

A criticism of index of farmers' real

income

by

J. S. Davis

AND

REJOINDER

by

L. H. Bean

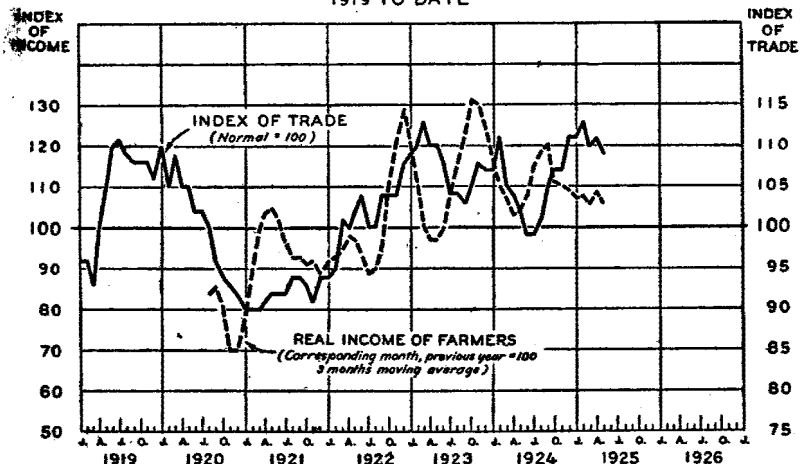
NOTES

A CRITICISM OF THE INDEX OF FARMERS' REAL INCOME

Mr. Bean's paper on "Measures of Agricultural Purchasing Power," published in the *Journal of Farm Economics* for July, is for the most part excellent. It contributes much to clarify a subject in which much confusion has existed. At one point considered briefly in its concluding pages, however, it seems to the present writer to be open to criticism. The current importance of the subject is such as to warrant a friendly expression of this criticism.

The chart on p. 370, here reprinted with title and explanation, is seri-

REAL INCOME OF FARMERS
AND
THE TOTAL VOLUME OF TRADE
1919 TO DATE



ously misleading. It seems to present a monthly index of farmers' real income that is comparable with Snyder's monthly index of the physical volume of trade. It seems to show an upward trend of this real income from late in 1920 to late in 1923, and its fluctuation on a level well above normal from late in 1922 until early in 1925, the close of the period covered. It seems to show, as indeed the accompanying comment definitely implies (though in it the words "farmers' cash income" are used), "a remarkably close relationship" between monthly variation in farmers' real income and the physical volume of trade, with the former preceding the latter. It seems to afford striking evidence of intimate dependence of business upon agricultural prosperity. The uncritical reader can hardly fail to get these impressions, yet I venture to submit

that all are erroneous, and that even Mr. Bean's stated inferences are in part unwarranted.

The fundamental error lies in the fact that the index of farmers' real income is not what it appears to be, and is in no way suited for direct comparison with an index like Snyder's. Gross cash income from marketings, even assuming the data are trustworthy, is not proper material for computing an index of the real income of farmers,¹ however useful it may be for a series to be compared with series showing general business activity. Adjustment by the index for non-agricultural prices at wholesale is a very crude method of translating farmers' money income into real income. The method of adjusting for seasonal variation by expressing each monthly figure as a percentage of the similar figure for the same month of the preceding year is exceedingly defective. More important, however, than any of these is the fact that the index is not, like Snyder's, expressed in terms of an estimated normal or even in terms of a fixed base; rather it is one of the most elusive types of index, referred to a constantly shifting base,—that of the same month in the preceding year.

A true index of farmers' real income, if it could be obtained by months, might well show something utterly different—probably a sharp decline in 1920-21 and a slight additional decline extending into 1922, to a lower point than any shown on the chart, followed by a fairly continuous recovery (by no means at a uniform rate) into 1925, to a level in 1924-25 around normal or perhaps somewhat above. This I infer (admittedly on no very substantial basis) in part from a study of the chart, in part from other data that Mr. Bean presents,² and in part from other information. It would show, I am strongly disposed to believe, that recovery of the volume of trade preceded the improvement of farmers' real income by a year or more; that the recovery of farmers' real income continued during the period from late in 1922 until the middle of 1924, when the physical volume of trade was tending downwards; and that, despite its advance, farmers' real income was below normal throughout a considerable period in which the physical volume of trade was above normal.

