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UNITED STATES DEPARTMENT OF AGRICULTURE  
Bureau of Agricultural Economics

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U. S. Department of Agriculture

A PROGRAM FOR THE IMPROVEMENT AND ELABORATION OF DATA  
NEEDED FOR COMMODITY PRICE FORECASTING

By O. C. Stine, Principal Agricultural Economist, Division of  
Statistical and Historical Research

Address, Joint Meeting of the American Economic Association, the  
American Statistical Association, and the American Farm Economic Association,  
Washington, D. C., December 28, 1929

I know that some of you do not believe in price forecasting. But many of us are engaged in aiding producers to adjust production to demand and in deciding when and how to market; or in aiding distributors and consumers to decide when to buy. We are trying to make some practical use of economic theory and statistics. Whether we acknowledge it or not, we are forecasting or aiding our employers to forecast prices.

Enough is known about prices to enable competent analysts to make price forecasts sufficiently accurate to be useful in planning production, marketing, consumption or buying, to the advantage of the producer, the distributor or the consumer. Whenever it is possible by such means to bring about a more accurate adjustment of prices to fundamental supply and demand conditions, the producer, the distributor and the consumer may all profit through the elimination of economic wastes. These two propositions are re-phrased from the conclusion of the paper read last year at the meeting of the Farm Economic Association on "The Progress in Price Analysis and an Appraisal of Success in Price Forecasting" 1/. I am restating these two propositions as my justification for advocating great care and large expenditures in the collection and analysis of data as to production, prices and consumption of commodities, for use in price forecasting.

The subject assigned to me seems to be comprehensive as to the commodities to be considered, but lack of knowledge of non-agricultural commodities makes it necessary for me to confine my discussion to agricultural commodities.

As a basis for price forecasting we need and must have greater precision in price analysis. Availability and character of data largely determine what can be done. The economic statistician can not make bricks without straw, the opinion of many to the contrary notwithstanding. Although we have a great mass of commodity statistics, the analyst is always confronted with the need of something more or better. The statistics of cotton are probably more complete

1/O.C. Stine, Journal of Farm Economics, Vol. XI, No. 1, January  
1929 p 128-140.

and more reliable than of any other agricultural commodity of major importance in the United States, but the analyst still finds need of more and better cotton data. For a forecast of prices early in the season to aid farmers in planning the marketing of their cotton crop, an analyst would want a more prompt and more complete survey of the carryover of American cotton in foreign countries, more information about the quantity and quality of the production of foreign cotton, more data as to cotton consumed by industries and prospective industrial demand at home and abroad, and data as to the volume and character of trading on the cotton exchanges. For most commodities the need for more and better data is much greater than in the case of cotton, and in many such cases a request or demand for price forecasts is literally a demand for bricks to be made without straw or clay.

It would be impossible for me to deal with all agricultural commodities or even with the important commodities in detail. It is commonly said that prices are determined by supply and demand. Perhaps I can review the field in a more satisfactory manner by dividing it into three parts, - supply, demand and prices, and reviewing each in turn.

Let us consider first supply data, including production, carry-over, stocks, shipments and receipts. As a basis for forecasting the prices of a commodity on a given market, we need to forecast the supplies bearing upon that market, and also need representative and comparable series for a period long enough to establish the relationship between supplies and prices. Of course, I need not tell you, but only remind you, that each commodity presents peculiar problems in determining what supplies are related to the market and to the prices to be forecasted.

For some commodities we have world-wide markets. A forecast of wheat prices for the season requires a consideration of world supplies, including the crop and carryover, and the prospects for supplies for the next season. Adjusting the forecast to a market in the United States requires a fairly accurate estimate of the supplies most closely related to the specific market. In making a forecast of the course of prices during the season or of the price at any time or for a short period in the season, the location of supplies and the movement of wheat in relation to the market become important. A price forecasting service on a commodity such as wheat, therefore, involves a comprehensive collection of data as to world production, stocks, receipts at principal markets, and any other available data as to the volume and rate of movement from producing areas.

