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The relations between agriculture, labor, and business are many, complex, and difficult to analyze. Perhaps that is why there are at least three extreme schools of thought on the subject: agricultural fundamentalists, industrial fundamentalists, and skeptics.

1. The agricultural fundamentalists believe that all income originates in agriculture, and increases as farm products are processed and distributed; that booms and depressions start in agriculture; and that governmental assistance to agriculture benefits business and consumers.

2. The industrial fundamentalists believe that a nation's growth and prosperity depend not upon its agriculture, but rather upon its "secondary" and "tertiary" industries; that booms and depressions starts in such industries as manufacturing and banking; and that farm relief should be subordinated to fiscal and monetary measures, unemployment benefits, public works, and so on.

3. The skeptics see little evidence of any consistent relationship between agriculture and industry; they think that booms and depressions may start anywhere; and that we need a balanced economic policy, including agricultural programs along with a variety of other measures to maintain a steady growth in industrial employment and production, and a reasonably stable price level.

I am one of the skeptics - as I have just defined the term. My talk today will not convert any of you who may be either agricultural fundamentalists or industrial fundamentalists. I know from long experience that any kind of fundamentalist has a sort of religious zeal. He clings to his faith through thick and thin. Like the chart-reading school of stock market speculators, he sees only confirmation of his theories in any set of statistics that turns up.

Of course, we skeptics are not without zeal. But we have no theory to sell. We only doubt the extreme views of the fundamentalists. We have been puzzled by the statistical trends since World War II, and we are trying in a fumbling way to understand relationships between agriculture and the rest of the economy.

Our good friend, John D. Black, discussed these trends in some detail in his excellent Presidental Address to the American Economic Association in December 1955. As the basis for my talk today, I have brought up to date a few of Dr. Black's statistics. I shall review some recent and current trends. Then I shall indicate briefly what trends now seem most likely in the next 20 to 25 years. Finally, in the belief that these trends are not inevitable, but rather that they can be changed by our policies and programs, I shall discuss some of the kinds of research that may remove some of the mystery from this important subject, so that competent economists and statisticians will reach aggreement about the basic facts concerning relationships among agriculture, labor, and business.

I. Some Recent and Current Trends

This section of my talks is based largely upon material supplied by my colleague Nate Koffsky.

Much of the agrument about the relation between agriculture and the rest of the economy centers around the interpretation of trends in farm income compared with trends in the national income. Back in 1955, at the Annual Outlook Conference, we had a chart, "National and Farm Income", and that year also Dr. Black presented a similar chart in connection with his presidental address. Although I have heard some criticism of both charts, I am showing a modified version of our 1955 agricultural outlook chart, brought up to date.

Because there seems to be something controversial about the whole subject, very likely you will criticize this chart too. But this should not prevent us from trying to find the facts. Several years ago I disagreed with a scholar who argued that the National Bureau of Economic Research should stop studying the distribution of incomes because that subject was controversial. If we avoid controversial subjects in economics, our job will be uninteresting and useless. I would be glad to have any suggestions for better ways to show the relation between trends in national income and in farm income. But for the time being this series of charts will have to do.

Figure 1 shows that there was a very high positive correlation between changes in aggregate farm income and national income during most of the period from 1910 to 1948. After 1948, however, farm income fell off while national income kept on rising to new record levels. These figures are not corrected to allow for the drop in numbers of farms and farm people. Nor do they include the income farm people get from nonfarm sources.

Now, let us look at four charts, each of which shows the relation between income per capita of farm and nonfarm people for the years 1935 through 1957. All four of these charts display the same statistical facts. Yet they seem to give different, and even conflicting, impressions to some people. Thus, the first chart may give the impression of increasing disparity, while the other three may give the impression that the income gap is narrowing. In recent outlook meetings we have tried each of the first three charts.

I am showing these four charts side by side today to emphasize that they all indicate the same thing. They all demonstrate that per capita farm income since 1935 has increased by about the same or a little greater proportion than per capita nonfarm income. They also reveal that per capita farm income has risen very little in recent years, the 1957 figure being at just about the same level as that of 1948 and 1951. They show, moreover, that in the same recent years when farm income stopped rising, per capita nonfarm income kept on going up.

