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Quarterly Estimates of Realized Gross and Net Farm Income

By Ernest W. Grove

Realized net income of farm operators reached a postwar high of 16.8 billion dollars in 1947 and declined to a postwar low of 12.4 billion dollars in 1950. These estimates are for calendar years. On a quarterly basis, in terms of seasonally adjusted annual rates, the postwar high was 17.9 billion dollars in the first quarter of 1947, and the postwar low was 11.7 billion dollars in the second quarter of 1950. Thus, farmers' net income actually declined 35 percent during a period of a little more than 3 years as compared with a drop of only 26 percent indicated by the annual data. It is evident that the annual estimates do not measure the full swing from high to low. To overcome this handicap in the historical record of farm income, and to provide a foundation for more frequent and more up-to-date appraisal of the farm income situation in the future, this paper presents a new quarterly series on gross and net realized income of farm operators in terms of seasonally adjusted annual rates for 1929-53. These estimates will be published regularly henceforth in The Farm Income Situation.

NEW ESTIMATES of realized gross and net farm income—given in detail in table 1 and summarized in figure 1—show considerably more variation than annual data, given also in table 1 for comparative purposes.

These are the first seasonally adjusted quarterly estimates of realized net farm income that have been derived by subtracting independently adjusted estimates of farm production expenses from totals of similarly adjusted estimates of individual components of realized gross farm income. This is undoubtedly the most satisfactory approach, but until recently inadequate data have presented obstacles that seemed insurmountable.

Difficulties are still involved, but we found that the methods here developed do provide a fairly reliable measure of quarterly changes in net farm income with seasonal influences eliminated. First

of the methods to be described are those used in estimating production expenses, the chief stumbling block in the past; then follow methods for estimating each major component of gross farm income.

Farm Production Expenses

The expenses of farm production are conveniently divided into current operating expenses and overhead costs. The latter include taxes, rent, mortgage interest, and depreciation. They represent about a third of total production expenses. Although payment for some of these items is due at certain fixed times in the year, they all may properly be considered as applying to the year as a whole and—in terms of seasonally adjusted annual rates—to any part of the year. There would be no serious problem, therefore, in deriving

TABLE 1.—*Realized gross and net farm income by quarters, seasonally adjusted at annual rates, 1929-53*
 [In billions of dollars]

Item	1929					1930				
	Quarter				Year	Quarter				Year
	I	II	III	IV		I	II	III	IV	
Cash receipts from farm marketings.....	11.4	10.4	11.9	11.5	11.3	10.1	9.5	8.6	8.0	9.1
Home consumption of farm products.....	1.7	1.7	1.7	1.7	1.7	1.7	1.6	1.5	1.4	1.5
Rental value of farm dwellings.....	.8	.8	.8	.9	.8	.9	.8	.8	.8	.8
Realized gross farm income.....	13.9	12.9	14.4	14.1	13.8	12.7	11.9	10.9	10.2	11.4
Farm production expenses.....	7.7	7.8	7.7	7.6	7.7	7.4	7.1	6.9	6.6	7.0
Farmers' realized net income.....	6.2	5.1	6.7	6.5	6.1	5.3	4.8	4.0	3.6	4.4
1931					1932					
Cash receipts from farm marketings.....	7.4	6.9	5.6	5.6	6.4	5.6	4.7	4.3	4.3	4.7
Home consumption of farm products.....	1.3	1.3	1.2	1.2	1.3	1.1	1.0	1.0	1.0	1.0
Rental value of farm dwellings.....	.8	.8	.7	.7	.7	.7	.7	.6	.6	.7
Realized gross farm income.....	9.5	9.0	7.5	7.5	8.4	7.4	6.4	5.9	5.9	6.4
Farm production expenses.....	6.2	5.7	5.3	5.0	5.6	4.7	4.6	4.4	4.3	4.5
Farmers' realized net income.....	3.3	3.3	2.2	2.5	2.8	2.7	1.8	1.5	1.6	1.9
1933					1934					
Cash receipts from farm marketings.....	4.2	5.7	5.7	5.6	5.3	6.1	6.3	6.7	6.1	6.3
Government payments to farmers.....			.2	.3	.1	.3	.4	.5	.6	.5
Home consumption of farm products.....	.9	1.0	1.1	1.1	1.0	1.1	1.0	1.1	1.2	1.1
Rental value of farm dwellings.....	.6	.6	.6	.6	.6	.6	.6	.6	.7	.6
Realized gross farm income.....	5.7	7.3	7.6	7.6	7.0	8.1	8.3	8.9	8.6	8.5
Farm production expenses.....	4.1	4.2	4.5	4.6	4.3	4.6	4.6	4.8	4.8	4.7
Farmers' realized net income.....	1.6	3.1	3.1	3.0	2.7	3.5	3.7	4.1	3.8	3.8
1935					1936					
Cash receipts from farm marketings.....	6.5	7.2	7.2	7.4	7.1	7.4	8.1	9.0	8.9	8.3
Government payments to farmers.....	.6	.6	.6	.5	.6	.3	.2	.3	.3	.3
Home consumption of farm products.....	1.3	1.4	1.3	1.3	1.3	1.3	1.3	1.4	1.5	1.4
Rental value of farm dwellings.....	.6	.6	.6	.6	.6	.6	.6	.6	.7	.6
Realized gross farm income.....	9.0	9.8	9.7	9.8	9.6	9.6	10.2	11.3	11.4	10.6
Farm production expenses.....	5.0	5.1	5.1	5.1	5.1	5.2	5.3	5.7	6.0	5.5
Farmers' realized net income.....	4.0	4.7	4.6	4.7	4.5	4.4	4.9	5.6	5.4	5.1
1937					1938					
Cash receipts from farm marketings.....	8.6	8.9	9.2	8.6	8.8	8.0	7.7	7.5	7.6	7.7
Government payments to farmers.....	.4	.4	.3	.3	.4	.3	.4	.5	.6	.4
Home consumption of farm products.....	1.5	1.5	1.4	1.2	1.4	1.3	1.2	1.3	1.3	1.3
Rental value of farm dwellings.....	.7	.6	.6	.6	.6	.6	.6	.6	.6	.6
Realized gross farm income.....	11.2	11.4	11.5	10.7	11.2	10.2	9.9	9.9	10.1	10.0
Farm production expenses.....	6.1	6.3	6.1	5.9	6.1	5.8	5.8	5.8	5.8	5.8
Farmers' realized net income.....	5.1	5.1	5.4	4.8	5.1	4.4	4.1	4.1	4.3	4.2

