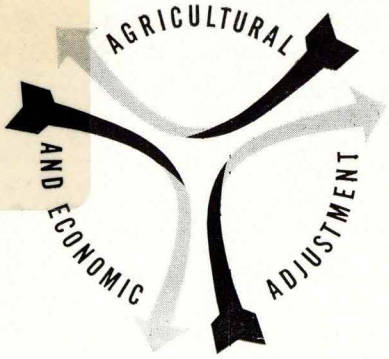

An Alternative Parity Formula for Agriculture

by Wayne Fuller, Glen Purnell, Lonnie Fielder,
Marvin Laursen, Ray Beneke and Geoffrey Shepherd

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FOREWORD

This report was prepared at Iowa State University under the subproject of the interregional project IRM-1, "National Policies for Agricultural Prices and Incomes."

The subproject was set up and directed by Geoffrey Shepherd and Ray Beneke. The procedures were worked out and applied to corn by Wayne Fuller. These procedures then were applied, with appropriate modifications, to cotton by Lonnie Fielder, to milk by Glen Purnell and to wheat by Marvin Laursen.

Costs and returns data used in this publication were prepared under the supervision of Wylie D. Goodsell, Farm Economics Research Division, Agricultural Research Service, United States Department of Agriculture.

The members of the IRM-1 committee provided many helpful suggestions and criticisms.

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CONTENTS

SUMMARY

The parity price ratio—the ratio between the indexes of prices received and paid by farmers—is widely used as a measure of farmers' economic status, and percentages of parity prices are used as the bases for price support operations running into billions of dollars. The purpose of this report is to examine the parity formula, to see how well suited it is to these purposes and to develop an alternative formula.

Investigation indicates that the parity ratio and parity prices for different products are not very appropriate measures, for the following reasons:

1. The original index base period, 1909-14, is out of date. A more recent base would be more appropriate.

2. The same parity index (index of prices paid by farmers) is used for all farm products in the United States. Parity prices for individual farm products would more closely reflect the parity purchasing power of those products if parity indexes were computed separately for each product.

3. The parity price ratio reflects changes in the level of the prices received relative to prices paid by farmers, but it does not reflect changes in the quantities produced or purchased. In other words, the parity ratio is not responsive to shifts in the rate at which inputs are transformed into outputs.

4. The parity price ratio compares the purchasing power of farm products per unit of product (bushel, bale, etc.) with their purchasing power per unit in an earlier base period. What farmers are really interested in, however, is parity of returns to their labor and management with returns in other occupations now.

An alternative parity formula might replace the ratio of prices received to prices paid by the ratio of returns to labor and management on farms to returns to labor and management in other occupations. A "parity returns" formula of this sort should be more meaningful and provide a more accurate measure of the relative *economic* status of *farmers* than the present parity price formula, which shows only the relative *price* status of *farm products.*

In the present report, an attempt is made to develop a parity returns formula of this nature.

Parity returns should provide a more appropriate measure of the changes in the relative economic status of farmers than does the present parity price ratio. Nevertheless, several problems are associated with the empirical application of the concept. Among the most troublesome are the identification of comparable resources (particularly labor) on and off farms, the definition of comparable returns to resources under differing conditions and the selection and aggregation of data.

In this study, the following procedures are used:

1. Parity returns to the services of capital and land are computed by multiplying the current value of the capital and land by the current Federal Land Bank interest rate.

2. Parity returns to labor are computed by multiplying the current earnings of manufacturing workers by the ratio of farm labor returns to these earnings during a recent base period. A base period is necessary because of the difficulties encountered in attempting to measure the nonmonetary items associated with, and the skills required by, different occupations. Although the use of a base period reduces these problems to manageable proportions, it means that the level of the resulting series, as with the present parity price formula, is a function of the base period.

3. Parity labor returns, parity returns to land and capital and current operating expenses are summed to obtain "parity gross income."

4. Actual gross income is divided by parity gross income and the quotient multiplied by 100 to give the *parity returns indicator.*

Thus, when the parity returns indicator equals 100 (i.e., when actual gross income equals parity gross income) the resources engaged in agricultural production are considered to be receiving "parity returns."

Parity returns prices are computed as a quotient of parity gross income and total production, where total production is expressed in terms of the product concerned. Thus, if the parity returns price of corn is to be determined, total production is expressed in corn value equivalents. The parity returns prices provide a set of prices which, when multiplied by the respective outputs, would yield parity returns. This parity returns formula was applied to data from several relatively homogeneous production areas. Important corn-, wheat-, cotton- and milk-producing areas were considered.

The parity returns indicators for the corn and wheat areas rose nearly 20 points relative to the United States parity price ratio over the period. For the cotton areas, the two series showed similar long-run trends. For the dairy areas, the parity returns indicator moved in much the same manner as the parity price ratio, until after 1952 when it rose (relatively) about 10 points.

Over the period 1930-57, the parity returns indicators for the different products varied more from year to year than the present United States parity price ratio, except for milk, which varied less.

The parity-returns *prices* of corn declined more than 20 percent relative to the modernized parity price over the 1930-57 period. The decline for wheat was more than 25 percent. The parity returns price for cotton rose (relatively) more than 40 percent from 1930 to 1940, but declined about 10 percent from 1940 to 1957.

An Alternative Parity Formula For Agriculture

BY WAYNE FULLER, GLEN PURNELL, LONNIE FIELDER, MARVIN LAURSEN,
RAY BENEKE AND GEOFFREY SHEPHERD

The present parity price formula provides the parity ratio—that is, the ratio between the prices received and the prices paid by farmers. It also provides parity prices for individual farm products—prices that would give farm products the same purchasing power per unit which they had in an earlier base period.

The parity ratio—the ratio between the prices received and the prices paid by farmers—is regarded by many people as a measure of the economic status of agriculture.[1] When the parity ratio is 81, for example, that ratio is regarded as indicating that the prices received by farmers are too low; some regard a parity ratio of 81 as indicating that the prices of farm products are 19 percent too low.

The same sort of opinion is held concerning parity prices for individual farm products. When the prices received by farmers for corn are only 55 percent of the parity price of corn, this is generally believed to indicate that corn prices are too low; some believe that it indicates that corn prices are 45 percent too low. Certain percentages of the parity prices for some farm products are used for bases for the price support operation of the Commodity Credit Corporation for those products. These operations run into billions of dollars. The purpose of this report is to examine the parity formula, see how well suited it is for these purposes and determine whether any more appropriate formula might be developed.

OBJECTIVE OF THE PARITY FORMULA

The parity concept developed step by step during the 1920's and early 1930's.[2] E. W. Grove said of parity, ". . . the concept as we now know it did not spring full blown from the brain of some economic Jupiter, but rather grew out of the continuous groping for a concrete measure of justice for the farmer, and was steadily modified by conditions prevailing in the economic life of farmers and the nation. In other words, parity did not develop as the practical application of an economic theory immaculately conceived, free from all taint of original sin in the form of class interest. On the contrary, parity, like Topsy, just growed; and whatever economic justification can be found for it in its present form may be considered largely a rationalization."[3]

The first specific parity formula was incorporated into the Agricultural Adjustment Act of 1933. The objective stated in the Act was to "re-establish prices to farmers at a level that will give agricultural commodities a purchasing power with respect to articles that farmers buy, equivalent to the purchasing power of agricultural commodities in the base period. The base period in the case of all agricultural commodities except tobacco shall be the pre-war period, August 1909 — July 1914. In the case of tobacco, the base period shall be the post-war period, August 1919 — July 1929."[4]

The word "parity" itself was not used in the AA Act of 1933. It first appeared in agricultural legislation in the AA Act of 1938. The purpose of that Act, as stated in the opening paragraph, was concerned with: "assisting farmers to obtain, insofar as practicable, parity prices for such commodities and parity of income. . . ."

Pursuant to the objective stated in the AA Act of 1933, the parity formula was developed to reflect changes in the prices of the "articles that farmers buy." Parity prices then could be computed for agricultural commodities that farmers sell which would give those commodities the same purchasing power that they had in the base period.

CONTENT OF THE PARITY FORMULA

The USDA had been compiling and publishing the price data called for in the AA Act of 1933 for some years previous to 1933. The index of prices *received*

[1]For example: "The drop in prices . . . caused the parity ratio—index of relative farm prosperity—to fall one point . . . ." (Des Moines Register. July 28, 1956.)
". . . the parity ratio—measure of the farmers' well-being in relation to the whole economy . . . ." (News item by Charles Bailey of the Des Moines Register's Washington Bureau. Des Moines Register. Nov. 30, 1957. p. 11.)
"Regardless of the pros or cons of the parity formula in regard to setting price supports, it still is the nation's chief yardstick for measuring the relative position of the farmer and the long-term price trends." (John Harms. Outlook for ag leaders. County Agent and Vo-Ag Teacher. February 1959.)

[2]The development and present status of the present parity price formula is well outlined in: U. S. Congress. Senate. Possible methods of improving the parity formula. 85th Cong., 1st sess., S. Doc, 18. pp. 8-13. U. S. Govt. Print. Off., Wash., D. C. 1957.

[3]E. W. Grove. The concept of income parity for agriculture. Studies in income and wealth, Vol. 6. National Bureau of Economic Research, New York. 1943.

[4]U. S. Statutes at Large. Vol. 48. Agricultural Adjustment Act. Public Law 10. p. 32. 73d. Cong., 1st sess. U. S. Govt. Print. Off., Wash., D.C. May 12, 1933.

by farmers for the products they sell was compiled on a monthly basis beginning with 1909. It was first published in 1921.

The basic data for the index of prices paid for the "articles that farmers buy" were more difficult to obtain. This index was compiled on an annual basis beginning with 1909, on a quarterly basis beginning with 1924 and on a monthly basis beginning with 1937. This index of prices paid by farmers is called the parity index. It was first published in 1928. At that time, the pre-World War I base of 1910-14 seemed a reasonable base to use for both series—the prices received by farmers and the prices paid by farmers. In addition, 1910-14 was the earliest period for which an adequate set of these data was available.

The parity formula laid down in the AA Act of 1933 was amended and re-enacted several times after 1933.[5] The prices of certain services were added to the prices paid by farmers, and "comparable prices" were provided for some products which had not come into general use until after 1929. In addition, the Agricultural Act of 1948 introduced a table of loan rates that varied inversely with the supply of the crop. The Agricultural Act of 1948 included provisions which "modernized" the parity formula. This modification of the formula was an attempt to take into account shifts in relationships among the prices of the different agricultural commodities which had occurred since the 1910-14 period. The base period for computing the relative parity prices of individual farm products (the parity prices relative to each other) was changed from 1910-14 to a more recent period—the most recent 10-year moving average. The 1910-14 base period was retained, however, for parity prices as a whole. This modernized formula was to become effective in 1950. The Agricultural Act of 1949 modified the formula by the inclusion of farm wage rates in the parity index and the inclusion of direct subsidy payments on dairy products, cattle and lambs in prices received before it became effective.

This is the way the parity price of corn for Jan. 15 1959, would have been figured under the modernized parity formula. The 120-month (January 1949 — December 1958) average of prices received for corn, adjusted to include an allowance for unredeemed loans, etc., was $1.40 per bushel. During the same 10-year period, the index of prices received by farmers (the parity index) averaged 257. Dividing $1.40 by 257 gives $0.545 per bushel. This is the adjusted base price for corn. Multiplying this adjusted price base by 308, the parity index for Dec. 15, 1958, gives $1.68. This would have been the indicated parity price for corn under the new formula.

The parity price under the old formula would have been the average price of corn—August 1909-July 1914, 64.2 cents—multiplied directly by the current index of prices paid by farmers, including interest and taxes, 308, divided by 100; this equals $1.98.[6]

The parity price of corn computed by means of the new formula, therefore, would have been 30 cents lower than the parity price computed by the old formula. But the parity prices for some other products would have been higher, so that the level of parity for all farm products as a group would have been the same under the new formula as under the old.

To avoid extremely sharp declines in the parity price of any commodity, transitional parity prices were provided by the 1948 act. They were to be used for those commodities for which the new parity prices are less than 95 percent of the old parity prices in 1950, 90 percent in 1951, and so on. In other words, the parity price as calculated under the old method was to be reduced 5 percent each year until the transitional parity was less than the parity price as defined by the new act. From then on, the new parity was to be used. These transitional prices were incorporated into the 1949 act. In actual practice, for several years "dual parity" was used with the six basic crops. The parity prices computed by the modernized formula were permitted to go into effect only if they were higher than prices computed under the old formula. By December 1958, however, the effective parity price for corn was $1.78, the transitional price after 2 years of transition; it was 10 percent lower than the old parity price of $1.98.

The index of prices received and prices paid from 1910 to 1958 are given in table 1. The ratio between the two indexes (the parity ratio) is also given. The data are shown graphically in fig. 1.

PARITY INCOME

It was recognized from the first that prices were only one of the factors that determined income. It also was

TABLE 1. PRICES RECEIVED BY FARMERS FOR COMMODITIES, AND PRICES PAID BY FARMERS FOR COMMODITIES, INTEREST, TAXES AND WAGE RATES, UNITED STATES, 1910-58.*

	Index numbers (1910-14 = 100)					
Year	Prices rec'd.	Prices paid	Parity ratio	Year	Prices rec'd.	Prices paid	Parity ratio
1910	104	97	107	1930	125	151	83
1911	94	98	96	1931	87	130	67
1912	99	101	98	1932	65	112	58
1913	102	101	101	1933	70	109	64
1914	101	103	98	1934	90	120	75
1915	99	105	94	1935	109	124	88
1916	119	116	103	1936	114	124	92
1917	178	148	120	1937	122	131	93
1918	206	173	118	1938	97	124	78
1919	217	197	110	1939	95	123	77
1920	211	214	99	1940	100	124	81
1921	124	155	80	1941	124	133	93
1922	131	151	87	1942	159	152	105
1923	142	159	89	1943	193	171	113
1924	143	160	89	1944	197	182	108
1925	156	164	95	1945	207	190	109
1926	145	160	91	1946	236	208	113
1927	140	159	88	1947	276	240	115
1928	148	162	91	1948	287	260	110
1929	148	160	92	1949	250	251	100
				1950	258	256	101
				1951	302	282	107
				1952	288	287	101
				1953	255	277	92
				1954	246	277	89
				1955	233	276	84
				1956	230	278	83
				1957	235	286	82
				1958	250	293	85

*Source: United States Department of Agriculture, Agr. Mktg. Serv. Agricultural Outlook Charts, 1959.
United States Department of Agriculture, Agr. Mktg. Serv. Agricultural prices. Jan. 1959.

[5]The details concerning these amendments and the steps involved in the computation of parity prices for different products are given in: B. R. Stauber, et al. The revised price indexes. Agricultural Economics Research. 2, no. 2: 33-62. April 1950. Some interesting background on the evolution of the term parity is given in: R. L. Tontz. Evolution of the term parity in agricultural usage. The Southwestern Social Science Quarterly. pp. 345-355. March 1955.

[6]United States Department of Agriculture, Agr. Mktg. Serv. Agricultural prices. p. 18, Oct. 31, 1958, sets forth the procedure used above.

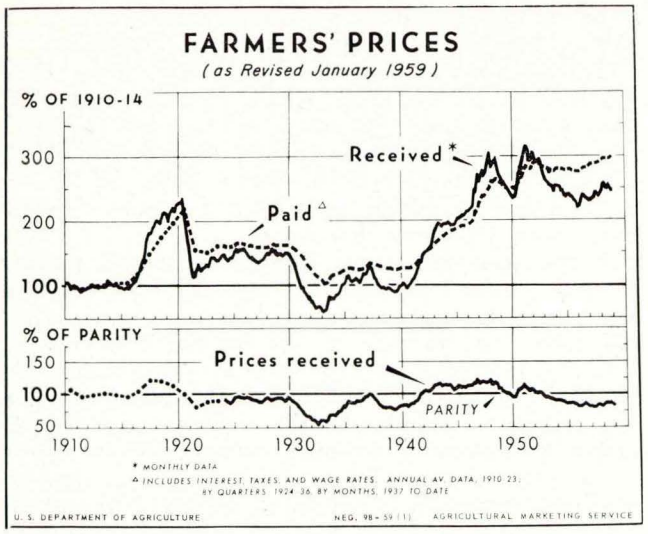

Fig. 1. Prices received and prices paid by farmers, and percent of parity, 1910-58 (1910-14=100).

recognized that farmers were interested in income, not prices. So along with the development of parity prices went several legislative attempts to define parity income.

During the 1930's, the concept of parity income developed as an extension of the parity price concept. It first appeared in legislation in 1936. A declared purpose of the Soil Conservation and Domestic Allotment Act of 1936 was the "reestablishment, at as rapid a rate as the Secretary of Agriculture determines to be practicable and in the general public interest, of the ratio between the purchasing power of the net income per person on farms and the income per person not on farms that prevailed during the 5-year period August, 1909—July, 1914, inclusive, as determined from statistics available in the United States Department of Agriculture and the maintenance of such ratio."

There was much criticism of this definition of parity income. In the Agricultural Adjustment Act of 1938, therefore, the definition was changed to read as follows: " 'Parity,' as applied to income, shall be that per capita net income of individuals on farms from farming operations that bears to the per capita net income of individuals not on farms, the same relation as prevailed during the period from August, 1909—July, 1914."

The 1938 definition of parity income differed from the 1936 definition in four respects: (1) The term "net" was used; it was applied to per-capita income of persons not on farms as well as to that of persons on farms. (2) The "purchasing power" provision in the 1936 definition was omitted in the 1938 definition. (3) The income of persons on farms included income from farming operations only. (4) The limitation "as determined from statistics available in the USDA" was omitted.[7]

The 1938 definition avoided some of the difficulties inherent in measurements of net income. The estimates of net income from farming operations per person on farms do not include income from nonagricultural sources, while the estimates of net income per person not on farms do include income from agricultural sources. The net income to persons on farms from nonagricultural sources is a considerable item. For the 10 years, 1948-57, it averaged 5.8 billion dollars, compared with 15.5 billion dollars from farming operations.[8] It would seem that the estimates of income per person living on farms should include the income from all sources, if they are to be compared with the estimates of income per person not on farms.

The inclusion of income from nonagricultural sources still would leave some considerable inaccuracies in the estimates for purposes of comparison with the net incomes of other groups. Farmers ordinarily get less than 50 percent of the retail value of the food they produce. The estimates of net farm income, however, value the farm products produced on the farm and consumed by the farm household at farm prices. If those products were valued at retail prices, that would have increased the net income to persons on farms in 1939 by more than 20 percent.[9] The rental value of farm dwellings, estimated in recent years at $300 per year per farm, perhaps is low also by comparison with the rental value of comparable dwellings and sites in town. Other items—taxes, charges for depreciation on equipment, etc.,—also may need checking for comparability.

