities produced in 1909 as weights.   These index numbers, or comments based upon them, were published in the March 1909 issue of the *Crop Reporter* and from time to time subsequently in that publication and its successor, the *Monthly Crop Report*.   A description of the index appeared on page 96 of the August 1918 issue of the *Monthly Crop Report*. This index was later shifted to 1913 as a base, with prices for the latter years shifted from a first-of-the-month to an estimated mid-month basis.   The latter shift seems to have been made to synchronize the crop index with the index of farm prices of livestock which was based on 15th-of-the-month prices.   Index numbers of farm prices of livestock included six items.[4]   This index used 1913 as a base and used quantities marketed in 1909 as weights.

These two indexes were combined in one index of farm prices by taking a simple arithmetic average of the two on the assumption that crops and livestock were of equal importance.[5]

G. F. Warren published index numbers of prices received by producers of farm products in the bulletin entitled, *Prices of Farm Products in the United States*.[6]   These index numbers consisted of price relatives for 31 farm products and a weighted average of the 31 relatives.   The base period for each month was the average for the same month during the period August 1909–July 1914.   The weights were based on sales as indicated by the Census of 1909.

Present workers in the field who have struggled with the question of weight base period will be interested in a quotation from page 46 of that bulletin: "To be exact, the weighting should change each year and each month, but the weighted average figure is little affected by

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[2] The revised indexes are the outgrowth of the work of the Bureau Committee on Index Numbers and a special subcommittee on the Prices Received and Prices Paid Indexes.   The members of the Committees, other than the authors, are: Glen Barton, Richard O. Been, Wylie D. Goodsell, Margaret Jarman Hagood, Roger F. Hale, George D. Harrell, Harold T. Lingard, T. Wilson Longmore, Howard L. Parsons, William H. Scofield, Robert C. Tetro, James Vermeer, and Paul E. Wallrabenstein.   Dr. Gertrude Weiss, of the Bureau of Human Nutrition and Home Economics, served as a member of the subcommittee in connection with the family living component of the Index.   This article is based largely upon the reports prepared by the Committees.   The work done by Arthur G. Peterson, formerly on the Bureau staff, also contributed greatly to the revision, and his earlier work was drawn upon freely.   This revision, in common with the earlier work on these indexes, has benefited from advice and consultation of Dr. O. C. Stine.

The computation of the indexes was under the direction of Roger F. Hale, A. R. Kendall, Frederic A. Coffe, and Joseph M. Sales for the Parity Index, and George D. Harrell for the Prices Received Index.   The extensive computations required were made by the clerical staff of the Division of Agricultural Price Statistics, assisted by a special clerical detail recruited throughout the Bureau.

[3] Corn, wheat, oats, barley, rye, buckwheat, potatoes, hay, cotton, and flax.   UNITED STATES BUREAU OF AGRICULTURAL ECONOMICS.   METHOD OF OBTAINING INDEX NUMBER OF PRICES.   U. S. Bur. Crop Est. Monthly Crop Rept.   August 1918.   p. 96.

[4] Hogs, beef cattle, veal calves, sheep, lambs, and chickens.

[5] This discussion is based on a paper by CLAYTON, C. F.   INDEX NUMBERS OF THE PRICES OF FARM PRODUCTS.   Jour. Farm Econ. 8:347–355.   1926.

[6] WARREN, G. F.   PRICES OF FARM PRODUCTS IN THE UNITED STATES.   U. S. Dept. Agr., Dept. Bul. 999, 72 pp. 1921.

differences in the weights. In fact, the unweighted average is nearly always practically the same as the weighted."[7]

New index numbers of prices of farm products were published by the Bureau in 1924. This index included prices of 30 commodities. In addition, indexes were computed for each of six groups into which the 30 commodities were divided.[8]

This index used the period August 1909–July 1914 as a base period. The weights were quantities selected to represent average annual marketings for the period 1918–23. The index was of the fixed-weight aggregative type. At least one reason for the selection of the weight-base period was to permit comparisons with the Bureau of Labor Statistics Index of wholesale prices of agricultural products and of all commodities which, at that time, were weighted with 1919 quantities. This series of index numbers was developed by O. C. Stine and L. H. Bean.

The index numbers of prices received by farmers were revised in 1934. The principal changes were (1) the use of improved price series for dairy products and tobacco, (2) the addition of prices of 20 products including a group of truck crops, and (3) a shift in weights from the marketings during the 1918–23 period to those of the 1924–29 period. Truck crops were introduced into the index in 1924 at the level of all groups for the period 1924–29.[9] Even in this revision there was no major grouping of subgroups into all crop and all livestock and products groups. This revision of the index was developed by Arthur G. Peterson. A further revision of the Index of Prices Received by Farmers was published in the January 1944 issue of *Agricultural Prices*. This revision was prepared by Arthur G. Peterson, with the collaboration of Roger F. Hale. Both of these revisions were made under the supervision of O. C. Stine.

The more significant changes in data and items included in the 1944 revision of the index are as follows:

(1) The price series for wholesale milk was revised.

(2) The weighting of State prices of meat animals in computing the national average, by months, was changed from the January 1 number on farms to volume of shipments and local slaughter.

(3) Soybeans and turkeys were added to the index.

(4) Some of the series for fruits and truck crops were reconstructed and peaches, strawberries, and grapes, were added.

(5) The tobacco price series was reconstructed.

(6) The quantity weights were shifted to marketings during the 5-year period 1935–39.

Several significant changes were made in the regrouping of commodities in this revision. Index numbers for 12 subgroups were set up and the subgroups were combined into major groups of all crops and livestock and products. Prices for 48 commodities were included.[10]

Prices Paid by Farmers

The Bureau of Agricultural Economics in 1928 first published an Index of Prices Paid by Farmers. It was the work of C. M. Purves, under the supervision of Dr. Stine. The foreword to the publication of that index reads as follows: [11]

"The depression in the agricultural industry during the past few years has caused an increasing number of inquiries to be made regarding the purchasing power of farm products. To meet these inquiries the Bureau of Agricultural Economics has been showing the relationship of the prices received by farmers for agricultural products to the prices of wholesale nonagricultural commodities. This method of measuring the

[7] Compare with BLACK, JOHN D., and MUDGETT, BRUCE D. RESEARCH IN AGRICULTURAL INDEX NUMBERS. Social Science Research Counc., Scope and Method Series, Bul. 10:35–39. 1938.

[8] Grains, fruits and vegetables, cotton and cottonseed, meat animals, dairy and poultry products, and unclassified. UNITED STATES BUREAU OF AGRICULTURAL ECONOMICS. NEW INDEX NUMBERS OF FARM PRICES. U. S. Bur. Agr. Econ. Crops and Markets, August 1924, p. 285.

[9] A more complete discussion of this revision of the index can be found in the following publication: INDEX NUMBERS OF PRICES RECEIVED BY FARMERS FOR FARM PRODUCTS, 1910–1935, issued by the Bureau of Agricultural Economics. Issued in 1934; reissued in 1935. [Processed.]

[10] A full description of this revised index is given in the following publication: INDEX NUMBERS OF PRICES RECEIVED BY FARMERS, 1910–48, issued by the BUREAU OF AGRICULTURAL ECONOMICS. 37 pp., illus. Washington, D. C. 1949. [Processed.]

[11] UNITED STATES BUREAU OF AGRICULTURAL ECONOMICS, DIVISION OF STATISTICAL AND HISTORICAL RESEARCH. INDEX NUMBERS OF PRICES FARMERS PAY FOR COMMODITIES PURCHASED. 24 pp. Washington, D. C. 1928. [Processed.]

value of farm products has not been entirely satisfactory because farmers do not buy at whole-sale, nor are index numbers of nonagricultural wholesale prices weighted according to the amount of farmers' purchases."

The foreword explained that this index number of prices paid by farmers had been constructed to meet the need of a better measure of price changes in commodities bought by farmers for use in the family living and for production. The weights used for the index number had been determined largely from data collected by the Department of Agriculture and from Census reports. The prices paid by farmers had been collected by Crop Estimates. It stated that C. F. Sarle and members of the Divisions of Farm Management and Costs, and Farm Population and Rural Life had contributed toward the development of this index number of prices paid by farmers.

The several subgroups of this index were combined into major groups representing prices paid for family living goods and prices paid for production goods. The weights were based mainly on the available data for the period 1920–25. It should be understood that the weight data for this initial index were less complete than those used in the Prices Received Index. The aggregative method was used in the construction of the subgroup indexes but the relatives for the subgroups were combined, using the percentage contribution of each group to an over-all budget as weights.

Legal Recognition of Index

With the passage of the Agricultural Adjustment Act of 1933, the Index of Prices Paid by Farmers became more than merely an interesting "statistic." In that act it was declared to be the policy of the Congress to establish prices to farmers at a level which would give agricultural commodities the same purchasing power as they had in the base period. With some exceptions the period August 1909–July 1914 was designated as the base period. The device used to measure the purchasing power of agricultural commodities was the Index of Prices Paid by Farmers. Thus the Parity Price formula was born.

This Index of Prices Paid was revised in 1933, at which time the budget weights used in combining the subgroups were shifted to averages for the period 1924–29. The report in which this revision was published [12] points out that considerable additional information regarding farmers' purchases had become available since the initial publication in 1928. These additional data were considered in preparing the revision. Changes in the revised index resulted from the addition of a few new commodities, revised weights in a few instances, and adding prices for some commodities extrapolated for years before 1927.

Interest and taxes were combined, in August 1935, with the Index of Prices Paid. This was done as the result of amendments to the Agricultural Adjustment Act of 1933 which specified that with respect to commodities on the prewar base period, the measure of purchasing power should also reflect current interest payments per acre on indebtedness secured by real estate and tax payments per acre on farm real estate.

The definition of parity prices in the Agricultural Adjustment Act of 1938 also specified that changes in freight rates should be reflected in the determination of parity prices for those commodities for which the base period was August 1909–July 1914. Changes in freight rates have not been explicitly included in the Parity Index, because, as the prices paid by farmers are retail prices, they already reflect changes in freight rates. Prices received by farmers, which are local market prices, also reflect the influence of changes in freight rates.

As a part of a study on income parity for agriculture a tentative revision of the Index of Prices Paid was undertaken in 1936. A preliminary report was published in May 1939,[13] but this revision was never officially adopted. Among the many changes were: About 20 items, including prices paid by farmers for feeder livestock, were added, the price data for about 70 items that had been added in the middle of the 1920's were extended back to 1910, and the total number of commodities

[12] UNITED STATES BUREAU OF AGRICULTURAL ECONOMICS, DIVISION OF STATISTICAL AND HISTORICAL RESEARCH. INDEX NUMBERS OF PRICES PAID BY FARMERS FOR COMMODITIES, 1910–1935. 28 pp. Washington, D. C. 1934. [Processed.]

[13] UNITED STATES BUREAU OF AGRICULTURAL ECONOMICS, AGRICULTURAL ADJUSTMENT ADMINISTRATION, and BUREAU OF HOME ECONOMICS. INCOME PARITY FOR AGRICULTURE. PART III, PRICES PAID BY FARMERS FOR COMMODITIES AND SERVICES. SEC. 5, INDEX NUMBERS OF PRICES PAID BY FARMERS FOR COMMODITIES, 1910–38. (PRELIMINARY.) 55 pp., illus. Washington, D. C. 1939. [Processed.]

in 1910 (exclusive of duplicates) was increased from 7 to 156. The weights for commodities used in living were shifted to 1935–36, on the basis of data from *Consumer Purchases Study* made by the Bureau of Human Nutrition and Home Economics.[14] Weights for the production items were left on the basis of the 1924–29 period.

In connection with a study of the parity formula by the Senate Committee on Agriculture and Forestry made in 1941, another tentative revision was prepared.[15] Weights for the production items were shifted to 1935–39 and other minor changes were made. This revision also was never adopted for official use.

In the developmental period of these indexes one of the problems of paramount importance was the choice of the point or level of reference, that is, the base period which is taken as 100 percent. Two other problems of continuing importance, particularly with respect to the Prices Paid Index, were (1) securing price quotations on an adequate number of commodities so that the index would be stable and representative, and (2) securing adequate information on quantities of commodities bought by farmers to serve as weights in constructing the index.

In the publication of the Index of Prices Received in 1924 it was pointed out that the 5-year base period was used instead of 1 year on the grounds that a 5-year average price of any one commodity was more nearly normal than the price for any single year. At that time the fact that the period ending July 1914 was relatively free from war influence gave it standing.

At the time the first published Index of Prices Paid was being developed, it was considered desirable that a period of fairly stable prices should be used as the base period, but prices had not been stable long enough in the postwar period to provide a satisfactory base. A paper by Frederick C. Mills, in which he developed an index of dispersion of wholesale prices 1891 to 1926 inclusive, indicated that the period of least dispersion was 1905–14.[16] The desire for a period of stable prices, plus the fact that there was then no postwar period of stability similar to the one of 1910–14, seems to have been a major factor in the decision to use 1910–14 as the base period for the new index. It would still have been possible to use a base period in the late 1920's, in subsequent revisions. This whole question was settled for the time, however, when the Agricultural Adjustment Act of 1933 definitely established the period 1910–14 as the base for the Parity Index.

Source of Price Data

The price data used in the construction of these two indexes are those collected by Agricultural Estimates of the Bureau of Agricultural Economics. The procedures used in preparing estimates of either prices received or prices paid are much the same as those used in preparing estimates of acreage or yield.