Figure 3 gives more detail concerning recent trends in farm and nonfarm income. It is based upon monthly data from 1951 through February 1958. Both the farm and non farm figures are seasonally adjusted. Even so, the data on farm income jump around somewhat from month to month. But farm income trended downward from the fall of 1951 to perhaps the middle of 1955. Farm income was fairly stable from 1955 through 1957, and has been increasing in recent months. The latest figure, that for April, indicates that farm income was 9 percent above the same month a year ago.

During most of this same period, nonfarm income rose rather steadily, although there was a little dip in 1954. However, nonfarm income has dropped since last fall, while farm income has been rising.

In this short period from 1951 to date, there has apparently been an inverse correlation between farm income and nonfarm income. When farm income has dropped, nonfarm income has risen. When nonfarm income has dropped, farm income has risen. I don't pretend to know all the reasons for this phenomenon. Some say that farm income since the fall of 1957 has risen because consumers have not been buying automobiles and have more money to spend for food and clothing. This may have something to do with the observed facts. I suppose, though, that the main factor both in the drop in farm income from 1951 to 1955 and the increase since late 1956 has been the agricultural supply situation. Continued high farm production and large stocks were certainly a depressing factor from 1951 to 1955. In the past year or so the stocks of some important commodities have been reduced. Also, market supplies of livestock products and fruits and vegetables have been rather short in recent months. I would not count on this inverse relationship lasting much longer.

Of course, agriculture is declining in relative importance. This has been happening ever since the country was settled. Figure 4 compares three measures of relative importance: farm income, farm population, and farm assets, each expressed as a percentage of the U. S. total. It is only natural that farm income is a smaller share of total national income than it was back in 1935. Farm population has dropped from 25 percent of the total U. S. population in 1935 to 12 percent in 1957. The proportion of national income going to farmers dropped in line with the decrease in the percentage of people who were farmers. The trend in farm assets as a percentage of national wealth has been less regular. It increased during the war, reached a peak in 1946, and then fell rather substantially until 1957. However, the percentage was only a little lower than the percentage in 1935.

It is difficult to get any satisfactory definition of parity farm income. This is partly because farm income is a return both to labor and capital, for the farmer is both working man and capitalist. He needs to get some return both for his labor and for the money he has invested in his land, buildings, and equipment. This chart, like the other three I have just discussed, suggests that farm income today has about the same relation to farm population and assets as it did before World War II. Of course, this does not mean that the present level of farm income is "right" or "satisfactory". Our best estimates indicate that the per capita net income of farmers is only about half the cash income of nonfarmers. You all realize, I am sure, that this is only part of the very complicated statistical picture. It does not mean that farm purchasing power, or that farm living standards, are only half those of nonfarmers.

Figure 5 presents some data that were prepared recently for the Joint Economic Committee. They are based on census figures that divide all farm families into two categories — those who operate farms with annual sales of $2,500 or more, and those who operate farms with annual sales of less than $2,500. There are about 2 million farms in the first group and about 2 3/4 million in the second group.

The chart shows for each year from 1947 through 1956 the average income obtained by each group of farms. The data include income obtained both from

farming and from off-farm sources. Medium-to-high production farms sell more than 90 percent of all farm products sold, and thus receive most of the total farm income. The trends shown by the data to the left of this chart are practically the same as the trends in total farm income. Even in the case of medium-to-high production farms, about 25 percent of the total farm family income is from sources off the farm--double the percentage of ten years ago. The increase in off-farm income has gone a long way toward offsetting the decline in farm income, especially since 1951.

The data to the right-hand side of the chart show the corresponding figures for low-production farms. Note that the total family income of these farms actually increased considerably from 1947 to 1956. The increase was due entirely to a substantial rise in off-farm income -- their income from farming actually dropped. The number of farms decreased by about a million during the last decade. This drop centered mainly in the low-production farms pictured to the right of the chart.

Low-production farms are really of two different kinds. One kind gets its living mainly from off-farm sources. The problems of this group are not primarily agricultural. But there still is a fairly large group of low-production farms that are dependent primarily upon agriculture for what income they get. These farms represent the heart of the low-income agricultural problem. The Department's rural development program is aimed at this group.