Finally, the existing net income figures do not include the nonmonetary items of income on the farm and off the farm—the independence of the farm operator compared with the dependence of the urban worker on his job, the open-air nature of farm work, the generally poorer schools in the country, etc.

The 1938 definition of net income, however, avoided this difficulty of measuring intangibles. It did not call for direct comparisons of current net incomes on farms with current net incomes off farms. Thus, if current income data showed net farm income to be only half as much as nonfarm income (or twice as much) that would still represent income parity if half (or twice) were the relation that existed in the base period.

The Agricultural Act of 1948 changed the definition of parity farm income again. Title II, Sec. 201 (2), defined parity farm income as follows:

"(2) 'Parity,' as applied to income shall be that gross income from agriculture which will provide the farm operator and his family with a standard of living equivalent to those afforded persons dependent upon other gainful occupations."

This new definition was incorporated into the Agricultural Act of 1949 which became effective on January 1, 1950. This definition got away from the problems involved in any formula which includes a base period. It escaped, for example, the problem of what base period to use (one period might have a much higher or lower

[7]A more detailed appraisal of these and other points is given in E. W. Grove's article, The concept of income parity for agriculture. Studies in Income and Wealth. Vol. 6. pp. 97-139. National Bureau of Economic Research. 1943.

[8]United States Department of Agriculture, Agr. Mktg. Serv. The farm income situation. p. 20. July 1958.

[9]There is some disagreement whether these products should be valued at farm prices or at retail prices. People in town have to buy their food at retail prices, so on the face of it, farm and nonfarm incomes would seem to be more nearly comparable if the food produced on the operator's own farm were valued at retail prices, too. Against this, it may well be argued that a gallon of peas in the pod just picked from the farm garden by the farm wife, for example, is not at all comparable with the package of frozen peas ready to put in the pot purchased by the city housewife. For another example, however, eggs from the hen house are just as ready to cook as eggs in the retail store, and usually fresher.

parity income than another). It also got away from the problem of continuous obsolescence of any base period. But it got into a different problem—the problem of comparing levels of living in different occupations. The new formula involved more than a simple comparison of farm and nonfarm dollar incomes. It required, in addition, the determination of differences in their purchasing power, as represented by their different levels of living. So far, while this new definition was "effective January 1, 1950," it has not been computed and put into actual use.

The Agricultural Act of 1948 also defined parity gross income for individual commodities as follows: " 'Parity,' as applied to income from any agricultural commodity for any year, shall be that gross income which bears the same relationship to parity income from agriculture for such year as the average gross income from such commodity for the preceding ten calendar years bears to the average gross income from agriculture for such ten calendar years." This was the first time that a method of apportioning income parity among the individual commodities was prescribed by law. Inasmuch as the over-all level of parity gross income could not be determined, this additional step has not had much significance.

APPRAISAL OF THE PRESENT PARITY PRICE FORMULA

How accurate a measure of farmers' economic status do the parity price ratio and the different parity prices provide?[10] The answer to this question also would throw some light on the second question—how well do parity prices serve as bases for price supports?

The present parity price formula uses as a parity criterion the purchasing power per unit of a farm product compared with its purchasing power back in 1910-14. But this does not provide an exact standard by which to measure farmers' economic status today. There are several reasons for this.

1. THE 1910-14 BASE PERIOD IS OUT OF DATE.

The 1910-14 base period used in the formula lies more than 40 years in the past. It is getting less and less representative of present-day conditions, in view of the changes in technology and other influences on the supply of and demand for farm products that have taken place since 1910-14.

The modernized formula in the Agricultural Act of 1949 recognized that the old parity formula perpetuated the relationships among the prices of different farm products that existed in 1910-14, through all the changes in supply and demand that had taken place since 1910-14. The modernized formula in the 1948 and 1949 acts shifted the base for computing the parity prices of individual farm products from 1910-14 to the most recent 10-year moving average. But it still retained the 1910-14 base for the prices of farm products as a whole. A recent base should reflect present conditions in agriculture more accurately than the old 1910-14 base.

The average parity ratio over the recent 10-year period, 1947-56, on the 1910-14 base, figures out at 98.2. This is not far from 100, that is, not far from the 1910-14 ratio. This recent 10-year period includes 1947, when the parity ratio reached its all-time high, 115; it also includes more recent years when the ratio was close to its lowest level since the 1930's.

A few years ago, the USDA recommended shifting the parity price base from 1910-14 to 1947-56. It recognized that this shift would leave the level of parity prices much the same as they are on the old 1910-14 base, since the 1910-14 base parity ratio averaged within two points of 100 during 1947-56. But it pointed out that the change would "make the statistical calculations necessary to maintain technically sound indexes simpler to carry forward and it would recognize, at least in principle, that there is no sound argument for indefinitely holding conditions constant as of any particular base period."[11]

2. THE PARITY INDEX IS THE SAME FOR ALL FARM PRODUCTS.

The present parity index is a single index for the whole United States. It is based upon the prices of about 350 goods and three services (interest, taxes and wages). The index shows the prices of goods and services for the average farmer in the United States.

But most actual farmers differ widely from average farmers. Some of them are cotton farmers, using cotton machinery, fertilizer and labor; some are Corn Belt farmers, using corn planters, pickers, etc.; some are wheat farmers, using "one-way's" and combines; some are truck farmers, ranchers, fruit growers, etc., each with his own list of goods and services purchased, differing in kind and quantity from that of the others. The parity index—an average index for the whole United States—does not accurately fit any of them.

The prices paid for different items in the parity index have risen at markedly different rates since 1940. Hired labor wages have risen to an index of well over 400 (1935-39 = 100). Machinery prices have more than doubled. But fertilizer prices have risen only 50 percent. The combination of resources used in the production of different farm products has changed in different ways in different areas. The use of machinery on Southern Piedmont cotton farms exactly doubled from 1935 to 1953, but on Central Northeast dairy farms, it rose only 36 percent. The use of labor declined at different rates among the different farm areas. Yet the same weights for all types of farms are used in the parity index. The prices of the different factors of production change at different rates, so the use of the same quantity weights for all farm areas, when in fact the quantity weights change at different rates, means that the single parity index for the United States as a whole is not an accurate index of the prices paid in each of the different farming areas. Parity prices for individual farm products would reflect the parity purchasing power of those products more accurately if the parity index were computed separately for each product.

[10]The use of the term "accurate" here does not refer to accuracy in the computational or statistical sense, but only to the accuracy with which any price index can measure farmers' economic status. The parity ratio and parity prices are accurate measures of the things they were set up to measure—the purchasing power of farm products per unit of product.

[11]Senate Doc. No. 18, op. cit. p. 5.

The two changes outlined above would involve no fundamental change in the parity price formula. They would merely change the data put into the formula. The formula would still be a prices-received and prices-paid formula.

Three additional features of the parity formula now need to be considered. Changing these features would involve making changes in the formula itself.

3. THE PARITY FORMULA IGNORES CHANGES IN QUANTITIES.

Prices are only one of the elements that determine farmers' economic status. The other important element is the quantities of the products concerned. A farmer's economic status would be very low if he got a high price for his corn, for example, but had only a few bushels to sell. Economic status is measured more accurately by prices multiplied by quantities sold than by prices or quantities alone, much as the area of a tract of land is measured more accurately by its length multiplied by its width than by either length or width alone.

Production per farmer now is more than twice as high as it was in 1910-14, so parity prices now would bring in more than twice the gross income per farmer compared with income in 1910-14. If production per farmer had declined since 1910-14, parity prices now would bring less gross income per farmer. The parity formula, therefore, would reflect farmers' gross income status with greater accuracy if it included quantities produced per farmer, as well as prices received.

But gross income is only one step closer to a measure of economic status than prices received. A second step is needed—to deduct costs from gross income in order to measure net income.

The present parity index measures only one element in the costs incurred by farmers. The index is only an index of prices per unit paid by farmers, not an index of costs (i.e., prices x quantities of inputs) incurred by farmers. The index of the prices of things farmers buy might stand at 100, but if farmers now buy twice as much machinery, fertilizer, etc., as they did in 1909-14, they would be paying out an amount that should be represented by 200, not 100. The index shows only the prices, not the costs (prices x quantities) of things that farmers buy.[12]

The nature of the anomalies that result from ignoring changes in quantities purchased is illustrated by the increase that has taken place in the use of fertilizer. The quantity of fertilizer used in the United States more than tripled from 1940 to 1957. If fertilizer prices had remained constant, the parity price index would have shown no change, but farmers in 1957 actually would have paid out more than three times as much hard cash for fertilizer as they paid in 1940. Per farm, they would have paid out more than four times as much.

[12]The weights used in constructing the price indexes have been changed three times. Likewise, the commodity coverage of the indexes has been expanded. As of January 1959, the prices-paid index is constructed using 1955 quantities as weights, and the prices-received index uses average quantities during the 1953-57 period as weights. Indexes published for the period following February 1935, and prior to the current revision used 1937-41 quantity weights. For the period prior to 1935, 1924-29 weights were used.
Altering the base weights adjusts for changes in the relative importance of inputs, but not for changes in the quantity of inputs per unit produced.

TABLE 2. TOTAL COSTS PER UNIT OF PRODUCTION, TYPICAL FARMS, 1957 AS A PERCENT OF 1947-49.

Type of farm	Percent of 1947-49
Cotton farms, Southern Piedmont	115
Dairy farms, Central Northeast	104
Hog-beef fattening farms, Corn Belt	110
Tobacco-cotton farms, North Carolina	131
Cattle ranches, Northern Plains	121
Winter wheat farms, Southern Plains	185

Source of table: United States Department of Agriculture, Agr. Res. Serv. Farm costs and returns. U.S. Dept. Agr., Agr. Inf. Bul. 176 (Rev. June 1958).
For a detailed explanation of total costs per unit of production see: The United States Department of Agriculture, Agr. Res. Serv. Costs and returns. U.S. Dept. Agr. Stat. Bul. 197. p. 12. 1956.

The data showing changes in production costs in different types of farming show how these changes in costs differ among themselves. The diversity of these changes shows up even over so short a period of time as 1947-49 to 1957. On dairy farms in the Central Northeast, production costs per unit of production from 1947-49 to 1957 increased 4 percent; the corresponding changes in other types of farming ranged up to an increase of 85 percent for winter wheat farms in the Southern Plains. The data for these and other types of farming are shown in table 2. It should be noted, however, that some of the variation in costs per unit is due to variation in yields resulting from weather effects.

4. FARMERS REALLY WANT PARITY INCOME

The present parity price formula is a prices-received and prices-paid formula in which the prices received by farmers in the base period are multiplied by the current index of prices paid by farmers. The changes outlined above would convert this formula into an income-cost formula, in which the gross income received per farm operator in the base period would be multiplied by the current index of costs incurred.

But what farmers are really interested in is parity income. This does not mean an income with a purchasing power equal to their income during an earlier base period, but an income comparable with incomes in other occupations now. Measuring this sort of parity would require that the parity income formula relate net income per farm operator to current incomes in other occupations.

This kind of comparison is often made directly. The "per capita income of farm and nonfarm people from all sources" in the United States in 1957, for example, was $967 and $2,082, respectively.[13] Thus, income per person on farms appears to have been less than half as great as nonfarm income per person in the rest of the economy.

Another kind of comparison is often made between average farm income per farm worker ($1,793 in 1957) and average annual wage per employed factory worker ($4,284 in 1957).[14] Here again, the farm income (in this case from farming only) appears as less than half the nonfarm income (in this case, employed factory workers' annual wage).

The comparison of net income per farm operator with the income per worker in other occupations, how-

[13]United States Department of Agriculture, Agr. Mktg. Serv. The farm income situation. p. 24. July 1958.
[14]Ibid. p. 25.

ever, has serious deficiencies as a measure of parity. It is doubtful whether the comparison of the income of a farm owner-operator with the income of an industrial worker, for example, is meaningful, even if we ignore possible differences in the skills required by the two occupations. The industrial worker's income is obtained from the sale of his labor, while the farm operator's income is derived not only from his labor, but also from his investment in land and equipment.

The net income of a farm operator depends not only upon price and physical output-input relationships, but also upon the quantity and quality of resources which he commits to production. Thus, a farm operator may have a low income from farming because he owns few resources and/or his resources are of low quality and/or he uses only part of his resources in agricultural production. For example, the income from farming of a "farm operator" who works 150 days a year in off-farm employment may be expected to be less than the farm income of a full-time operator who operates a farm containing twice as many acres, and also less than the income of a factory worker. Likewise, a semiretired farm operator who works few hours (and perhaps hours of low productivity) will have a low farm income.

Other "farm operators" may control only small quantities of land and capital. If they do not engage in off-farm employment, part of their labor supply is "wasted" in the sense that it is not utilized productively. The resulting low income of these "farmers" may be a source of social concern, but their income problems arise primarily from an insufficiency of resources.

The differences in farm operators' income which arise from variation in the quantity of owned resources used in production weaken the validity of a parity concept based upon net farm operator income.[15] A more valid basis would be a comparison of returns per unit of resource used in agricultural production with returns per unit of similar resources used in nonagricultural production.

The next section is devoted to discussion of a parity indicator which employs resource returns as a parity criterion.

A PARITY FORMULA BASED ON RESOURCE RETURNS

First, it is necessary to define parity returns to resources. To this end, parity returns may be defined as the returns to resources employed in agriculture which are equivalent to the returns received by comparable resources engaged in nonagricultural production.

RETURNS TO WORKING CAPITAL AND LAND

Under the above definition, parity returns to the capital resources used in agriculture are the returns received by comparable capital used in nonagricultural production.

It is difficult to identify farm and nonfarm capital situations which are comparable with respect to risk and stability of returns. Since capital is fairly mobile between the farm and nonfarm sector, however, comparable returns to farm working capital can be approximated by use of the interest rates paid by farmers on short-term loans.

The valuation of the services of land is also troublesome. Farm land has few alternative uses, but its ownership is not restricted to farmers. The current value of land represents what the owner could obtain if he chose to sell it. Hence, with mobility of capital, the owner could expect a return on this value equal to that which he could obtain elsewhere under situations of comparable risk. Thus the current value of the land, multiplied by the corresponding farm mortgage interest rate, can be used to approximate parity returns to land.

This method, which provides a workable estimate of the value of the services of land, will be used in this study. There would be dangers associated with its use, however, if a parity returns system were used as a basis for price supports. If supports were maintained at a high level for an extended period, the price of land might be bid up, which in turn would lead to a still higher support level, and so on.[16]

An alternative for estimating the value of the services of land would be to use share rents. Share rental systems, however, are not prevalent in all areas. Even if one ascertained the share of the product received by the land, there often are additional provisions in the leasing arrangement indicating, for example, how the cost of inputs such as fuel, seed or fertilizer will be shared by landlord and tenant. In addition, pasture and hay land typically is rented for cash. Wide differences in these provisions from farm to farm and area to area make it difficult to use share rents as a method of imputing a return to land.

RETURNS TO LABOR[17]

There are two difficulties associated with the estimation of parity returns to labor. First, there is the problem of selecting nonfarm occupations where the skills, training and management ability required are similar to those required for operating a farm. A series selected to approximate returns to human effort in nonfarm employments should reflect labor and management returns, exclusive of returns from capital resources. For purposes of this analysis, such a series should relate to work which requires skills similar to those required of farmers, and which, therefore, represents potential returns available to farm operators considering alternative employment.

Beyond the problem of selecting comparable occupations remains the problem of estimating returns in the two types of employment. The complexities involved in evaluating the farm-produced food consumed in the home and the rental value of the farm home were mentioned previously. Evaluating the conditions associated with different types of employment presents even greater difficulty. For example, the city worker may have to

[15]Parity income formulas are discussed at length in Senate Document No. 18, op. cit., pp. 31-45.

[16]If it were believed that such a situation might arise, the method of valuation might be altered. For example, the parity returns to land might be tied to a price index. Parity returns per acre then could be defined as the product of the current interest rate, the base period value per acre and the current index of, for example, prices paid by farmers.

[17]No distinction is made here between the management and labor inputs of the farm operator. Labor returns, as used hereafter, are the returns to the operator for both his labor and management services.

drive long distances to work, and his occupation may require greater outlays for work clothing. On the other hand, he may receive benefits such as compensation in case of accident. Also the goods and services available to those living in rural areas often differ in price, quality and quantity from those available to urban residents. The difficulties associated with the selection of nonfarm occupations that are comparable to farming and the further difficulties of estimating comparable returns in rural and urban areas make it almost impossible to compute farm and nonfarm labor returns in units which can be compared directly. It becomes necessary, therefore, to compare farm and nonfarm returns relative to some base period.

Once a period is selected it becomes possible to state that returns to resources engaged in farming are, for example, lower relative to nonfarm earnings than they were during the base period.[18] Thus parity farm-labor returns become the earnings which bear the same ratio to nonfarm labor earnings as existed during the base period. By the use of this principle, the parity farm-labor returns for the current year can be computed by multiplying the current nonfarm labor returns by the base period ratio of farm to nonfarm labor returns. Employing a base period in this manner is analogous to the current parity price formula computations, where the prices received by farmers in a base period are multiplied by the current index of prices paid by farmers.

The use of a ratio to construct parity labor returns reduces the restrictions imposed upon the nonfarm wage series used for comparison. It is still necessary that the series represent only returns to labor, but the level of the series becomes secondary to the manner in which the series moves.

In this study, the series, Hourly earnings of employed workers in manufacturing,[19] will be used.

The base period ratio is computed as the quotient of hourly earnings in manufacturing and the hourly returns to operator and family labor. Total parity returns to farm labor for the current year are the product of the base period ratio, current hourly earnings in manufacturing and the hours worked by the operator and his family. Under this procedure, the yearly parity returns to the efforts of the operator and his family are a function of the hours worked. The parity returns procedure focuses on the relative earnings of resources in farm and nonfarm production. Thus the appropriate units for the parity calculation are resources used, not resources available. If the ratio of farm to nonfarm earnings were established using yearly earnings, the parity computations would not reflect shifts in the relative number of hours worked by farmers and nonfarmers.

PARITY GROSS INCOME AND THE PARITY RETURNS INDICATOR

The procedures previously outlined lead to the following specific definition of parity gross income: Parity gross income is that income which covers operating expenses, yields a rate of return to working capital and land equal to current interest rates and yields a return to the farm labor resource which bears the same ratio to nonfarm labor returns as existed during the base period. Under this definition, parity gross income for an individual year is obtained by summing operating expenses, the charge for capital services and land and the parity labor returns.

The ratio between the gross income actually achieved and parity gross income expressed as a percentage may be called the "parity returns indicator"; it is referred to by this name in the rest of this report. These percentages or ratios between the actual gross income and the parity gross income provide a measure of the economic status of farmers which differs from the present United States parity price ratio in some respects, but is similar to it in some other respects.