TABLE 1.—*Realized gross and net farm income by quarters, seasonally adjusted at annual rates, 1929-53—*
Continued

[In billions of dollars]

Item	1939					1940				
	Quarter				Year	Quarter				Year
	I	II	III	IV		I	II	III	IV	
Cash receipts from farm marketings.....	7.9	7.7	7.6	8.1	7.8	8.3	8.1	8.1	8.8	8.3
Government payments to farmers.....	.7	.7	.8	.8	.8	.8	.7	.7	.7	.7
Home consumption of farm products.....	1.3	1.2	1.2	1.2	1.2	1.3	1.2	1.2	1.3	1.3
Rental value of farm dwellings.....	.6	.6	.6	.6	.6	.6	.6	.6	.7	.6
Realized gross farm income.....	10.5	10.2	10.2	10.7	10.4	11.0	10.6	10.6	11.5	10.9
Farm production expenses.....	6.0	6.1	6.1	6.4	6.1	6.6	6.6	6.6	6.7	6.6
Farmers' realized net income.....	4.5	4.1	4.1	4.3	4.3	4.4	4.0	4.0	4.8	4.3
	1941					1942				
	Quarter				Year	Quarter				Year
	I	II	III	IV		I	II	III	IV	
Cash receipts from farm marketings.....	9.1	10.7	12.1	12.4	11.1	13.4	14.8	16.3	17.5	15.5
Government payments to farmers.....	.6	.5	.5	.6	.5	.6	.7	.7	.6	.6
Home consumption of farm products.....	1.3	1.3	1.5	1.6	1.4	1.7	1.7	1.8	1.9	1.8
Rental value of farm dwellings.....	.7	.6	.6	.7	.7	.6	.7	.7	.7	.7
Realized gross farm income.....	11.7	13.1	14.7	15.3	13.7	16.3	17.9	19.5	20.7	18.6
Farm production expenses.....	7.0	7.3	7.9	8.4	7.6	9.0	9.5	10.0	10.5	9.8
Farmers' realized net income.....	4.7	5.8	6.8	6.9	6.1	7.3	8.4	9.5	10.2	8.8
	1943					1944				
	Quarter				Year	Quarter				Year
	I	II	III	IV		I	II	III	IV	
Cash receipts from farm marketings.....	18.1	19.8	19.6	19.9	19.4	20.8	21.0	19.2	20.5	20.4
Government payments to farmers.....	.6	.7	.6	.7	.6	.8	.8	.8	.7	.8
Home consumption of farm products.....	2.1	2.2	2.1	2.2	2.2	2.2	2.1	2.1	2.2	2.1
Rental value of farm dwellings.....	.7	.7	.7	.8	.7	.8	.8	.8	.8	.8
Realized gross farm income.....	21.5	23.4	23.0	23.6	22.9	24.6	24.7	22.9	24.2	24.1
Farm production expenses.....	11.0	11.3	11.4	11.7	11.4	11.9	12.1	12.2	12.3	12.1
Farmers' realized net income.....	10.5	12.1	11.6	11.9	11.5	12.7	12.6	10.7	11.9	12.0
	1945					1946				
	Quarter				Year	Quarter				Year
	I	II	III	IV		I	II	III	IV	
Cash receipts from farm marketings.....	21.9	21.5	20.8	21.3	21.4	21.7	22.4	26.1	28.1	24.6
Government payments to farmers.....	.7	.7	.8	.8	.7	.9	.9	.7	.6	.8
Home consumption of farm products.....	2.2	2.2	2.2	2.3	2.2	2.3	2.3	2.6	2.9	2.5
Rental value of farm dwellings.....	.9	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.2	1.1
Realized gross farm income.....	25.7	25.4	24.8	25.4	25.3	25.9	26.7	30.5	32.8	29.0
Farm production expenses.....	12.7	13.0	13.1	13.4	13.0	13.8	14.3	15.3	15.7	14.8
Farmers' realized net income.....	13.0	12.4	11.7	12.0	12.3	12.1	12.4	15.2	17.1	14.2

TABLE 1.—*Realized gross and net farm income by quarters, seasonally adjusted at annual rates, 1929-53—*
Continued

[In billions of dollars]