We may indeed conclude that the increase in the farmers' cash income since 1921-22 has contributed to the industrial recovery and the high level of business activity in recent years, that the physical volume of trade is influenced by the physical volume of farm marketings, and even that there is a real but as yet unmeasured relation between fluctu-

¹ Cf. Warren and Pearson, in *Farm Economics*, June 10, 1925, p. 287: "It is a strange economic theory that assumes that the prosperity of an industry is measured by the purchasing power of the gross cash value of the product;" and C. F. Clayton in *Journal of Farm Economics*, July, 1926, p. 354.

² For example, if one "deflates" the Department of Agriculture data for net income of farmers per farm (p. 363) by a July-June annual average of monthly figures of the Department's calculation of the wholesale index of non-agricultural commodities on a 5-year pre-war base (admittedly a crude procedure), one gets the following figures for "real net income" per farm in the crop years since the war, in terms of 1910-14 dollars:

1919-20-----	550	1922-23-----	396
1920-21-----	349	1923-24-----	465
1921-22-----	342	1924-25-----	542

tuations in farmers' real income and general business activity; but these conclusions are by no means identical with Mr. Bean's.

The simple fact is that no one has yet published a serviceable monthly index of real income of farmers, if indeed such an index is possible. The peculiar type of index here employed may justify itself in the statistician's office as a preliminary device for discovering relations between agricultural marketings or prosperity and general business activity, and for suggesting profitable ways of exploring these relations further. It might appropriately be published, with a correct title and a carefully guarded explanation, as a tentative contribution to the study of these relations for the benefit of other investigators. But it is exceedingly unfortunate to have it appear as a true index of farmers' real income, comparable with indexes of common types, and to have the text comment fail to correct improper inferences of large import.

If these criticisms are well-founded, they have a special pertinence. Mr. Bean's paper is designed to clarify thinking in a domain in which there has been a vast amount of abuse of statistics; yet in this particular he leads his readers astray. Furthermore, the identical chart, credited to the Department of Agriculture, is printed as the frontispiece of the National Industrial Conference Board's recent report on *The Agricultural Problem in the United States*, which has been given wide publicity. The Board failed to note that the curve conveys the impression of a much more favorable status of the farmer than its own investigation disclosed; but the curve apparently contributed substantial support to the Board's thesis regarding the intimacy of relationship between agricultural and industrial prosperity. As a matter of fact, this relationship is exceedingly complex, and serious analysis of this important subject has barely begun.

JOSEPH S. DAVIS.

Food Research Institute,
Stanford University.

REJOINDER

Mr. Davis' main criticism appears to be that in the comparison between changes in farmers' "real" income and changes in the total volume of trade, I have used a "most elusive" type of seasonal adjustment and have consequently arrived at inferences which are not warranted. The simple rejoinder to this is that the same inferences as to the relationship between farmers' income and the total volume of trade since the bottom of the depression are warranted even when the original data are adjusted for "normal" seasonal variations, determined by the accepted less elusive methods.

The several points raised by Mr. Davis appear to group themselves into the following general questions as to:

1—The adequacy of the data used as a measure of farmers' real income.

2—The adequacy of the method used in adjusting the data for seasonal variation.

3—The correctness of the implied or stated conclusions.

It should perhaps be pointed out here that the chart under criticism was included in my paper to illustrate a certain point, and that no elaborate description or discussion was necessary or could have been undertaken in an address (limited to ten or fifteen minutes) on a much broader topic.

Those who may desire the basic data representing farmers' income are referred to *Crops and Markets, Supplement*, September, 1925, p. 303. We published there for the first time estimates of the monthly money incomes of farmers derived from marketings from July, 1919, through June, 1925. These monthly incomes were also shown in terms of pre-war non-agricultural wholesale prices and, for want of a better title, were labeled "Real Money Income of Farmers," the word "money" being retained to indicate that only the cash portion of the farmer's income was under consideration. In the chart criticised by Mr. Davis these "deflated" money incomes were expressed as percentages of the corresponding months of the previous year. So much for the source of the basic data.