The differences and similarities of these two measures perhaps can best be seen with the aid of mathematical notation. Parity gross income as defined here is:

$$\Sigma\ p_1q_1 + \frac{W_1}{W_0 p_{0L} q_{1L}}$$

where p_1 refers to the price of inputs (excluding the labor of the farm operator) used in the current period, q_1 to the quantities of these inputs used in the current period, W_1 to the current nonfarm labor earnings, W_0 to the nonfarm labor earnings during the base period, p_{0L} to the return to farm labor during the base period and q_{1L} to the current quantity of farm labor used. The $\Sigma\ p_1q_1$ includes all operating expenses, the depreciation on machinery and buildings and the interest charge for capital and land.

Gross income in the current year can be denoted by $\Sigma\ P_1Q_1$, where P_1 denotes the price and Q_1 the quantity of items produced. Capital letters are used to differentiate product prices and quantities from input prices and quantities.

Thus the formula for the parity returns indicator is:

$$\frac{\Sigma\ P_1Q_1}{\Sigma\ q_1p_1 + \frac{W_1}{W_0}\ p_{0L}q_{1L}}$$

The present United States parity price ratio can be represented by the quotient:[20]

$$\frac{\frac{\Sigma\ Q_0P_1}{\Sigma\ Q_0P_0}}{\frac{\Sigma\ p_1q_0}{\Sigma\ p_0q_0}}$$

expressed in percentage terms; that is, the index of prices received, divided by the index of prices paid and converted to a percentage.

The parity returns indicator differs from the parity price ratio in several respects.

[18]The assumption implicit here is that nonmoney or unmeasured considerations between farm and nonfarm occupations do not change over time.

[19]This series is published in several sources. See, for example: U.S. Department of Commerce, Bureau of the Census. Statistical Abstract of the United States, U.S. Govt. Print. Off. Current data are given in: U.S. Office of Business Economics. Survey of Current Business, U.S. Govt. Print. Off., Wash., D.C. (Published monthly.)

[20]This expression, used for demonstration purposes, is not completely accurate. The price indexes have been revised several times since their introduction. Although the period 1910-14 has been retained as the base period for the level of prices, the commodity coverage and the weighting have been changed. The prices-paid index is currently computed with 1955 weights, while the prices-received index is computed with 1953-57 weights.

In the following discussion, it should be remembered that these differences arise from the introduction of parity returns as the parity criterion.

1. In this study, the parity returns indicators will be computed for relatively small areas. Under these circumstances, the indicators are influenced only by the prices of the inputs used in those areas. These prices may change at rates differing from the average of the input prices for the whole United States used in constructing the present United States parity index.

2. In contrast to the United States parity index, which uses constant weights, the area indicators use current weights; i.e., the quantities of inputs actually used and the outputs realized each year. Since the numerator of the parity returns indicator is the product of current production and prices, the indicator is influenced by fluctuations in yields resulting from weather and other natural phenomena.

3. A sizable portion of the United States prices-paid index (parity index) is devoted to the prices of items used in family maintenance. These items are not included in the computations of the parity returns indicators. Rather, human effort is valued as a resource input, the value depending upon returns to labor in the nonfarm segment.

4. Perhaps of greatest importance is the fact that the parity returns indicator is responsive to changes in technology or efficiency. This can be illustrated by abbreviating the parity returns indicator to $\frac{\Sigma P_1 Q_1}{\Sigma p_1 q_1}$ by including $\frac{W_1}{W_0} p_{0L} q_{1L}$ in the summation, $\Sigma p_1 q_1$. To facilitate comparison with the present parity price ratio, the $\frac{\Sigma P_1 Q_1}{\Sigma p_1 q_1}$ is multiplied by identities;

$$\frac{\Sigma P_1 Q_1}{\Sigma p_1 q_1} \cdot \frac{\Sigma p_0 q_1}{\Sigma p_0 q_1} \cdot \frac{\Sigma P_0 Q_1}{\Sigma P_0 Q_1}$$

and the terms rearranged to obtain:

$$\frac{\frac{\Sigma P_1 Q_1}{\Sigma P_0 Q_1}}{\frac{\Sigma p_1 q_1}{\Sigma p_0 q_1}} \cdot \frac{\Sigma P_0 Q_1}{\Sigma p_0 q_1}$$

Thus one sees that the parity returns indicator is a ratio of price indexes similar to the parity price ratio (the items included and the weighting differing) multiplied by an index of output per unit of input.[21] The p_1 for labor $\left(\frac{p_{0L} W_1}{W_2} \right)$ is a function of the nonfarm labor return. To the extent that technological advances in the nonfarm segment are reflected in the nonfarm wage series, the parity returns indicators will reflect changes in efficiency relative to the nonfarm segment, not absolute changes in efficiency. For short periods, the fluctuations in production because of weather may obscure the effects of technological or price changes, but over a period of years the effects of price and technology will become more evident.

[21] The index $\frac{\Sigma P_0 Q_1}{\Sigma p_0 q_1}$ will equal 100 during the base period because the definition of the p_0 for labor assures that $\Sigma p_0 q_0 = \Sigma P_0 Q_0$. Slightly different algebraic manipulation permits expression of the parity returns indicator as: $\frac{\frac{\Sigma P_1 Q_0}{\Sigma P_0 Q_0}}{\frac{\Sigma p_1 q_0}{\Sigma p_0 q_0}} \cdot \frac{\frac{\Sigma P_1 Q_1}{\Sigma P_1 Q_0}}{\frac{\Sigma p_1 q_1}{\Sigma p_1 q_0}}$

This expression and that in the text show that the ratio of the value of output to the value of input contains both price components and quantity components.

COMPUTATION OF PARITY RETURNS PRICES FROM THE PARITY GROSS INCOME

The parity returns price of a product is defined as the price which will yield a parity return to the resources used in the production of this product. Thus, if only one product were produced in an area, the parity price of this product could be obtained by dividing the parity gross income by the quantity produced. If, as is the case, several products are produced in an area, it is necessary to construct a set of parity returns prices such that the sum of quantities multiplied by their respective parity returns prices equals parity gross income.

Such a set of prices can be constructed with the aid of the market prices which existed during the immediately preceding 10 years, for example. The parity returns price of a product then is defined as the price which bears the same ratio to its average price over the preceding 10 years as the parity gross income bears to the sum of product quantities multiplied by their respective average prices. Thus, the relationship among the parity returns prices is determined by average market prices, and the level of parity returns prices is determined by the parity gross income and the quantity produced.

The parity returns price of A for the current period, denoted by $\overline{P}_{1A}$, is given by:

$$\overline{P}_{1A} = \frac{P_{tA} \left(\Sigma p_1 q_1 + \frac{W_1}{W_0} p_{0L} q_{1L} \right)}{\sum_j P_{tj} Q_{1j}}$$

where Q_{1j} represents the output of product j, P_{tA} represents the average price of A during the previous 10 years and P_{tj} represents the average price of the product j during the previous 10 years. The Q_{1j}'s above may be either current production or some estimate of "normal production." It is easily shown that the sum of product quantities multiplied by their respective parity returns prices ($\Sigma \overline{P}_j Q_{1j}$) equals the parity gross income.

In a manner similar to that of the preceding section, the parity returns price of A may be rewritten as:

$$\overline{P}_{1A} = \frac{P_{tA}}{\frac{\Sigma P_{tj} Q_{1j}}{\Sigma P_0 Q_1}} \cdot \frac{\Sigma p_1 q_1}{\Sigma p_0 q_1} \cdot \frac{\Sigma p_0 q_1}{\Sigma P_0 Q_1}.$$

The parity returns price of product A thus is made up of three components. The first component is the ratio of the average price of A during the preceding 10 years to the index of the average price of all products produced in the area during the previous 10 years.

The second component is an index of input prices. The third component is the inverse of the index of output per unit of input. One notes that the first two components are based upon computations which approximate those made with the present modernized parity price formula.[22] The indexes of input prices differ, however. The index of input prices constructed in the parity returns calculations contains as a subindex the earnings of manufacturing workers, while the United States index of prices paid includes the prices of items used for family living. The computation of the parity returns price is further distinguished by the inclusion of an index of output per unit of input.

Changes in the parity returns price reflect changes in the cost of producing farm commodities. It is thus a special kind of cost-of-production price. The level of the price is not based on an estimated cost of production. For that reason, the price is not a cost-of-production price in the sense of covering "the" cost of production. But the parity returns price changes from year to year with changes in the costs of production that are included in the formula. It may be considered as a *change*-in-cost-of-production price. The present parity price itself for that matter is a change-in-cost-of-production price, but an imperfect one; it is actually a change-in-price-of-production price, which leaves changes in quantities out of account.

[22]The modernized parity price of A is given by:

$$\overline{P}_{1A} = \frac{P_{tA}}{\left(\frac{\Sigma P_1 Q_0}{\Sigma P_0 Q_0}\right)_t} \cdot \frac{\Sigma p_1 q_0}{\Sigma p_0 q_0}$$

where $\frac{\Sigma p_1 q_0}{\Sigma p_0 q_0}$ is the United States index of prices paid and $\left(\frac{\Sigma P_1 Q_0}{\Sigma P_0 Q_0}\right)_t$ is the average of the United States prices-received index for the previous 10 years.

EMPIRICAL DATA FOR APPLICATION OF THE PARITY RETURNS CONCEPT

To compute parity returns under the definition just given, it is necessary to obtain detailed farm input and output data.

The USDA compiles and publishes comprehensive farm costs and income data. These data, however, are for all farms as defined by the Census. In the 1954 Census, 30.4 percent of these farms were not commercial farms but were part-time, residential and abnormal units (institutional, etc.) with an average gross farm income (value of farm products sold) of only $347. The corresponding figure for commercial farms was $7,305. Lumping these two subaverages together, weighted in each case by the number of farms in the class, results in an over-all average gross income for all farms in the United States of $5,188. This is 29 percent lower than the average gross income for the commercial farms.

Furthermore, the USDA data are published by states and regions (groups of states) and for the United States as a whole, not by relatively homogeneous economic type of farming areas.

Data drawn from commercial farms, grouped by homogeneous type of farming areas, are needed to enable parity returns to be computed separately by areas. Data of this sort, for commercial farms, by type of farming areas, are compiled in the USDA, ARS, under the direction of Wylie Goodsell.[23] These data are designed to represent the types of commercial farms in the areas shown in fig. 2. The data provide estimates of the quantities and prices of inputs including estimates of the quantities of capital and labor used in production as

[23]The data are published annually in bulletin form. The most recent bulletin is entitled "Farm costs and returns, commercial family-operated farms by type and location." Agr. Inf. Bul. 176. August 1959.

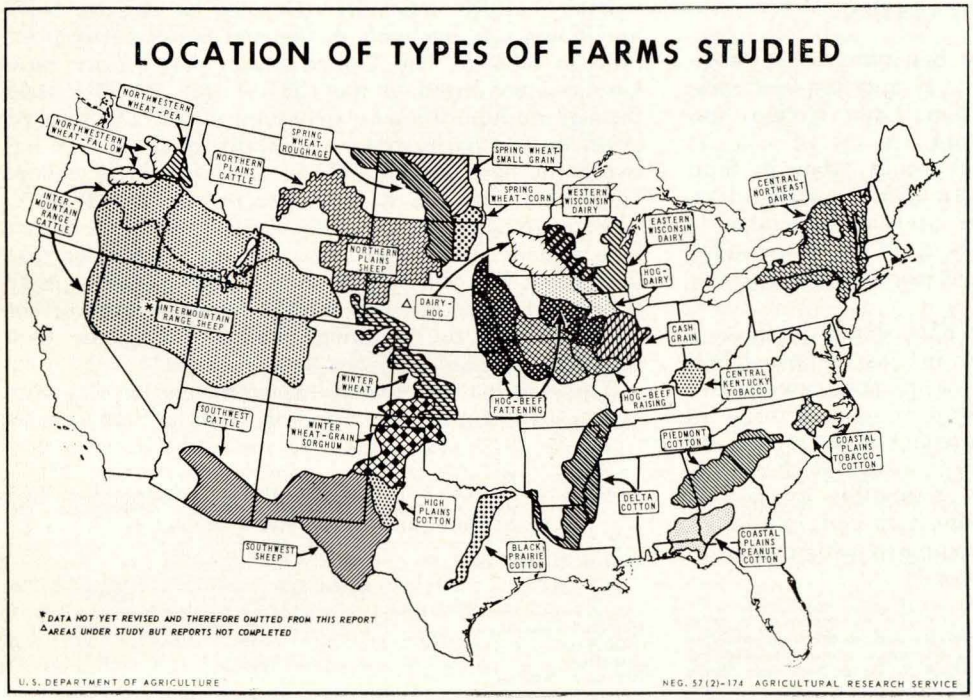

FIGURE 2

well as estimates of the quantities and prices of outputs. The data are presented on a per-farm basis for commercial family-operated farms of the specific type for areas sampled. "Per farm" here means "average of the specific type." Part-time farms, large farms, residential, abnormal and specialty farms are excluded from the estimates. A commercial family-operated farm is one which produces between $1,200 and $20,000 in gross income from farm products at 1944 prices. The total investment per farm does not exceed $70,000 (at 1944 prices), and the operator does not work off the farm more than 100 days during the calendar year. The basic data are obtained from the United States Census of Agriculture, rural carrier and mailed questionnaires sent to farmers by the Agricultural Estimates Division, AMS, and enumerative field surveys.[24] The data for several important types of farming areas are complete from 1930 through 1957.

In the Goodsell reports, the labor return to farm operator and family labor is computed by subtracting operating expenses and a charge for capital and land from the gross farm income. Gross farm income includes all sales, physical changes in inventory valued at year-end prices, food produced and consumed on the farm valued at prices received by farmers, an allowance for house rent equal to 8 percent of the current value of the house and direct government payments. Operating expenses include cash expenses and an adjustment for the depreciation of machinery and buildings. The charge for capital consists of the current value of land and buildings and working capital multiplied by the current Federal Land Bank mortgage interest rate.

Transcribed copies of the detailed basic data summarized in the annual cost and returns reports were made available by Wylie Goodsell. These data provide the empirical basis for the procedures and computations in the rest of this report.

APPLICATION TO CORN

The results for the four Corn Belt farm areas—hog-beef fattening, cash-grain, hog-dairy and hog-beef raising—are presented in this section. Later sections use the data for cotton, wheat and milk.

The returns to operator and family labor in four Corn Belt farm areas from 1930 to 1957, based on data taken from the Goodsell reports, are shown in table 3. For comparison, a column has been added to the table showing the earnings of employed manufacturing workers during the same period.

Several characteristics of the data shown in table 3 are noteworthy. One is the low returns to farm labor during the early 1930's (negative in most cases). Another is the favorable relationship of labor returns in the cash-grain and hog-beef fattening areas to the returns of manufacturing workers in many of the years since 1940. A third interesting relationship is the low labor return in the hog-beef raising area and, to a lesser extent, in the hog-dairy area, compared with the cash-grain and hog-beef fattening areas.

[24]A more complete explanation of data sources and methods of computation is given in: W. D. Goodsell. Costs and returns, commercial family-operated farms by type and size, 1930-1951. U.S. Dept. Agr. Stat. Bul. 197, 1956.

TABLE 3. HOURLY RETURN TO OPERATOR AND FAMILY LABOR ON CORN BELT FARMS COMPARED WITH HOURLY EARNINGS OF EMPLOYED PRODUCTION WORKERS IN MANUFACTURING.*

Year	Hog-beef fattening	Cash-grain	Hog-dairy	Hog-beef raising	Earnings of manufacturing workers
1930	$ 0.09	$-0.10	$ 0.08	$-0.08	$ 0.55
1931	-0.04	-0.21	-0.04	-0.08	0.52
1932	-0.07	-0.30	-0.08	-0.13	0.45
1933	-0.11	-0.28	-0.04	-0.13	0.44
1934	-0.36	-0.22	-0.16	-0.32	0.53
1935	0.51	0.46	0.27	0.14	0.55
1936	-0.06	0.16	0.16	-0.09	0.56
1937	0.80	0.70	0.30	0.22	0.62
1938	0.43	0.25	0.24	0.11	0.63
1939	0.32	0.34	0.20	0.15	0.63
1940	0.43	0.21	0.18	0.13	0.66
1941	0.56	0.85	0.39	0.28	0.73
1942	1.36	1.20	0.75	0.62	0.85
1943	1.28	1.44	0.85	0.61	0.96
1944	1.22	1.34	0.70	0.44	1.02
1945	1.21	1.52	0.82	0.42	1.02
1946	2.65	2.30	1.20	0.86	1.09
1947	2.04	1.92	0.99	0.40	1.24
1948	3.07	3.04	1.54	1.14	1.35
1949	1.99	1.62	1.02	0.85	1.40
1950	2.10	1.57	0.94	0.93	1.46
1951	2.40	2.54	1.35	1.01	1.59
1952	1.75	2.09	1.25	0.96	1.67
1953	1.28	1.43	1.18	0.61	1.77
1954	1.92	1.82	1.25	0.49	1.81
1955	0.57	1.10	0.68	0.50	1.88
1956	1.29	1.92	0.87	0.51	1.98
1957†	1.46	0.66	0.99	0.66	2.07

*Hourly returns to labor on farms obtained from: Goodsell, Wylie D. Costs and returns, commercial family-operated farms by type and size. United States Department of Agriculture, Agr. Res. Serv. Stat. Bul. 197, Agr. Inf. Bul. 158, Agr. Inf. Bul. 176 and Agr. Inf. Bul. 176 (Rev. June 1958).
Hourly returns to production workers in manufacturing obtained from: U. S. Dept. of Commerce. Statistical Abstract of the United States. U. S. Govt. Print. Off. 1931-57.
†Preliminary.

PARITY RETURNS INDICATOR

Parity gross income was computed for the four Corn Belt areas, using parity labor returns established by alternative base periods, 1937-41 and 1949-54. Returns to operator and family labor were markedly higher relative to nonfarm returns during the latter period (table 4).

Parity returns indicators computed on the two bases are shown together with the United States parity price ratio in table 5. The United States parity price ratio has been converted to the 1937-41 and 1949-54 bases through multiplication by a constant factor. The marked effect on the parity returns indicator of the choice between the base periods 1937-41 and 1949-54 is evident (table 5). There is a difference of approximately 15 percentage points between the series on the two different base periods. This difference serves as a reminder that this index, like the present United States parity price index and other indexes, merely compares the current situation with the situation existing during the base period.

The area parity returns indicators tend to fluctuate over a greater range than does the United States parity

TABLE 4. RATIO OF RETURNS PER HOUR OF OPERATOR AND FAMILY LABOR TO THE HOURLY EARNINGS OF MANUFACTURING WORKERS.

Type of farming area	Period	
	1937-41	1949-54
Hog-beef fattening	0.78	1.18
Cash-grain	0.71	1.14
Hog-dairy	0.40	0.72
Hog-beef raising	0.27	0.50

TABLE 5. PARITY RETURNS INDICATORS FOR FOUR CORN BELT AREAS COMPARED WITH UNITED STATES PARITY PRICE RATIO.