Prices paid by farmers are reported [17] on mail questionnaires filled out voluntarily by several thousand independent retail merchants. Prices paid for individual commodities are averaged for individual States and then weighted by latest available estimates of purchases of each commodity by farmers in each State, to obtain an average for the country as a whole.

The prices received by farmers relate to average prices which farmers receive for their products sold at local markets or at the point to which farmers deliver their products in their own conveyances or in local conveyances they hire for the purpose. These prices are gathered from various sources, but mostly from voluntary reporters. In general, price reporters may be classified in the following broad groups: (1) Country merchants, (2) dealers in farm produce at local shipping points, (3) operators of country mills and elevators, (4) managers of local creameries and milk-receiving stations, (5) managers of cooperative marketing organizations, (6) rural bankers, and (7) well-informed farmers. In 1949, the total number of price reporters was about 10,000.

[14] United States Bureau of Home Economics. consumer purchases study. farm series. 7 v. Washington, Govt. Print. Off. 1939–41.

[15] United States Bureau of Agricultural Economics. material bearing on parity prices. Presented at a hearing before a subcommittee of the Committee on Agriculture and Forestry, United States Senate, July 1941. v. p. Washington, D. C. [Processed.]

[16] Mills, Frederick C. post-war prices and pre-war trends. Amer. Statis. Assoc. Jour. 23:45–67. 1928.

[17] Quarterly since 1923 for most groups of items; annually before that date, and in recent years monthly for some items.

These prices have been collected principally by means of mail questionnaires. The reported prices are tabulated and averaged by crop-reporting districts. These district averages are weighted by district sales or production estimates, to obtain weighted State averages. The State averages are weighted by State marketing or production estimates to arrive at national averages.[18]

The January 1950 Revised Indexes

Turning now to a direct consideration of the new indexes, the changes made by the January 1950 revisions may be summarized as follows:

1. Both indexes are now on the same base period of January 1910–December 1914=100. Heretofore the Prices Paid Index has been on this base, but the Prices Received Index has been on a base of August 1909–July 1914=100. This change makes only a minute difference in the level of the index—about one-seventh of 1 percent, but it is in compliance [19] with the Agricultural Adjustment Act of 1938 as amended by the Agricultural Acts of 1948 and 1949, hereinafter referred to as the "Amended Act."

2. Both indexes are now constructed with weights representing the same period. From 1910 to 1935, both indexes use weights from the period 1924–29; from 1935 to the present, both use weights representing 1937–41. Before this revision was made the Parity Index was constructed with weights for 1924–29; the Prices Received Index with weights from 1935–39. The subject of weights is discussed later in more detail.

3. Both indexes are now computed in the same way, resulting in the equivalent of a weighted aggregative formula, with certain modifications (to be referred to later) resulting from problems of introducing new commodities and of reflecting changes in the weighting pattern.

4. A number of changes have been made in commodity coverage. In the case of the Prices Received Index, the changes in commodity cover-

age are relatively insignificant. In the case of the Parity Index, the representation for the first time extends to virtually all important types of farm expenditures. In particular, cost rates for electricity and telephones have been added as representative of services bought by farmers. This is consistent with the Amended Act which for the first time specifies "Services" among the items to be considered in computing parity prices.[20] Wages paid to hired labor are included in the revised index, as specified by the Amended Act. The changes in coverage are discussed below.

Expanded Commodity Coverage

In some respects the increased commodity coverage is the most significant change in the Index of Prices Paid by Farmers effected by the January 1950 revision.

Prices Paid by Farmers

Just before the latest revision the Index of Prices Paid by Farmers for commodities included price series for 175 commodities. The number had been practically unchanged for 15 years. In 1910 the representation included only 74 commodities but this had been expanded to 85 in 1914. It was recognized that this commodity representation was too small to provide accurate measures of the price changes since 1910–14 for many groups of commodities purchased by farmers, and did not insure a fully satisfactory measure of the general level of prices paid by farmers.

To strengthen the commodity coverage in the Prices Paid Index, the BAE, beginning in 1935, expanded the collection of price series of commodities purchased by farmers until at the end of 1949 prices were being obtained for nearly 500 commodities—almost 3 times the number of commodities actually included in the old index. In addition, the price data for earlier periods, particularly 1910–14, was expanded by means of a historical survey of prices paid by farmers in 19 States conducted by the BAE in 1936, and by compilations of prices from mail-order catalogues and other sources. Consequently, at the time of the current revision of the Prices Paid Index, a considerable

[18] A more complete discussion of the prices-received and prices-paid data appears in U. S. D. A. Miscellaneous Publication 703, THE AGRICULTURAL ESTIMATING AND REPORTING SERVICES OF THE UNITED STATES DEPARTMENT OF AGRICULTURE. December 1949. Chapter 15.

[19] See Agricultural Adjustment Act of 1938 as amended by the Agricultural Acts of 1948 and 1949: Title III, Subtitle A, Section 301 (a) (1) (B); (7 U. S. C. 2 Sup. Sec. 1301, et seq. Pub. Laws 28, 272, 439, 81st Cong.).

[20] Agricultural Adjustment Act of 1938 as amended by the Agricultural Acts of 1948 and 1949: Title III, Subtitle A, Section 301 (a) (1) (C). See footnote 19.

TABLE 1.—*Preliminary calculations of food and clothing indexes at several levels of commodity representation*

	Number of items	(June 1939=100) 1942	1948
Food [1]			
All items	60	133. 9	228. 3
Items with 0.5+percent expenditure weight	44	133. 7	228. 4
Items with 1.0+percent expenditure weight	23	136. 5	240. 6
Items with 2.0+percent expenditure weight	10	136. 5	232. 5
Old index	22	137	242
Clothing [2]			
All items	75	129. 3	257. 1
Items with 0.5+percent expenditure weight	36	139. 9	256. 8
Items with 1.0+percent expenditure weight	22	139. 7	264. 2
Items with 2.0+percent expenditure weight	9	138. 1	248. 9
Old index	17	141	248

[1] Not including tobacco and cigarettes. Published index also includes rice and margarine, although preliminary indications did not reveal that these items met the 0.5 percent requirement.

[2] Recheck revealed that 6 additional items met the 0.5 percent requirement. These were included in the official index, bringing the total to 42.

body of new price data for the last 10 to 15 years was available, as well as improved and expanded price series for earlier periods.

In the determination of what commodities and how many were to be represented in the Index of Prices Paid by Farmers, the goal was to include enough commodities to provide dependable measures of the price movement for all commodities and for major commodity groups, without overburdening the collection process and the mechanics of computing the index each month. The availbility of the greatly increased number of price series required the adoption of some criteria for determining which and how many commodities should be included to meet these objectives.

The expansion of available price data was greatest in the fields of food and clothing. Price series available for use in the food index totaled 60 compared with 22 in the index before the revision, and 75 price series for use in the clothing index compared with the 17 items in the earlier index. Beginning with the assumption that using all available price data would yield the most accurate measure of the level of prices paid by farmers—a reasonable assumption unless there is bias in the selection of items to be priced—food and clothing trial indexes were computed with the following representation of commodities.

(1) All items for which price data were available.
(2) All items priced which accounted for at least 0.5 percent of the average expenditure for the appropriate group in 1937–41 (the weight base period adopted for the revised index subsequent to March 1935).

(3) All items priced which accounted for at least 1.0 percent of the group expenditure in 1937–41.
(4) All items priced which accounted for at least 2.0 percent of the group expenditure in 1937–41.

The trial indexes for food and clothing at the several levels of commodity representation for 1942 and 1948, with June 1939=100, are shown in table 1. These periods were selected to indicate the price changes that occurred from just before the war to the year just before the establishment of general price controls, and to the year in which the postwar inflation was at a peak.

These tests indicated that exclusion of items which did not directly account for at least 0.5 percent of the expenditure for that group of commodities did not affect appreciably the level of the group index. The use of higher cut-off points yielded substantial changes in the levels of the group indexes. Therefore the tentative criterion was adopted that those commodities which accounted for 0.5 percent or more of the group expenditure were to be represented in the group index. However, items which were close to the cut-off point were reviewed by appropriate specialists for evaluation from the standpoint of whether their increasing or diminishing importance warranted their inclusion or exclusion in the index. (On this basis, women's rayon hose have been excluded although accounting for 0.5 percent of the clothing expenditure in 1937–41, whereas margarine has been included although representing 0.4 percent of food expenditures.)

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TABLE 2.—*Index of prices paid by farmers: Number of commodities in old and new index for selected years, by commodity subgroups* [1]

Commodity group	1910		1914		1927		1935		1949	
	Old index	New index	Old index	New index	Old index	New index	Old index	New index	Old index	New index
Family living:										
Food	7	22	9	22	22	22	22	48	22	48
Clothing	8	14	13	14	16	14	17	42	17	42
Household operations	4	6	4	6	11	6	11	12	11	12
Household furnishings	10	22	10	22	21	22	21	38	21	38
Building material, house	7	7	7	7	15	15	15	23	14	23
Autos and auto supplies [2]					1	4	1	14	1	14
Total	36	71	43	71	86	83	87	177	86	177
Production:										
Feed	5	9	5	9	12	10	12	22	12	22
Livestock	0	3	0	3	0	3	0	6	0	6
Motor supplies						4		12		12
Motor vehicles [3]	0		0		3	3	3	14	3	14
Farm machinery	12	28	12	28	20	28	22	31	27	31
Farm supplies	13	14	13	14	16	14	16	20	14	20
Fertilizer	1	4	1	4	10	6	9	8	7	8
Building and fencing material	7	7	7	7	20	20	20	24	19	24
Seed	0	6	4	6	7	10	7	21	7	21
Total	38	71	42	71	88	98	89	158	89	158
All commodities	74	142	85	142	174	181	176	335	175	335

[1] The numbers in the table include certain duplications. For example, several lumber items in the "building material, house" group in the family living component of the index are included also under "building and fencing materials" in the production component. Titles of commodity subgroups as listed follow the designations in the new index and differ slightly in some cases from previous designations.

[2] In old index the item "autos" was counted as one commodity, although it was an average of prices for several makes of cars. In new index, each make is counted as a separate commodity.

[3] Automobiles, trucks, and tractors. Composite prices for each were used in old index and in new, before 1935. In 1935 and after, the different items for which prices are collected are counted individually.

As a result of the application of these criteria in determining commodity representation in the Index of Prices Paid by Farmers, the revised index now includes 335 commodities as compared with 175 commodities in the old index. In table 2 the number of commodities included are compared for the old and new indexes for selected years from 1910 to 1949. Moreover, the representation in the earliest year has been approximately doubled. It is also of interest that 26 of the 175 items included in the old index no longer qualified for inclusion after 1935, according to the criteria adopted for commodity representation. Among these were salt, vinegar, muslin, and walking plows.

In tables 3 and 4 are shown the complete listing of the commodities in the new Parity Index, their contribution to the commodity part of the index as of September 1949, and corresponding information for the old index as of the same date. Alto-gether these commodities contributed 82.8 percent to the total "aggregate" for the Parity Index as of that date.

Although the 1950 revision includes, in some measure at least, all the major fields of farm-family expenditures, not all fields are adequately covered. Thus, Services have been added to the fields covered by this revision by the inclusion of telephone rates, electric rates, and newspaper-subscription rates. But because of the lack of data the field of cost of medical services is not represented. Some developmental work has been done as to techniques, but it has not yet been practicable to undertake the collection of such data. Likewise the field of commodity coverage needs to be rounded out in certain places, notably with respect to containers used in marketing farm produce. This important group of cost items is currently represented by the single item of "bushel

TABLE 3.—*Commodities used for family living and their relative importance within the family living group, Sept. 15, 1949*

Group and commodity	Relative importance Old index	Relative importance New index [1]	Group and commodity	Relative importance Old index	Relative importance New index [1]
	Pct.	*Pct.*		*Pct.*	*Pct.*
Commodities used in living	100.00	100.00	Commodities used in living—Continued		
Food and tobacco	*33.70*	*39.18*	Food and tobacco—Continued		
Sugar	3.98	1.63	Vinegar	0.23	------
Syrup, table	------	.90	Cigarettes	------	.72
Candy, hard	------	.26	Tobacco, smoking	------	1.03
Bread, white	1.17	2.47	Clothing	*33.22*	*23.62*
Flour	7.24	3.81	Men's clothing:		
Baking powder	------	.51	Overalls	3.02	.97
Corn meal	.55	.83	Shirts, cotton, work	2.61	.66
Oats, rolled	.40	.41	Undershirts or shorts	.77	.35
Crackers, soda	------	.45	Union suits, heavy, cotton	1.06	.50
Macaroni	------	.19	Gloves, canvas	.77	.22
Corn flakes	------	.27	Socks, cotton	.70	.14
Wheat flakes	------	.16	Trousers, cotton	------	.25
Rice	.39	.38	Shirts, broadcloth	------	.36
Steak, round	6.24	2.96	Jackets, wool	------	1.09
Hamburger	------	.90	Suits, wool	6.37	.11
Bacon, sliced	.93	.68	Trousers, wool	2.20	1.36
Ham, whole	------	.57	Overcoats	------	.32
Pork chops	------	.62	Hats, felt	1.65	.48
Pork sausage	------	.36	Jackets, leather	------	.76
Salt pork	------	.37	Shoes, work	4.31	.36
Bologna	------	1.09	Boots, rubber, knee-length	.55	.49
Salmon, canned	------	1.81	Shoes, dress	------	.78
Pork loin	2.86	------	Overshoes	------	.14
Butter	2.10	1.61	Boys' clothing:		
Cheese, American	.55	.94	Overalls	------	.30
Milk, evaporated	------	.35	Suits, wool	------	.92
Milk, fluid	------	.57	Sweaters, wool	------	.23
Eggs	------	.27	Shoes	------	.56
Potatoes	------	1.22	Women's clothing:		
Beans, dry	------	.60	Dresses, house, percale	3.16	.63
Cabbage	------	.37	Dresses, street, cotton	------	.99
Lettuce	------	.46	Nightgowns, cotton	------	1.50
Tomatoes, fresh	------	.32	Hose, cotton	------	.12
Corn, canned	------	.60	Coats, lightweight	------	.63
Peas, canned	------	.27	Coats, fur trim	------	.33
Apples	1.47	1.51	Coats, no fur	------	1.13
Bananas	.83	.75	Sweaters, wool	------	.40
Lemons	.31	.23	Hats, felt	------	.57
Oranges	.45	.88	Dresses, rayon	------	.14
Grapefruit	------	.35	Step-ins or panties	.43	.28
Raisins	.19	------	Slips, rayon	------	.11
Lard	.48	.81	Hose, nylon	------	.37
Shortening, vegetable	------	.19	Hose, rayon	.74	------
Salad dressing	------	.34	Hats, straw	------	.20
Peanut butter	------	.29	Shoes	3.58	1.69
Margarine	------	.13	Girls' clothing:		
Coffee	2.18	2.40	Dresses, wash	------	1.23
Tea	.70	.34	Coats, heavy	------	.51
Salt	.31	------	Shoes	------	.53
Soda	.14	------			

[1] January 1950 revisions.