Item	1947					1948				
	Quarter				Year	Quarter				Year
	I	II	III	IV		I	II	III	IV	
Cash receipts from farm marketings-----	29.9	27.7	30.4	30.8	29.7	28.7	31.2	30.8	30.1	30.2
Government payments to farmers-----	.3	.3	.3	.3	.3	.3	.3	.2	.2	.3
Home consumption of farm products-----	2.7	2.6	2.7	2.7	2.7	2.7	2.6	2.7	2.5	2.6
Rental value of farm dwellings-----	1.3	1.3	1.3	1.4	1.3	1.4	1.4	1.4	1.5	1.4
Realized gross farm income-----	34.2	31.9	34.7	35.2	34.0	33.1	35.5	35.1	34.3	34.5
Farm production expenses-----	16.3	17.0	17.5	18.1	17.2	18.9	19.2	18.9	18.6	18.9
Farmers' realized net income-----	17.9	14.9	17.2	17.1	16.8	14.2	16.3	16.2	15.7	15.6
1949					1950					
Cash receipts from farm marketings-----	28.6	28.3	27.6	27.3	27.9	27.5	27.4	28.4	30.0	28.3
Government payments to farmers-----	.2	.2	.2	.2	.2	.2	.3	.3	.3	.3
Home consumption of farm products-----	2.3	2.2	2.2	2.0	2.2	2.0	2.0	2.0	2.0	2.0
Rental value of farm dwellings-----	1.5	1.5	1.4	1.4	1.5	1.4	1.4	1.5	1.5	1.5
Realized gross farm income-----	32.6	32.2	31.4	30.9	31.8	31.1	31.1	32.2	33.8	32.1
Farm production expenses-----	18.4	18.4	18.0	17.9	18.2	18.6	19.4	20.1	20.7	19.7
Farmers' realized net income-----	14.2	13.8	13.4	13.0	13.6	12.5	11.7	12.1	13.1	12.4
1951					1952					
Cash receipts from farm marketings-----	31.5	32.8	33.0	33.9	32.8	31.9	32.4	33.5	31.7	32.4
Government payments to farmers-----	.3	.3	.3	.3	.3	.3	.3	.3	.2	.3
Home consumption of farm products-----	2.2	2.3	2.2	2.2	2.2	2.2	2.2	2.1	2.1	2.1
Rental value of farm dwellings-----	1.5	1.6	1.7	1.7	1.6	1.7	1.7	1.7	1.8	1.7
Realized gross farm income-----	35.5	37.0	37.2	38.1	36.9	36.1	36.6	37.6	35.8	36.5
Farm production expenses-----	21.9	22.5	22.3	22.5	22.3	23.2	23.3	23.0	22.6	23.0
Farmers' realized net income-----	13.6	14.5	14.9	15.6	14.6	12.9	13.3	14.6	13.2	13.5
1953										
Cash receipts from farm marketings-----	32.3	31.2	30.0	30.5	31.0	-----	-----	-----	-----	-----
Government payments to farmers-----	.2	.2	.2	.2	.2	-----	-----	-----	-----	-----
Home consumption of farm products-----	2.1	2.1	2.1	2.0	2.1	-----	-----	-----	-----	-----
Rental value of farm dwellings-----	1.8	1.8	1.7	1.7	1.7	-----	-----	-----	-----	-----
Realized gross farm income-----	36.4	35.3	34.0	34.4	35.0	-----	-----	-----	-----	-----
Farm production expenses-----	22.8	22.2	22.0	21.9	22.2	-----	-----	-----	-----	-----
Farmers' realized net income-----	13.6	13.1	12.0	12.5	12.8	-----	-----	-----	-----	-----

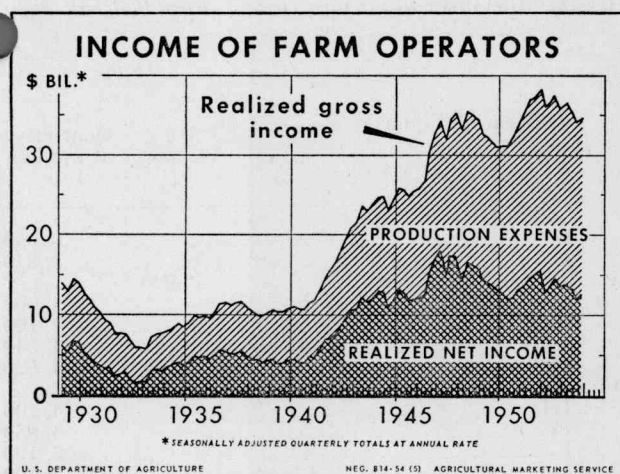


FIGURE 1.

quarterly estimates of overhead costs alone.

But current operating expenses are incurred in varying amounts throughout the year. Most of them are known to exhibit marked seasonal variations that are related in one way or another to variations in farm production itself. If actual quarterly data on operating expenses were available, the usual methods of seasonal adjustment would be appropriate. Unfortunately, such data are not available. Prices paid by farmers for the various expense items are reported monthly; but quantities can ordinarily be approximated only on an annual basis. Under the circumstances, it was necessary to lump current expenses with overhead costs and to allocate total production expenses by quarters in a manner which assumes, in effect, that they are all overhead costs.

The method relies heavily on monthly index numbers of prices paid by farmers for all production items, including interest, taxes, and wage rates, which are published currently in *Agricultural Prices*. With few exceptions, most important of which is rent, this index covers all the commodities and services included in farm production expenses, and it is suitably weighted to provide a good measure of changes in the overall price factor underlying total production expenses. Annual averages of the price index are closely correlated with total annual production expenses, not only because the latter reflect price changes, but also because the total volume of inputs usually increases with rising prices and declines with falling prices.