Year	Hog-beef fattening	Cash-grain	Hog-dairy	Hog-beef raising	Av. of four areas	United States parity price ratio base =100
			1937-41 base			
1930	79	68	84	71	76	98
1931	70	57	68	67	66	79
1932	64	45	60	57	56	68
1933	55	41	63	52	53	76
1934	37	47	48	29	40	88
1935	105	106	107	98	104	104
1936	61	80	91	60	73	108
1937	121	119	106	108	114	110
1938	96	86	99	91	93	92
1939	89	92	93	97	93	91
1940	95	83	91	93	90	95
1941	99	119	110	110	110	110
1942	132	131	134	141	134	124
1943	123	135	135	132	131	133
1944	117	126	120	115	120	128
1945	116	132	128	112	122	129
1946	160	156	146	143	151	134
1947	131	134	126	104	124	136
1948	145	160	146	143	148	130
1949	121	117	120	127	121	118
1950	120	113	115	129	119	119
1951	121	132	127	129	127	126
1952	108	119	121	124	118	118
1953	98	103	117	106	106	109
1954	109	110	119	100	110	105
1955	84	93	97	99	93	100
1956	96	110	104	99	102	97
1957	98	86	105	104	98	100
			1949-54 base			
1930	70	58	70	60	64	85
1931	59	49	56	57	55	68
1932	56	39	49	48	48	59
1933	46	34	50	44	44	65
1934	32	40	38	24	34	76
1935	91	88	86	83	87	90
1936	52	67	73	49	60	94
1937	104	99	86	88	94	95
1938	82	72	80	75	77	80
1939	77	78	75	80	78	78
1940	82	71	73	77	76	83
1941	86	101	89	90	92	95
1942	114	110	109	117	112	107
1943	105	114	110	110	110	115
1944	101	107	98	95	100	110
1945	100	112	105	93	102	111
1946	140	133	121	120	128	115
1947	115	114	104	88	105	117
1948	129	137	122	122	128	112
1949	107	100	100	107	104	102
1950	107	98	96	109	102	103
1951	108	114	106	109	109	109
1952	96	103	101	105	101	103
1953	86	89	97	89	90	94
1954	97	95	98	83	93	91
1955	74	80	79	82	79	86
1956	84	94	85	83	86	85
1957	86	74	86	87	83	84

price ratio. These variations arise primarily from fluctuations in yields because of weather and other natural phenomena. Yield variations may be rather large for areas as small as those studied and have obvious effects on the parity returns indicator in such years as 1934, 1936, 1946, 1947 and 1948.

Direct government payments were included in the gross income used to construct the parity returns indicators. Their exclusion would materially lower the parity returns indicators during the years 1934 to 1945 and again in 1956 and 1957. These payments have no direct influence on the United States parity price ratio.

There appears to be some tendency for the area parity returns indicators to rise relative to the United States parity price ratio (note particularly the early years of the period). The average parity returns indicator for the four areas shows a relative rise of nearly 20 points. Input prices in the corn areas rose relative to the United States index of prices paid, but technological developments such as hybrid seed corn increased the output-input ratio more than enough to offset this.

PARITY RETURNS PRICES OF CORN

Parity returns price computations were made for the four corn areas. The following equations, equivalent to the parity returns price formula previously given, were used:

$$r_j = \frac{P_{tj}}{P_{tc}}$$

$$\bar{P}_{1c} = \frac{\Sigma p_1 q_1 + \frac{W_1}{W_0} p_{0L} q_{1L}}{\Sigma r_j Q_{1j}} .$$

A unit of the j*th* product is expressed in terms of bushels of corn by using the ratios among the market prices existing during the preceding 10 years. This conversion factor is denoted by r_j. The $\Sigma r_j Q_{1j}$ then represents the current production per farm expressed in corn value equivalents. This quantity will be abbreviated to ΣrQ in the following discussion.

The current quantities produced, denoted as Q, were obtained by summing the quantity sold, the change in inventory and the quantity consumed in the home. Farms in the three livestock areas generally have only small sales of grain and often have net purchases of corn or other grain. These net purchases were treated as negative quantities[25] when computing the ΣrQ. Likewise, the purchases of feeder cattle in the hog-beef fattening area were included in the ΣrQ as negative quantities.

The 10-year average market price of corn in the cash-grain area was used as a standard in computing the r's for each area. That is, the r for beef cattle in the hog-beef fattening area was computed by dividing the 10-year sum of cattle prices existing in the hog-beef fattening area by the 10-year sum of corn prices existing in the cash-grain area. This means that the ΣrQ for each area is the total production per farm expressed in "corn at the cash-grain location" equivalents. The parity prices computed by use of these ΣrQ's will differ among areas because of differences in production coefficients or in input prices, but will not differ because of the market price differentials arising from the location of the producing areas.

The relative product prices, the r's, were established by use of the averages over the immediately preceding 10-year period, except for the years 1930 to 1940. Since prices comparable to those in the Goodsell data were not readily available for the years prior to 1930, the r's computed from the first 10-years' data were used to compute the ΣrQ's for that period.

[25]When purchases of corn are treated as negative quantities, the market price of corn has no influence on the parity price. Since the quantity purchased is treated as negative production, the value of the purchases is not included in the expense component of parity gross income. If grain purchases were treated as expenses, the level of parity gross income and, hence, the level of the parity price of corn would be partially dependent upon the market price of corn.

In this study, gross income is composed of sales, inventory changes, a rental allowance for the farm home, farm-produced food consumed in the home and direct government payments. Sales, inventory changes, purchases of livestock and grain and farm-produced food consumed in the home are included in the ΣrQ. Therefore, the rental allowance for the farm home, purchases of grain and livestock and direct government payments were subtracted from the parity gross income.[26] The remaining parity gross income was then divided by the ΣrQ to obtain the parity returns price of corn. The parity returns prices of corn for the four areas, together with the modernized parity price of corn and the market price of corn for the cash-grain area are shown in table 6.

It was necessary to compute a modernized parity price for the area, since none appropriate for the area being studied was available. In this computation, the adjusted base price for corn was obtained by dividing the average price of corn received by farmers in the cash-grain area during the preceding 10 years by the average of the United States index of prices received for the same period. The adjusted base price was constructed using prices for the cash-grain area when available. Prices at the cash-grain location were approximated for the period 1920-29 by lowering United States prices to the cash-grain level. The modernized parity price in the table is the adjusted base price, multiplied by the United States index of prices paid by farmers for that year.

Thus, the modernized parity prices shown in the table are computed from area prices of corn and the United States indexes of prices received and paid. At present, the modernized parity price for an area is computed using the average United States price of corn and then applying an area differential. The two procedures will not necessarily yield identical results.

In table 6, the modernized parity prices have been converted to the 1937-41 and 1949-54 base periods by multiplying modernized parity prices based on the 1910-14 period by 0.85 and 0.98, respectively.

Weather effects cause fluctuations in yield, which in turn cause discrepancies among areas in parity prices computed from current production. Recalling that the parity returns prices in table 6 were computed from current production, one notes the high level of parity returns prices in such years as 1934, 1936 and 1947, and the variation among area parity return prices in such years as 1933, 1940 and 1954. These weather effects tend to obscure shifts in parity prices which arise from changes in input prices or from changes in the technical output-input coefficients.

One of several methods could be employed to "normalize" production to remove the effects of weather. A moving average of production could be used to estimate the product quantities appearing in the ΣrQ. This estimate, however, would be somewhat out of date, particularly during a period when trends in production coefficients are significant. In addition, a simple moving average would not reflect the effect of an increase in the use of inputs such as fertilizer on total production.

Another method of "normalizing" production would be to project regression estimates of yield, modified to include input effects, separately for each crop. Construction of individual yield trends for all crops produced in an area, however, would be a laborious procedure.

A third method of "normalizing" production would be to use multiple regression techniques to estimate a trend value for total production (ΣrQ). This third method was adopted for this study. The ratio of output to input, $\frac{\Sigma rQ}{\Sigma p_0 q_1}$, was formed and used as the dependent variable in the regression. Weather variables and time were entered as independent variables. The data for the four areas were pooled to obtain a common trend in

TABLE 6. AREA PARITY RETURNS PRICES OF CORN AND MODERNIZED PARITY PRICES OF CORN, IN DOLLARS PER BUSHEL.

Year	Hog-beef fattening	Cash-grain	Hog-dairy	Hog-beef raising	Av. of four areas	Modernized parity prices	Price rec'd. by farmers, cash-gr. area
				1937-41 base			
1930	0.81	1.07	0.84	1.01	0.93	0.65	0.73
1931	0.73	0.72	0.75	0.75	0.74	0.56	0.42
1932	0.54	0.57	0.58	0.57	0.56	0.49	0.21
1933	0.54	0.83	0.56	0.64	0.64	0.47	0.32
1934	0.88	0.94	0.78	1.06	0.92	0.52	0.59
1935	0.60	0.52	0.53	0.56	0.55	0.54	0.69
1936	0.82	0.75	0.68	0.93	0.80	0.55	0.72
1937	0.58	0.52	0.61	0.55	0.56	0.60	0.77
1938	0.59	0.57	0.58	0.62	0.59	0.59	0.45
1939	0.56	0.52	0.54	0.53	0.54	0.58	0.43
1940	0.58	0.68	0.57	0.56	0.60	0.57	0.56
1941	0.63	0.59	0.64	0.68	0.63	0.61	0.63
1942	0.64	0.67	0.66	0.64	0.65	0.70	0.77
1943	0.73	0.75	0.75	0.76	0.75	0.80	0.98
1944	0.82	0.87	0.82	0.85	0.84	0.84	1.06
1945	0.84	0.84	0.79	0.94	0.85	0.87	1.06
1946	0.83	0.81	0.83	0.85	0.83	0.93	1.26
1947	1.13	1.16	1.11	1.29	1.17	1.06	1.75
1948	0.99	0.95	1.05	1.02	1.00	1.17	1.81
1949	1.09	1.02	1.09	1.07	1.07	1.17	1.14
1950	1.09	1.16	1.13	1.09	1.12	1.18	1.35
1951	1.24	1.21	1.21	1.26	1.23	1.29	1.67
1952	1.16	1.30	1.23	1.22	1.23	1.32	1.64
1953	1.30	1.38	1.26	1.38	1.33	1.29	1.42
1954	1.24	1.31	1.18	1.41	1.28	1.30	1.45
1955	1.27	1.31	1.25	1.10	1.23	1.31	1.24
1956	1.28	1.13	1.17	1.20	1.20	1.32	1.26
1957	1.28	1.40	1.24	1.28	1.30	1.36	1.12
				1949-54 base			
1930	0.94	1.25	1.02	1.19	1.10	0.76	
1931	0.86	0.84	0.92	0.89	0.88	0.64	
1932	0.64	0.68	0.71	0.68	0.68	0.56	
1933	0.65	0.99	0.70	0.76	0.78	0.55	
1934	1.07	1.14	1.00	1.32	1.13	0.60	
1935	0.74	0.64	0.68	0.71	0.69	0.63	
1936	1.00	0.92	0.86	1.15	0.98	0.63	
1937	0.71	0.63	0.77	0.69	0.70	0.70	
1938	0.72	0.68	0.73	0.76	0.72	0.68	
1939	0.69	0.63	0.69	0.67	0.67	0.67	
1940	0.70	0.81	0.72	0.70	0.73	0.67	
1941	0.77	0.71	0.81	0.85	0.78	0.71	
1942	0.78	0.80	0.84	0.80	0.80	0.81	
1943	0.89	0.91	0.94	0.95	0.92	0.92	
1944	0.99	1.03	1.03	1.05	1.02	0.98	
1945	1.01	0.99	0.98	1.15	1.03	1.00	
1946	0.99	0.95	1.02	1.02	1.00	1.08	
1947	1.34	1.36	1.35	1.55	1.40	1.23	
1948	1.17	1.11	1.27	1.23	1.20	1.36	
1949	1.30	1.19	1.32	1.28	1.27	1.35	
1950	1.30	1.35	1.36	1.30	1.33	1.36	
1951	1.47	1.40	1.45	1.49	1.45	1.49	
1952	1.37	1.51	1.48	1.45	1.45	1.53	
1953	1.54	1.61	1.54	1.66	1.59	1.50	
1954	1.47	1.52	1.44	1.72	1.54	1.51	
1955	1.51	1.54	1.53	1.38	1.49	1.51	
1956	1.53	1.33	1.45	1.47	1.44	1.53	
1957	1.52	1.63	1.53	1.55	1.56	1.58	

[26]Direct government payments were subtracted from the parity gross income on the assumption that the payments were made for not fully utilizing inputs (e.g., land and machinery) in the production of commodities and on the assumption that the payments best approximated the value of inputs not committed to production.

the output-input ratio. The regression analysis indicated that the output-input ratio increased 1.64 percent of the mean per year. The trend production (i.e., the trend ΣrQ, for the current year) is obtained by multiplying the current quantity of inputs (Σp_0q_1) by the trend value of the output-input ratio. The procedures and estimating equations used to obtain the time trend in the output-input ratio are presented in the appendix.

The parity return prices of corn shown in table 7 and fig. 3 were computed using the trend-estimated ΣrQ. House rent and purchases of grain and livestock were subtracted from the parity gross income, and the remainder divided by the trend ΣrQ to give the parity returns price of corn. Direct government payments were not subtracted from the parity gross income, since the trend ΣrQ was computed as a function of total inputs, that is, all inputs which make up the parity gross income. The period 1949-54 was used as the base period. Minor adjustments were made in the ratio of farm labor returns to manufacturing earnings so that the average of the parity returns prices for the 1949-54 period would be the same in all areas.

Since a common time trend in the quantity

$$\frac{\Sigma rQ}{\Sigma p_0q_1} = \frac{\Sigma P_tQ_1}{P_{tc}\ \Sigma P_0Q_1} \bullet \frac{\Sigma P_0Q_1}{\Sigma p_0q_1}$$ was computed

for the four areas, the differences among the area parity prices given in table 7 are due to differences in the $\frac{\Sigma p_1q_1}{\Sigma p_0q_1}$, the index of input prices. (See the earlier section on the computation of parity returns prices.) This index, derived by dividing parity gross income less grain and livestock purchases by the quantity of inputs, is shown in table 8. The index of input prices is made up of three subindexes corresponding to the three components of parity gross income: the index of prices of operating expense items such as fuel and fertilizer, the index of the "use price" (interest rate times price) of land and capital and the index of hourly earnings of employed workers in manufacturing.

During the period studied, the area indexes of input prices increased relative to the United States index of prices paid by farmers. The component of the input price index common to all areas, the index of hourly earnings of employed manufacturing workers, increased at an even faster rate. While the United States index of prices paid about doubled from 1930 to 1957, the wage of manufacturing workers more than tripled. During the 28-year period, the area price indexes for operating expense items generally increased slightly, while the index of the "use price" of capital inputs decreased relative to the United States index of prices paid.

If prices of inputs alone were used to determine the area parity returns prices, the latter would have increased relative to the modernized parity price during the period studied. Since the parity return prices actual-

TABLE 7. PARITY RETURN PRICES OF CORN COMPUTED FROM TREND PRODUCTION BY AREAS, AND MODERNIZED PARITY PRICES OF CORN, 1949-54 BASE, IN DOLLARS PER BUSHEL.

Year	Hog-beef fattening	Cash-grain	Hog-dairy	Hog-beef raising	Av. of four areas	Modernized parity prices	Price rec'd. by farmers, cash-gr. area
1930	0.99	1.01	0.97	1.06	1.01	0.76	0.73
1931	0.87	0.87	0.85	0.91	0.88	0.64	0.42
1932	0.72	0.73	0.70	0.77	0.73	0.56	0.21
1933	0.64	0.64	0.63	0.69	0.65	0.55	0.32
1934	0.72	0.72	0.71	0.73	0.72	0.60	0.59
1935	0.73	0.71	0.72	0.73	0.72	0.63	0.69
1936	0.73	0.71	0.72	0.73	0.72	0.63	0.72
1937	0.77	0.78	0.78	0.78	0.78	0.70	0.77
1938	0.74	0.76	0.75	0.75	0.75	0.68	0.45
1939	0.72	0.74	0.73	0.74	0.73	0.67	0.43
1940	0.75	0.76	0.74	0.74	0.75	0.67	0.56
1941	0.80	0.80	0.79	0.79	0.80	0.71	0.63
1942	0.90	0.90	0.90	0.89	0.90	0.81	0.77
1943	0.99	0.97	0.99	0.98	0.98	0.92	0.98
1944	1.05	1.03	1.05	1.02	1.04	0.98	1.06
1945	1.05	1.03	1.05	1.04	1.04	1.00	1.06
1946	1.09	1.08	1.10	1.09	1.09	1.08	1.26
1947	1.24	1.20	1.24	1.24	1.23	1.23	1.75
1948	1.35	1.32	1.36	1.34	1.34	1.36	1.81
1949	1.34	1.32	1.35	1.34	1.34	1.35	1.14
1950	1.35	1.33	1.36	1.35	1.35	1.36	1.35
1951	1.46	1.44	1.45	1.46	1.45	1.49	1.67
1952	1.52	1.50	1.51	1.52	1.51	1.53	1.64
1953	1.49	1.53	1.49	1.50	1.50	1.50	1.42
1954	1.48	1.52	1.48	1.48	1.49	1.51	1.45
1955	1.47	1.54	1.48	1.46	1.49	1.51	1.24
1956	1.49	1.56	1.50	1.48	1.51	1.53	1.26
1957	1.58	1.69	1.60	1.58	1.61	1.58	1.12

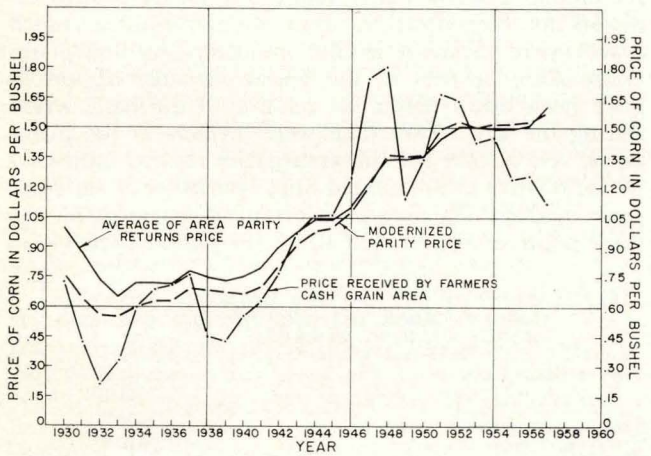

Fig. 3. Parity returns price and modernized parity price of corn compared with price received by farmers in the cash-grain area, 1949-54 base.

TABLE 8. PRICE INDEXES, 1949-54 = 100.