II. Long-Run Trends or "Projections"

In recent years many economists have been interested in projecting economic trends several years or even several decades into the future. Probably most of you are acquainted with the work John D. Black did along this line for the Paley Commission and with that done by Rex Daly and others in the Department of Agriculture. Some of you may have seen the big, detailed report, "Timber Resources for America's Future," recently published by the U. S. Forest Service. The interest in this field has not been limited by any means to agriculture and agricultural trends. Many prominent economists and statisticians have made projections of the gross national product several decades ahead.

Occasionally some doubts are expressed about the accuracy and usefulness of such projections. Mark Twain in "Life on the Mississippi" expressed such doubts many years ago. He said:

> "In the space of one hundred and seventy-six years the lower Mississippi has shortened itself two hundred and forty-two miles. That is an average of a trifle over one mile and a third per year. Therefore, any calm person, who is not blind or idiotic, can see that in the old Colitic Silurian Period, just a million years ago next November, the lower Mississippi was upward of one million three hundred thousand miles long, and stuck out over the Gulf of Mexico like a fishing-rod. And by the same token any person can see that seven hundred and forty-two years from now the Lower Mississippi will be only a mile and three-quarters long, and Cairo and New Orleans will have joined their streets together, and be plodding comfortably along under a single mayor and a mutual board of aldermen. There is something fascinating about science. One gets such wholesale returns of conjecture out of such a trifling investment of fact."

Some of you may have felt that certain of our economic projections also strive for "wholesale returns of conjecture out of a trifling investment of fact." It is true that the economist and statistician have to work with only a few basic assumptions, such as the rates of growth of population and productivity. But I am sure you know that any good economist and statistician tries hard to avoid the kind of error pointed out by Mark Twain. He knows that the Mississippi River never did stick out over the Gulf of Mexico, and he has good reason to believe that the length of the Mississippi will never be zero. In about the same way, any agricultural economist and statistician who knows the facts about American agriculture can be reasonably certain that the farm population in this country will not decrease to zero by 1975 or even by the year 2,000. And he knows that if our consumption of animal products is doubled, we will have to produce more feed.

Rex Daly's most recent projections were presented to the Joint Economic Committee in November 1957. They suggest that domestic requirements for farm products will increase by about 20 percent in the next decade, and perhaps by about 50 percent in the next two decades. The main reason for expecting such increases is that we are projecting a continued rapid increase in population, with a growth of 37 percent from 1956 to 1975. In addition, we are projecting increased average incomes for the whole U. S. population. Even though the bulk of this increased income will be spent on non-agricultural products, we expect about a 3 percent increase in the per capita use of farm products between 1956 and 1965, and about an 8 percent increase by 1975. This, together with a 37 percent increase in population, indicates a total increase of about 50 percent in the market for farm products.

This does not mean, of course, that there will be a 50 percent increase in the consumption of each individual farm product by 1975. Recent trends in food consumption have varied a great deal from commodity to commodity. I am sure agricultural economists in Maine, for example, know that the per capita consumption of potatoes has been declining. This is true also of cereal products, dry beans, and peas. Between now and 1975 there may well be some further decline in the per capita consumption of this group of foods. The expected increase in population may just about offset the declines in per capita consumption, resulting in about the same total consumption as we have today. On the other hand, Daly's projections suggest that from 1956 to 1975 there may be something like a 61 percent increase in the consumption of poultry products, 56 percent in meats, 48 percent in dairy products, 36 percent in eggs, and 26 percent in non-food products. The expected large increase in the consumption of animal products will also mean an increase of about 40 percent in requirements for feed.

At first glance these projections may seem extremely favorable to agriculture. They may suggest that we will soon eat our way out of agricultural surpluses. Yet, Glen Barton and other farm management experts in the Agricultural Research Service figure that recent and expected improvements in farm technology will make it not only possible but rather likely that agricultural production will continue to outrun demand, at least for several years to come. Probably the cost-price squeeze is not over. Probably we will have surpluses, and price-support operations, for many years to come.

This brings me to some concluding observations about the purpose of long-run projections. I don't see any great value in any sort of fortune telling unless the victim can do something about changing his fortune. Even

assuming that the economist and statistician can tell us exactly where the economy will stand in 1975, I am not sure that he has earned his pay. I think what we must search for is not a single projection as if there were something fateful and inevitable about it. Rather, I think we must search for a number of alternative projections, indicating what the long-term trends would be if we followed each of several alternative policies. Only then can the public, and the Congress, decide wisely what policies to follow. I have seen very little along this line yet. Gerhard Colm made at least a start in this direction in a report prepared for the National Planning Association entitled, "The American Economy in 1960".