For this reason, fairly acceptable quarterly estimates of production expenses might have been read

from the simple linear regression of total annual expenses on the annual price index, using quarterly averages of the price index for interpolation. Inputs have not, however, always moved in the same direction as the price factor. In the years 1935-40 in particular, inputs rose considerably without much change in the average of their prices.

In view of this and other shorter periods of divergent movements in the price and volume factors, a procedure somewhat more elaborate than the simple regression method seemed justified. The method actually used involved four separate steps:

(1) Quarterly and annual averages of the index of prices paid for all production items were computed from the monthly indexes available from 1937 to date. Before 1937 the index is available only as of March, June, September, and December of each year; so quarterly and annual averages were derived for the years 1926-36 on the assumption that the index for each of the 4 months applied to the preceding and following months as well. This involved some error in the Januarys because that month should reflect interest, taxes, and wage rates for the new year rather than those reflected in the preceding December index. But as the error was small, no attempt was made to remove it except in January 1933, for which a suitable adjustment was made to insure a more accurate reflection of the cyclical low point in the quarterly index.

(2) Using the annual price indexes thus computed, annual estimates of total production expenses were deflated thereby to provide a measure of annual input at constant (1910-14 average) prices.

(3) Annual changes in input were then distributed evenly by quarters as illustrated, with hypothetical data, in table 2. Since the annual inputs center on July 1, half way between the second and third quarters of each year, the usual method of quarterly allocation was to compute the difference between the annual input and the fourth-quarter input already determined for the preceding year, and to assign 40 percent of this difference as the quarterly change in input. As illustrated by years C, D, F, and G in the table, averages of the quarterly inputs so determined are equal to the annual inputs. In starting the series, of course, as in years A and B in the table, it was necessary to use 40 percent of the difference be-

TABLE 2.—*Illustrative derivation of quarterly estimates of agricultural input, using hypothetical data*

Year and quarter	Input		Year and quarter	Input	
	Annual	Quarterly at annual rate		Annual	Quarterly at annual rate
A.....	4, 680		I.....		3, 680
I.....		4, 640	II.....		3, 840
II.....		4, 600		3, 920	
B.....	4, 580		III.....		4, 000
III.....		4, 560	IV.....		4, 160
IV.....		4, 520	I.....		4, 340
I.....		4, 500	II.....		4, 520
II.....		4, 480	G.....	4, 610	
C.....	4, 470		III.....		4, 700
III.....		4, 460	IV.....		4, 880
IV.....		4, 440	I.....		5, 100
I.....		4, 260	II.....		5, 100
II.....		4, 080	H.....	5, 100	
D.....	3, 990		III.....		5, 100
III.....		3, 900	IV.....		5, 100
IV.....		3, 720	I.....		5, 090
I.....		3, 520	II.....		5, 090
II.....		3, 520	I.....	5, 090	
E.....	3, 520		III.....		5, 090
III.....		3, 520	IV.....		5, 090
IV.....		3, 520			

tween the 2 annual inputs since a fourth-quarter estimate for the first year was not available. In the actual calculations, the quarterly series was started with 1926 so that by 1929 it would be moving in the right direction.

An exception to the above rule had to be made for each year representing a turning point in annual input (years E and H in the table). The trend changed at some time during the course of the year, without any evidence as to when it actually did change. Therefore, a constant level of input throughout the year was the most reasonable assumption to make. Although this exception proved applicable only in 1932, a major cyclical turning point, it might also be necessary during a period of short-run ups and downs in annual input to avoid an unreasonable see-saw effect on the quarterly interpolations. A second exception frequently applies to the most recent year in the series (year I in the table). Until the trend of input is definitely established by later events, it may be necessary to assume a constant rate of input in all 4 quarters of the most recent year.

(4) The fourth and last step was to reflate quarterly inputs at annual rates determined in the preceding step, using the quarterly average price indexes described in step (1), to give quarterly

estimates at annual rates in current prices. Adjustments were then made for any discrepancy—usually quite small—between the 4-quarter averages of these data and the original annual estimates of production expenses.

In view of the limited information at hand, the final results shown in rounded form in table 1 are the best that could be obtained. Their trends may be somewhat smoother than would have been obtained by direct seasonal adjustment of actual quarterly estimates based on complete information. But otherwise they are a reasonable representation of quarterly changes in the total expense factor. On a current basis, before there is any definite estimate of expenses for the year as a whole, it will usually be necessary to base quarterly estimates on the price index alone, assuming that input remains unchanged from the preceding year. On the few occasions of definite evidence of a current increase or decrease in total input, the method will permit the incorporation of such changes even in current estimates.

Cash Receipts From Farm Marketings

Because of the relative stability of farm production expenses, quarterly changes in farmers'

realized net income are largely determined by changes in their gross income. And as cash receipts from marketings are the dominant element in gross income, they should be estimated as accurately as possible in terms of seasonally adjusted annual rates. Fortunately for this purpose—and in marked contrast to the situation with respect to production expenses—complete quarterly data are available on cash receipts from marketings. In fact, data are actually available on a monthly basis in terms of quantities sold, average prices, and cash receipts for about 100 individual farm commodities by States.