Year	Input prices: Hog-beef fattening	Cash-grain	Hog-dairy	Hog-beef raising	Hourly earnings of emply'd. mfg. workers	Prices paid by farmers including interest, taxes and wage rates
1930	48	48	47	51	34	55
1931	43	43	42	45	32	48
1932	36	36	35	39	28	41
1933	33	32	32	36	27	40
1934	38	37	37	39	33	44
1935	39	38	39	39	34	46
1936	39	38	39	40	34	46
1937	42	43	43	44	39	48
1938	42	43	42	43	39	46
1939	41	42	42	43	39	45
1940	43	44	43	44	41	46
1941	47	47	47	47	45	49
1942	54	54	54	54	53	56
1943	60	59	60	60	59	63
1944	64	64	65	64	63	67
1945	65	65	66	66	63	70
1946	69	69	70	70	67	76
1947	80	78	81	81	76	88
1948	89	86	89	88	84	95
1949	89	88	91	90	87	92
1950	92	90	92	91	91	94
1951	101	100	100	100	98	103
1952	106	105	105	106	103	105
1953	106	108	106	106	109	102
1954	106	109	107	107	112	103
1955	107	113	108	106	116	103
1956	110	115	111	110	122	105
1957	119	127	119	118	126	109

ly behaved in the opposite manner, it is clear that the downward influence of improvements in the rate at which inputs are transformed into products more than offset the price effects.

Table 7 and fig. 3 show that, during the early years, the area parity returns prices of corn tend to be above the modernized parity prices. (The two come together during the base period 1949-54.) That is, during the period 1930 to 1957, parity prices based upon resource returns decreased relative to parity prices computed by the present modernized parity formula. The divergence can be further emphasized by expressing the two prices as a percentage of their respective 1930 values. Thus, the modernized parity price for 1957 stands at 208 percent of its 1930 level, while the parity returns price for 1957 is only 159 percent of its 1930 level.

The area parity returns prices can be thought of as "cost of production" prices, where total land and capital costs are defined in terms of interest rates, and the labor cost is defined relative to nonfarm labor returns. Total production costs are allocated among units of different products by using their relative market prices during the immediately preceding 10 years. Thus, changes in the area parity returns prices of corn are approximations to the changes in costs of production, the absolute level of "cost" being arbitrary, since it is determined by the base period. Therefore, table 7 presents evidence that during the 1930-57 period the "cost of producing" corn in the Corn Belt decreased relative to the modernized parity price of corn.

TABLE 9. HOURLY RETURN TO OPERATOR AND FAMILY LABOR ON WHEAT FARMS COMPARED WITH HOURLY EARNINGS OF EMPLOYED PRODUCTION WORKERS IN MANUFACTURING.*

Year	Wheat-roughage-livestock	Wheat-small grain-livestock	Winter wheat	Wheat-pea	Earnings of manufacturing workers
1930	$-0.19	$-0.19	$ 0.24	.....	$ 0.55
1931	-0.45	-0.42	-0.08	.....	0.52
1932	-0.27	-0.32	-0.64	.....	0.45
1933	-0.37	-0.18	-0.79	.....	0.44
1934	-0.53	-0.37	-0.48	.....	0.53
1935	-0.21	-0.06	-0.25	$ 0.96	0.55
1936	-0.61	-0.40	0.25	0.98	0.56
1937	-0.41	-0.02	-0.02	0.70	0.62
1938	-0.20	-0.11	0.07	-0.19	0.63
1939	0.07	0.03	-0.27	0.49	0.63
1940	0.16	0.25	-0.03	0.44	0.66
1941	0.68	0.75	1.10	1.93	0.73
1942	0.94	0.96	1.95	5.15	0.85
1943	1.17	1.51	1.72	4.85	0.96
1944	1.25	1.31	1.92	4.57	1.02
1945	1.17	1.67	2.17	3.61	1.02
1946	1.45	1.75	2.95	5.75	1.09
1947	2.21	3.13	5.24	5.95	1.24
1948	1.90	2.58	2.80	3.74	1.35
1949	0.64	0.86	1.63	1.98	1.40
1950	1.05	1.68	2.62	2.77	1.46
1951	1.40	2.20	1.68	2.84	1.59
1952	0.24	0.75	4.32	4.33	1.67
1953	0.92	0.90	0.87	4.17	1.77
1954	0.39	0.16	1.94	4.55	1.81
1955	0.81	1.66	0.89	1.70	1.88
1956	0.37	2.05	0.34	2.82	1.98
1957†	0.66	0.55	0.82	2.91	2.07

*Hourly returns to labor on farms obtained from: Goodsell, Wylie D. Costs and returns, commercial family-operated farms by type and size. United States Department of Agriculture, Agr. Res. Serv. Stat. Bul. 197, Agr. Inf. Bul. 158, Agr. Inf. Bul. 176 and Agr. Inf. Bul. 176 (Rev. June 1958.)
Hourly returns to production workers in manufacturing obtained from: U.S. Dept. Commerce. Statistical Abstract of the United States. U.S. Govt. Print. Off. Wash., D.C. 1931-57.
†Preliminary.

APPLICATION TO WHEAT

Data for four important wheat-producing areas—wheat-roughage livestock, wheat- small grain -livestock, wheat-pea and winter wheat—were used in this study (see fig. 2).[27]

The hourly returns to operator and family labor in the wheat areas, as taken from the Goodsell reports, are shown in table 9. Returns to operator and family labor were negative or very low in every year from 1930 through 1940, but returns were high for the period 1942 to 1948, generally exceeding the earnings of manufacturing workers. The variations in farm operator and family labor returns between years, within areas and among areas within years are great (note particularly the years 1952, 1954 and 1956). These variations reflect the marked effects of weather factors on wheat production.

PARITY RETURNS INDICATOR

Partiy returns indicators were computed for the wheat areas using the base period 1949-54. Direct government payments were included in the gross income used to construct these parity returns indicators. Their exclusion from the computations would have lowered the average of the parity returns indicator for the period 1935-39 from 60 to 50. Operators in these areas received direct government payments in all years following 1934. These payments were sizable (more than 2 percent of the gross) during the years 1934 to 1944, 1956 and 1957.

The 1937-41 period was not used as an alternative base for wheat, since negative farm labor returns were received during part of this period, and as a result the ratios of farm labor returns to manufacturing workers earnings were very low. The average ratios of hourly farm labor returns to hourly earnings of manufacturing workers during the period 1949-54 are shown in table 10.

The parity returns indicators (the ratio between actual gross income and parity gross income multiplied by 100) for the four wheat areas together with the United States parity price ratio are given in table 11.

This table shows that the area parity returns indicators fluctuate considerably from year to year and differ among areas in many years. The parity returns indictors for the wheat-pea area do not show us much year-to-year variation as the indicators for the plains areas. Also, farmers in the wheat-pea area appear to have been much better off relative to the base period during the late 1930's than were farmers in the plains areas. A tendency for the area parity returns indicators to rise relative to the United States parity price ratio appears evident. The area parity returns indicators for the three plain areas averaged 42 for the period 1930-34, 53

TABLE 10. RATIO OF RETURNS PER HOUR OF OPERATOR AND FAMILY LABOR TO THE HOURLY EARNINGS OF MANUFACTURING WORKERS.

Type of farming area	Base period 1949-54
Wheat-roughage-livestock	0.48
Wheat- small grain -livestock	0.67
Winter wheat	1.35
Wheat-pea	2.15

[27]On the map, these areas are designated as spring wheat-roughage, spring wheat-small grain, Northwestern wheat-pea and winter wheat, respectively.

TABLE 11. PARITY RETURNS INDICATORS FOR WHEAT AREAS COMPARED WITH UNITED STATES PARITY PRICE RATIO, 1949-54 BASE.

Year	Wheat-roughage-livestock	Wheat-small grain-livestock	Winter wheat	Wheat-pea	Av. of wheat areas for which data are available	U. S. parity price ratio 1949-54 = 100
1930	62	61	80	....	68	85
1931	32	33	63	....	43	68
1932	42	34	40	....	39	59
1933	25	41	31	....	32	65
1934	16	21	46	....	28	76
1935	57	59	56	92	66	90
1936	1	19	77	93	48	94
1937	41	62	64	81	62	95
1938	51	56	64	57	57	80
1939	76	68	48	75	67	78
1940	85	85	58	74	76	83
1941	131	117	105	109	116	95
1942	142	122	131	168	141	107
1943	151	146	113	150	140	115
1944	148	130	116	140	134	110
1945	141	145	123	124	133	111
1946	151	143	141	152	147	115
1947	175	176	189	143	171	117
1948	150	146	121	110	132	112
1949	99	97	95	88	95	102
1950	114	120	113	96	111	103
1951	123	130	92	96	110	109
1952	81	90	139	107	104	103
1953	103	92	76	104	94	94
1954	83	72	92	106	88	91
1955	97	110	74	78	90	86
1956	82	117	64	88	88	85
1957	90	81	72	88	83	84

for the period 1935-39 and 119 for the period 1940-44. In comparison, the average United States parity ratios (on a 1949-54 base) for the same periods were 71, 87 and 102. Both series average 100 for the 1949-54 base period. The large differences between the two series are due, in part, to yield fluctuations caused by weather variations. It appears, however, that the removal of these effects would show the parity returns indicators rising relative to the United States parity ratio. The differences in results obtained by the parity returns concept as compared with the parity price concept will be more evident when the parity returns prices of the next section are examined.

PARITY RETURNS PRICES OF WHEAT

The computation of parity returns prices for wheat proceeds as explained previously. The parity returns price of wheat is equal to parity gross income divided by the total output expressed in wheat value equivalents. Total output was expressed in wheat value equivalents by multiplying all quantities by their respective relative prices. The relative prices, the r's, are the quotient of the average price of the product during the preceding 10 years and the average price of wheat during the same period. The ΣrQ for each area is expressed in terms of wheat at the winter wheat location. The quantities included in the ΣrQ are the algebraic sum of sales, inventory changes, farm products used in the home and net purchases of grain and livestock.

The wheat produced in the different areas are not identical products. The hard red winter wheat of the Southern Plains is used in bread and similar products requiring high-protein flour. Two types of wheat are produced in the Dakotas, hard red spring wheat for bread and durum wheat for macaroni. The soft white wheat of the Washington area is used primarily for pastries. The prices of hard winter wheat and spring wheat have moved in much the same manner, although the price of durum has improved somewhat relative to the other wheats. The price of soft white wheat in the wheat-pea area has risen relative to the price of winter wheat in the Southern Plains area, from 81 percent of the hard winter price during the 5 years 1935-39 to 97 percent during the 5 years 1953-57.

One might easily treat these two types of wheat as two commodities. In this analysis, however, soft white wheat has been converted to wheat in the Southern Plains equivalents to allow comparisons of prices among areas.

Computations of parity returns prices for wheat were made using current output, but are not included in this report. The parity returns prices were extremely variable, varying inversely with output. When current production, as expressed in ΣrQ, was low, the parity returns price of wheat was high, since the parity gross income changes only slightly from year to year. These parity returns prices were over $3 per bushel in several years, and they were as high as $44 per bushel in the wheat-roughage-livestock area in 1936. Because of the erratic movement in parity returns prices obtained by use of current production, regression analysis was employed to remove year-to-year variations in output resulting chiefly from variations in weather. The regression equations are presented in the appendix.

First, an estimate of the yearly increase in the output-input ratio (the ΣrQ divided by the quantity of inputs) was computed. This increase, assumed to be the same in all the wheat areas, was about 2.1 percent of the mean per year for the period 1930-57. The trend value of the output-input ratio, multiplied by the quantity of inputs, furnishes an estimate of production under "average" weather conditions. This trend, ΣrQ, and

TABLE 12. PARITY RETURNS PRICES OF WHEAT COMPUTED FROM TREND PRODUCTION BY AREAS, AND MODERNIZED PARITY PRICES OF WHEAT, 1949-54 BASE, IN DOLLARS PER BUSHEL.

Year	Wheat-roughage-livestock	Wheat-small grain-lvstk.	Winter wheat	Wheat-pea	Av. of areas for which data are available	Modernized parity price	Price rec'd. by farmers, winter-wheat area
1930	1.56	1.53	1.52	.....	1.54	1.16	0.69
1931	1.32	1.29	1.31	.....	1.31	0.96	0.37
1932	1.14	1.09	1.14	.....	1.12	0.80	0.33
1933	1.02	0.97	0.99	.....	0.99	0.76	0.62
1934	1.11	1.07	1.08	.....	1.09	0.86	0.81
1935	1.11	1.05	1.05	0.95	1.04	0.89	0.88
1936	1.08	1.05	1.04	0.94	1.03	0.87	0.97
1937	1.16	1.12	1.10	1.01	1.10	0.92	1.08
1938	1.12	1.10	1.05	1.00	1.07	0.88	0.61
1939	1.05	1.04	1.01	0.96	1.02	0.87	0.59
1940	1.04	1.03	0.99	1.00	1.02	0.87	0.68
1941	1.06	1.08	1.06	1.04	1.06	0.95	0.72
1942	1.20	1.21	1.19	1.17	1.19	1.10	1.00
1943	1.31	1.34	1.29	1.30	1.31	1.24	1.28
1944	1.40	1.42	1.38	1.37	1.39	1.28	1.43
1945	1.41	1.44	1.40	1.39	1.41	1.31	1.46
1946	1.46	1.47	1.46	1.46	1.46	1.42	1.77
1947	1.68	1.68	1.65	1.62	1.66	1.63	2.20
1948	1.84	1.84	1.79	1.77	1.81	1.78	2.09
1949	1.83	1.85	1.79	1.78	1.81	1.74	1.88
1950	1.82	1.82	1.79	1.80	1.81	1.80	1.96
1951	1.94	1.93	1.93	1.93	1.93	2.00	2.13
1952	2.00	1.96	2.01	1.98	1.99	2.05	2.06
1953	1.96	1.97	1.98	1.99	1.98	1.99	1.97
1954	1.91	1.95	1.96	1.98	1.95	2.02	2.06
1955	1.88	1.91	1.97	2.00	1.94	2.04	2.05
1956	1.89	1.94	2.00	2.09	1.98	2.09	1.95
1957	2.04	2.09	2.15	2.20	2.12	2.18	1.91

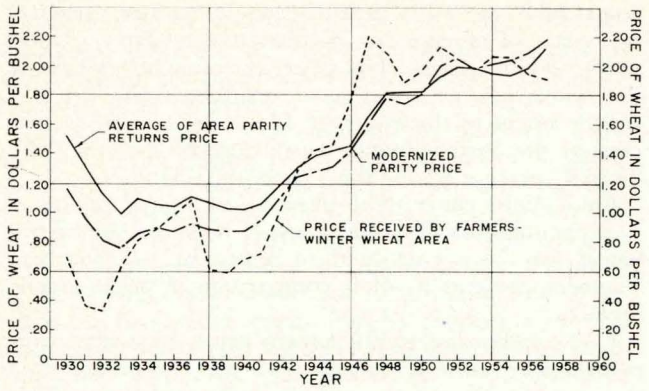

Fig. 4. Parity returns and modernized parity price of wheat compared with price received by farmers in the winter wheat area, 1949-54 base.

parity gross income were used to compute the parity returns prices shown in table 12. Minor adjustments were made in the base period ratio of farm to nonfarm labor returns to bring the area parity returns prices to the same level during the base period.

Comparison of the parity returns prices and the modernized parity prices shows that the two series changed at different rates during the period of the study, parity returns prices decreasing relative to modernized parity prices. Figure 4 illustrates the trends of these price series.

The area parity returns prices of wheat are a function of input prices and the output-input coefficients. Table 13 presents the indexes of input prices, the index of hourly earnings of manufacturing workers and the United States index of prices paid by farmers. The input prices indexes were computed by dividing parity gross income, less purchases of grain and livestock, by the quantity of total inputs, less purchases of grain and livestock. The index of input prices for the wheat-pea area has risen relative to input prices in other areas. This change has occurred because of the greater importance of operator and family labor (priced at a multiple of manufacturing earnings) in the input index for the wheat-pea area.

In the short run, the area trend parity returns prices move quite closely with the index of input prices; i.e., when the index of prices paid increases, a similar change is found in the parity returns prices. Over the long run, however, the influence of technological change on the output-input ratio and, thus, on the parity returns prices becomes more important. Using the trend to construct the parity returns prices assumes that the annual increase in output produced per unit of input was uniform over the period. This increase acts to lower the parity returns prices and is primarily responsible for the decrease in parity returns prices relative to modernized parity prices.

TABLE 13. PRICE INDEXES, 1949-54 = 100.

Year	Input prices				Hourly earnings of emply'd. manufactur-ing workers	Prices paid by farmers; including interest, taxes & wage rates
	Wheat-roughage-livestock	Wheat-small grain-lvstk.	Winter wheat	Wheat-pea		
1930	50	49	48	.....	34	55
1931	43	43	43	.....	32	48
1932	39	37	38	.....	28	41
1933	36	34	34	.....	27	40
1934	40	38	38	.....	33	44
1935	41	38	38	35	34	46
1936	41	39	39	35	34	46
1937	45	43	43	39	39	48
1938	44	43	42	39	39	46
1939	43	42	41	39	39	45
1940	43	42	41	41	41	46
1941	44	45	45	44	45	49
1942	51	52	51	51	53	56
1943	57	58	56	57	59	63
1944	63	63	62	62	63	67
1945	65	65	64	64	63	70
1946	69	69	68	69	67	76
1947	80	80	79	79	76	88
1948	90	90	87	87	84	95
1949	91	92	89	89	87	92
1950	92	92	91	92	91	94
1951	101	99	100	100	98	103
1952	106	103	106	105	103	105
1953	106	105	107	107	109	102
1954	104	106	107	108	112	103
1955	105	106	109	111	116	103
1956	107	110	113	118	122	105
1957	117	120	124	126	126	109

APPLICATION TO COTTON

The data for cotton are used as further empirical application of the procedures and computations set forth in the first part of this study. The data for two cotton areas, Southern Piedmont and Texas Black Prairie, are complete from 1930 to 1957. The data for one area, Texas High Plains (nonirrigated), commence with 1937. The data for three areas—Texas High Plains (irrigated), Mississippi Delta (large farms) and Mississippi Delta (small farms)—include only the years 1944 to 1957. The cotton data are unique in that, for two areas, data are compiled for two types of farms within one geographic area.

The returns to operator and family labor in the cotton areas, taken from data in the USDA reports, are shown in table 14. The returns to farm labor during the early 1930's were generally very low. Labor returns in these areas show moderate year-to-year variation, except in the Texas High Plains (nonirrigated) area where rainfall limits production. Large differences in labor returns among types of farms are evident. For example, labor and management returns to operators in the Mississippi Delta (large farms) are approximately 10 times as great as returns to operators in the Southern Piedmont area.