To provide the basis for a program of marketing the wheat crop of the United States we need an accounting of world stocks as of July 1, and the best possible forecast of production for the season. Outside of the United States, only Canada makes a comprehensive survey

of stocks and that not until at the end of August. Many of the countries harvesting in July or August make no forecasts or estimates until after the harvesting is over or nearly over. The trade makes forecasts but in many cases these forecasts are based upon limited observations and superficial information. The official forecasts and estimates also need improvement. In June of 1928, for example, all available information indicated a world wheat crop somewhat less than the crop of the previous season, and certainly no greater. It followed, however, that throughout the season forecasts and estimates were continually increased. The winter wheat crop of the United States turned out to be 68 million bushels, or 13 per cent in excess of the June forecast, and the world crop turned out to be 8 per cent greater than that of the previous year. The result, of course, was a considerable reduction in price from what might have been expected on the basis of early crop forecasts.

The want of data with reference to the production of some classes of livestock and livestock products is even greater than in the case of crops. For example, we have a great interest in the world wool situation, but for no country do we have a forecast of production and for very few countries do we have a satisfactory historical series of estimates of production. Stocks, except at a few important points, are unknown. A program for the improvement of supply data for use in forecasting prices of wool requires in the first place more accurate estimates of the number of sheep that produce wool, information as to conditions that affect the production per sheep, forecasts and estimates of production of wool, and periodically, fairly complete surveys of wool stocks throughout the world. While the need for world-wide data as to the production and stocks of butter, beef and pork may not be quite so pressing as that for wool, in each case there is room for a great improvement in data as a basis for forecasting prices of these commodities in the markets of the United States.

We need a world wide crop and livestock reporting service. If the International Institute of Agriculture would function to develop in every important producing country an accurate census and fairly accurate annual censuses or estimates of crop areas, numbers of livestock, and production; scientific methods of forecasting production as early in the season as it is possible to determine with a fair degree of accuracy the probable outturn; and a fairly complete annual or frequent survey of stocks; it would perform a great service for the statistician who has to deal with products having a world-wide market. This production estimating service, of course, should be supplemented by the collection of reliable data as to market receipts, and other indications of the movement of supplies from producer to consumer.

To the extent that foreign countries and the International Institute of Agriculture fail to meet our needs, the United States Department of Agriculture must try to make up the deficiency. The Department has made some progress in forecasting crops in foreign countries. Analyses of the relation of weather conditions to yields in Argentina, Australia and Canada have been used in the present season to forecast the crops in these countries well in advance of the harvest. A beginning is being made also at forecasting hog production in some North European countries. This work needs to be

extended to other countries and other commodities, and it should be supplemented by reports from trained observers placed in foreign countries to function as State Crop Estimators function in the United States.

As citizens of the United States we boast of the most comprehensive census and the best crop reporting service in the world. But when we submit the results of our censuses, our estimates, and forecasts of production to the test of utility in forecasting prices, we find a need for great improvement in our own data. The forecasts of production in the United States are as a rule early enough to be useful in planning the marketing of crops. Other commodities need to be added to the crop forecasting list, and the early forecasts need to be made more accurate indications of the final outturn of production. The Department of Agriculture is willing to extend its crop forecasting list to the limit of available funds and to improve the accuracy of the early forecasts as much as possible. The same may be said about the annual estimates of production. These annual estimates and forecasts are based upon censuses and other indications of or checks upon production. In every direction we find room for improvement in estimates and even in censuses.