This detailed information, however, represents an embarrassment of riches from the standpoint of seasonal adjustment of total cash receipts from marketings. Ideally, total cash receipts ought to be adjusted for seasonal variation in terms of separate analyses for each commodity included in the total, because the normal seasonal pattern of marketings varies tremendously among the different commodities. Moreover, the normal seasonal pattern of marketings may be different for the *same* commodity in different States, and many commodities exhibit regular seasonal variations in their monthly average prices as well as their monthly marketings. Therefore, a good theoretical case might be made for the proposition that separate seasonal analyses ought to be made for both the price and volume factors underlying cash receipts for each commodity in each State.¹

But such a detailed analysis of seasonal variations in cash receipts is not feasible; and even if it were, there are grounds, based on past experience, for doubting its desirability when national totals of cash receipts on a seasonally adjusted basis are the only objective.

Monthly index numbers of total cash receipts from farm marketings on a seasonally adjusted basis were first published by the Bureau of Agricultural Economics in 1935. In addition, separate indexes were shown for some of the major commodity groups. They were published regularly in this form in *The Farm Income Situation* until early 1947, when they were discontinued. There were five reasons for discontinuance:

¹ For a discussion of some of the methods that would be applicable to such a detailed analysis, see FOOTE, R. J. and FOX, KARL A. SEASONAL VARIATION: METHODS OF MEASUREMENT AND TESTS OF SIGNIFICANCE. U. S. Dept. Agr. Handbook No. 48. 1952.

(1) The inherent instability in the seasonal pattern of marketings of individual farm commodities, of certain major crops in particular; (2) the additional erratic influence of crop loans and redemptions under the program of the Commodity Credit Corporation; (3) the fact that seasonal adjustment factors then in use were out of date, with resources lacking for their improvement on the individual commodity terms with which they had been started; (4) especially poor experience with the indexes during the months of abnormal marketings before and after price decontrol in 1946; and (5) the logical fallacy involved in the seasonal adjustment of current cash receipts which are themselves of necessity determined in part on the basis of the seasonal pattern of marketings in previous years.

An abnormal test period like 1946 may not soon recur, but the other difficulties listed above are still applicable. The logical fallacy just mentioned, however, applies only to certain of the major crops. It does not apply to cotton or tobacco, for which current information on actual monthly marketings is available, nor does it apply to any of the principal livestock commodities. It still constitutes a strong objection to the current publication of seasonally adjusted data for the crops to which it applies. But this objection probably loses some of its force in terms of seasonally adjusted *total* cash receipts—and perhaps even more if determination of the latter is merely one of several steps in the derivation of seasonally adjusted net income. In any case, this fallacy makes the use of any detailed analyses of seasonal variations rather pointless, to say the least, when applied to current data. And the other difficulties listed above suggest that detailed analyses had better be avoided on a historical basis also.

The first difficulty mentioned—the inherent instability in the seasonal pattern of most crops—was well stated in connection with the first publication of the seasonally adjusted indexes in 1935:

"It is difficult to determine what might be considered normal seasonal changes in income from crops. In many cases more than half of the crop is moved to market within a few months of harvest, and the movement of the remainder of the crop in the other 9 months is often irregular. Furthermore the harvesting season shifts to some extent from year to year with changes in weather conditions. . . . Consequently, after making adjustments for any average seasonal change, there may still remain

in any season considerable variation from this average due to *seasonal* conditions, as well as to economic conditions that are not directly related to the usual seasonal factors in the income from marketings."²

In other words—and to put the matter a little more strongly—there may be no such thing as a "normal" seasonal pattern of marketings for most crops, except within relatively wide limits. And unless seasonal adjustment factors were somehow computed independently for each year, to take into account erratic and presumably temporary shifts in the seasonal pattern of sales, the seasonally adjusted data would retain many sharp and meaningless fluctuations that should have been removed. This problem has been aggravated since 1938 by the loan program of the Commodity Credit Corporation.³

When a farmer puts a crop under CCC loan, the transaction is counted as the equivalent of a sale and the proceeds are included in cash receipts. If the farmer redeems the crop later, because its price has risen or is expected to rise enough to make such redemption worth while, repayment of the loan is deducted as an offset to cash receipts in the month in which it occurs. In crop years of heavy loans followed by similarly heavy redemption, this procedure has the effect, logical as far as it goes, of shifting a large part of what would ordinarily be spring marketings back into the second half of the preceding calendar year. But the question then arises as to whether such a shift should not be treated as a temporary change in the seasonality of the commodity in question, a change that should not be allowed to manifest itself in the seasonally adjusted data.

These matters could doubtless be dealt with in terms of seasonal adjustments for each individual commodity, to be combined into a seasonally adjusted grand total for all commodities. But to do so at all satisfactorily would require thorough historical analysis of seasonal variations for each commodity, followed by a continuous process of

interpreting and policing the data to keep results up to date and applicable to current conditions.

Under the circumstances it seemed best not to attempt such detailed analyses for individual commodities, but rather to develop quarterly seasonal adjustment factors only for certain of the major totals of cash receipts. Specifically, the totals analyzed were (1) cash receipts from all crops, (2) cash receipts from all livestock and livestock products, and, as a check on these results, (3) cash receipts from all commodities taken together. Seasonal adjustment in these terms automatically assigns considerably less weight to irregular variations in the individual commodity series than would a build-up of the total on an individual commodity basis. Overall adjustments are also more manageable; and temporary abnormalities in individual series that remain troublesome despite the smaller influence they are permitted to exert on the totals can more readily be dealt with.