PARITY RETURNS INDICATOR

Parity gross income was computed for the six cotton areas using two base periods, 1937-41 and 1949-54. The ratios of hourly farm labor returns to hourly earnings of manufacturing workers for the six cotton areas are shown in table 15. The parity returns indicators (the ratio between actual gross income and parity gross income) for the six cotton areas and the United States parity price ratio are shown in table 16. The differences in the level of the parity returns indicators computed on the two base periods is not as great for cotton as it is for the other commodities included in this study.

Although the parity returns indicators differ considerably from the United States parity ratio in individual years, there is little evidence of a trend in one series relative to the other.

TABLE 14. HOURLY RETURN TO OPERATOR AND FAMILY LABOR ON COTTON FARMS COMPARED WITH HOURLY EARNINGS OF EMPLOYED PRODUCTION WORKERS IN MANUFACTURING.*

Year	So. Piedmont	Black Prairie	High Plains		Miss. Delta		Earnings of manufacturing workers
			Nonirrigated	Irrigated	Large farms	Small farms	
1930	$-0.01	$ 0.03	.....	.....	.....	.....	$0.55
1931	-0.04	-0.06	.....	.....	.....	.....	0.52
1932	-0.03	-0.01	.....	.....	.....	.....	0.45
1933	0.07	0.14	.....	.....	.....	.....	0.44
1934	0.10	0.17	.....	.....	.....	.....	0.53
1935	0.10	0.20	.....	.....	.....	.....	0.55
1936	0.13	0.25	.....	.....	.....	.....	0.56
1937	0.07	0.21	$0.56	.....	.....	.....	0.62
1938	0.08	0.16	0.20	.....	.....	.....	0.63
1939	0.12	0.19	0.41	.....	.....	.....	0.63
1940	0.14	0.22	0.36	.....	.....	.....	0.66
1941	0.12	0.33	1.09	.....	.....	.....	0.73
1942	0.27	0.34	1.40	.....	.....	.....	0.85
1943	0.25	0.52	1.73	.....	.....	.....	0.96
1944	0.28	0.41	1.72	$1.89	$2.61	$0.41	1.02
1945	0.32	0.43	0.52	0.51	2.10	0.40	1.02
1946	0.49	0.64	0.76	2.07	3.70	0.59	1.09
1947	0.43	1.02	3.95	5.07	4.63	0.61	1.24
1948	0.48	0.79	0.91	2.47	7.67	0.78	1.35
1949	0.22	0.85	3.26	4.28	2.75	0.44	1.40
1950	0.31	0.95	2.31	3.69	6.84	0.62	1.46
1951	0.64	0.55	2.84	5.58	3.32	0.47	1.59
1952	0.50	0.84	0.27	4.14	5.91	0.62	1.67
1953	0.41	1.09	-1.18	2.32	5.72	0.65	1.77
1954	0.26	0.33	1.37	4.04	3.44	0.48	1.81
1955	0.59	0.66	0.42	1.50	6.19	0.66	1.88
1956	0.31	-0.11	0.41	3.77	3.79	0.53	1.98
1957†	0.33	0.18	2.23	3.07	0.82	0.24	2.07

*Hourly returns to labor on farms obtained from: Goodsell, Wylie D. Costs and returns, commercial family-operated farms by type and size. United States Department of Agriculture, Agr. Res. Serv. Stat. Bul. 197, Agr. Inf. Bul. 158, Agr. Inf. Bul. 176 and Agr. Inf. Bul. 176 (Rev. June 1958).
Hourly returns to production workers in manufacturing obtained from: U. S. Dept. Commerce. Statistical Abstract of the United States. U. S. Govt. Print. Off., Wash., D.C. 1931-57.
†Preliminary.

PARITY RETURNS PRICES OF COTTON

The computation of parity returns prices for cotton proceeds as before, the relative prices (r's) being established by using the average cotton price as the divisor. Thus, the ΣrQ for the cotton areas represents the current production per farm expressed in cotton value equivalents. The current quantity produced, Q, includes the quantity sold, the change in inventory and the quantity consumed in the home. The 10-year average market price of cotton in the Southern Piedmont area was used as a standard in computing the r's for each area. Thus, the ΣrQ for each cotton area is the total production per farm expressed in "cotton at the Southern Piedmont location" equivalents.

The r's were established by use of the averages over the immediately preceding 10-year period, except for the first 10 years of data in each area (the years 1930 to 1939 in the Southern Piedmont and Texas Black Prairie areas, 1937 to 1946 in the Texas High Plains, nonirrigated, area and 1944 to 1953 in the other three areas). In the Southern Piedmont and Texas Black Prairie areas, the r's for these years were established from the data for 1930-39 and are constant during those years. In the other areas, the r's for the first 10 years of data were assumed to move in the same manner as they moved in the Black Prairie and Piedmont areas. If the r's for relatively important products are changing rapidly, parity returns prices in the different areas during the first years of data may not be completely comparable. The differences introduced by this method of computation do not appear to be very large, because of the importance of cotton in all areas.

Gross income is composed of sales, inventory changes,

TABLE 15. RATIO OF RETURNS PER HOUR OF OPERATOR AND FAMILY LABOR TO THE HOURLY EARNINGS OF MANUFACTURING WORKERS.

Type of farming area	Base period	
	1937-41	1949-54
Southern Piedmont	0.16	0.24
Black Prairie, Texas	0.34	0.48
High Plains, Texas (nonirrigated)	0.80	0.92
High Plains, Texas (irrigated)	*	2.47
Mississippi Delta (large)	*	2.88
Mississippi Delta (small)	*	0.34

*Data not available.

TABLE 16. PARITY RETURNS INDICATORS FOR THREE COTTON AREAS COMPARED WITH THE UNITED STATES PARITY PRICE RATIO.

Year	Southern Piedmont	Black Prairie	Nonirrigated High Plains	Irrigated High Plains	Mississippi Delta		Av. of areas for which data are available	U.S. parity price ratio base = 100
					Large farms	Small farms		
1937-41 base								
1930	83	76	....	....	....	....	80	98
1931	73	59	....	....	....	....	66	79
1932	70	64	....	....	....	....	67	68
1933	101	98	....	....	....	....	100	76
1934	103	98	....	....	....	....	100	88
1935	103	103	....	....	....	....	103	104
1936	110	112	....	....	....	....	111	108
1937	94	100	103	....	....	....	99	110
1938	94	92	78	....	....	....	88	92
1939	104	96	93	....	....	....	98	91
1940	107	99	89	....	....	....	98	95
1941	100	112	130	....	....	....	114	110
1942	121	106	133	....	....	....	120	124
1943	113	120	139	....	....	....	124	133
1944	115	106	131	....	....	....	117	128
1945	119	107	86	....	....	....	104	129
1946	134	122	96	....	....	....	117	134
1947	123	138	168	....	....	....	143	136
1948	123	118	95	....	....	....	112	130
1949	100	118	138	....	....	....	119	118
1950	108	123	128	....	....	....	120	119
1951	127	100	130	....	....	....	119	126
1952	115	110	78	....	....	....	101	118
1953	108	116	34	....	....	....	86	109
1954	98	88	100	....	....	....	95	105
1955	117	100	77	....	....	....	98	100
1956	99	69	74	....	....	....	92	97
1957	100	82	111	....	....	....	98	100
1949-54 base								
1930	77	69	....	....	....	....	73	85
1931	67	53	....	....	....	....	60	68
1932	63	56	....	....	....	....	60	59
1933	91	86	....	....	....	....	88	65
1934	94	86	....	....	....	....	90	76
1935	92	89	....	....	....	....	90	90
1936	100	98	....	....	....	....	99	94
1937	85	88	99	....	....	....	91	95
1938	84	80	74	....	....	....	79	80
1939	94	84	88	....	....	....	89	78
1940	96	87	84	....	....	....	89	83
1941	89	98	123	....	....	....	103	95
1942	109	93	127	....	....	....	110	107
1943	102	106	132	....	....	....	113	115
1944	104	94	126	89	98	111	104	110
1945	108	95	81	60	94	108	91	111
1946	122	109	91	90	104	129	108	115
1947	112	124	162	125	106	122	125	117
1948	112	107	90	90	117	130	108	112
1949	90	108	134	108	93	97	105	102
1950	98	112	122	101	113	112	110	103
1951	117	92	125	115	94	95	106	109
1952	106	101	75	100	105	104	98	103
1953	99	107	32	83	103	103	88	94
1954	90	80	95	97	91	91	91	91
1955	107	91	74	75	104	102	92	86
1956	90	62	71	91	91	93	83	84
1957	91	74	106	84	76	75	84	84

TABLE 19. PRICE INDEXES, 1949-54 = 100.

Year	Input prices: Southern Piedmont	Black Prairie	Non-irrigated	Irrigated	Large farms	Small farms	Hourly earnings of employd. mfg. workers	Prices pd. by farmers including interest, taxes and wage rates
1930	43	48	.....	.....	.....	.....	34	55
1931	36	40	.....	.....	.....	.....	32	48
1932	30	34	.....	.....	.....	.....	28	41
1933	31	32	.....	.....	.....	.....	27	40
1934	38	39	.....	.....	.....	.....	33	44
1935	38	40	.....	.....	.....	.....	34	46
1936	38	39	.....	.....	.....	.....	34	46
1937	40	41	40	.....	.....	.....	39	48
1938	39	41	41	.....	.....	.....	39	46
1939	40	41	41	.....	.....	.....	39	45
1940	41	42	42	.....	.....	.....	41	46
1941	45	47	46	.....	.....	.....	45	49
1942	55	54	52	.....	.....	.....	53	56
1943	61	60	60	.....	.....	.....	59	63
1944	66	66	65	65	66	66	63	67
1945	69	66	67	66	69	67	63	70
1946	78	73	73	73	82	73	67	76
1947	85	83	84	83	87	82	76	88
1948	92	88	90	90	93	91	84	95
1949	90	91	92	92	89	90	87	92
1950	93	93	94	94	97	93	91	94
1951	103	103	100	102	102	101	98	103
1952	105	105	104	105	106	104	103	105
1953	104	104	109	104	102	105	109	102
1954	104	106	101	103	105	107	112	103
1955	110	106	105	105	104	106	116	103
1956	110	112	109	108	109	108	122	105
1957	117	119	117	119	116	115	126	109

APPLICATION TO MILK

Data for four dairy areas are included in the "Costs and Returns" publications of the USDA. These areas are the Central Northeast, dairy-hog, Eastern Wisconsin and Western Wisconsin. Data for two of these (the Central Northeast and dairy-hog) are available at the present time and are included here. The Central Northeast area is located in New York and adjacent states, while the dairy-hog area is in Minnesota. Specific boundaries are given in fig. 2.

Table 20 can be used to compare hourly returns to operator and family labor in the two dairy-farm areas with the earnings of manufacturing workers. One sees that farm labor returns were low during the decade of the 1930's (negative in some of the early years of this period). The nature of the change in relationship between labor returns on dairy farms and earnings of employed manufacturing workers can be illustrated by a few averages. The average hourly returns to labor in dairy farming from 1930 to 1939 were \$0.09 in the Central Northeast and \$0.06 in the dairy-hog areas, while the average hourly earnings of employed manufacturing workers for the same period were \$0.55. The average hourly farm labor returns from 1945 to 1954 were \$0.73 in the Central Northeast dairy area and \$0.69 in the dairy-hog area, while employed manufacturing workers received an average of \$1.44 per hour during the same period. Labor returns in the dairy areas thus averaged 49 percent of the earnings of manufacturing workers during this latter period, as compared with 14 percent during the earlier period. A second interesting point illustrated in this table is the relatively uniform manner in which returns to labor rise and fall in the two dairy areas. After 1939, the level of the returns to labor is very similar in the two areas.

The ratios of hourly farm labor returns to hourly earnings of manufacturing workers for the two periods 1937-41 and 1949-54 are shown in table 21. The returns to operator and family labor were considerably higher relative to manufacturing earnings during the latter period.

TABLE 20. HOURLY RETURNS TO OPERATOR AND FAMILY LABOR ON DAIRY FARMS COMPARED WITH HOURLY EARNINGS OF EMPLOYED PRODUCTION WORKERS IN MANUFACTURING.*

Year	Central Northeast	Dairy-hog	Earnings of manufacturing workers
1930	\$ 0.15	\$ 0.15	\$0.55
1931	0.07	–0.07	0.52
1932	–0.01	–0.07	0.45
1933	0.02	–0.03	0.44
1934	0.02	–0.12	0.53
1935	0.16	0.16	0.55
1936	0.12	0.12	0.56
1937	0.16	0.18	0.62
1938	0.13	0.13	0.63
1939	0.08	0.15	0.63
1940	0.20	0.14	0.66
1941	0.25	0.29	0.73
1942	0.46	0.45	0.85
1943	0.46	0.48	0.96
1944	0.52	0.46	1.02
1945	0.64	0.54	1.02
1946	0.81	0.69	1.09
1947	0.71	0.64	1.24
1948	0.98	0.88	1.35
1949	0.53	0.53	1.40
1950	0.64	0.50	1.46
1951	0.89	0.90	1.59
1952	0.74	0.86	1.67
1953	0.62	0.73	1.77
1954	0.69	0.60	1.81
1955	0.80	0.57	1.88
1956	0.73	0.67	1.98
1957†	0.90	0.58	2.07

*Hourly returns to labor on farms obtained from: Goodsell, Wylie D. Costs and returns, commercial family-operated farms by type and size. United States Department of Agriculture, Agr. Res. Serv. Stat. Bul. 197, Agr. Inf. Bul. 158, Agr. Inf. Bul. 176 and Agr. Inf. Bul. 176 (Rev. June 1958).
Hourly returns to production workers in manufacturing obtained from: U. S. Dept. Commerce. Statistical Abstract of the United States. U. S. Govt. Print. Off., Wash., D.C. 1931-57.
†Preliminary.

PARITY RETURNS INDICATOR

With the use of the definitions and procedures established in previous sections of this study, parity returns indicators were calculated using 1937-41 and 1949-54 as base periods. The parity returns indicator (the ratio between actual gross income and parity gross income expressed in percentages) is shown in table 22. The effect of using two different base periods can be seen by observing that the parity returns indicator based on the 1937-41 period is considerably higher than the indicator constructed on the 1949-54 base period.

Careful observation reveals a slight upward trend in the parity returns indicator for the dairy-hog area relative to the United States parity price ratio over the period. The parity returns indicator for the Central Northeast dairy area, however, shows no significant trend up or down relative to the United States parity price ratio, but does show less variation in level.

TABLE 21. RATIO OF RETURNS PER HOUR OF OPERATOR AND FAMILY LABOR TO THE HOURLY EARNINGS OF MANUFACTURING WORKERS.

Area	Base period: 1937-41	1949-54
Central Northeast	0.25	0.42
Dairy-hog	0.27	0.43

TABLE 22. PARITY RETURNS INDICATORS FOR DAIRY AREAS COMPARED WITH UNITED STATES PARITY PRICE RATIO.

Year	1937-41 base				1949-54 base			
	Central Northeast	Dairy-hog	Av. of two areas	U.S. parity price ratio 1937-41 = 100	Central Northeast	Dairy-hog	Av. of two areas	U.S. parity price ratio 1949-54 = 100
1930	102	85	94	98	91	75	83	85
1931	92	64	78	79	81	57	69	68
1932	80	63	72	68	71	55	63	59
1933	86	67	76	76	76	58	67	65
1934	85	49	67	88	75	42	58	76
1935	103	103	103	104	91	88	90	90
1936	98	95	96	108	87	82	84	94
1937	100	103	102	110	89	88	88	95
1938	97	93	95	92	85	80	82	80
1939	91	95	93	91	80	81	80	78
1940	104	93	98	95	92	80	86	83
1941	107	114	110	110	94	97	96	95
1942	123	128	126	124	108	109	108	107
1943	119	125	122	133	104	107	106	115
1944	120	118	119	128	106	101	104	110
1945	129	127	128	129	114	109	112	111
1946	136	136	136	134	121	118	120	115
1947	124	124	124	136	110	108	109	117
1948	135	135	135	130	120	118	119	112
1949	110	110	110	118	97	96	96	102
1950	114	106	110	119	101	93	97	103
1951	122	125	124	126	109	111	110	109
1952	113	120	116	118	101	106	104	103
1953	107	112	110	109	95	99	97	94
1954	110	105	108	105	97	93	95	91
1955	114	103	108	100	100	91	96	86
1956	110	106	108	97	96	93	94	85
1957	115	101	108	100	101	89	95	84

PARITY RETURNS PRICES OF MILK

The parity returns prices of milk were obtained by dividing parity gross income by output per farm expressed in milk equivalents (ΣrQ). The r's were established from 10-year moving averages. In dairy areas, purchases of grain and hay were treated as expenses and included in the parity gross income.

An adjustment was made in the parity returns prices between dairy areas to compensate for the differential in location. This was done by taking the absolute difference between the market prices in the two areas and adding it to the parity returns price in the dairy-hog area. This adjusted the parity returns prices in the dairy-hog area to the Central Northeast price level. The absolute difference was used to adjust the prices in the case of milk, rather than the relative difference (as in the case of the other commodities), because of the wide spread in market prices between the two widely separated areas.

TABLE 23. DAIRY AREA PARITY RETURNS PRICES OF MILK AND MODERNIZED PARITY PRICES OF MILK, IN DOLLARS PER 100 POUNDS.

Year	1937-41 base				1949-54 base				
	Central Northeast	Dairy-hog	Av. of two areas	Modernized parity price	Central Northeast	Dairy-hog	Av. of two areas	Market price Central Northeast	Modernized parity price
1930	2.32	2.46	2.39	2.25	2.59	2.70	2.64	2.40	2.61
1931	1.96	2.39	2.18	1.97	2.22	2.65	2.44	1.82	2.29
1932	1.68	1.92	1.80	1.71	1.89	2.11	2.00	1.30	1.98
1933	1.66	1.80	1.73	1.68	1.87	2.00	1.94	1.43	1.94
1934	1.91	2.28	2.10	1.85	2.16	2.59	2.38	1.69	2.15
1935	1.77	1.86	1.82	1.95	2.00	2.09	2.04	1.84	2.26
1936	2.00	2.09	2.04	1.97	2.25	2.36	2.30	1.95	2.28
1937	1.94	2.02	1.98	2.08	2.20	2.28	2.24	1.96	2.40
1938	1.89	2.01	1.95	1.92	2.16	2.27	2.22	1.79	2.23
1939	1.99	1.81	1.90	1.91	2.27	2.05	2.16	1.79	2.22
1940	1.89	1.88	1.88	1.94	2.16	2.12	2.14	2.00	2.25
1941	2.16	1.99	2.08	2.08	2.46	2.26	2.36	2.36	2.41
1942	2.24	2.19	2.22	2.36	2.57	2.49	2.53	2.80	2.74
1943	2.77	2.53	2.65	2.63	3.18	2.88	3.03	3.26	3.04
1944	2.71	2.61	2.66	2.74	3.14	2.98	3.06	3.43	3.18
1945	2.55	2.59	2.57	2.85	2.96	2.95	2.96	3.44	3.30
1946	2.95	2.84	2.90	3.10	3.37	3.20	3.28	4.29	3.59
1947	3.63	3.46	3.54	3.60	4.12	3.88	4.00	4.54	4.17
1948	3.83	3.61	3.72	3.89	4.33	4.01	4.17	5.29	4.50
1949	3.96	3.68	3.82	3.77	4.51	4.08	4.30	4.27	4.37
1950	3.68	3.89	3.78	3.81	4.17	4.30	4.24	4.06	4.41
1951	3.94	3.95	3.94	4.12	4.45	4.33	4.39	4.63	4.78
1952	4.25	3.96	4.10	4.12	4.76	4.33	4.54	4.83	4.77
1953	3.93	4.04	3.98	3.96	4.45	4.42	4.44	4.35	4.58
1954	3.74	3.98	3.86	3.96	4.27	4.36	4.32	4.36	4.58
1955	3.65	3.88	3.76	3.96	4.18	4.25	4.22	4.40	4.58
1956	3.82	3.89	3.86	4.03	4.38	4.26	4.32	4.34	4.67
1957	3.90	4.47	4.18	4.16	4.46	4.66	4.56	4.66	4.82

The rental allowance for the home, dairy subsidies and other direct government payments were deducted from parity gross income, and the remaining parity gross income divided by the ΣrQ to obtain the parity returns prices of milk. The parity returns prices of milk, computed with current production quantities, are presented in table 23. The modernized parity price and market price of milk in the Central Northeast area are included for comparison. The modernized parity price of milk for the Central Northeast was computed by methods analogous to those explained previously.