I wish to call attention particularly to the need of revising historical production series for use in determining the relation between supply and price. Holbrook Working of the Food Research Institute made a thorough analysis of the estimates of wheat production over a series of years and concluded that whereas in recent years the final estimates have been fairly accurate, in the period prior to 1902 both the estimates of production and the censuses were probably considerably below the actual production. Taking 1899, for example, the original official estimate of wheat production was 547 million bushels and this was subsequently revised to 636 millions. The census reported 659 millions, but Working, on the basis of mill grindings and other indications of available supplies, concludes that the production of that year was probably 682 million bushels, 22 millions in excess of the census figure and 135 millions in excess of the first estimate. One of the principal reasons for this first estimate being so far off was that the previous census upon which estimates for the decade had been based was also too low. Dr. Working estimates that the production of 1889 was probably 618 million bushels, but the census reported only 468 millions. 2/

It is more difficult to count or estimate potatoes than wheat, and many forecasters have stumbled on defective potato production data. The production of potatoes in 1924 was estimated to be 455 million bushels. This was subsequently reduced to 422 millions, but the census found only 352 million bushels. What was the production of potatoes in 1924? This is enough to point the finger straight at the need of revising past data and making plans for improving both census taking and estimating.

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2/ Holbrook Working. Wheat Acreage and Production in the United States Since 1866. Wheat Studies of the Food Research Institute. Vol. II, No. 7 June 1926.

Improvements in production data in the United States require first of all a more careful consideration of the problems involved in obtaining accurate censuses. The census is or ought to be the starting point for estimating production for the decade, but an incomplete or inaccurate census cannot be accepted as a proper basis for estimates. Both the census findings and estimates must be checked by data from all other available sources in determining how to use them. The need for accuracy requires greater care in formulating questions, taking the census, and editing and tabulating the schedules.

Improvement in estimates requires greater care in securing comparable and representative reports and constantly checking preliminary estimates with data from every possible source as to the disposition or movement of the product. Furthermore, the estimator ought not to stop with the revision of his data after he has left it behind him past a census. For time series the estimates between censuses must be revised backwards. The final estimates for any period ought to be based upon the censuses both at the beginning and the end of the period. Improvement of the annual estimates for a series of years, to be used in the analysis of prices as a basis for forecasting, therefore, requires some thorough-going research to revise production estimates and censuses for a period of years long enough to give a proper basis for determining trends and cycles in production and provide a reliable measure of the relationship between supplies and prices.

You may ask how long the series should be. The proper or necessary length of the series will differ to some extent and must be determined in each case. As a rule a short-time series, five to ten years, is an unsafe basis for making forecasts. In the case of cattle, sixteen or more years are required to establish one cycle, and we ought to have at least three, which would require a period of about fifty years for which we ought to have comparable production data.

Forecasting prices of livestock presents many supply data problems in addition to those encountered in attempting to forecast the prices of crops. In the first place, a series of annual estimates of production are wanting for most livestock products, and there are no forecasts of production excepting what may be made from intentions to breed sows or the numbers of livestock on farms. Furthermore, shifting census dates and changing forms of questions tend to destroy the comparability of the data as to the numbers of animals on farms through the past decades. The price analyst who is preparing his slate of Christmas wishes might well include -

(1) A request that Congress decide upon a time in the season for taking a census when the best census can be taken, and hereafter take all censuses as of the same time in the season;

(2) That the census takers and their advisors formulate their questions as to the numbers of livestock and the production so that the results for the different censuses will have as high a degree of comparability as it is possible to obtain through care in formulating comparable questions;

- (3) That the annual estimates of livestock then be adjusted to the census base;
- (4) That the livestock production, including meat production from the total slaughter of animals, milk and its production, eggs and poultry be estimated annually, and in some cases even monthly if possible;
- (5) That provision be made for forecasting production or marketings annually and monthly.

There would still remain the problem of establishing comparable time series of production. This is almost hopeless but patient research could accomplish something in reconstructing production series from numbers of animals, slaughterings and receipts at markets. In the meantime we must stumble along and do the best we can with the available data.