Group and commodity	Old index (Pct.)	New index [1] (Pct.)
Commodities used in living—Continued		
Clothing—Continued		
Yard goods:		
Percale	0.60	0.61
Gingham		.30
Muslin	.70	------
Household operations	9.11	10.23
Coal, soft, prepared sizes	2.81	1.13
Coal, soft, run of mine		1.00
Coal, hard	.76	.72
Kerosene	.95	.97
Gasoline		.18
Wood	.97	.41
Electricity		1.32
Telephone		.57
Newspapers		.98
Starch, laundry	.07	.16
Soap, laundry	.40	1.80
Soap, toilet	.33	.99
Brooms	.23	------
Autos and auto supplies		13.59
Auto supplies: [2]		
Gasoline	1.69	.99
Oil	.40	1.06
Tires, 6.00 x 16	.50	1.48
Tubes, 6.00 x 16		1.42
Batteries, storage		.71
Spark plugs		.77
Chains, tire		1.00
Autos	7.27	------
Ford, de luxe		4.68
Ford, custom de luxe		.55
Chevrolet, special		.62
Chevrolet, de luxe		.11
Plymouth, de luxe		.12
Plymouth, special de luxe		.01
Buick, special		.07
Household furnishings	6.31	8.73
Bedroom suites		.40
Beds, metal	.24	.09
Bed springs	.28	.07
Living-room suites	.91	.20
Chairs, occasional		.10
Dining-room suites		.63
Tables, dining-room	.45	------
Chairs, dining-room, oak	.35	------
Dressers	.38	------
Lamps, floor		.17
Radios, battery-operated		.20
Radios, electric		.37
Cabinets, kitchen	.24	.39
Refrigerators, electric		.19
Stoves, coal or wood	1.14	.14

Group and commodity	Old index (Pct.)	New index [1] (Pct.)
Commodities used in living—Continued		
Household furnishings—Continued		
Stoves, gas		0.80
Stoves, electric		.73
Stoves, kerosene		.29
Washing machines, electric	0.09	.16
Washing machines, gasoline	.28	.18
Wash boilers, copper bottom	.07	.30
Irons, electric		.18
Vacuum cleaners		.11
Brooms		.05
Plates, dinner	.09	.10
Glasses, water		.30
Fruit jars	.04	.10
Sewing machines, electric		.03
Sewing machines, foot-operated	.16	.08
Rugs, Axminster	.41	.40
Felt-base rugs	.13	.31
Mattresses, inner-spring		.45
Mattresses, all-felted	.36	.13
Sheets	.23	.20
Blankets, wool		.14
Blankets, cotton	.16	.10
Comforters	.16	.10
Bath towels		.11
Toweling, bleached	.14	.28
Muslin		.09
Curtains		.06
Building materials, house	10.39	4.65
Framing, 2 x 4 x 16	1.13	.66
Rough boards	.69	.31
Dressed boards		.12
Ship-lap	.87	.35
Drop-siding		.19
Bevel-siding	1.53	.13
Shingles, wood	1.32	.33
Flooring, yellow pine	.78	.25
Flooring, fir		.23
Doors	.42	.09
Windows	.65	.24
Nails	.14	.09
Screen wire, galvanized	.16	.04
Roofing, galvanized steel		.10
Roofing, composition		.18
Gypsum boards		.02
Shingles, asphalt		.05
Insulating boards		.07
Gypsum laths	.33	------
Cement, Portland	.21	.18
Concrete blocks		.64
Brick, common	.76	.09
Paint, house	1.40	.24
Linseed oil		.05

[1] January 1950 revision.
[2] Auto supplies were a part of Household Supplies or Household Operations in the old index.

TABLE 4.—*Commodities used for production and their relative importance within the production group, Sept. 15, 1949*

Group and commodity	Relative importance Old index	Relative importance New index [1]
	Pct.	*Pct.*
Commodities used in production	100.00	100.00
Feed	21.13	25.78
Hay, alfalfa	3.18	1.36
Hay, other	------	1.16
Corn	3.65	1.97
Oats	.61	.99
Barley	------	.28
Wheat	------	.40
Cottonseed meal	2.59	1.90
Soybean meal	------	.61
Linseed meal	.65	------
Meat scrap	.61	.33
Tankage	------	.33
Bran	2.45	1.06
Middlings	2.55	1.04
Mill run	------	.23
Corn meal	1.92	.35
Corn gluten	.77	.15
Hominy feed	------	.51
Scratch grain	------	1.29
Laying mash	------	4.35
Starter mash	------	2.12
Mixed dairy, under 29 percent protein	1.90	3.56
Mixed dairy, 29 percent protein and over	------	1.21
Stock salt	.25	.58
Livestock	------	16.35
Feeders and stockers:		
Cattle and calves	------	11.44
Lambs	------	1.85
Hogs	------	.19
Dairy cattle	------	.65
Baby chicks	------	1.91
Turkey poults	------	.31
Motor vehicles	15.04	13.02
Automobiles	10.19	------
Ford, 8-cylinder, 2-door sedan:		
De luxe	------	.53
De luxe, custom	------	.55
Chevrolet, 2-door sedan:		
Special	------	.65
Deluxe	------	.68
Plymouth, 2-door sedan:		
De luxe	------	.35
Special de luxe	------	.38
Buick, special, 4-door sedan	------	.48
Trucks	4.85	------
Ford, 1½-ton capacity	------	1.08
Chevrolet, 1½-ton capacity	------	1.23
International pick-up	------	.35
Tractors	3.56	------
Wheel, under 20 belt horsepower	------	1.44
Wheel, 20–29 belt horsepower	------	3.60
Wheel, 30 and more belt horsepower	------	.95
Crawler	------	.75

Group and commodity	Relative importance Old index	Relative importance New index [1]
Commodities used in production—Con.	*Pct.*	*Pct.*
Equipment and supplies [2]	14.79	------
Motor supplies	------	9.58
Gasoline	3.38	------
Autos and trucks	------	4.27
Tractors	------	1.53
Kerosene	.51	.18
Distillate	------	1.03
Motor oil	1.14	.94
Grease	------	.07
Auto tires	1.11	.59
Inner tubes	------	.11
Truck tires	------	.50
Tire chains	------	.07
Storage batteries	------	.18
Spark plugs	------	.11
Farm supplies	------	7.31
Axes	------	.16
Hammers	------	.07
Pitchforks, 3-tine	.43	.16
Pitchforks, 4-tine	------	.07
Hoes	.32	.11
Scythes	------	.04
Hand sprayers	------	.09
Iron pipe	.69	------
Milk cans	.81	.22
Milk pails	.13	.13
Brooders, coal-burning	------	.04
Brooders, oil-burning	------	.07
Brooders, electric	------	.04
Rope, manila	1.52	.40
Binder twine	2.31	1.15
Baskets, veneer, bushel	.60	2.40
Horse collars, leather	1.48	.49
Lead arsenate	.36	.75
Paris green	------	.04
Calcium arsenate	------	.24
Electricity	------	.64
Farm machinery	12.68	10.32
Plows, 1-horse walking	.15	------
Plows, 2-horse walking	.18	------
Plows, tractor, 1-bottom	------	.14
Plows, tractor, 2-bottom	.42	.85
Plows, tractor, 3-bottom	------	.18
Disk harrows, single	------	.16
Disk harrows, tandem	.54	.30
Spiketooth harrows, section	.27	.11
Harrows, springtooth, 2 sections	.15	------
Cultivators, 1-horse, walking	.06	------
Cultivators, 1-row, riding	.51	------
Cultivators, 2-row, tractor	.39	.76
Manure spreaders	.91	.44
Planters, corn, 2-row	.39	·23
Planters, corn and cotton, 1-row	.15	------
Grain drills, 12-tube	.72	.41

[1] January 1950 revision.
[2] Includes both Motor Supplies and Farm Supplies in the old index, but is divided into these 2 groups in the new index.

Group and commodity	Relative importance		Group and commodity	Relative importance	
	Old index	New index [1]		Old index	New index [1]
Commodities used in production—Con.			**Commodities used in production—Con.**		
Farm machinery—Continued	*Pct.*	*Pct.*	Building and fencing materials—Con.	*Pct.*	*Pct.*
Grain drills, 20-tube		0.53	Nails	0.29	0.13
Mowers, 5-foot	0.79	.34	Paint, house	1.84	.75
Mowers, tractor		.30	Linseed oil		.10
Hay rakes, sulky dump	.18		Cement, Portland	.51	.28
Hay rakes, side-delivery	.21	.21	Brick, common	.51	.15
Hay loaders	.24	.16	Roofing, composition	.11	.15
Combines, 12-foot cut		.44	Roofing, galvanized	.29	.41
Combines, 5–6-foot cut	3.06	1.18	Asphalt shingles		.05
Corn binders	.39	.16	Barbed wire, 2-point	.61	.34
Corn picker-huskers		.53	Barbed wire, 4-point		.31
Ensilage cutters	.21	.14	Poultry netting	1.19	.21
Grain binders		.41	Posts, wood	.51	.18
Potato diggers	.09		Posts, steel	.69	.13
Grain threshers		.28	Farm gates	.51	.21
Hammer mills	.21	.23	Woven wire		.52
Cream separators, 500-pound capacity	.79	.21	Windmills	.14	.05
Cream separators, 750-pound capacity		.18	Iron pipe, galvanized		.23
Milker outfits		.39	Lift pumps	.47	
Farm trucks	.24	.11	Seed	5.90	4.74
Farm wagons	.61	.16	Cottonseed	.88	
Wagon boxes	.24		Potatoes	.38	.67
Spray outfits		.41	Soybeans		.42
Gas engines	.58	.23	Cowpeas		.11
Electric motors		.14	Hybrid corn		.39
Fertilizer	5.59	5.94	Open-pollinated corn		.25
Mixed fertilizer:			Oats		.50
2–12–6	3.29	1.40	Barley		.19
3–12–6		.82	Wheat		.42
4–12–4	.61	1.17	Rye		.17
Nitrate of soda	.47	.94	Alfalfa, common	} 1.48 {	.34
Ammonium sulphate	.14	.27	Alfalfa, improved variety		.11
Superphosphate	.87	.65	Clover, red	1.35	.36
Muriate of potash	.05	.17	Clover, sweet	.46	.14
Agricultural limestone	.16	.52	Clover, alsike		.11
Building and fencing materials	21.31	6.96	Lespedeza, Korean		.08
Framing lumber	2.82	.75	Timothy	.80	.22
Rough boards	1.44	.64	Kentucky bluegrass	.55	.06
Dressed boards		.28	Common ryegrass		.03
Ship-lap, common pine	.90	.36	Sudan grass		.08
Drop-siding	2.13	.34	Austrian winter peas		.03
Shingles, wood	6.03	.31	Vetch, hairy		.06
Windows, barn	.32	.08			

[1] January 1950 revision.

baskets," whereas a recent check showed several hundred types were in use, of which at least 30 were widely used.

Prices Received by Farmers

Similar criteria for commodity representation were applied to the items to be included in the Index of Prices Received by Farmers. To be included in the index, it was required that a farm product accounted for at least 0.5 percent of the cash receipts from its farm-product group, in 1937–41. As this index had been extensively revised in 1943 with weights to reflect average cash receipts in 1935–39, only a few changes were necessary. In the January 1950, revision, grain sorghums were added to the index of feed grains and hay and, because of diminishing importance and difficulty in maintaining adequate price series, farm-churned butter was dropped from the index

of dairy-product prices received by farmers. Thus the total index now includes 48 commodities—the same as before the latest revision.

As in the Index of Prices Received before the January 1950 revision, data for some commodities are not available all the way back to 1910. Thus strawberries were added to the index in January 1919, truck crops in January 1924, and soybeans, grain sorghums, and turkeys in January 1935.