The original quarterly data on cash receipts are given in table 3. Though unadjusted for seasonal variation, they were adjusted wherever necessary by a constant factor for each year so as to agree with the latest revised annual total for that year. This procedure was necessary because it was not possible to go back and make detailed revisions of the monthly and quarterly estimates previously developed. Discrepancies thus allowed for are generally small. Moreover, the nature of annual revisions after the development of monthly and quarterly estimates is frequently such as to provide a new estimate of annual production or sales—but no new information on the monthly distribution of sales. Consequently, the uniform adjustments here used are not likely to have introduced any significant distortions in the seasonal patterns.

To develop seasonal adjustment factors for quarterly cash receipts, the data in table 3 were processed. Each step was carried through separately for crops, for livestock and products, and for the two combined. The 3-step process we used follows:

(1) Percentage ratios of the original quarterly data to centered 4-quarter moving totals were computed for 1924–53. The results of this first step are summarized in table 4.

(2) Another set of percentage ratios was computed in exactly the same way, except that the original quarterly data were first deflated by cor-

² PURVES, C. M. ESTIMATES OF CASH INCOME FROM FARM MARKETINGS, monthly, 1924–34. U. S. Dept. Agr. 1935. (Processed.) P. 8. [Emphasis supplied.]

³ An unpublished analysis of monthly wheat marketings, prepared by James F. Cooney, Jr., showed considerable irregularity but nevertheless a fairly consistent seasonal pattern from 1924 through 1937. Beginning with 1938, however, CCC loans and redemptions introduced some general change in the pattern, together with a much greater degree of irregularity.

TABLE 3.—Cash receipts from farm marketings, by crops and livestock, by quarters, 1924-53

[In millions of dollars]

Year and quarter	Total	Livestock	Crops	Year and quarter	Total	Livestock	Crops
1924				1935			
I.....	2,219	1,151	1,068	I.....	1,336	880	456
II.....	1,942	1,219	723	II.....	1,494	1,074	420
III.....	2,589	1,161	1,428	III.....	1,987	1,054	933
IV.....	3,452	1,277	2,175	IV.....	2,257	1,109	1,148
1925				1936			
I.....	2,561	1,298	1,263	I.....	1,511	1,005	506
II.....	2,170	1,425	745	II.....	1,656	1,147	509
III.....	2,839	1,353	1,486	III.....	2,474	1,245	1,229
IV.....	3,451	1,396	2,055	IV.....	2,715	1,332	1,383
1926				1937			
I.....	2,421	1,367	1,054	I.....	1,763	1,106	657
II.....	2,368	1,506	862	II.....	1,834	1,249	585
III.....	2,781	1,405	1,376	III.....	2,586	1,284	1,302
IV.....	2,980	1,401	1,579	IV.....	2,636	1,274	1,362
1927				1938			
I.....	2,397	1,387	1,010	I.....	1,673	1,047	626
II.....	2,362	1,511	851	II.....	1,605	1,105	500
III.....	2,804	1,336	1,468	III.....	2,101	1,168	933
IV.....	3,169	1,369	1,800	IV.....	2,324	1,192	1,132
1928				1939			
I.....	2,435	1,476	959	I.....	1,642	1,043	599
II.....	2,406	1,576	830	II.....	1,589	1,105	484
III.....	2,696	1,470	1,226	III.....	2,116	1,136	980
IV.....	3,451	1,510	1,941	IV.....	2,472	1,240	1,232
1929				1940			
I.....	2,539	1,451	1,088	I.....	1,721	1,065	656
II.....	2,400	1,670	730	II.....	1,702	1,191	511
III.....	3,047	1,572	1,475	III.....	2,204	1,222	982
IV.....	3,313	1,486	1,827	IV.....	2,705	1,419	1,286
1930				1941			
I.....	2,312	1,371	941	I.....	1,877	1,266	611
II.....	2,203	1,449	754	II.....	2,228	1,605	623
III.....	2,237	1,183	1,054	III.....	3,258	1,673	1,585
IV.....	2,298	1,183	1,115	IV.....	3,712	1,926	1,786
1931				1942			
I.....	1,698	1,047	651	I.....	2,762	1,893	869
II.....	1,589	1,046	543	II.....	3,070	2,260	810
III.....	1,454	886	568	III.....	4,390	2,266	2,124
IV.....	1,628	858	770	IV.....	5,264	2,628	2,636
1932				1943			
I.....	1,293	721	572	I.....	3,770	2,498	1,272
II.....	1,092	696	396	II.....	4,191	3,015	1,176
III.....	1,113	677	436	III.....	5,344	2,844	2,500
IV.....	1,237	657	580	IV.....	6,053	3,109	2,944
1933				1944			
I.....	955	582	373	I.....	4,319	2,800	1,519
II.....	1,265	759	506	II.....	4,356	2,973	1,383
III.....	1,486	774	712	III.....	5,297	2,682	2,615
IV.....	1,602	728	874	IV.....	6,405	2,882	3,523
1934				1945			
I.....	1,388	740	648	I.....	4,515	2,769	1,746
II.....	1,391	844	547	II.....	4,426	3,022	1,404
III.....	1,766	848	918	III.....	5,720	2,886	2,834
IV.....	1,769	897	872	IV.....	6,722	3,287	3,435