I hope that in the next decade or so we will go much farther along this line in connection with agricultural projections. If it is true that we are faced with another decade or more of a cost-price squeeze in agriculture, can't we do something about it? Must the economist and statistician limit his work to the mechanical projection of past trends? I certainly hope not. There is a crying need for objective, scientific analysis to throw light upon the probable effects of the numerous alternatives that are being discussed. Where would we be by 1975 if we had no agricultural price support program? Or where would we be if we find some way of continuing to export large quantities of surplus products, or some kind of food stamp plan or other means of increasing domestic demand for food, or some form of certificate plan or "self-help" program under which farmers would pay part or all of the cost of supporting prices of their crops, or if payments are made to farmers from the Federal Treasury with or without production control? Probably you can think of still other alternatives. As I see it, the economist and statistician should help us reach agreement as to where each of such alternatives would take us by, say, 1975 or 2000. I am afraid we still have a long way to go before we can produce a convincing analysis.

III. Relations Between Agriculture and the Rest of the Economy

If economic policy is ever to become objective and scientific, the economist and the statistician must be able to measure the interrelationships between different segments of the economy. Agricultural economists should not be satisfied to repeat ancient slogans. Rather, they need to provide some cold, statistical facts about the relation of agriculture to the general employment and business situation.

Some work along this line has been done recently by agricultural economists. My former colleague, Professor Karl A. Fox, now at Iowa State University, has made some statistical measurements of the effects of farm price supports upon general economic stability.[1/] Professor Dale Hathaway, of Michigan State University, has recently made an important study of this subject.[2/] Still more recently, Walter Wilcox has prepared a paper on a similar subject for early publication in the Journal of Farm Economics.

1/ Karl A. Fox, "Farm Price Supports and Economic Stability" in the Report, "Increasing Understanding of Public Problems and Policies". Farm Foundation. 1955.

2/ Dale E. Hathaway, "Agriculture and the Business Cycle". Report of Hearings before the Joint Economic Committee. Washington. Nov. 22, 1957. pp. 51-69.

Although good work in this difficult area of research has been done, obviously we need a great deal more. In this field we must deal with many interrelated equations. This sort of thing did not make much difference to men like Walras and Pareto who were interested only in pure economic theory and mathematics. When we want to make statistical estimates, our job is quite different. I believe we still must use some sort of economic models, but these must be simplified in some way to make them at all practical from the standpoint of computation. We obviously cannot deal with a whole set of demand and supply equations for each of the 170 million persons in the United States.

I would like to discuss two general types of models that may be useful in the future. The first is a set of equations showing the demand and supply relationships within agriculture. The second is the Leontief system of equations showing the interrelationships between agriculture and other segments of the economy.

Professor W. A. Cromarty of Michigan State University has undertaken an ambitious study of intra-agricultural relationships representing the demand for and supply of a number of different groups of farm commodities. He proposes to use over 40 equations, involving estimates of such things as elasticities of demand and supply. Assuming that Mr. Cromarty can get usable estimates of the parameters of his equations, he should be able to throw a great deal of light upon the effects of price support, storage programs, purchase and diversion, and export programs upon the output and prices of farm products and upon the gross and net incomes of farmers. His equations should also make it possible to take account of some of the indirect effects of farm programs. For example, the effect of corn loans upon feed supplies and upon costs of feed to the New England dairy and poultry industries.

Of course, Mr. Cromarty's study is not designed to provide information about relations between farming and other industries. If his system of equations were enlarged to cover the entire economy, it doubtless would include several hundred equations. It would be certainly a difficult and time-consuming job to get any sort of estimates of the parameters of all these equations — including such things as the elasticities of demand for and supply of all sorts of nonagricultural commodities and services. To get anywhere with this complex problem, we have to make some sort of heroic assumptions.