The year-to-year variations in the parity returns prices were greater in the Central Northeast area during the last 7 years of the period studied than they were in the dairy-hog area. They were also greater than the variations in the modernized parity prices. In the previous years, however, there was no marked general difference in the annual price variations in one area compared with the other, or with modernized parity prices. The wider price variations in the Central Northeast area during the latter years resulted mainly from the variations in the prices of inputs.

For the United States as a whole, the price of milk has been trending downward relative to other prices. This means that the moving average of parity prices tends to overvalue milk relative to the current price situation. Hence, the modernized parity price is above the market price during the base period; i.e., $4.58 compared with $4.42 per 100 pounds.

Total production in the dairy areas moves in a relatively smooth trend when compared with the fluctuations in production evidenced in other areas, indicating that weather has a much smaller effect on total production in the dairy areas. Therefore, no attempt was made to include a weather variable when estimating a trend production (ΣrQ). The regression model $\frac{Y}{X_1} = a + bX_2$ is used, where $\frac{Y}{X_1}$ is the ratio of ΣrQ to inputs and X_2 is time. Inputs are computed by modifying the Goodsell index as described in the appendix. The following correlation coefficients of determination, r^2, were obtained: Central Northeast area, 0.71 and dairy-hog area, 0.83. The average ratio of ΣrQ to inputs for the 28 years 1930-57 was approximately 0.24 and 0.30 for the Central Northeast and dairy-hog areas, respectively. The estimated time trend in this ratio was about 0.0025 per year in the Central Northeast area and about 0.0056 per year in the dairy-hog area.

The parity returns prices of milk shown in table 24 and fig. 6 were computed by dividing parity gross income by the trend ΣrQ. The trend ΣrQ is obtained by multiplying the quantity of inputs by the trend estimate of the output-input ratio. Direct government payments were subtracted from the parity gross income, since ΣrQ was computed as a function of all inputs which make up the parity gross income.

Table 25 shows the input price indexes for each area, along with the United States parity indexes and the index of earnings of manufacturing workers with 1949-54 as a base period. It can be seen that the area indexes of input prices increased slightly relative to the United States parity index. The price indexes agree closely between areas, although it is possible that there was a slight increase in the dairy-hog area relative to the Northeast area.

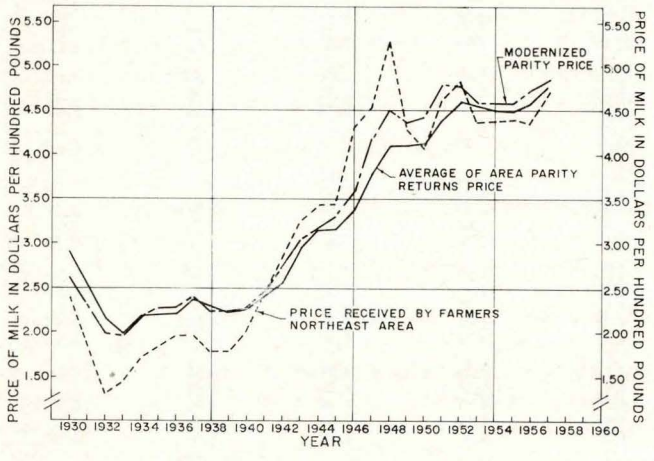

Fig. 6. Parity returns price and modernized parity price of milk compared with price received by farmers for milk in the Central Northeast area, 1949-54 base.

COMPARISON OF RESULTS FOR THE DIFFERENT PRODUCTS

This section compares the results obtained in the preceding commodity sections.

PARITY RETURNS INDICATOR

The annual parity returns indicators for wheat, for cotton, for corn and for dairy areas are compared with the United States parity price ratio in table 26. This table shows that over the period 1930-57, except for the dairy areas, the parity returns indicators display more year-to-year variation than the United States

TABLE 24. PARITY RETURNS PRICES OF MILK BY AREAS COMPUTED FROM TREND PRODUCTION AND MODERNIZED PARITY PRICES OF MILK, 1949-54 BASE, IN DOLLARS PER 100 POUNDS.

Year	Central Northeast	Dairy-hog	Av. of two areas	Modernized parity price	Market price in Central Northeast
1930	2.84	3.01	2.92	2.61	2.40
1931	2.38	2.69	2.54	2.29	1.82
1932	1.95	2.33	2.14	1.98	1.30
1933	1.84	2.12	1.98	1.94	1.43
1934	2.04	2.30	2.17	2.15	1.69
1935	2.09	2.31	2.20	2.26	1.84
1936	2.09	2.31	2.20	2.28	1.95
1937	2.28	2.46	2.37	2.40	1.96
1938	2.16	2.39	2.28	2.23	1.79
1939	2.13	2.32	2.22	2.22	1.79
1940	2.18	2.32	2.25	2.25	2.00
1941	2.32	2.40	2.36	2.41	2.36
1942	2.64	2.66	2.65	2.74	2.80
1943	2.96	2.92	2.94	3.04	3.26
1944	3.21	3.08	3.14	3.18	3.43
1945	3.22	3.11	3.16	3.30	3.44
1946	3.49	3.27	3.38	3.59	4.29
1947	3.94	3.63	3.78	4.17	4.54
1948	4.23	3.98	4.10	4.50	5.29
1949	4.13	4.06	4.10	4.37	4.27
1950	4.10	4.16	4.13	4.41	4.06
1951	4.40	4.41	4.40	4.78	4.63
1952	4.67	4.54	4.60	4.77	4.83
1953	4.54	4.54	4.54	4.58	4.35
1954	4.45	4.53	4.49	4.58	4.36
1955	4.43	4.55	4.49	4.58	4.40
1956	4.52	4.66	4.59	4.67	4.34
1957	4.75	5.06	4.90	4.82	4.66

TABLE 25. PRICE INDEXES FOR DAIRY AREAS AND MANUFACTURING EARNINGS COMPARED WITH UNITED STATES INDEX OF PRICES PAID BY FARMERS, 1949-54 = 100.

Year	Input prices: Central Northeast	Input prices: Dairy-hog	Hourly earnings of employed manufacturing workers	Prices paid by farmers including interest, taxes and wage rates
1930	52	49	34	55
1931	44	43	32	48
1932	36	37	28	41
1933	35	33	27	40
1934	39	38	33	44
1935	41	38	34	46
1936	41	39	34	46
1937	45	43	39	48
1938	43	43	39	46
1939	43	42	39	45
1940	45	43	41	46
1941	48	46	45	49
1942	55	53	53	56
1943	62	59	59	63
1944	68	64	63	67
1945	69	65	63	70
1946	75	70	67	76
1947	86	80	76	88
1948	93	89	84	95
1949	92	90	87	92
1950	92	92	91	94
1951	100	100	98	103
1952	107	105	103	105
1953	105	106	109	102
1954	104	106	112	103
1955	105	107	116	103
1956	108	111	122	105
1957	114	113	126	109

parity price ratio. This is a direct result of the fact that the parity returns indicators reflect changes in the output-input ratios as well as changes in prices, and of the fact that the parity returns indicators are computed for relatively small areas. The year-to-year variation in the parity returns indicator is particularly marked for the wheat areas where the year-to-year variation in yields is large.

The parity returns indicators for the corn and wheat areas rose nearly 20 points relative to the United States parity price ratio over the period studied. Although input prices in these areas rose relative to the United States index of prices paid, sizable improvements in the rate at which inputs were transformed into outputs resulted in the upward trend of the parity returns indicator relative to the parity price ratio.

TABLE 26. PARITY RETURNS INDICATORS, 1949-54 = 100.

Year	Corn areas	Wheat areas	Cotton areas	Milk areas	U. S. parity price ratio
1930	64	68	73	83	85
1931	55	43	60	69	68
1932	48	39	60	63	59
1933	44	32	88	67	65
1934	34	28	90	58	76
1935	87	66	90	90	90
1936	60	48	99	84	94
1937	94	62	91	88	95
1938	77	57	79	82	80
1939	78	67	89	80	78
1940	76	76	89	86	83
1941	92	116	103	96	95
1942	112	141	110	108	107
1943	110	140	113	106	115
1944	100	134	104	104	110
1945	102	133	91	112	111
1946	128	147	108	120	115
1947	105	171	125	109	117
1948	128	132	108	119	112
1949	104	95	105	96	102
1950	102	111	110	97	103
1951	109	110	106	110	109
1952	101	104	98	104	103
1953	90	94	88	97	94
1954	93	88	91	95	91
1955	79	90	92	96	86
1956	86	88	83	94	85
1957	83	83	84	95	84

TABLE 27. MODERNIZED PARITY PRICES OF CORN, WHEAT, COTTON AND MILK, AS A PERCENT OF THE CORRESPONDING PARITY RETURNS PRICE.

Year	Corn	Wheat	Cotton	Milk
1930	75	75	126	89
1931	73	73	130	90
1932	77	71	130	93
1933	85	77	123	98
1934	83	79	107	99
1935	88	86	102	103
1936	88	84	101	104
1937	90	84	100	101
1938	91	82	92	98
1939	92	85	86	100
1940	89	85	83	100
1941	89	90	83	102
1942	90	92	87	103
1943	94	95	88	103
1944	94	92	86	101
1945	96	93	86	104
1946	99	97	85	106
1947	100	98	93	110
1948	101	98	97	110
1949	101	96	93	107
1950	101	99	93	107
1951	103	104	98	109
1952	101	103	97	104
1953	100	101	95	101
1954	101	104	97	102
1955	101	105	97	102
1956	101	106	97	102
1957	98	103	93	102

The ratio of output per unit of input in the dairy areas also increased, but the ratio of prices received to prices paid declined relative to the United States parity price ratio. These two trends tended to offset each other, with the result that the parity returns indicators in these areas moved in much the same manner as the United States parity ratio. After 1952, the parity returns indicator rose (relatively) about 10 points.

There appeared to be little change in the output-input ratios in the cotton areas during the period studied. Likewise, the ratio of prices received to input prices displayed no long-time trend relative to the United States price ratio.

PARITY RETURNS PRICES

Table 27 and fig. 7 show a comparison of modernized parity prices with the parity returns prices for the four products. Four pairs of lines would be too much to show on one chart. So in fig. 7, the modernized parity price for each product is plotted as a percentage

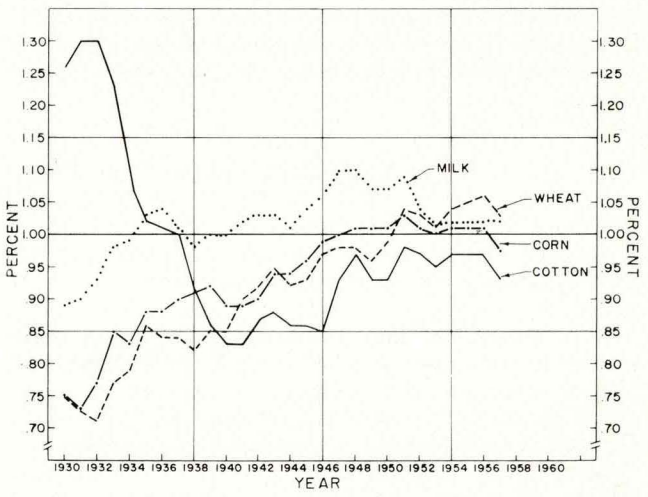

Fig. 7. Modernized parity price as a percent of parity returns price of corn, wheat, cotton and milk.

of the corresponding parity returns price for that product. The four then can be compared.

There is a definite upward trend in the modernized parity prices of wheat and corn relative to the parity returns prices. The modernized parity price of wheat increased 28 percent relative to the parity returns price during the 28 years studied, while the percentage change was 23 percent for corn. The modernized parity price of cotton fell more than 40 percent relative to the parity returns price until 1940; after that time, the trend rose about 10 percent.

To the extent to which changes in the parity returns prices measure changes in costs of production, it appears that changes in modernized parity prices rose significantly relative to changes in costs during this period. The quantity of inputs required to produce a bushel of corn or wheat or 100 pounds of milk definitely decreased during the period studied. No such improvement was observable in cotton production.

Introduction of earnings of employed manufacturing workers into the index of input prices caused the index of input prices to increase relative to the United States prices-paid index. In the wheat and corn areas, the index of output per unit of input increased faster than the relative rise of input prices, resulting in the fall of parity returns prices relative to modernized parity. In the dairy areas, output per unit of input increased at a slower rate, hence, parity returns prices and modernized parity prices diverged less.

Market prices are more important in determining the level of modernized parity prices than of parity returns prices. The ratio of market price to prices received for all commodities for the preceding 10 years is used in both computations. In the modernized parity calculations, "all" commodities means those included in the United States prices-received index, while in the parity returns formula, "all" refers only to those commodities produced in that particular area. Thus, for example, the ratio of the prices received for corn to the index of prices received can be expected to vary less in the parity returns computations because fewer commodities are included in the prices-received index (and those included are more closely related to corn in production), and as a corollary, corn is more important in the index. The movements in the modernized parity price of cotton relative to the parity returns prices resulted primarily from shifts in the price received for cotton relative to the United States index of prices received.

OVER-ALL APPRAISAL

Several features of the resource returns indicator as a measure of economic status and the implications of such a measure for agricultural policy may now be appraised.

It seems evident that a measure based upon parity returns to resources employed in agriculture should provide a more accurate measure of farmers' economic status than the present parity ratio, since it reflects changes in technological output-input relationships.

Although it is not difficult to construct a conceptual framework around which to build the parity returns structure, giving empirical content to the system presents a number of problems. Among the most troublesome are the following:

a. It is difficult to identify "comparable resources" on and off farms. This identification is particularly complex in the case of the human (labor) resource. Are the skills and ability demanded of farm operators in the Corn Belt, for example, similar to those required of semi-skilled factory workers or factory foremen? The skills and management ability required to manage a large farm with a total investment of $200,000 differ considerably from those required of a small farm operator or of a production worker. Similar problems arise in connection with returns to capital. Is the level of risk surrounding the working capital on the farm most nearly comparable to common stocks, preferred stocks, corporate bonds or to some other type of urban investment?

b. Defining comparable returns to similar resources under widely differing working conditions is an equally complex problem. Both the comparable resources problem in part, and the comparable returns problem to a greater degree, necessitate recourse to the "base period" device. Thus the level of the parity returns indictor becomes largely a function of the base period chosen. On this score, the parity returns structure is no better than the conventional parity price system.

c. The efficiency with which resources are utilized varies among farms and among areas. This creates the problem of selecting the farm units from which data will be obtained. The estimates in the foregoing report are based upon the operations of the "average commercial farmer" in more or less homogenous type-of-farming operations.

d. The parity returns indicator involves the assembling and computing of considerable quantities of data. Since sample surveys seem to be the only feasible means of obtaining some of the needed data, the returns indicator is subject to sampling error. Obtaining separate measurements of quantities and prices for a number of production areas naturally requires the assembling of more data than is required for the construction of a single price index for the country as a whole.

e. The use of detailed data means that computation of a parity returns indicator cannot be completed until some time after the end of the production period. Estimates could be made, however, by using price indexes and projected output-input relationships.

f. The average return per farm operator in each area covers a wide diversity of returns among individual farms. The diversity is not as great, however, as that which lies behind the present parity prices; the area in each case is smaller and more homogeneous than the area covered by the present parity prices.

In this study, the calculations were carried out independently for several rather small production areas. In addition, simple averages of the resulting parity returns prices and parity returns indicators were computed for areas producing the same commodity. Once an adjustment was made to remove the effects of weather, the movements through time of the parity returns prices computed for the individual small areas were quite similar. Thus, the simple average price computed in this study would be quite similar to an average price computed by weighting each area price by the produc-

tion in that area. Different sources of data, methods of aggregation and computation could be used while retaining resource returns as the parity criterion. For example, it would be possible to convert the present parity price ratio into a parity returns indicator by deleting the portion of the prices-paid index devoted to family living items, adding a component to the prices-paid index representing labor returns in the nonfarm segment and multiplying the resulting ratio of prices paid to prices received by an index of output per unit of input.

Parity returns prices might also be established using a method similar to the present modernized parity computations. Parity returns prices could be defined as the product of an adjusted base price, the modified prices paid index just described and an index of output per unit of input.

It would also be possible to compute a parity returns price of a commodity such as cotton using data obtained from all cotton-producing areas and computing a ratio of farm to nonfarm labor returns from the avage returns in these areas. The data would be averaged first, then a single price computed—as opposed to the procedure used in this study wherein prices were computed from the ratio of farm to nonfarm returns in each area—and the resulting set of prices then averaged. Aggregation before computation would mean that only one ratio of labor returns and one price would need to be computed. Shifts of production from one geographic area to another could influence the price computed from a single ratio of labor returns. Assume that farmers in one area are currently receiving half as much for their labor as those in an adjacent area. The average ratio for all producers then falls between these two extremes. Use of the common ratio to compute parity prices is equivalent to establishing parity prices based upon the common ratio for both areas, then constructing a weighted average of these prices—the weights being proportionate to production. Use of the common ratio and the assumed pattern of earnings would result in higher parity prices for the area of low-labor returns. Hence a shift in production to the area of high-labor returns would cause the area of low-labor returns to receive less weight in the average, and, as a result, the average parity price would fall.