Continued

TABLE 3.—*Cash receipts from farm marketings, by crops and livestock, by quarters, 1924-53—Continued*

[In millions of dollars]

Year and quarter	Total	Livestock	Crops	Year and quarter	Total	Livestock	Crops
1946				1950			
I.....	4, 415	2, 772	1, 643	I.....	5, 661	3, 329	2, 332
II.....	4, 458	2, 968	1, 490	II.....	5, 350	3, 811	1, 539
III.....	7, 053	3, 483	3, 570	III.....	7, 559	4, 136	3, 423
IV.....	8, 638	4, 507	4, 131	IV.....	9, 758	4, 700	5, 058
1947				1951			
I.....	6, 094	3, 703	2, 391	I.....	6, 574	4, 410	2, 164
II.....	5, 687	3, 941	1, 746	II.....	6, 426	4, 853	1, 573
III.....	8, 302	4, 059	4, 243	III.....	8, 753	4, 915	3, 838
IV.....	9, 623	4, 773	4, 850	IV.....	11, 046	5, 434	5, 612
1948				1952			
I.....	5, 941	3, 821	2, 120	I.....	6, 688	4, 338	2, 350
II.....	6, 394	4, 343	2, 051	II.....	6, 464	4, 497	1, 967
III.....	8, 376	4, 388	3, 988	III.....	8, 972	4, 646	4, 326
IV.....	9, 496	4, 519	4, 977	IV.....	10, 249	4, 873	5, 376
1949				1953			
I.....	5, 882	3, 613	2, 269	I.....	6, 774	4, 110	2, 664
II.....	5, 774	3, 844	1, 930	II.....	6, 087	4, 313	1, 774
III.....	7, 588	3, 863	3, 725	III.....	8, 007	4, 233	3, 774
IV.....	8, 700	4, 039	4, 661	IV.....	10, 107	4, 522	5, 585

responding quarterly average index numbers of prices received by farmers. The results provided a rough measure of the seasonal factor in volume alone, eliminating the effect of price changes. During most of the years analyzed price changes were substantial and, in some, quite rapid; they were mainly nonseasonal in character; and their effect on the undeflated ratios of step (1) was sometimes to obscure or otherwise distort real changes in the seasonal pattern of cash receipts.

(3) Both sets of ratios were plotted on a time chart for each quarter. Their trends were noted and compared, and points or intervals of change in the ratios were marked off. Average ratios were then computed for periods of years which seemed to be homogeneous from the standpoint of the seasonal importance of the quarter under study, omitting from the averages any abnormal ratios such as those encountered in the livestock series for 1946. These averages, after any adjustments necessary to make their sum in any given year equal 100, served as seasonal adjustment factors for use in the direct translation of the original quarterly data to a seasonally adjusted annual-rate basis.

In some years, ratios computed from deflated data differed considerably from those computed from current-dollar data, but differences between their averages for similar periods of years were

usually rather small. But where such differences were significant, averages based on current-dollar ratios were generally chosen as the appropriate seasonal adjustment factors. This choice was made on the ground that some commodities exhibit regular seasonal fluctuations in their prices, fluctuations that should be reflected along with those in marketings in the seasonal adjustment factors for cash receipts. Only where the current-dollar ratios were clearly distorted by rapid nonseasonal price changes were the deflated ratios given any weight. But deflated ratios proved indispensable as an aid in pin-pointing years of change in seasonal influences and in demarcating periods of homogeneity with respect to such influences.

The three average periods given in table 4 show the general nature of the changes in seasonality of cash receipts that have occurred in the last 20 years; and the average percentage ratios in the table are, of course, fair approximations of the seasonal adjustment factors actually used. They are not identical because (1) changes in the seasonal distribution of cash receipts were not as sharp nor as uniform as might be inferred from the table, (2) abnormal periods reflected in the table were excluded in calculating the seasonal factors, and (3) seasonal factors in a few cases reflect some weight assigned to ratios calculated from deflated data.

TABLE 4.—*Percentage distribution of cash receipts, by crops and livestock, and by quarters, averages 1925-52*

Period	TOTAL CASH RECEIPTS				
	Quarter				Year
	I	II	III	IV	
Average:	Percent	Percent	Percent	Percent	Percent
1925-34-----	22. 6	22. 2	25. 9	29. 3	100
1935-44-----	20. 6	21. 0	27. 6	30. 8	100
1945-52-----	20. 6	19. 9	27. 3	32. 2	100
LIVESTOCK RECEIPTS					
1925-34-----	24. 0	26. 4	24. 7	24. 9	100
1935-44-----	23. 1	25. 5	25. 0	26. 4	100
1945-52-----	22. 9	24. 4	25. 0	27. 7	100
CROP RECEIPTS					
1925-34-----	21. 0	17. 7	27. 2	34. 1	100
1935-44-----	17. 5	14. 8	31. 1	36. 6	100
1945-52-----	17. 7	14. 0	30. 2	38. 1	100

Data in table 4 indicate that there was considerable shift in distribution of cash receipts from the first half of the calendar year, particularly the second quarter, to the second half, particularly the fourth quarter. Except for the influence of CCC loans and redemptions mentioned earlier, the reasons for this shift are not clear; and the commodities primarily responsible for it could be isolated only through the kind of detailed commodity analyses that have previously been discussed and rejected.