A set of assumptions well worth trying is that proposed by Professor Leontief of Harvard. Nathan Koffsky and Harry Norcross of the Division of Agricultural Economics have been getting together the basic data needed to construct a Leontief input-output matrix for 1955. This matrix will classify all economic activities into about 115 industry groups, including 17 commodity groups within agriculture. So far, their work has been limited to obtaining the basic data to put into such a matrix. Until this is finished, we will not be able to make a detailed analysis to show, for example, what effects agricultural programs might have on each industry within agriculture and outside of agriculture.

But to get some idea of the sort of results we might expect, I have made a very rough analysis, which is summarized in Table 1. For this purpose, the 1947 data were aggregated into four groups of industries -- farming, farm supplies, processors of farm products, and all other industries.

Part A of the table shows the inter-industry transactions in 1947. For example, the first row of the table shows that farmers produced 40.9 billion dollars' worth of goods, of which 10.4 billion was sold to other farmers, 0.2 billion to the supply industries, 18.9 billion to processing, and 0.0 to all other, leaving 11.4 billion dollars' worth sold in unprocessed form to domestic consumers and to exports. Similarly, the first column shows that farmers paid out 10.4 billion dollars to other farmers, 4.1 billion to supply industries, 4.7 billion to processors, 3.4 billion to all other industries, and 3.0 billion to labor.

Now here is where the heroic assumption comes in. For the purpose of this analysis, I assume, as does Leontief, a constant ratio between the total sales of any industry and each of the inputs. More specifically, this analysis assumes that if the total sales of farm products were increased, say 10 percent, farmers would pay out 10 percent more to other farmers, 10 percent more to supply industries, 10 percent more to processors, 10 percent more to all other industries, and 10 percent more to labor. In a similar manner, this analysis assumes that the ratios in the other columns of the table also remain fixed.

The appropriate ratios are shown in Part B of the table. Take column 1, for example. It shows that for every dollar's worth of sales by farmers, 25.4 cents is paid out to other farmers, 10.0 cents to supply industries, 11.5 cents to processors, and 8.3 cents to all other industries. The numbers in the other three columns can be interpreted similarly.

Those of you who know matrix algebra will be able to insert the numbers from Part A of the table into Part B and check all the ratios. In Part B of the table X_1, X_2, and X_4 represent the total sales of each of the four industries.

Many economists have questioned whether the ratios in Part B of the table do actually remain constant. They point out, for example, that input-output relations are not likely to be linear, nor are they likely to stay constant over any substantial period of time. There is doubtless merit in these criticisms. I doubt if we can assume that these ratios will stay exactly fixed either when outputs change or over any period of time when there are substantial changes in technology. Still, I think there is some empirical evidence that an analysis based on the Leontief matrix is likely to give reasonably useful approximations, at least for a few years after the input-output data were obtained.

Part C of the table is simply the inverse of Part B. Part B shows a set of equations which we could use to estimate final demand if the total sales of each industry were given. Part C is the inverse; that is, it is a set of equations which enable us to estimate total sales of each industry if final demands are given.

I don't want to claim too much for these equations. They are intended only to illustrate the type of analysis that may become possible when we have more complete, more accurate, and more recent data. We could use equations like those shown in Part C to estimate what would happen to the total sales of each industry if, for example, the final demand for unprocessed agricultural products were increased by any specified amount. Actually, this table indicates that an increase of 1.0 billion dollars in the final demand for either unprocessed or processed farm commodities would tend to increase total sales of all

industries together by about 2.3 billion. In other words, there would be a "multiplier" of about 2.3 in either case. The effects upon farm income, however, would be quite different. An increase of 1.0 billion dollars in the final demand for unprocessed farm products would raise farm income by about 1.4 billion dollars, while an increase of 1.0 billion dollars in the final demand for processed farm products would raise farm income by only about 0.3 billion.

I repeat that this little analysis and the table are only intended as rough illustrations of some of the main relationships between agriculture and the rest of the economy. Much more work needs to be done before these relationships can be worked out in greater detail, brought up to date, and made more precise. For the present, I would like to make three comments concerning this sort of analysis.