Their adequacy need not here be argued. They represent the first estimates by months by the Department of Agriculture of the money value of farmers' marketings, that part of farmers' income which is directly related to the exchange of goods and services between agriculture and non-agricultural enterprises. Although the estimates of money income by months may possibly be improved, for the present none other are available for our purpose.

The index of the total volume of trade, computed by Mr. Carl Snyder, of the Federal Reserve Bank of New York, is essentially a measure of non-agricultural activity. It is by far the most comprehensive index of trade, being composed of a number of commercial, financial, and industrial series which may be affected by agricultural conditions. Although farm marketings are also included or represented, they exercise so small an influence in the composite index that it is practically 95 per cent non-agricultural.

The adequacy of the index of non-agricultural prices, and its limitations, I have already indicated on page 365 of this *Journal* (July, 1926) and it need not here be repeated. I heartily sympathize with Mr. Davis' desire for "a true index of the farmers' real income," whatever that may be. But for the present we are limited to the use of the most tangible and important part of it, namely, the cash income from marketings.

The adjustment made for seasonal variation may well be questioned inasmuch as it is not usually employed, but this in itself does not invalidate its use. Considered technically the adjustment used is the

extreme type of a variable seasonal adjustment.¹ Its opposite extreme is the usually accepted but arbitrarily constant adjustment for "normal" seasonal variation as determined by the link relative² or some more simple method.

It is obvious, in the first place, that no "normal" seasonal variation can be determined from farm income data which are limited to that most abnormal period, 1919-24. Secondly, in the search for relationships between economic data, one cannot be bound by the methods of seasonal adjustment that happen to be employed or preferred by any one school of economists or statisticians. The choice of method should take into account the nature of the data as made available to or as known by those whose reactions are under investigation. In this case it is desired to study the reactions of the business community as a whole to the changes in the farmers' money income. We know that the average business man who is concerned with agricultural buying power does not have available any definite measure of the farmers' monthly income adjusted seasonally and for trend by any of the usually accepted methods. What he probably does have available are certain data on changes in crop prospects, in prices, and in marketings and each of these is generally compared by him or for him with the corresponding data of the previous year. If he adjusts his plans according to these data at all, it must be an adjustment on the basis of these simple comparisons only, translated into terms of his ability to sell more or less goods in the farm areas. Might it not then be possible that data on farmers' income, adjusted for seasonal variation by comparing with the corresponding month a year previous rather than by some fictitious "normal," more accurately reflect the response of the business community to the information as it knows it? We can not therefore agree with Mr. Davis that to compare two series of data they must both be adjusted in exactly the same way and that results obtained by any other adjustment are necessarily erroneous and misleading.

Mr. Davis charges that my stated inferences are in part unwarranted and that the uncritical reader can hardly fail to get erroneous impressions. The only inferences that I stated and would state again are that the buying power of the farmers' cash income since the bottom of the depression formed a substantial basis for the industrial recovery of 1922 and subsequent high activity and that changes in the farmers' buying power tended to precede changes in the total volume of trade. For any other inferences, particularly as to trend of farm income and as to the farmers' prosperity, the reader himself must take responsibility.

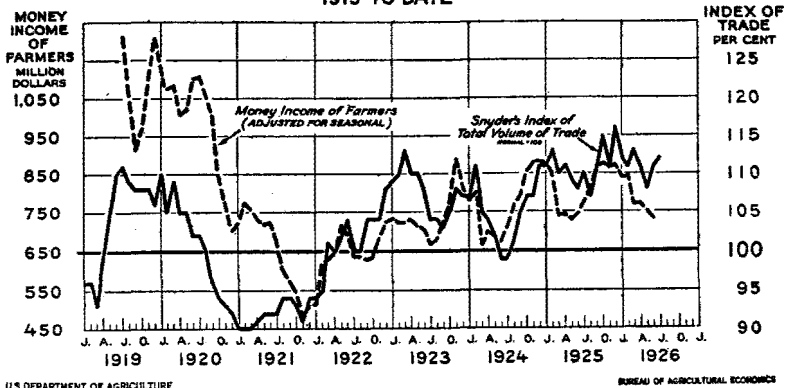
The accompanying chart substantiates my "stated inferences." With an additional year's data on money income now available, it seems more reasonable to attempt an adjustment for a constant "normal" seasonal variation. In this chart the original estimates of money income