Two changes were made in the price series used for individual commodities as more appropriate price series became available. Thus, United States average prices for rice were substituted for prices for Louisiana rice beginning January 1930. Prices received by farmers for baled hay were substituted for loose-hay prices in July 1949.

Imputation of Quantity Weights

Prices Paid by Farmers

In constructing group index numbers, the assignment of weights to individual commodities which are to be included in the index can be made on two bases: (1) the actual quantity of the specific commodity purchased by farmers in the weight base period or (2) through the process of imputation, the expansion of these weights to represent equivalent quantities of like or related items for which price series are not available, or are not to be included in the index.

The first method involves the major difficulty of selecting and pricing items so that the influence on the total index, of all groups, subgroups, and individual items, shall be proportional to their relative importance in the aggregate. The second, which involves imputation of weights for like items, assumes that prices for commodities not represented in the total index move in line with prices of similar items which are included in the index. There is some evidence that to assume similar price movements for like items—that the imputations if held within reasonable limits—yield a more accurate group index than the restriction of weighting to actual quantities purchased of the specific commodity.

It was noted previously that of 60 food items for which prices were available, 44 were selected by certain criteria for inclusion in the food index. The choice between the two methods of ascribing weights would appear to depend upon whether the subgroup indexes including only those 44 items agree more closely with the corresponding subgroup indexes including all available items (60) on the one hand, or with the food index including all available items on the other. If the former is the case, it appears likely that imputing weights for nonincluded items to the individual commodities will result in measuring more accurately the price changes of all foods than will imputing the weights for omitted commodities to the food groups as a whole; and vice versa.

Table 5 presents the trial indexes for 1948 (June 1939=100) by subgroups using (a) all available food price series and (b) only those items tentatively selected for use in the revised food price index. In both cases, the weights assigned to individual items were those relating to the commodity, with no imputation of any kind.

Column 6 presents the differences between the two sets of subgroup indexes, and column 7 shows the differences between the subgroup indexes based on items actually included in the revised index and the total index including all items for which prices were available. The subindexes based on items actually included differ less from the more complete subgroups than from the total index.

It appears, therefore, that the imputation for cereal and bakery products not in the index should be to cereal and bakery products which are in the index, rather than to the total food index; and the same seems true of sweets, meats, dairy products, etc.

By analogy it would appear desirable to apportion on a prorata basis the imputed weights among the several items in any subgroup; that is, among bread, corn meal, rice, flour, oatmeal, corn flakes, wheat flakes, macaroni, and soda crackers, the items in the cereal and bakery-products subgroup.

The procedure of imputing weights has been carried out to individual commodities so far as this has been practicable. In imputing the weight for commodities not included in the index, the quantity weight for the item represented in the index was expanded by the ratio of the expenditure for all items imputed to it (including the represented item) to the expenditure for the represented item alone.

Rather obviously, there are limits beyond which this system of imputation would be invalid. Thus, for some services, notably those connected with medical care and veterinary services, rates

TABLE 5.—*Prices paid by farmers, food: Importance of specific subgroups in farm-family food purchases, 1937–41, and indexes of price changes by subgroups and for all foods*

Commodity subgroup	Food expenditures [1]			Price indexes 1948 [1] (June 1939=100)			
	60 commodities [2]	44 commodities [3]	Relative coverage	60 commodities [2]	44 commodities [3]	Deviations [4] from	
						Subgroup	All subgroups
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Percent	*Percent*	*Percent*				
Cereals and bakery products	22.3	20.8	90	224.8	225.2	+0.4	−5.3
Meats	12.2	11.6	95	274.4	275.0	+.6	+44.6
Eggs	.8	.8	100	310.3	310.3	0	+79.9
Dairy products	8.6	8.6	100	259.0	259.0	0	+28.6
Fats and oils	5.6	5.2	93.	270.3	271.2	+.9	+40.8
Vegetables	8.0	7.1	89	191.2	188.6	−2.6	−41.8
Fruits	7.6	6.3	83	200.0	199.6	−.4	−30.9
Beverages	5.3	5.0	94	248.8	248.5	−.3	+18.1
Sweets	6.9	6.5	94	169.7	170.0	+.3	−60.4
All food [5]	77.3	71.9	93	229.3	230.5	.6	38.9

[1] Without imputations.
[2] All commodities for which acceptable current series are available.
[3] All items included in the revised food index except for rice in the cereal and bakery products group, and margarine in fats and oils.
[4] Average deviations, disregarding signs.
[5] Not including tobacco and cigarettes.

could not be imputed to individual items represented in the index. Consequently, weights for such services for which adequate price data are not available have been imputed to the living and production groups indexes as a whole.

Prices Received by Farmers

The weights for the Index of Prices Received by Farmers, which represent the average quantities of (and cash receipts from) farm products sold in 1924–29 and in 1937–41, were also developed to represent the imputed weights for items not included in the index. However, the farm-product groups were generally more homogenous than the commodity groups of prices paid by farmers, or, as in the case of truck crops and fruits, so diversified as to make it inadvisable to impute weights to individual commodities. Therefore, the imputation of weights in this index has been accomplished at the group level. Thus, the weights for truck crops not included in the index are distributed proportionately among the several truck crops represented. The weights for the all crops and all livestock and products groups represent the total cash receipts from these groups although some groups, as forest products, are not represented in the index.

Group Indexes

Prices Paid by Farmers

The expansion in commodity coverage in the Index of Prices Paid by Farmers provided the means for improving the groupings of commodities over those used heretofore. The major changes in the group indexes are as follows.

Living: (1) The revised *Food index* includes two tobacco products as well as 46 food items, (2) automobile supplies were removed from *Household Operating Expenses* and included with automobiles to form a new group *Autos and Auto Supplies* (since March 1924) and (3) *Household Operations* (since March 1935) also includes rates for electricity used in the farm home, and cost rates for telephones and rural newspapers.

Production: (1) A new group *Livestock Purchased* was included to reflect the large expenditures by farmers for livestock for production pur-

poses, (2) rates for electricity for farm production were included in *Equipment and Supplies* (since March 1935), (3) motor-vehicle supplies were removed from *Equipment and Supplies* and combined with automotive parts to form a new group of *Motor Supplies* (since March 1924) and (4) autos, motortrucks, and tractors were combined in one index, Motor Vehicles, rather than in two indexes, Autos and Trucks, and Tractors.

The current groups are indicated in table 7 (p. 51) in connection with the discussion of group weights.

It appears that the larger number of commodities now included in the index may permit the computation of subgroup indexes wherever the commodity coverage and price data are adequate for that purpose. But this matter is subject to further study.

Prices Received by Farmers

The latest revisions in this index were of minor importance. The commodity groupings have not been changed from those of the previous index.

Weights and Weight-Base Periods

In the literature of index numbers it is generally agreed that price relatives should be "weighted" by "values," since the importance of a price change in a given context is usually at least roughly proportional to the value of the commodity the price change of which is measured by the relative. Similarly, in the aggregative type of index, prices (not price-relatives) are weighted by quantities, for the same reason. Under certain well-known conditions, not always realized in practice, the weighted average of relatives is identical to an aggregative index; but under other conditions this is not true.

Writers are less unanimous in their views as to the best period from which to select the weights for a comparison between certain given years. Some writers favor "base-year" weights; others have suggested "given-year" weights; others recommend a combination (for example, Fisher's "Ideal Formula"). For the present purpose it is futile to wrestle with the choice between such views, for although price data are available more or less currently, weight data are available only at various or irregular intervals, depending upon the commodity. This problem is more crucial with respect to quantities of commodities *purchased* by farmers than with respect to quantities of farm products *sold* by them, but even in the latter case, revisions of data would provide a constant problem. It is accordingly out of the question currently to use a formula such as Fisher's Ideal or Paasche's. The limitations of available data—theoretical perfection aside—impose the use of some type of historical weights, and at least in the case of commodities bought by farmers they require that weights be constant over some more-or-less extensive period, simply because new data are not available except at considerable intervals.

On the other hand, it is common knowledge that production and consumption habits change over time with respect to commodities included in the Prices Received and the Prices Paid Index; yet on the whole such changes come rather gradually except for current fluctuations arising from changes in supply, buying power, etc. Thus, neither production nor consumption patterns of the period following World War II are identical to those of the period preceding World War I which is now used as the base period for both indexes. Nor are they equivalent to those of the 1935–39 period, from which weights for the Prices Received Index prior to the January 1950 revision were derived. The same is true of the 1924–28 period from which the old Prices Paid Index weights have been derived. But, if 1910–14, 1924–28, or 1935–39 weights are not applicable to the situation following World War II, then conversely, and by the force of the same logic, current weights are just as improper for 1935–39, 1924–28, or 1910–14. As the period covered by the index lengthens, the incongruity of using a single set of weights over the whole period increases. Thus over a sufficiently long period, commodities once important in the index (and presumably in the economy) become superseded, and may disappear altogether; so securing quotations on them becomes difficult, meaningless, and eventually impossible.

This suggests that commodity lists and weights should be reexamined at moderately short intervals, so that both may be applicable, so far as possible, to the period under review. Moreover, it seems clear, in the nature of the case, that comparisons between two time periods separated by a short interval will be more accurate than those separated by a long interval.

It is intuitively and logically clear that the

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most accurate price comparisons are those for which the same commodities are represented in the index over the period involved; and by the same token, are those for which the quantities used as weights reasonably well represent the quantities actually produced, traded, or consumed, as the case may be.[21] One way of resolving the dilemma lies in constructing indexes over a series of intervals, during each of which an applicable set of weights would be used which are reasonably representative of the period. The indexes for the several periods would then be linked together. Thus if a decade were the period selected, the index for 1930–40 would be constructed with commodities, prices, and weights pertaining to that period. For the 1940–50 decade, a new index—using commodities, prices, and weights appropriate to that period—would be used.

Actually, a decade in some cases may prove too long or too short a period, and the decennial years may not be the optimum times for making the link. Thus if a crisis of war, depression, boom, or drought, occurs at the decennium, that year might well be avoided and the linkage made in a year less affected by critical circumstances. But generally, as a matter of future policy, it was the recommendation of the Committee that a review and possible revision not less frequent than every 10 years would constitute a practicable plan.

An alternative method would consist in reconstructing the index over the whole period to 1910, using current weights and inserting commodities from time to time, linking them to their predecessor commodities in such a way as to preserve the base-year aggregates unchanged. This method is open to the objection that modern weights are not applicable to the early years of the index, and to use them distorts the true facts.

In the case of the current revision, application of the adopted principle led to the following solution: Weights for the period 1924–29 were utilized for the Parity Index through March 1935, and weights from the 1937–41 period from March 1935 to the present, the indexes being linked at March 1935. For the period before 1935, weights from the period 1924–29 were retained because the available data were mostly pertinent to that period. The 1924–29 period was also a fairly stable period in the 1920's. For the period since

1935—the area in which modernization is particularly cogent—the choice of 1937–41 was made. The subcommittee that studied this problem made its recommendation of this choice.[22]

"The subcommittee recommends the adoption of the period 1937–41 as the most suitable weight base period presently available for both the Index of Prices Received and the Index of Prices Paid, Interest, and Taxes. This recommendation is made for the following reasons:

"1. It is the most recent period available which was not unduly affected by the war and its aftermath of price inflation and shortages of many goods. As such, it is likely to be more representative of the pattern of farmers' sales and purchases over the next few years than any other period preceding the war.

"2. It is a long enough period (5 years) to iron out sharp variations in intercommodity relationships which might be significant in a shorter period. The period 1937–41 was a fairly stable one with respect to the over-all level of agricultural production. Pricewise, the period covers a short price cycle. Both prices received and prices paid were at their high points for the late thirties in 1937. They declined during 1938 and 1939, reflecting a drop in business activity and the first impact of the opening of hostilities in Europe. They rose as economic activity expanded during 1940 and 1941 and in the latter year averaged close to the 1937 level. Hence the period is almost equally divided between declining and advancing price movements.

"3. It is also the most recent period for which comprehensive data are available as to the expenditure pattern for farm family living. Studies of these expenditures are available for the period 1935–36 and 1941. They provide a point of departure for determining weights for the family living items. The two periods covered are indicative of the range in farm family living expenditures that probably occurred during the 1937–41 period. On the production side, considerable data are available from the Censuses of Agriculture, the Censuses of Manufacturers and other sources.

"While the period 1937–41 appears to be the most suitable weight base period currently avail-

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[21] See RESEARCH IN AGRICULTURAL INDEX NUMBERS. op cit.

[22] Report from Subcommittee on Prices Received and Paid, to the Chairman of the Bureau Committee on Index Numbers, April 26, 1949. (Unpublished.)

able for these indexes, several shortcomings should be noted:

"1. This period is nearly a decade in the past. Since then, advancing technology and higher real incomes have altered appreciably the pattern of living and production on farms.

"2. Special circumstances affect some of the years. The 1936 drought had an effect on prices, incomes and expenditures in succeeding years, particularly 1937. The national defense effort was a significant influence on the economy in later years of this period.

"Other periods were considered but did not appear to be so suitable as the 1937–41 period.

"1. Periods prior to the mid-thirties were ruled out primarily because of the vast changes in the patterns of living and production which have since occurred. It would be extremely unrealistic to price that consumption pattern currently. The rapid mechanization of farm production and the growth of rural electrification are two cases in point. In addition, the early thirties were largely depression years.