1. Some agricultural economists who saw the results of this analysis suggested that a multiplier of 2.3 was roughly in line with the statistic that the farmer gets about 40 cents of the consumer's food dollar -- in other words, that the farm dollar is multiplied by about 2.5 by the time the consumer pays her food bill. I think this is mainly a statistical accident. Note that Table 1 shows the same multiplier for processed commodities as for unprocessed commodities. If we were measuring simply the pyramiding of costs, we would expect the multiplier for processed goods to be much larger than that for unprocessed goods. The analysis in Table 1 is different -- it attempts to measure how a change in final demand for any product affects each of the four industry groups. It includes the initial, secondary, tirtiary, etc, effects. Our multiplier more nearly represents the sum of a geometric series. Imagine two industries. When Industry A gets an extra dollar it pays out $\frac{1}{2}$ dollar to Industry B; then Industry B pays $\frac{1}{2} \cdot \frac{1}{2}$ dollar to Industry A; Industry A pays $\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2}$ dollar to Industry B. It is a well-known algebraic fact that after an infinite number of rounds of such payments, the initial dollar has increased to two dollars. This would be a multiplier of 2.0. If the industries paid out about 57 cents of each dollar earned, the multiplier would be 2.3. With 4 industry groups, instead of two, the algebra is a little more complicated, but the principle is the same.

2. These preliminary results should not be taken to indicate that there is anything magic about the multiplier for agriculture. All industries doubtless have multipliers. The table indicates that these multipliers may be roughly of the same magnitudes. At least this appears to be true when we lump together all industries into a few big aggregates.

3. Although we have not yet used this analysis to test the effectiveness of agricultural programs, I think two conclusions are rather apparent: first, that agricultural programs alone will not insure general stability and prosperity; and, second, that on the other hand, a strong agricultural program is needed in addition to such things as monetary and fiscal measures, public works, social security, and other nonagricultural programs for balanced economic growth.

IV. Present State of the Agricultural Economy

Since last fall, agriculture has been one of the few sources of strength in the current recession. Prices received by farmers on May 15, 1958 were 9 percent above those of a year earlier. Net realized farm income in the first 3 months of this year was 11 percent higher than a year ago.

The recent increases in prices of farm commodities was mainly due to two factors: first, the reduction in the slaughter of cattle and hogs which has cut back red meat supplies by about 10 percent; and, second, the early freeze which sharply reduced the supplies of citrus fruit and many vegetables. We can doubtless expect some increase in supplies of most farm commodities during the rest of this calendar year. When this occurs, the prices of several farm products may ease off somewhat. However, we expect net realized farm income this year to be considerably above last year. Present indications suggest an increase of 5 to 10 percent.

So far, the current business,recession appears to have had little effect upon agriculture. Consumer purchases of food and farm products continue strong. The main effect of the recession probably has been to make it more difficult for some farmers to find part-time industrial work. Also, in some areas the business recession may have increased the supply of unskilled farm labor.

Table 1.--Input-output Analysis

A. Original data, based on 1947

	Farming	Supply	Processing	All other	Final demand (x_{io})	Total Sales
Farming	10.4	0.2	18.9	0.0	11.4	40.9
Supply	4.1	18.6	14.4	28.7	13.3	79.1
Proc. & dist.	4.7	5.5	23.9	28.1	74.8	137.0
All other	3.4	14.8	17.7	46.5	74.3	156.7
Labor	3.0	17.1	51.1	31.5		413.7

B. Matrix Equation

	Farming	Supply	Processing	All other			
Farming	+.745	-.003	-.138	-.000	X_1		x_{10}
Supply	-.100	+.765	-.105	-.183	X_2	=	x_{20}
Proc. & dist.	-.115	-.070	+.826	-.179	X_3		x_{30}
All other	-.083	-.187	-.129	+.703	X_4		x_{40}

C. Inverse-Matrix Equation

X_1	1.395	.047	.251	.076		x_{10}
X_2 =	.292	1.447	.304	.454		x_{20}
X_3	.283	.223	1.349	.401		x_{30}
X_4	.294	.431	.358	1.626		x_{40}
	2.3	2.1	2.3	2.6		

Raising final demand for either unprocessed or processed farm products by 1.0 billion dollars increases total sales of all goods and services by 2.3 billion. In other words, there is a "multiplier" of 2.3 in either case. But a 1.0 billion dollar increase in final demand for unprocessed farm products would raise farm income by 1.4 billion, while an increase of 1.0 billion dollars in final demand for processed farm products would raise farm income by 0.3 billion.