When the three sets of seasonal factors had been completed, they were applied to the original quarterly data of table 3 to produce seasonally adjusted estimates on an annual-rate basis. Comparison of the independently adjusted grand totals with those resulting from the separate adjustment of the crop and livestock totals indicated differences that were generally insignificant except in 1950 and 1951. The largest differences were in the second quarters of those 2 years, when abnormally large quantities of crops were redeemed by farmers from the Commodity Credit Corporation. As previously noted, the loan repayments accompanying such redemptions are deducted as an offset to cash receipts from regular market sales at the time they are made, their net effect being a cor-

responding reduction in the volume of marketings implicit in the resulting estimate of cash receipts. How such abnormalities should be considered on a seasonally adjusted basis is perhaps open to argument. So far as the seasonally adjusted annual rates given in table 1 are concerned, it was decided simply to hold their effects to a minimum by using the independently adjusted grand totals for 1950 and 1951 instead of those resulting from the separate crop and livestock adjustments.

Government Payments to Farmers

Government payments are the only component of farmers' income other than cash receipts from marketings for which complete information on a quarterly basis is actually available. But because of the erratic fluctuations encountered in this series, the usual methods of seasonal adjustment are not applicable.

Government payments generally exhibit marked seasonal variation from quarter to quarter in any one year. But the seasonal pattern varies considerably from one year to the next because of changes (1) in programs and types of payment, (2) in fiscal-year appropriations for the same program—which may have different effects on the seasonal pattern of payments in 2 successive calendar years, and (3) in the speed with which money due is actually paid out.

In view of these circumstances, quarterly estimates of Government payments given in table 1 are based directly on 4-quarter moving totals, centered, and then adjusted to actual calendar-year totals. This method removes seasonal variations from the series. An unavoidable disadvantage is that it also reduces the amplitude of nonseasonal fluctuations but this is heavily outweighed by its advantages in a case of this sort.

Another disadvantage from the standpoint of keeping estimates current is the half-year lag in the moving totals. Satisfactory projections of Government payments can be made, however, in terms of the amount of money that has been or is expected to be appropriated for this purpose. And the estimates can be kept up to date with reasonable accuracy on this basis.

Home Consumption of Farm Products

The value of home consumption represents the annual quantities of farm products that are con-

sumed directly in farm households, with those quantities valued at prices received for the sale of similar products. We have no information as to quarterly variations in quantities so consumed, but quarterly price data are available for most of the items involved. As the situation with respect to available information in this case is analogous to that found in the case of farm production expenses, the method used for quarterly interpolation is also similar.

Annual estimates of the value of home consumption were first deflated by the index of prices received by farmers; annual changes in these deflated values were allocated evenly among the various quarters of each year as in the case of production expenses previously described; the resulting quarterly values at constant prices were then reinflated by corresponding quarterly average indexes of prices received; and, finally, these results were in turn adjusted wherever necessary to bring their calendar-year averages in line with the original annual estimates. These calculations were carried through separately for the totals of crops and of livestock and livestock products included in home consumption.

This "deflation-reinflation" method of quarterly interpolation, it should be noted, is somewhat less satisfactory in its present application than it was when applied to production expenses. There are two difficulties, both involving the suitability of the price indexes for the present purpose. In the first place, the index of prices received is weighted in terms of total quantities of the various commodities produced or sold by farmers, whereas quantities actually consumed in the farm home would be the most appropriate weights for the purpose. This defect is more serious for crops than for livestock because the crop price index does not include forest products, which are important in home consumption in the form of fuelwood, whereas it *does* include a number of other nonfood crops which do not enter into home consumption.

The second difficulty arises from seasonal variations in the price index. Although certain of its components, both crops and livestock, exhibit marked seasonal variations, and seasonally adjusted indexes for these components are available, the overall indexes are published only on an un-

adjusted basis. Thus, the use of these unadjusted indexes in deriving quarterly estimates of the value of home consumption unavoidably retains in the latter a small degree of seasonality in the price factor which should logically be eliminated. These two defects are noted for the record; but resultant distortions in quarterly estimates cannot be large, and are probably insignificant.

Usually no current information on changes in quantities entering into home consumption is available. Current quarterly estimates of the value of home consumption must therefore be made from changes in the price factor alone, assuming quantities unchanged from the previous year.

Rental Value of Farm Dwellings

Lack of information as a basis for allocating the rental value of farm dwellings among the 4 quarters of a year was not a serious handicap, because of the relative stability of the series in question. The rental value of dwellings responds to broad cyclical swings, but the changes from 1 year to the next tend to be small. Such changes as do occur, moreover, exhibit fairly consistent trends rather than the erratic fluctuations characteristic of some of the other series. For this reason, quarterly estimates given in table 1 are acceptable despite the dearth of actual information on a quarterly basis.

Nothing whatever is available prior to 1942. Consequently, annual changes in the series during the years 1929-41 were simply allocated evenly among the various quarters in such a manner that the 4-quarter average for each year equaled the actual estimate for the year as a whole. Beginning with 1942, quarterly estimates were interpolated on the basis of changes in the Department's index numbers of the average value per acre of all farm real estate. This index, published only once a year previous to 1942, is now published 3 times a year, as of March 1, July 1, and November 1. As the rental value of a dwelling is closely associated with its sale value, and the sale value of a farmer's dwelling is directly related to that of his farm as a whole, the index of average total value per acre provides a fairly satisfactory basis for quarterly interpolation of the rental value of farm dwellings. It also serves in the preparation of current quarterly estimates, before an estimate for the year as a whole is available.