"2. The 1935–39 period had previously been recommended by the Central Statistical Board as a standard base period for government index numbers although the Board recognized that consideration should eventually be given to shifting this base period forward in time. This period is not considered suitable for agricultural index numbers because of the effect of the droughts in 1934 and 1936.

"3. The year 1941 was also considered as a base period. In many respects the situation in that year better represents the near future than any other prewar period. Industrial production in 1941 averaged 60 percent above 1935–39. Currently, it is about 85 percent above prewar. Unemployment totaled about 5½ million compared with more than 8 million in 1937–41 and about 3½ currently. The share of the national economy devoted to the national defense in 1941 was about 13 percent, compared with about 1 percent in 1937–41. Currently, defense activity accounts for about 12 percent of the total.

"The major drawback to the use of 1941 as a base is the insecure base involved in the use of a single year and that one in which defense activity was an especially important element. Normal inter-commodity relationships may be disturbed by unusual factors. When a number of years are included, the effect of these unusual circumstances is tempered. In addition, the 1941 data on family expenditures, while extremely valuable for weighting purposes, are particularly subject to errors of sampling and reporting since the sample of farm families surveyed was small. It is desirable to make use of the 1935–36 data to supplement those for 1941.

"4. The war and postwar periods, at least until 1949, have been ruled out as suitable base periods. Until recently, they have been periods of price inflation characterized by scarcities of many commodities. They are hardly representative of what may lie ahead unless another war becomes imminent. *However, it is strongly recommended that investigations be planned now to secure data which can be used as a basis for weights for the index of prices paid for a suitable post-war period.* The 1937–41 period is almost a decade behind. It is essential that the weight base period does not lag too far behind the current calculation of the index.

"5. While the current proposal for computing the income support standard and related prices is based partly on the average Parity Index in the preceding 10 years, it is not considered that this would require a moving weight-base period. Nor are the data available to compute such weights."

After the two weight periods were chosen, the remaining problem related to the selection of the link point, that is, the point at which to link the indexes. The year 1935 was selected. To have chosen a point exactly half-way between the two weight periods would have placed the link point in 1933 or 1934, but both of these were years in which many disturbing phases of the depression were still present. To have made the change before the beginning of the depression would have brought use of 1937–41 weights virtually into the 1924–29 period. To have placed the link period any later would have carried the use of 1924–29 weights virtually into the new weight period. None of these choices seems free of objection, but as 1935 was considered freer of objection than any other period, it was decided to make the linkage at the first month in 1935 for which substantially complete data were available. This meant January 1935 for the Prices Received Index, and March 1935 for the Prices Paid Index; for the quarterly reports from independent stores relate to March, June, September, and December, whereas the index is calculated from a much

TABLE 6.—*Group weights for index of prices received by farmers* [1]

Commodity group	1924–29 weights			1937–41 weights		
	Average cash receipts	Percent weights		Average cash receipts	Percent weights	
		Of groups	Of total		Of groups	Of total
Crops:	*1,000 dollars*	*Percent*	*Percent*	*1,000 dollars*	*Percent*	*Percent*
Food grains	885, 705	18. 6	8. 9	562, 580	16. 7	7. 1
Feed grains and hay	742, 830	15. 6	7. 5	499, 135	14. 9	6. 4
Cotton	1, 370, 442	28. 9	13. 9	662, 074	19. 7	8. 4
Tobacco	255, 171	5. 4	2. 6	289, 962	8. 6	3. 7
Oil-bearing crops	233, 619	4. 9	2. 3	236, 829	7. 1	3. 0
Fruit	595, 722	12. 5	6. 0	489, 968	14. 6	6. 2
Truck crops	345, 674	7. 3	3. 5	395, 158	11. 8	5. 0
Other vegetable	322, 188	6. 8	3. 3	222, 974	6. 6	2. 8
Total in Index	4, 751, 351	100. 0	----------	3, 358, 680	100. 0	----------
Other crops	441, 352	----------	----------	379, 655	----------	----------
Total crops	5, 192, 703	----------	48. 0	3, 738, 335	----------	42. 6
Livestock and products:						
Meat animals	2, 801, 103	50. 2	26. 1	2, 491, 310	49. 9	28. 6
Dairy products	1, 627, 643	29. 1	15. 1	1, 534, 336	30. 7	17. 6
Poultry and eggs	1, 060, 590	19. 0	9. 9	869, 600	17. 4	10. 0
Wool	96, 556	1. 7	. 9	101, 866	2. 0	1. 2
Total in index	5, 585, 892	100. 0	----------	4, 997, 112	100. 0	----------
Other livestock and products	39, 791	----------	----------	47, 325	----------	----------
Total livestock and products	5, 625, 683	----------	52. 0	5, 044, 437	----------	57. 4
All farm products	10, 818, 386	----------	100. 0	8, 782, 772	----------	100. 0

[1] Weights used for obtaining aggregates for individual commodities during Jan. 1910–Jan. 1935 are average quantities sold by farmers for 6-year period, 1924–29. For January 1935 to date, weights are 5-year averages of sales by farmers during 1937–41. For livestock and livestock products, calendar-year sales were used in computing the averages; for crops, the corresponding crop-year sales were used.

For combining the various subgroup indexes into an all-crop, an all-livestock and livestock products, and an all-commodity index, weights are percentages based on average cash receipts received by farmers for the two periods 1924–29 and 1937–41.

smaller sample of price quotations in the intervening months.

The development of adequate weights by which to combine the prices of the various commodities into group indexes, and the group indexes into indexes of prices paid for commodities used for Living, for Production, and for Living and Production, requires estimates of (1) average quantities of commodities bought by farmers during the periods chosen for weights and (2) average total expenditures, with appropriate break-down by groups. For the Prices Received Index the same problem exists, except that quantities *sold* by farmers are required.

In the case of the Prices Received Index the solution is readily at hand, for the Department, over a long period of years, has collected and published reasonably adequate information concerning the production and sale of principal agricultural commodities. It has been necessary merely to compile the information from the records. The weights used for combining prices of commodities into the group indexes were the average quantities sold in the respective weight periods: 1924–29 for January 1910–January 1935; and 1937–41 for January 1935 forward.

Similarly, to combine the commodity group indexes (for example, food grains, feed grains, and hay, and cotton) into the All Crop Index, the average cash receipts from the sale of commodities in each subgroup were computed and expressed as a percentage of the average cash receipts from sale of all crops. Thus, during 1924–29, the cash receipts from sales of food grains averaged 18.6 percent of the cash receipts from sales of all crops, so that 18.6 percent is the weight given to the food-grain index, in combining it with the other crop-price indexes to get an All Crop Price Index. In

the same way, indexes of prices of meat animals, dairy products, and so forth, were computed, and then combined into an index of prices of livestock and livestock products. Finally, the index of all crops and the index of prices of all livestock and livestock products were combined into an index representing prices of all farm products, by giving the crop-price index a weight of 48.0 percent and the livestock and products index a weight of 52.0 percent. These are the proportions of cash receipts from sales of all farm products in the 1924–29 period represented by crops and by livestock and products respectively. In the period 1937–41 the weights were somewhat different, but the method of computation is similar. Table 6 gives the average cash receipts by groups for both periods, together with the percentage weights.

In the case of the Index of Prices Paid, not only is the problem more complex and difficult, but also the nature of the basic data is considerably less satisfactory, both in quantity and in quality. In the first place, information is available only at infrequent intervals concerning the expenditures of farm families for various types and groups of commodities and the quantities of the various commodities which they buy.

Moreover as the sources of information are diverse, questions of comparability of the different sources arise from time to time.

In table 7 are the estimated total annual average expenditures per farm for the periods 1924–29 and 1937–41, as used in the January 1950 revision of the Parity Index, together with a classification according to the expenditure groups represented in the Index. Table 8 gives the break-down of the Living, Production, and Living and Production components, separately.

The basic data concerning purchases and expenditure patterns, as used in the previous index, have been continued for the period prior to March 1935; that is, the same general set of weights, based upon the period 1924–29, was used as heretofore. Certain minor adjustments have been made, primarily to use revised information for the earlier period and to realign a few commodities according to the new grouping. Thus, in the Living component, gasoline, motor oil, and automobile tires have been taken out of the Household Operation group where they were carried in the old index, and placed in the Autos and Auto Supplies group. Also, in the Production

TABLE 7.—*Percentage weights for revised parity index*

Commodity group	1924–29 [1]		1937–41	
	Average expenditure per farm	Percent	Average expenditure per farm	Percent
	Dollars		*Dollars*	
Living	608	41.2	742	44.0
Food (including tobacco [2])	218	14.8	282	16.7
Clothing	185	12.5	144	8.6
Autos and auto supplies	67	4.5	117	6.9
Household operations	57	3.9	99	5.9
Household furnishings	36	2.4	68	4.0
Building materials, house	45	3.1	32	1.9
Production	536	36.4	694	41.2
Feed	148	10.1	171	10.2
Livestock	65	4.4	89	5.3
Motor supplies	58	3.9	88	5.2
Motor vehicles	58	3.9	88	5.2
Farm machinery	50	3.4	76	4.5
Building and fencing materials	55	3.7	45	2.7
Fertilizer and lime	39	2.7	52	3.1
Equipment and supplies	48	3.3	56	3.3
Seeds	15	1.0	29	1.7
Total commodities	1,144	77.6	1,436	85.2
Taxes	84	5.7	65	3.8
Interest	96	6.5	50	3.0
Commodities, interest, and taxes	1,324	89.8	1,551	92.0
Cash wage rates	150	10.2	135	8.0
Commodities, interest, taxes, and cash wage rates	1,474	100.0	1,686	100.0

[1] Same as weights in the current index except for revisions in expenditure estimates for 1924–29, the inclusion of livestock and wage rates for hired labor, and a few shifts in commodity grouping.
[2] Tobacco included only since March 1935.

group these same items have been taken out of the Equipment and Supplies group and placed in the Motor Vehicle Operation and Supplies group. Muslin, carried under Clothing in the old index, and brooms, carried under Household Operation, were both shifted to Household Furnishings. (Both items were dropped from the index in 1935 because of their decreasing importance.)

Basically, however, for the period 1910–March 1935, the quantity and value of purchase data used as weights are the same as were used in the old index.

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For the period since 1935, estimates of average purchases during the period 1937–41 have been used as weights. In the production component of the index, the estimates of total expenditures for production purposes and for each of the nine subgroups are based upon the Bureau's estimates of farm expenditures. These estimates are prepared on an annual basis; they reflect all available sources of information bearing upon the subject. Extensive use had been made of data from the Census of Manufactures, the Census of Agriculture, from Trade Associations, from special surveys, and from other miscellaneous sources.

The Bureau's estimates of farm expenditures are broken down into many subgroups each of which is estimated separately, depending upon the type of source information available. These have been combined so as to reflect the expenditures in each of the nine subgroups of commodities represented in the Production component of the Index.

No similar series of annual estimates are available from which to determine weights for the Family Living segment of the index, since March 1935. In this case the weights have been derived from two basic reports: (1) "Consumer Expenditures in the U. S.,"[23] based upon a study made in 1935–36 under the auspices of the National Resources Committee and conducted by the Bureau of Human Nutrition and Home Economics of the Department of Agriculture and the Bureau of Labor Statistics of the Department of Labor, as a Work Projects Administration project and (2) "Rural Family Spending and Saving in Wartime",[24] based upon a survey in 1941 and early 1942 by the Bureau of Human Nutrition and Home Economics and the Bureau of Labor Statistics.

In the 1935–36 study, enumerators collected data in 51 cities, 140 villages, and 66 farm counties. The data utilized in the Prices Paid Index were based upon the data from the 66 farm counties. The 1941 survey included records from 45 counties

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[23] United States National Resources Committee. FAMILY EXPENDITURES IN THE UNITED STATES. STATISTICAL TABLES AND APPENDIXES. 209 pp., illus. Washington, Government Printing Office, 1941.

[24] United States Bureau of Human Nutrition and Home Economics. RURAL FAMILY SPENDING AND SAVING IN WARTIME. United States Department of Agriculture. Miscellaneous Publication 520, 163 pp. 1943.

TABLE 8.—*Weights used for combining commodity-group indexes into Index of Prices paid by Farmers for Commodities for Living, for Production, and for Living and Production, 1924–29 and 1937–41*

Commodity groups	1924–29	1937–41
	Percent	*Percent*
Living	100. 0	100. 0
Food	35. 9	38. 0
Clothing	30. 4	19. 4
Household operations	9. 4	13. 3
Household furnishings	5. 9	9. 2
Building materials	7. 4	4. 3
Autos and auto supplies	11. 0	15. 8
Production	100. 0	100. 0
Feed	27. 6	24. 6
Livestock	12. 1	12. 8
Motor supplies	10. 8	12. 7
Motor vehicles	10. 8	12. 7
Farm machinery	9. 3	10. 9
Building or fencing materials	10. 3	6. 5
Fertilizer	7. 3	7. 5
Farm supplies	9. 0	8. 1
Seed	2. 8	4. 2
Living and production	100. 0	100. 0
Living	56. 5	51. 7
Production	43. 5	48. 3

as well as 62 cities. The rural counties were "selected by stratified sampling to give representation to all regions and to every economic group in the rural population."