PARITY PRICES AND SUPPORT PRICES

Although a resource returns indicator is a more accurate index of farmers' economic status than a price index or ratio, it is only an index. Thus, the use of parity returns prices in a price support program would not necessarily eliminate some features of price support programs which have been subjected to criticism.

Some of the criticisms leveled at parity prices are really criticisms of price support programs:

a. Some observers criticize attempts to use support prices to raise incomes as well as to stabilize prices. These persons point out the high costs of storing the large stocks that accumulate and the ultimate necessity of disposing of these "surplus" stocks.

b. Additional criticism is leveled at the misallocation of resources within agriculture and between agriculture and the rest of the economy which may arise under extended support operations.

c. Some critics claim that parity prices are "too high" or "unrealistic." This statement requires a comparison of "cost" situations or of relative income situations, but this comparison is often implicit rather than explicit.

This study is concerned only with methods for comparing incomes or resource returns in differing occupations. No absolute statements can be made concerning the comparative magnitudes of these returns, since economics lacks a logical framework for making quantitative interperson or intergroup comparisons of well-being. Therefore, comparisons must be related to a base period. Once a base period is selected, it is possible to compute the gross income defined here as parity and finally, the prices necessary to yield parity.

Because of the close relationship which has previously existed between parity prices and support operations, one further comment may be in order. The purpose of these support operations has not always been clear. If the purpose is to provide income support through the price mechanism, the parity returns prices provide a better guide than do parity prices. This superiority flows directly from the substitution of resource returns for prices as the criterion of parity.

If support prices are to be used only for stabilization, then support must be set in accordance with the underlying long-run supply and demand situation. For this purpose, a system whereby support prices were tied more closely to long-run market equilibrium prices would be preferable to the parity returns prices developed here.

APPENDIX

Variations in the total output per farm arise from changes in the quantity and combination of inputs, changes in technology and changes in weather conditions. The purpose of the procedures described here is to remove variations in production which are caused by variations in weather conditions. The estimate of production under "average" weather conditions used in the text is obtained by multiplying the estimated trend value of the output-input ratio by the quantity of inputs.

In order to use multiple regression procedures to estimate a trend in the output-input ratio, it was necessary first to construct a measure of the quantity of inputs and a measure of weather conditions. In the absence of previous data processing, one would construct an index of inputs using the same base period as that employed in the parity comparisons. The weight assigned to the labor input (p_{0L}) would be the actual return during the base period. This weighting would give $\Sigma P_0Q_0 = \Sigma p_0q_0$. In this study, however, the index of inputs constructed by Goodsell was modified, rather than a new index of inputs constructed with 1949-54 base weights.

The Goodsell index of the form Σq_1p_0 is computed with 1947-49 prices as weights. The per-acre land input is computed by multiplying the 1947-49 per-acre value of land and buildings by the 1947-49 Federal Land Bank mortgage interest rate. To estimate the total input of land services, the per-acre value is multiplied by the number of acres. The capital input is the product of the Jan. 1 inventory of crops, livestock and machinery, valued at 1947-49 prices, and the 1947-49 Federal Land Bank interest rate. Operator and family labor is included in the index at the wage of hired farm labor during the 1947-49 period.

For the purpose of this study, the input value, p_0, for operator and family labor was obtained by adjusting the actual return to labor during the 1949-54 period to the 1947-49 level. That is, the hourly return to operator and family labor during the 1949-54 period was divided by hourly earnings of manufacturing workers during the same period and this quantity multiplied by the hourly earnings of manufacturing workers for the 1947-49 period. The total value of the operator and family labor input is the product of the input value per hour and the total hours. Grain and livestock purchases are not included in the inputs, since they are treated as negative outputs.

Although it would be possible to compute a regression of output (ΣrQ) on time, inputs and weather, two factors complicate such a regression. The fact that quantity of inputs includes items used in harvesting and handling would tend to bias the input coefficient upward. Secondly, there is a high correlation between inputs and time; i.e., inputs have been increasing over time. Therefore, the ratio of output to input ($\Sigma rQ/\Sigma p_0q_1$) was formed and the regression of this ratio on time and weather variable computed for each area. The estimating equations and procedures are presented by commodity.

CORN

A weather variable designed to reflect conditions affecting production was constructed for each area. In the discussion of these variables, r will denote total monthly rainfall and T average monthly temperature. The subscripts—m, jn, jl, and a—will denote the months of May, June, July and August, respectively.

Two types of weather variables were constructed, one from rainfall data and one from temperature data. The basic hypothesis underlying construction of the weather variable based on rainfall is that, for a given month, rainfall beyond a certain quantity has little effect on production. The corresponding hypothesis concerning temperature is that variations in temperature below a certain point have little influence on output. Since there is an inverse correlation between rainfall and temperature, the two hypotheses are roughly comparable. It is quite possible that cool temperatures during the months of May and June may delay the maturity and/or decrease the yields of some crops, such as corn. On the other hand, there is probably a corresponding increase in the production of small grains and hay. Attempts to include a variable reflecting the existence of cold or wet springs did not yield significant results. The period of 1 month was selected for ease in data collection.

The break-off levels of rainfall and temperature used in constructing the variables are judgment points selected by studying the distribution of rainfall and temperature in years of high production.

The weather variables were constructed for the respective areas in the following manner:[31]

Hog-beef fattening area:

$$X_2 = T'_m + T'_{jn} + T'_{jl} + T'_a$$

where:

T'_m	$= 64$	$T_m \leqslant 64$
	$= T_m$	$T_m \geqslant 64$
T'_{jn}	$= 72$	$T_{jn} \leqslant 72$
	$= T_{jn}$	$T_{jn} \geqslant 72$
T'_{jl}	$= 76$	$T_{jl} \leqslant 76$
	$= T_{jl}$	$T_{jl} \geqslant 76$
T'_a	$= 74$	$T_a \leqslant 74$
	$= T_a$	$T_a \geqslant 74$

The temperatures are averages of temperatures in

[31]The temperatures given in degrees Fahrenheit are monthly averages computed by averaging the daily highs and daily lows. The weather bureau summarizes these temperatures and the total monthly rainfall amounts by sections of states. Where these sections approximated the areas under consideration, they were combined as indicated. In the cash-grain area, data were obtained from the following stations: Danville, Decatur, Bloomington, Lincoln, Pana and Watseka. U. S. Weather Bureau, Climatological Data, Iowa, Missouri, Illinois, Sections; Monthly Reports and Annual Summaries, 1930-57.

the northwest, west-central, southwest and east-central sections of Iowa.

Cash-grain area:

$$X_3 = r'_m + r'_{jn} + r'_{jl} + r'_a$$

where:

$$\begin{aligned} r'_m &= r_m & r_m &\leqslant 3.8 \\ &= 3.8 & r_m &\geqslant 3.8 \\ r'_{jn} &= r_{jn} & r_{jn} &\leqslant 5.0 \\ &= 5.0 & r_{jn} &\geqslant 5.0 \\ r'_{jl} &= r_{jl} & r_{jl} &\leqslant 3.9 \\ &= 3.9 & r_{jl} &\geqslant 3.9 \\ r'_a &= r_a & r_a &\leqslant 2.7 \\ &= 2.7 & r_a &\geqslant 2.7 \end{aligned}$$

The rainfall quantities are simple averages of six stations located throughout the cash-grain area.

Hog-dairy area:

$$X_4 = T'_m + T'_{jn} + T'_{jl} + T'_a$$

where:

$$\begin{aligned} T'_m &= 61 & T_m &\leqslant 61 \\ &= T_m & T_m &\geqslant 61 \\ T'_{jn} &= 68 & T_{jn} &\leqslant 68 \\ &= T_{jn} & T_{jn} &\geqslant 68 \\ T'_{jl} &= 74 & T_{jl} &\leqslant 74 \\ &= T_{jl} & T_{jl} &\geqslant 74 \\ T'_a &= 71 & T_a &\leqslant 71 \\ &= T_a & T_a &\geqslant 71 \end{aligned}$$

The temperatures are the averages for the northeast section of Iowa.

Hog-beef raising area:

$$X_5 = r'_m + r'_{jn} + r'_{jl} + r'_a$$

where:

$$\begin{aligned} r'_m &= r_m & r_m &\leqslant 3.0 \\ &= 3.0 & r_m &\geqslant 3.0 \\ r'_{jn} &= r_{jn} & r_{jn} &\leqslant 4.0 \\ &= 4.0 & r_{jn} &\geqslant 4.0 \\ r'_{jl} &= r_{jl} & r_{jl} &\leqslant 4.0 \\ &= 4.0 & r_{jl} &\geqslant 4.0 \\ r'_a &= r_a & r_a &\leqslant 3.0 \\ &= 3.0 & r_a &\geqslant 3.0 \end{aligned}$$

Rainfall amounts are averages for the south-central Iowa, southeast Iowa and northern Missouri sections.

Time was entered in the regressions as a linear variable with the midpoint between 1943 and 1944 as the origin. The period covered by the regression was 1930 through 1957. In the regression analysis, the output-input ratios were expressed as percentages of their respective mean values. These trends obtained for the separate areas pertain to a single crop produced in areas all lying within a somewhat homogeneous region, "the Corn Belt." This fact, coupled with the similarity of the trends, led to the computation of a common time trend. The sums of squares (with the output-input ratios expressed as a percentage of their respective mean values) were pooled to obtain a single coefficient for time. The results are presented in table 28.

The pooled regression gives an estimated increase in the output-input ratio of 1.64 percent of the mean per year. This value was employed to obtain the estimated ΣrQ used in computing the parity returns prices presented in the text.

WHEAT

Before the weather variables used in the multiple regressions for the wheat areas are presented, the logic behind their construction will be mentioned. Precipitation received in the winter months of December, January and February is generally limited, with slight benefits to wheat yields, while that received prior to and following this period is quite important and closely correlated with wheat production. Precipitation, having an influence on yields, can be separated into two periods: preseasonal (i.e., the late summer and autumn months) and seasonal (i.e., the spring months of the growing season).

TABLE 28. MULTIPLE REGRESSIONS ANALYSIS RELATING CHANGES IN OUTPUT-INPUT RATIO FOR CORN TO TIME AND WEATHER VARIABLES

	Area									
	Hog-beef fattening		Cash-grain		Hog-dairy		Hog-beef raising		Pooled regression	
Variables	b	S_b	b	S_b	b	S_b	b	S_b	b	S_b
X_1 Time	1.51	0.116	1.59	0.210	1.84	0.086	1.68	0.163	1.64	0.077
X_2 Temperature Deviation May > 64 June > 72 July > 76 Aug. > 74	-2.18	0.240							-2.10	0.302
X_3 Rainfall May > 3.8 June > 5.0 July > 3.9 Aug. > 2.7			5.05	0.804					4.96	0.567
X_4 Temperature May > 61 June > 68 July > 74 Aug. > 71					-1.34	0.176			-1.48	0.299
X_5 Rainfall May < 3.0 June < 4.0 July < 4.0 Aug. < 3.0							5.97	0.729		
No. of observations	28		28		28		28		112	
Coeff. of determination (R^2)	0.94		0.87		0.97		0.90		0.91	

Although early seasonal precipitation is correlated with wheat production, heavy rainfall during the development and ripening of wheat promotes parasitic diseases, rust and lodging, which reduce yields. Also, heavy rains retard harvest and result in grain losses. Therefore, a reasonable assumption is that excess rainfall received during development and ripening has a negative effect on wheat output. Since precipitation in the wheat areas often is limited, high temperatures have a more adverse effect on production than low temperatures. Associated with low humidity and wind, high temperatures occurring during development and ripening tend to reduce wheat yields.

These considerations resulted in the construction of the following weather variables.[32]

Winter wheat:

X_1 — Rainfall; i.e., total rainfall for the months of July, August, September, October, November, March and April.

$X_2 = T'_m + T'_{jn}$

where:

$$\begin{aligned} T'_m &= T_m & T_m &\geqslant 65 \\ &= 65 & T_m &\leqslant 65 \\ T'_{jn} &= T_{jn} & T_{jn} &\geqslant 75 \\ &= 75 & T_{jn} &\leqslant 75 \end{aligned}$$

$X_3 = r'_m + r'_{jn}$

where:

$$\begin{aligned} r'_m &= r_m & r_m &\geqslant 2 \\ &= 2 & r_m &\leqslant 2 \\ r'_{jn} &= r_{jn} & r_{jn} &\leqslant 2 \\ &= 2 & r_{jn} &\geqslant 2 \end{aligned}$$

Rainfall quantities are arithmetic means of rainfall at 25 stations located in the area, while temperatures are state averages for Kansas.

Wheat-roughage-livestock:

X_4 — Preseasonal rainfall; i.e., rainfall during August, September and October.

X_5 — Seasonal rainfall; i.e., total rainfall during April, May and June.

Rainfall quantities are arithmetic means of rainfall received at 19 weather stations located throughout the area.

Wheat-small grain-livestock:

X_6 — Preseasonal rainfall; i.e., total rainfall received during August, September and October.

$X_7 = T'_m + T'_{jn} + T'_{jl}$

where:

$$\begin{aligned} T'_m &= T_m & T_m &\geqslant 55 \\ &= 55 & T_m &\leqslant 55 \\ T'_{jn} &= T_{jn} & T_{jn} &\geqslant 64 \\ &= 64 & T_{jn} &\leqslant 64 \\ T'_{jl} &= T_{jl} & T_{jl} &\geqslant 70 \\ &= 70 & T_{jl} &\leqslant 70 \end{aligned}$$

The rainfall quantities are arithmetic means of rainfall received at 12 stations located throughout the area, while the temperatures are state averages for North Dakota.

Wheat-pea:

$X_8 = r'_{april} + r'_m + r'_{jn}$

where:

$$\begin{aligned} r'_{april} &= r_{april} & r_{april} &\leqslant 1.5 \\ &= 1.5 & r_{april} &\geqslant 1.5 \\ r'_m &= r_m & r_m &\leqslant 2.5 \\ &= 2.5 & r_m &\geqslant 2.5 \\ r'_{jn} &= r_{jn} & r_{jn} &\leqslant 2.5 \\ &= 2.5 & r_{jn} &\geqslant 2.5 \end{aligned}$$

$X_9 = T'_m + T'_{jn}$

where:

$$\begin{aligned} T'_m &= T_m & T_m &\geqslant 54 \\ &= 54 & T_m &\leqslant 54 \\ T'_{jn} &= T_{jn} & T_{jn} &\geqslant 58 \\ &= 58 & T_{jn} &\leqslant 58 \end{aligned}$$

Rainfall and temperature were obtained at three stations located within the area.

Time was entered in the regressions as a linear variable with the midpoint between 1943 and 1944 as the origin for the three plains areas and 1946 as the origin in the wheat-pea area.

The time trends obtained by separate regressions gave little indication that the trends were not the same in all areas. Therefore, the sums of squares were pooled to obtain a common time trend. The coefficients of determination, regression coefficients and standard errors for the separate regressions and for the pooled regression are shown in table 29. The mean ratios of output to input for the period for which data were available were approximately: wheat-roughage-livestock, 0.49; wheat- small grain -livestock, 0.50; winter wheat, 0.49; and wheat-pea, 0.57.

The time trend (i.e., regression coefficient of time) is used to compute the estimated trend output-input ratios. The estimated trend output-input ratio is obtained from the equation $\hat{Y} = \bar{y} + bX_t$, where X_t represents time, b represents the pooled regression coefficient for time and $\bar{y}$ represents the mean output-input ratio.

Although the regressions were computed to obtain estimates of an average or trend production, they give some indication of the differences in the rate of technological improvement in the production of the different crops. It would be necessary to make several restricting assumptions, however, before it would be possible to make precise quantitative statements about the rate of technological change.[33]

The use of the output-input ratio assumes a linear homogeneous production function. Note that the out-

[32]Weather data were obtained from the following sources: U.S. Dept. Agr., Weather Bureau. Report of the Chief of the Weather Bureau, 1929-30, 1930-31; U.S. Dept. Commerce, Weather Bureau. Climatic Summary of the U.S.—Supplement for 1931 through 1952. Nos. 5, 12, 20, 21, 28, 34 and 42; U.S. Dept. Commerce, Weather Bureau. Climatological Data Annual Summaries, 1953-57. Colorado LVII-LXI, No. 13. Kansas LXVII-LXX, No. 13. Montana LVI-LIX, No. 13. Nebraska LVIII-LXI, No. 13. No. Dakota LXII-LXV, No. 13. So. Dakota LVIII-LXI, No. 13. Wyoming LXII-LXV, No. 13. Washington LVI-LIX, No. 13. Idaho LVIII-LXI, No. 13.

[33]See for example G. W. Ladd. Biases in certain production indexes. Jour. Farm Econ. Vol. 39. pp. 75-85. 1957. or Vernon W. Ruttan. Regional patterns of technological change in American agriculture. Jour. Farm Econ. Vol. 40. pp. 196-207. May 1958.

put-input ratio employed here differs from that commonly constructed, in that production is expressed in terms of corn, wheat or cotton equivalents, and that the weights assigned to other products (r's) changed over time. If the changes in the r's do not correspond to changes in the rate of substitution in production, the ratio will be in error as an index of technology. It is, however, quite possible that allowing the weights to change gives a better estimate of technological change than would constant weights.

These regressions estimate changes in the output-input ratio which have actually taken place. Thus, it is possible that government control programs have had an effect on the output-input ratios. Attempts to take these programs into account by including dummy variables for control years did not yield significant results.

TABLE 29. MULTIPLE REGRESSIONS ANALYSIS RELATING CHANGES IN OUTPUT-INPUT RATIO FOR WHEAT TO TIME AND WEATHER VARIABLES.

	Area									
	Wheat-roughage livestock		Wheat-small grain livestock		Winter wheat		Wheat-pea		Pooled regression	
Variables	b	S_b	b	S_b	b	S_b	b	S_b	b	S_b
X_1 July, Aug. Sept., Oct., Nov., March, April rainfall					8.65	1.19			8.78	1.20
X_2 Temperature deviation May >65° June >75°					-3.75	1.47			-3.81	1.48
X_3 Rainfall May >2″ June >2″					-6.26	1.89			-6.43	1.89
X_4 Rainfall Aug., Sept., Oct.	13.16	2.92							13.38	2.50
X_5 Rainfall April, May, June	10.25	1.90							10.41	1.61
X_6 Rainfall Aug., Sept., Oct.			4.48	2.22					4.42	2.06
X_7 Temperature deviation May >55° June >64° July >70°			-3.48	1.10					-3.98	0.94
X_8 Rainfall April <1.5 May <2.5 June <2.5							6.45	3.69	5.69	4.26
X_9 Temperature deviation May >54° June >58°							-1.91	1.18	-1.83	1.39
X_{10} Time	2.17	0.52	2.60	0.51	2.01	0.43	1.63	0.49	2.13	0.24
No. of observations	28		28		28		23		108	
Coefficient of determination (R^2)	0.81		0.76		0.77		0.60		0.78	

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