¹ Suggested by Dr. W. I. King in the *Journal of the American Statistical Association*, September, 1924.

² Used by the Harvard Committee on Economic Research.

from marketings are adjusted only for seasonal variation.³ We have here again fluctuations in money income since 1921, corresponding in a large measure with fluctuations in trade and tending to precede the

MONEY INCOME OF FARMERS AND THE TOTAL VOLUME OF TRADE 1919 TO DATE



U.S. DEPARTMENT OF AGRICULTURE

BUREAU OF AGRICULTURAL ECONOMICS

latter. The same observations hold when this type of seasonal adjustment is applied to the income data expressed in terms of goods.⁴

Our studies have not progressed far enough to permit a final quantitative statement as to the effect of money or "real income" from marketings on business activity in general. It is quite likely that the relationship varies from period to period and that in some years industrial conditions affect agricultural income more than the latter affects industrial activity. During the past four or five years, as is evident from either of the charts, the direction of the relationship is almost unmistakable. Nor is the degree of relationship insignificant.

In the case of farmers' money income adjusted for both price changes and the variable seasonal,⁵ with a three months' lag in the index of trade, the coefficient of correlation of .73 is obtained for the four years following July, 1921. In the case of money income adjusted only for "normal" seasonal variation with a lag of two months in the index of trade, a coefficient of correlation of .71 is obtained for the four and one-half years since January, 1922. These coefficients, as ordinarily interpreted, suggest that approximately 50 per cent of the variations in trade may be accounted for by the variations in the farmers' money income irrespective of the way they are adjusted. One can hardly be accused of overreaching the mark for inferring from these comparisons that agricultural income has played an important part in our commercial, financial, and industrial activity since the depression of 1920-21.

On the basis of the evidence in the accompanying chart and in the

³ As determined for the years 1920-25 by the link-relative method, after eliminating a 12-month moving average trend. Beginning with July the seasonal percentages are: 91.2, 102.2, 126.1, 150.3, 124.5, 108.5, 97.9, 81.3, 84.2, 74.1, 80.7, 78.5.

⁴ That is, when deflated either by the index of non-agricultural prices of the Bureau of Labor Statistics or by Snyder's index of the general price level.

⁵ This is the series criticised by Mr. Davis.

income data adjusted for price changes, I would further disagree with Mr. Davis on some of his speculations: (a) The low point in farm income was reached in the fall of 1921, not in 1922. (b) The low point in the total volume of trade, it appears, was reached early in 1921, but this fact is not unrelated to the temporary recovery in farm income early in 1921 (this temporary recovery appears more marked in "real" income from marketings than in the money incomes shown here). (c) The farmers' income may or may not have been below normal during the period when the volume of trade was above. The fact is that our data are limited to the post-war period and we do not have a proper "normal" for farm income, in the sense that normal (long time trend) is used in the indexes of trade.

Finally, the present writer cannot accept full responsibility for the erroneous impressions of uncritical readers. It may be granted that the chart under criticism could and should have been more adequately labeled. A more exact title might be "Changes in Farmers' Real Income from Marketings." Yet we did attempt to warn the reader against getting the impression that the income curve fluctuated "on a level above normal from late in 1922," by indicating on the chart that in the index of trade 100 represented "normal" while in the index of income 100 stood for the corresponding month of the previous year. As a further caution we inserted a fairly detailed explanation at the bottom of the chart.

L. H. BEAN.

Bureau of Agricultural Economics,
United States Department of Agriculture.