Data concerning farm expenditures for living purposes in these two surveys were used in preparing the estimates adopted as weights for the 1937–41 period. More particularly, expenditures for the following items were derived by combining the results of the two surveys: (1) Food and Tobacco, (2) Clothing, (3) Household Operations, (4) Household Furnishings, and (5) Autos and Auto Supplies. Expenditures for a sixth group, Building Materials for House, were estimated from the Bureau of Agricultural Economics farm-expenditure data for all building materials. These six groups combined accounted for $734 out of the total of $742 per farm family for living purposes, indicated by these studies.

It has been assumed that these groups represent reasonably well the other expenditures for commodities and services; accordingly the $734 was inflated to the total of $742 and the several sub-

groups were similarly inflated. The break-down by subgroups (table 7) provides the percentage weights for combining the group indexes in the Living, Production, and Living and Production Indexes. Estimated expenditures for Interest, Taxes, and Wages to Hired Labor, are based upon official estimates of the Bureau of Agricultural Economics.

In general, the quantity weights for individual commodities were derived from the survey data on expenditures, by dividing expenditures for a particular commodity (including imputations for similar items for which no price data were available) by the average price in the weight period. Some adjustments were made where it was necessary to balance out expenditures for the several subgroups; and when survey data concerning certain commodities were lacking, other supplemental information was drawn upon.

Formula and Methods of Computation

In virtually any computation of index numbers the question arises as to whether the aggregative or average of relatives formula should be used. Both types have the sanction of authority. The aggregative has somewhat wider and better known usage. The average of relatives derives from the concept that the purpose of an index number is to measure the average price change of a certain phenomenon over a given period; that the price change for a particular commodity is indicated by the corresponding price relative; and that, in consequence, an *average* of relatives gives a measure of *average* change. Fortunately, as is well known, an average of relatives, weighted by base-year values, is identical to a weighted aggregative index using base-year quantities, in which case the claims to excellence of each of the formulae combine their force. Moreover, the upward Type bias of the arithmetical mean of relatives frequently tends to offset somewhat the downward Weight bias of base-year weights. Even so, this formula meets precisely neither the Factor nor Time Reversal Tests and is therefore theoretically open to some objection. It is to be noted that the identity of the aggregative and average of relatives exists only when *base year values* are used as *weights for the relatives*, and *base year quantities* as *weights* in the *aggregative*.

However, as already observed, the use of a formula, such as Fisher's Ideal

$$\left(\frac{\sum p_1 q_0}{\sum p_0 q_0} \cdot \frac{\sum p_1 q_1}{\sum p_0 q_1} \right)^{\frac{1}{2}}$$

which meets both the Factor and Time Reversal Tests, is impracticable because data on quantities of goods purchased, for use as weights, are available only at considerable intervals, and never on a "given-year basis" in time to use for any current calculations. As a practical compromise then, the weighted aggregative index was adopted.

This decision as to formula and the decision to use 1924–29 weights prior to 1935, and 1937–41 weights subsequent thereto mean that for a particular subgroup of commodities, say food, the aggregates for each year, quarter, or month, (depending upon the reporting period) are compiled by multiplying the current prices by the appropriate quantities, and summing. Thus, from 1910 to March 1935 the aggregates are $\Sigma p_i q_{24-29}$, where i represents the date (year and/or month) to which the index applies, "24–29" indicates average estimated quantities over the period 1924–29, and the summation is understood to relate to the prices and quantities in the index. From March 1935 and thereafter the aggregates are $\Sigma p_i q_{37-41}$.

Conceptually, the index for any particular group, say food, for any year from 1910 to March 1935, expressed relative to 1910–14=100, is accordingly,

$$\frac{\sum p_i q_{24-29}}{1/5 \sum_{j=1910}^{1914} \sum p_j q_{24-29}}$$

where the summation extends over the items in the particular group, and i (or j) designates the date to which a price relates.

After March 1935, the index for food, expressed relative to 1910–14=100, that is, linked to the 1910–March 1935 segment of the index, is

$$\frac{\sum p_{M35} q_{24-29}}{1/5 \sum_{j=1910}^{1914} \sum p_j q_{24-29}} \cdot \frac{\sum p_i q_{37-41}}{\sum p_{M35} q_{37-41}}$$

where p_{M35} refers to prices as of March 1935. Thus, the indexes after March 1935, with weights on a 1937–41 basis, are linked to the index before that date, maintaining 1910–14=100 as the basic reference point, or base.

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In a comparable way, the total index is considered as analogous; except that the summation extends over all items instead of over the particular group only, as in the case of the group index.

As a matter of computation, certain simplifications and shortcuts are utilized. As a device to keep the computations on the simplest basis, the combination of the subgroups (prior to 1935) that is, food, clothing, etc. into the Living goods index, and the combination of feed, machinery, etc. into the Production goods index; the combination of these two separately into an index of Living and Production goods combined; and finally the combination of Living and Production with Interest, Taxes, and Wage Rates are accomplished by expressing the subgroups on a 1924–29=100 basis, weighting them by the percentage which the expenditures for the particular subgroup bears to the next level combination of which it is a part, and converting both the commodity group indexes and the combinations back to 1910–14=100 by means of conversion factors. After March 1935, the combinations are made with 1937–41=100, using 1937–41 percentages as weights; and both the commodity group indexes and the combinations are linked to their counterparts by conversion factors.

These weights are given in tables 7 and 8.

In the same way, in computing the Prices Received Index, monthly aggregates for each commodity result from multiplying the price of each commodity by the average quantity sold during the weight period. Thus, from 1910 to January 1935, prices are multiplied by the average quantities marketed during 1924–29; from January 1935 to the present, prices are multiplied by average quantities marketed during 1937–41.

Before January 1935 the aggregates are summed for the various subgroups expressed with 1924–29=100, and weighted by the percentages representing the proportion of total cash receipts from the sale of the commodities in the particular group during the period 1924–29. The resulting index is converted to 1910–14=100, as are the group indexes. After January 1935, groups are combined on a 1937–41=100 basis, and are linked to the index on a 1910–14=100 basis at the January 1935 link point. The percentage weights used for combining the commodity group indexes into the All Crop, All Livestock, and All Farm Products indexes are shown in table 6.

The principal reason for using the percentage weights for combining groups is that it simplifies the problem of introducing new commodities as they become sufficiently important and as data become available, and of dropping commodities that are no longer important. More specifically, under this method it is necessary to adjust only the aggregates for the specific group involved, rather than the total aggregates. Experience with both methods of handling the problem over a considerable period led to this decision. It is necessary, however, in using percentage weights, that they be applied to the index series expressed relative to the same base period (that is, =100 percent) as that from which the percentage weights are derived. Otherwise, distortion results.

This may be seen as follows:

Let p_{ij} and q_{ij} be respectively the price and quantity for the ith commodity in the jth year, and $I_{kl,m}$ represent the index number for year l relative to year k, using quantities for year m as weights.

The Aggregative formula for $I_{kl,m}$ is

$$I_{kl,m} = \frac{\sum p_{il} q_{im}}{\sum p_{ik} q_{im}} \tag{1}$$

where the summation extends over all commodities in the index.

Moreover, as is well known, such an index computed on one base can be shifted to another base, thus:

$$I_{kl,m} = \frac{I_{ml,m}}{I_{mk,m}} = \frac{\sum p_{il} q_{im}}{\sum p_{im} q_{im}} \div \frac{\sum p_{ik} q_{im}}{\sum p_{im} q_{im}} = \frac{\sum p_{il} q_{im}}{\sum p_{ik} q_{im}} \tag{2}$$

Now suppose the $\sum pq$ for each year to be the sum of partial sums of pq for several commodity groups,

Let

$$\sum p_{il} q_{im} = \sum_a p_{il} q_{im} + \sum_b p_{il} q_{im} + \cdots \cdots \tag{3}$$

where the $a, b, \ldots$ indicate summation over the individual groups—say, food, clothing, etc.

Also let $W_a = \dfrac{\sum\limits_a p_{im} q_{im}}{\sum p_{im} q_{im}}$; $W_b = \dfrac{\sum\limits_b p_{im} q_{im}}{\sum p_{im} q_{im}}$, etc. $\tag{4}$

so that the W_i represent the proportion of total value in the weight year represented by a particular commodity group. Let this index be designated I'.

Then let

$$I'_{ml.m} = \frac{\sum\limits_a p_{il}q_{im}}{\sum\limits_a p_{im}q_{im}} \cdot W_a + \frac{\sum\limits_b p_{il}q_{im}}{\sum\limits_b p_{im}q_{im}} \cdot W_b + \ldots$$

$$= \frac{\sum\limits_a p_{il}q_{im}}{\sum\limits_a p_{im}q_{im}} \cdot \frac{\sum\limits_a p_{im}q_{im}}{\sum p_{im}q_{im}} + \frac{\sum\limits_b p_{il}q_{im}}{\sum\limits_b p_{im}q_{im}} \cdot \frac{\sum\limits_b p_{im}q_{im}}{\sum p_{im}q_{im}} + \ldots$$

$$= \frac{\sum\limits_a p_{il}q_{im} + \sum\limits_b p_{il}q_{im} + \ldots}{\sum p_{im}q_{im}} = \frac{\sum p_{il}q_{im}}{\sum p_{im}q_{im}} \qquad (5)$$

Similarly,

$$I'_{mk.m} = \frac{\sum\limits_a p_{ik}q_{im}}{\sum\limits_a p_{im}q_{im}} \cdot W_a + \frac{\sum\limits_b p_{ik}q_{im}}{\sum\limits_b p_{im}q_{im}} \cdot W_b + \ldots = \frac{\sum p_{ik}q_{im}}{\sum p_{im}q_{im}} \qquad (6)$$

And finally,

$$I'_{kl.m} = \frac{I'_{ml.m}}{I'_{mk.m}} = \frac{\sum p_{il}q_{im}}{\sum p_{im}q_{im}} \div \frac{\sum p_{ik}q_{im}}{\sum p_{im}q_{im}} = \frac{\sum p_{il}q_{im}}{\sum p_{ik}q_{im}} \qquad (7)$$

But this last expression is precisely the expression for $I_{kl.m}$ given by Equations (1) and (2). Hence $I'_{kl.m} = I_{kl.m}$.

On the other hand, let

$$I''_{kl.m} = \frac{\sum\limits_a p_{il}q_{im}}{\sum\limits_a p_{ik}q_{im}} W_a + \frac{\sum\limits_b p_{il}q_{im}}{\sum\limits_b p_{ik}q_{im}} W_b + \ldots$$

$$= \frac{\sum\limits_a p_{il}q_{im}}{\sum\limits_a p_{ik}q_{im}} \cdot \frac{\sum\limits_a p_{im}q_{im}}{\sum p_{im}q_{im}} + \frac{\sum\limits_b p_{il}q_{im}}{\sum\limits_b p_{ik}q_{im}} \cdot \frac{\sum\limits_b p_{im}q_{im}}{\sum p_{im}q_{im}} + \ldots \qquad (8)$$

$$\neq \frac{\sum p_{il}q_{im}}{\sum p_{ik}q_{im}} = I_{kl.m} \qquad (9)$$

unless $\sum\limits_v p_{ik}q_{im} = \sum\limits_v p_{im}q_{im}$

for all v, where v represents a particular commodity group.

It is perhaps worth remarking also, that the above argument is simplified to the extent that a single year is used as the base year, whereas the Bureau indexes use an average of several years for reasons already noted.

Adding and Dropping Commodities Represented in Indexes

Over the 40 years covered by the Prices Received and Prices Paid Indexes, many changes have occurred in the types of commodities commonly purchased by farmers; similar but less notable changes have occurred among those produced and sold. During this period, mechanization of farm production has developed rapidly. The use of electric power on farms is now widespread whereas it was practically unavailable to farm people in 1910. Modes of transportation have changed from the horse and buggy and farm wagon to the automobile and motortruck. In some areas of the West, even the airplane has entered the transportation picture.

These changes raise the problem of when new commodities should be introduced into the index and when outmoded commodities should be dropped. In the case of the Prices Paid Index, generally a new commodity should not be represented until it has become commonly purchased by farmers and its prices are fairly well stabilized in relation to other commodities. At the time new commodities first become available, they are usually still in the developmental stage and often are relatively high in price. As they move into mass production and consumption, their prices decline relative to other prices. Hence, if a commodity were introduced in the index at an early stage in development, a downward bias would be given to the index. In addition, it is essential that the introduction or dropping of a commodity should not result in a fictitious change in the level of the index.

The introduction of motor vehicles—automobiles, motortrucks and tractors—provides an illustration of the problems met when new commodity groups are introduced. The groups Autos and Auto Supplies in the Living component of the index, and Motor Vehicles and Motor Supplies in the Production component are represented in the index from 1924 on. They were not included before that date because (1) the first major expansion in the use of these commodities (particularly motortrucks and tractors) occurred in the decade 1920–30; (2) prices did not stabilize sufficiently in relation to other commodities for inclusion in the index before 1924 because of the rapid rise in prices during and following World

War I and the later sharp drop; and (3) in constructing the index for the period before 1935 on the 1924–29 weight-base period, the effect on the level of the index was minimized by introducing these groups at the beginning of 1924 when the indexes for all these groups were closer to the indexes for other groups than in any preceding year except during the period of rapid change prior to the 1920 peak. The handling of these items represents a change from the old index in which the automotive items were introduced over a period of years ranging from 1910 for gasoline, 1917 for autos, 1922 for tires, 1925 for tractors, and 1927 for trucks.

With respect to the inclusion of electricity rates, it was evident that a major expansion in farm electrification occurred after 1935, under the operations of the Rural Electrification Administration. Consequently, electricity rates have been represented in the index since 1935.

Three types of Service rates are represented in the new Parity Index. They cover bills for electricity, local telephone service, and newspaper subscriptions. All of these rates are included in the Living cost component of the index. In addition, rates paid for electricity that is bought for productive purposes is included in the Production component of the index. All three series were introduced into the index in 1935. Like the data on interest and taxes, they are all annual series.

Rates paid for electricity and telephone service are based on returns to special inquiries mailed to farmers during the period 1947–49. Consistent with the policy followed in pricing commodities, rates paid for electricity represent the average cost per kilowatt hour for the total quantity purchased. In the absence of official estimates for earlier years, these rates were extrapolated back to 1935 on the basis of a reasonably comparable series of average rates prepared by the Edison Electric Institute and published in their annual statistical bulletin.

To restrict the sampling variance due to inclusion of long-distance tolls, the series of rates for telephone service was confined to local rates, including tax. Monthly rates for local telephone service were extrapolated back to 1935, using data supplied by the Federal Communications Commission. Equivalent monthly rates were derived from source material of that Commission covering the number of telephones and local service revenue.

A series of average rates paid for local newspapers commonly purchased by farmers was compiled entirely from secondary data. Information from the directory of newspapers and periodicals, published by N. W. Ayers & Sons, provided the basic material. The series of average subscription rates used in the index is based on subscription rates for 39 daily papers in 19 States, from 1935 to 1946, and on 329 daily and 1,043 weekly papers representing all States from 1946 to the present.

Similar problems relating to adding and dropping were encountered for other commodities. To a large extent, the division of the index into two periods with two weight-base periods, 1924–29 and 1937–41, provided a means for adding new and dropping outmoded commodities. The criteria for commodity representation which reflected the relative importance of a commodity in its group expenditure resulted in adding to the index, for the period 1935 on, new commodities which had increased sufficiently in importance from 1924–29 to 1937–41 to qualify for inclusion; and in dropping commodities for which expenditures had declined sufficiently to rule out the commodity in the later period. Thus, prices of cotton stockings for women were included in the index for the earlier period; and prices of nylon stockings and their equivalent as indicated by changes in prices of silk and rayon hose were included in the later period. Walking plows were represented before 1935; one-bottom tractor plows since 1935.

The process of adding new commodities which are becoming important in the postwar years, as television, and of eliminating those connected with outmoded means of living and production would be facilitated by the collection of data on farmers' purchases. It is planned to collect these data for the postwar period in order to make it possible to shift to a .postwar weight-base period at an appropriate future time.

Compared with the Index of Prices Paid for commodities purchased by farmers, few changes have been required in the Index of Prices Received because of the development of new farm products.

Interest, Taxes, and Farm Wage Rates

The Amended Act specifies[20] that in addition to the prices for goods and services already described, consideration must be given in computing parity prices to "interest on farm indebtedness

TABLE 9.—*Index numbers of Prices Paid by Farmers for commodities, 1910–49: Comparison of the January 1950 revision with the old series*

Year	Living		Production		Living and production		Year	Living		Production		Living and production	
	January 1950 revision	Old series	January 1950 revision	Old series	January 1950 revision	Old series		January 1950 revision	Old series	January 1950 revision	Old series	January 1950 revision	Old series
1910	99	98	97	98	98	98	1930	144	150	135	139	140	145
1911	99	100	98	103	99	101	1931	124	128	113	122	119	125
1912	100	101	102	98	101	100	1932	106	108	99	107	102	108
1913	100	100	101	102	100	101	1933	108	108	99	106	104	107
1914	102	101	102	99	102	100	1934	122	122	114	121	118	122
1915	104	106	104	104	104	105	1935	124	124	122	124	123	124
1916	115	124	115	124	115	124	1936	124	123	122	123	123	123
1917	143	147	156	151	150	149	1937	128	128	132	133	130	130
1918	170	177	180	174	175	176	1938	122	122	122	123	122	122
1919	202	210	195	192	199	202	1939	120	120	121	120	121	120
1920	228	222	195	174	212	201	1940	121	121	123	122	122	121
1921	164	161	128	141	146	152	1941	130	131	130	129	130	130
1922	153	156	127	139	140	149	1942	149	154	148	147	149	151
1923	156	160	138	141	148	152	1943	166	170	164	160	165	166
1924	156	159	140	142	148	152	1944	175	178	173	170	174	175
1925	161	163	145	147	153	156	1945	182	185	176	171	180	179
1926	158	162	141	142	150	154	1946	202	210	191	188	197	201
1927	155	160	141	142	148	152	1947	237	255	224	229	231	244
1928	156	160	148	145	152	154	1948	251	271	250	250	250	262
1929	154	159	146	144	150	152	1949	243	262	238	243	241	254

secured by farm real estate," "taxes on farm real estate," and "wages paid hired farm labor."

The Bureau has for years had series measuring these three elements of farm expenditures, and to reflect them in the Parity Index, has treated these series very much as any other index components, weighting them together with the Index of Prices Paid for commodities bought for Living and Production, using the weights in table 7.

The series used to measure "interest on farm indebtedness secured by farm real estate," and "taxes on farm real estate" are those relating to such costs per acre of farm real estate. The series on interest payments per acre is based on interest charges due and payable during the calendar year. These charges do not reflect defaults in payments or payments made on charges due in previous years. The estimates of interest charges are developed annually from data on farm-mortgage loans and interest rates charged thereon which are obtained from the Bureau of the Census, special surveys, and lending agencies.

The tax series reflects all general and special ad valorem property taxes levied against farm real estate. Special assessments, presumably based upon benefits received and not on valuation, are excluded so far as possible. Taxes levied in a particular year are payable in the latter part of that year or during the early part of the following year. For purposes of determining parity prices, it is assumed that taxes levied in one year are payable in the next. The series is developed annually from data obtained from the Bureau of the Census and special surveys.

The wage rate series of the Bureau of Agricultural Economics is based on returns from quarterly mail surveys to farmers. Farmers are asked to report the average wage rates currently paid in their communities to hired farm workers. Before 1949, data concerning four types of wage rates (two on a daily and two on a monthly basis) were collected from all parts of the country. Beginning with January 1, 1949, wage rates for 9 different categories in all were collected, but for any particular geographic region only the categories most important in that region were covered.

The index of farm wage rates prior to 1949 is based on a monthly composite wage rate. This rate is computed by converting the two daily rates to monthly equivalent rates, and weighting the four rates by the estimated percentage of workers employed at each rate for each period when the wage rates are reported. The percentage of workers being hired at each rate is estimated from data

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TABLE 10.—*Index numbers of Prices Paid by Farmers, including interest, taxes, and wage rates, and the parity ratio: New formula compared with formula in use before Jan. 1, 1950, 1910–49*

Year	Parity index		Parity ratio		Year	Parity index		Parity ratio	
	New formula	Old formula	Using new formula	Using old formula		New formula	Old formula	Using new formula	Using old formula
1910	97	96	106	106	1930	151	159	83	81
1911	98	100	97	94	1931	130	140	67	64
1912	101	100	98	99	1932	112	124	58	55
1913	101	102	101	100	1933	109	119	64	61
1914	103	102	99	99	1934	120	128	75	70
1915	105	107	94	93	1935	124	128	88	85
1916	116	125	103	94	1936	124	127	92	90
1917	148	148	120	118	1937	131	132	93	92
1918	173	173	119	118	1938	124	126	78	77
1919	197	198	111	109	1939	123	123	77	77
1920	214	202	99	104	1940	124	124	81	81
1921	155	165	80	76	1941	132	131	93	95
1922	151	164	87	80	1942	152	149	104	107
1923	159	167	89	86	1943	170	160	113	121
1924	160	167	89	86	1944	182	168	108	118
1925	164	169	95	92	1945	189	171	109	121
1926	160	167	91	87	1946	207	191	113	124
1927	159	165	89	86	1947	240	230	115	121
1928	162	167	92	90	1948	259	248	110	116
1929	160	165	92	90	1949	250	242	100	104

TABLE 11.—*Index numbers of Prices Received by Farmers, 1910–49:*[1] *January 1950 revision compared with old series*

Year	Crops		Livestock and livestock products		All farm products		Year	Crops		Livestock and livestock products		All farm products	
	Revised series	Old series	Revised series	Old series	Revised series	Old series		Revised series	Old series	Revised series	Old series	Revised series	Old series
1910	105	103	102	102	103	102	1930	116	119	134	136	125	128
1911	101	100	88	90	95	94	1931	76	79	98	99	87	90
1912	100	100	98	99	99	99	1932	58	60	72	74	65	68
1913	98	98	105	106	102	102	1933	71	72	70	72	70	72
1914	96	94	107	108	102	101	1934	99	98	81	84	90	90
1915	96	94	102	104	99	99	1935	104	102	114	115	109	109
1916	120	118	117	118	119	118	1936	108	107	118	120	114	114
1917	191	187	165	165	178	175	1937	118	115	125	127	122	122
1918	219	215	194	194	206	204	1938	82	80	111	113	97	97
1919	230	226	206	207	218	215	1939	82	80	106	108	95	95
1920	236	232	190	192	212	211	1940	91	88	108	112	100	100
1921	121	121	127	130	124	124	1941	108	106	137	140	123	124
1922	137	138	126	127	131	132	1942	144	142	171	173	158	159
1923	156	154	128	132	142	143	1943	185	183	198	200	192	193
1924	159	156	128	131	143	143	1944	198	194	195	194	196	198
1925	164	163	149	150	156	156	1945	203	201	210	203	206	207
1926	139	140	151	152	146	146	1946	227	226	241	240	234	236
1927	135	135	146	148	141	142	1947	263	261	287	293	275	278
1928	142	144	155	158	149	151	1948	252	250	314	320	285	287
1929	135	135	159	161	148	149	1949	223	222	272	278	249	251

[1] Average per unit wartime-subsidy payments made on butterfat, milk, beef cattle, and lambs are included for period 1943–46 in both the revised and old series.

FARMERS' PRICES (Revised Indexes)
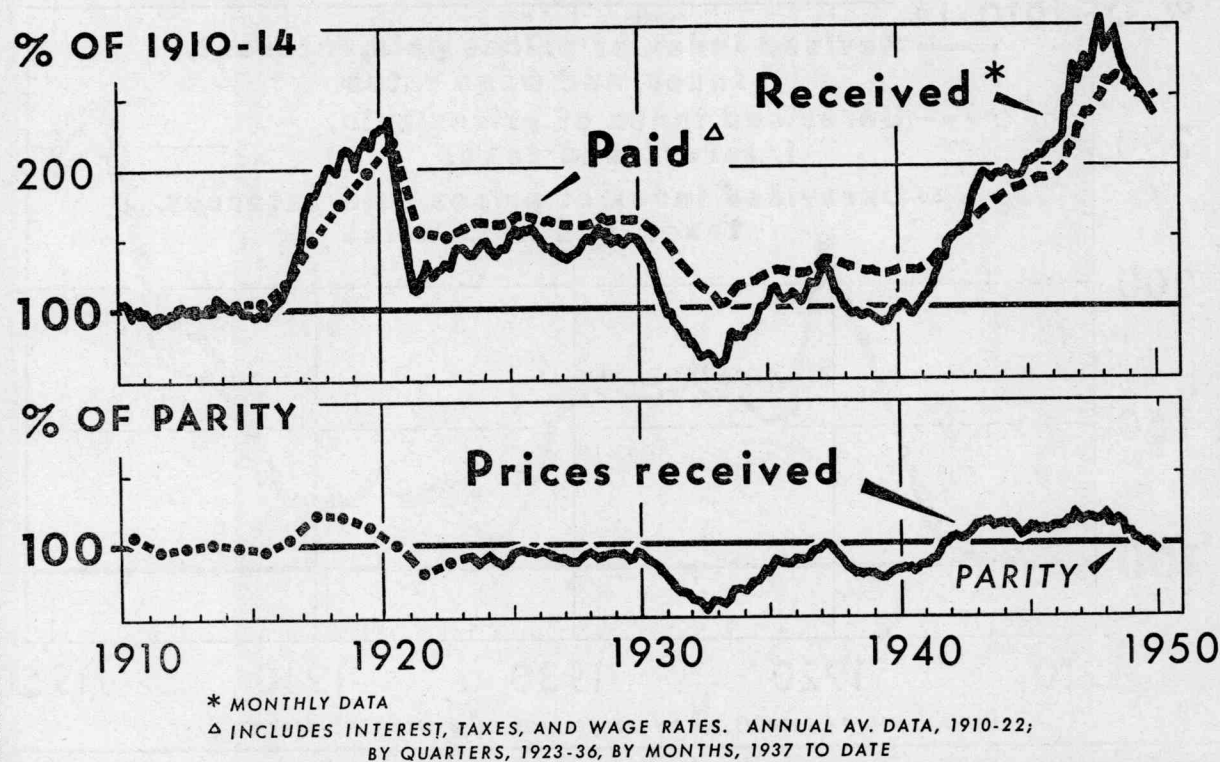
FIGURE 1.

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from interview surveys made in 1945, 1946, 1947, and 1948. The index for the new series of 9 types of wage rates, beginning in 1948, is based on an hourly composite rate. Each type of nonhourly wage rate is converted to an equivalent hourly rate, using estimated hours worked per unit of time. These hourly equivalents are weighted by the estimated percentage of workers employed at each rate for each quarter. The factors for conversion of rates to an hourly basis and the weights for combining the different hourly equivalent rates are derived from the above-mentioned interview survey data.

In linking the new series to the old in 1948, the annual average hourly composite derived from the new series for 1948 is equated to the annual aver-

age index for 1948, based on the monthly composite of the old series.

Seasonal adjustments for the series are based on a 4-quarter moving average, centered.

The complete Indexes of Prices Received and of Prices Paid by Farmers were published in Supplement No. 1 to the January 1950 issue of *Agricultural Prices*, and the Group Indexes in a Supplement to the February issue. It is not necessary to reproduce them here in their entirety. For convenience, however, table 9 gives the annual averages for the revised commodity components of the Parity Index, compared with the old series, and table 10 gives the New Parity Index compared with the old, together with comparisons of the Parity Ratios under the new formula and the
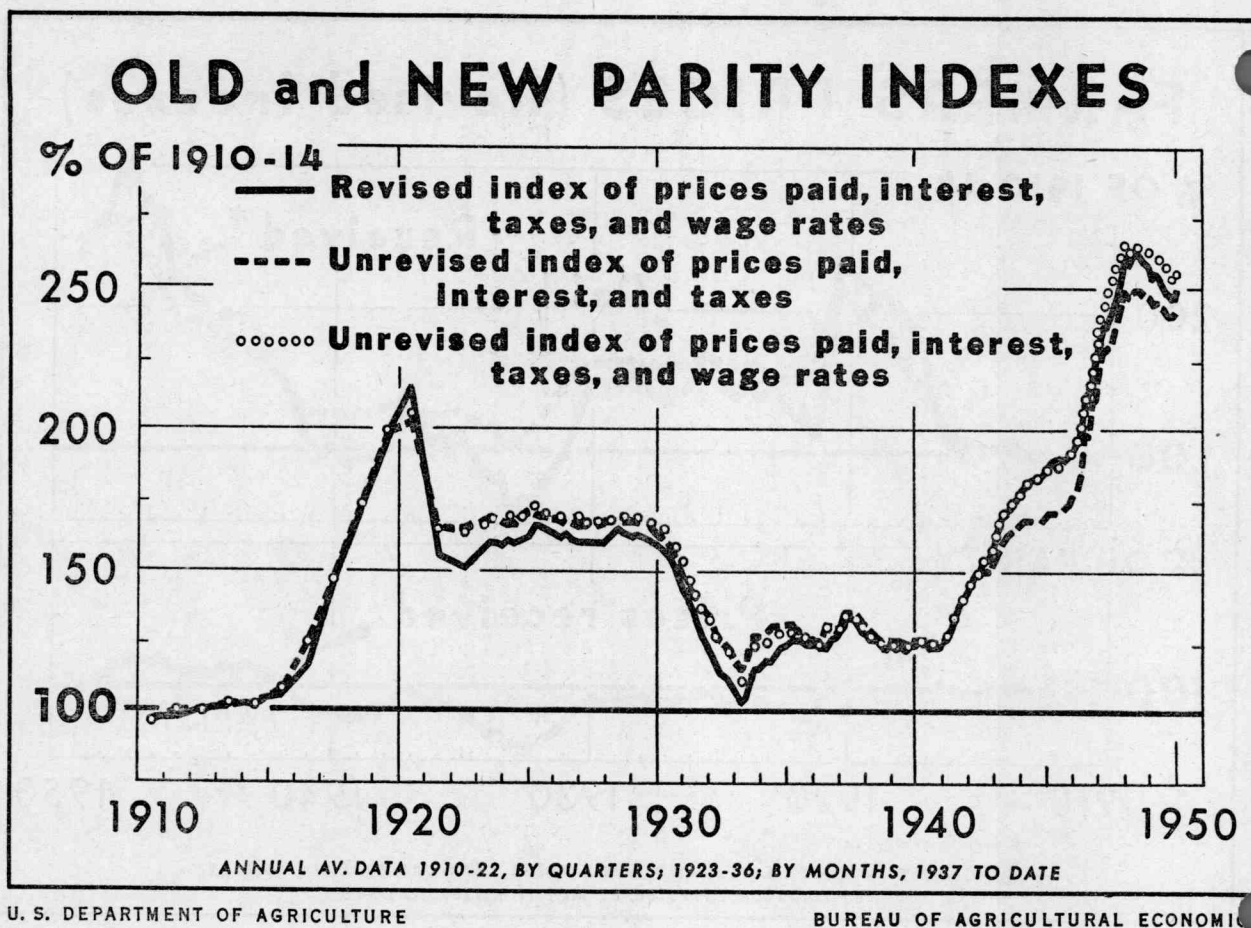
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OLD and NEW PARITY INDEXES

% OF 1910-14

— Revised index of prices paid, interest, taxes, and wage rates

---- Unrevised index of prices paid, Interest, and taxes

ooooo Unrevised index of prices paid, interest, taxes, and wage rates

ANNUAL AV. DATA 1910-22, BY QUARTERS; 1923-36; BY MONTHS, 1937 TO DATE

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FIGURE 2.

old. The New Formula, as used here, means the January revision of the Parity Index; that is, the Index of Prices Paid by Farmers, including Interest, Taxes, and Wage Rates paid to hired labor. The Old Formula refers to the index of Prices Paid by Farmers, including Interest and Taxes (but *not* including Wage Rates) and uses the old Index of Prices Paid as computed under the formula in effect before January 1, 1950. In computing the Parity Ratio under the New Formula the January 1950 revision of the Index of Prices Received by Farmers was used, and in computing the Parity Ratio under the Old Formula, the unrevised Index of Prices Received was used.

Table 11 gives a similar comparison of the old and revised Prices Received Index.

Figure 1 presents the revised Index of Prices Received by Farmers, the revised Index of Prices Paid by Farmers, including Interest, Taxes, and Wage Rates, together with the Parity Ratio which is the former index divided by the latter. Figure 2 presents a comparison of the old and revised Parity Indexes. Figure 3 presents a comparison of the revised index for all commodities to the old commodity index.

The Revised Index of Prices Paid by Farmers for commodities averaged about 2½ percent lower than the old index during the 1920's; it averaged about the same level during the 1936–45 decade; and it rose less rapidly after the removal of price controls in 1946. The expanded commodity coverage during the base period 1910–14 tended to lower the index for the 1920's, particularly in the clothing and house-furnishings components; the

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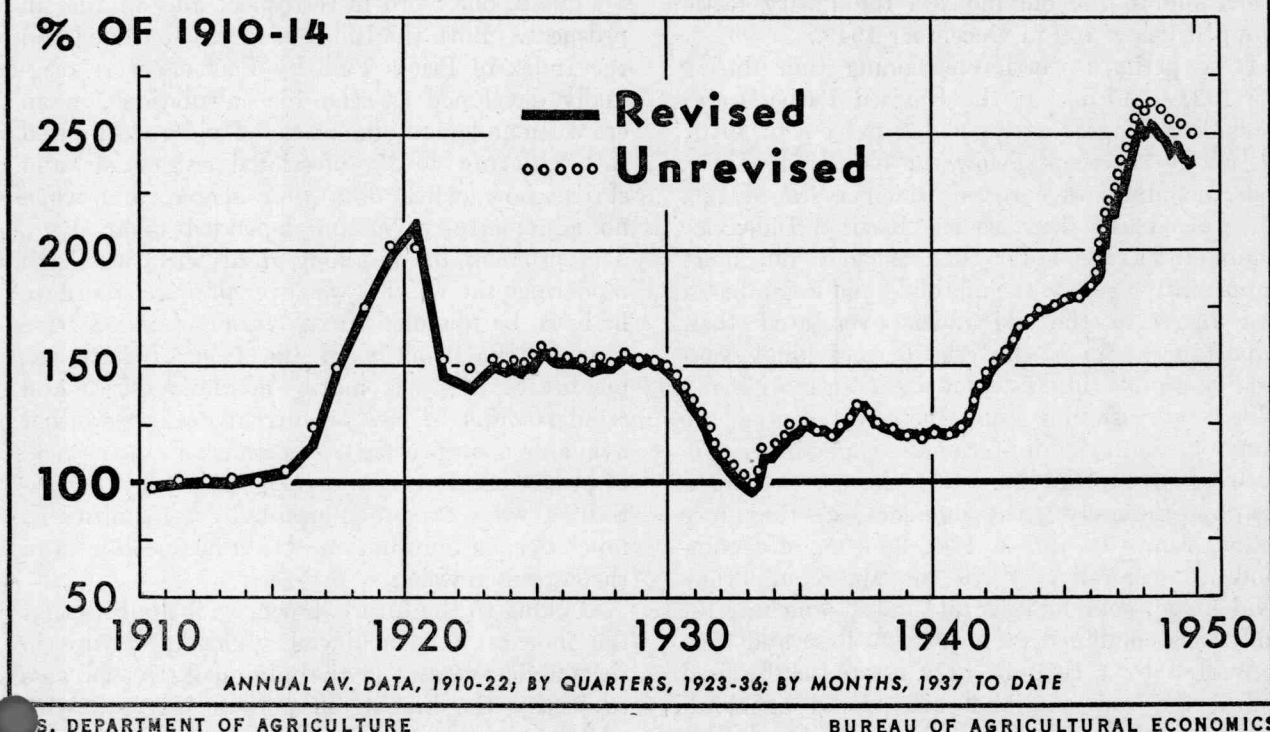# PRICES PAID FOR COMMODITIES
Revised and Unrevised Indexes

FIGURE 3.

shift in the method of combining the subindexes into the combined index also tended in the same direction; the change in the method of introducing autos into the living component tended to offset the above decreases in part, but the corresponding change in handling tractors tended on the downward side for the production component. In the 1936–45 decade, the counteracting influences balanced out.

The slower increase made by the Revised Index after the removal of price controls in 1946 results mainly from the smaller proportionate influence of some high-priced groups, notably clothing and building materials, together with the steadying influence of the broadened commodity coverage. Thus, in women's clothing, the expanded coverage and revised weights gave more influence to artificial fibers, which tended to advance less rapidly from 1946 to 1947 than the more volatile prices of cottons and woolens. Similarly, among building materials, the growing use of insulating board, gypsum lath, and asphalt roofing, as reflected in the expanded commodity coverage and revised weights, damped the rise in the revised index after mid-1946. Somewhat similar influences can be traced in some of the other groups, notably feed and seed.

The Revised Parity Index does not change materially the general pattern of the relation between the Index of Prices Received by Farmers on the one hand, and the Parity Index on the other. Thus, the Parity Ratio (Ratio of the Index of Prices Received by Farmers to the Parity Index) dropped below 100 in 1920 accord-

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ing to the Revised Indexes (1921 according to the old indexes) and remained there until September 1941 (it dropped below again in October and November but recovered in December). It remained above 100 then until May of 1949. According to the old indexes, the Parity Ratio dropped below 100 in December 1949.

It is perhaps worth mentioning that during the 1921–1930 decade the Revised Parity Index (including Wages) averaged 158 percent of 1910–14, about 5 percent below the old Parity Index (not including wage rates) which averaged 166. This was partly because the Revised Index for commodities was lower than the old, but more importantly because the method of adding interest and taxes to the old index overstated their importance. As in the case of individual commodity groups, interest and taxes were originally added by assuming that they represented the same percentage of farmers' expenditures in 1910–14 as in 1924–29. But this gave them a disproportionately great influence, as they rose faster from 1910–14 to 1924–29 than did commodities generally. Were the Index of Prices Paid for all commodities (old index) and interest and taxes combined on a 1924–29 base and then converted to a 1910–14 base as in the Revised Index, the computational bias would be eliminated and the old Index of Prices Paid including Interest and Taxes, instead of averaging 166, would have averaged 161 for the period 1921–30. The addition of Wage Rates on this basis would give a 10-year average of 162, compared with 158 for the 1950 Revision.

In the 1936–45 decade, the Revised Parity Index averaged 145, compared to 141 for the old. Finally, as of January 1950, the Revised Parity Index was 249; the old was 241. In both cases the difference is owing to wage rates, the effect of which in the last few years has been partially offset by the fact that the revised commodity component rose less sharply after the removal of price controls than did the old index, as already explained.

In Conclusion

Finally, one word in retrospect and another in prospect. Both the Index of Prices Received and the Index of Prices Paid by Farmers were originally developed as scientific calculations, in an era when understanding of such devices was limited rather narrowly to professional economists and statisticians, when data were scarce, and when no administrative action depended upon them. The problem of obtaining data with which to modernize the weights was ever present, and data had to be distilled from various and diverse sources. Particularly in the field of farm expenditures, no systematic, comprehensive, and regular source of new or current data was either available or in prospect. Fortunately in the field of prices, the Bureau's regular data-collecting activities were expanded gradually and provided much needed information, which has been used in the current revision.

Looking to the future, however, it appears that the indexes have achieved sufficient stature in the public eye and in the administrative process to justify the making of periodic surveys with adequate geographical coverage to obtain the necessary information concerning the changes in the pattern of farm expenditures—for both living and production. Only through such surveys will it be possible to keep the Indexes modern and dependable enough to serve their purposes well. The Bureau Committee on Index Numbers urged that it is now time to get data that would make possible moving to a weight period reflecting postwar conditions. The 1951 Budget of the Department of Agriculture requests the funds with which to make surveys of farm-expenditure patterns that would permit such a shift.