So far I have spoken only of total production. In most cases it is necessary to have data as to production by types and classes of a commodity. In the case of tobacco, for example, there are many types which must be treated separately. There is not much more relationship between the flue-cured tobacco of North Carolina and the cigar binder tobacco of Connecticut than there is between apples and potatoes. The five major classes of wheat need to be treated separately. The prices of the different classes of wool do not move together. Supplies of long and short staple cotton ought to be estimated separately. Analysis of cattle prices could be greatly facilitated by more data as to the number of animals marketed or to be marketed that fall into the important classes. Particularly desirable are accurate estimates of numbers of cattle on feed and forecasts of numbers that may be available for the feed lot. The Department of Agriculture recognizes the need of classifying supplies on the basis of market values or price relationships and some progress has been made in this direction.

Quality is also an important factor in determining prices, and analysts are beginning to emphasize this fact. I have been told by a tobacco man that it would be impossible to forecast the prices of tobacco because of the importance of quality in determining price. One of the first problems of the tobacco analyst, therefore, is to find some measure or index of quality and then establish some basis for forecasting quality. The Tobacco Division of the Department of Agriculture is beginning to secure information as to quality. We are still without an historical basis for determining the relation of quality to price, but research of the records of tobacco merchants may yet reveal some basis for determining variations in quality over a period of years. At any rate in the future we shall have from the Department of Agriculture some index of variations in quality.

Quality must be taken into account in forecasting the prices of other commodities, even though it may be less important in some cases than in the case of tobacco. Dr. Waugh has called attention to the im-

portance of quality in determining the price of certain fruits and vegetables. 3/ In all such cases the forecasting of prices must take into account the quality factor. In many cases quality seems to be an intangible matter which can be measured only indirectly. It is probable, however, that some basis can be found for indicating quality in connection with each commodity. In some cases it is possible that quality indices can be developed better by market inspectors than by producers and crop estimators.

It seems to me that here is a field in which the market news and inspection services can render the analyst a real service. The grain and cotton inspection services provide quantity measures of quality. Why not others?

Thus far I have dealt with national and international estimates of supplies. The price that the local producer may obtain in his local market may be determined in large part by local supplies. There ought to be a place in the economic program of every State for making studies of the relation of producers to their markets, and translating national and international forecasts, that may be made, into their probable effects upon local prices. For this purpose more careful attention needs to be given to State and county estimates of production.

We have worked so much with the relation of production to price that we are inclined to forget at times the importance of the consumer and his purchasing power or his demand in determining price. Data as to actual consumption of agricultural commodities are about as scarce as hens' teeth. Our knowledge of consumption for the most part is limited to what may be derived from data as to production, imports and exports. In the case of cotton and wheat we have fairly complete data as to mill consumption. Some manufacturers report wool consumption but others do not. We have periodically a manufacturers' census but with a few exceptions it is only recently that manufacturers have been required to report the quantities of materials used. Perhaps in the future we can have even more data from manufacturers as to the volume of the raw materials used in manufacturing. But this is only the first step toward the final consumer and we need to get closer to him.

Estimates of consumption for the United States as a whole are not sufficient. We need estimates by regions, states and cities. To illustrate, the South consumes large quantities of pork and pork products. What will be the effect of a depression in income from cotton upon the demand for hogs? To answer the question we need some measure of what the South consumes. We need historical data, but that is practically out of the question except by inference from general knowledge of the character of the products consumed by the South and the effect of cotton depressions upon the prices of these products in relation to prices of pork products.

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3/ Frederick V. Taugh. Quality as a Determinant of Vegetable Prices....1939.

Recently we have noted an apparent marked falling off in the demand for butter. From an analysis of available data we know that the demand for butter is associated with factory payrolls. We have a fairly definite index of payroll's but not a very satisfactory index of consumption. We have no means of locating consumption either geographically or by classes of consumers. If we could do this, we might in the future analyze probable changes in payrolls and indicate where and how much butter consumption might be affected.

For more precise analysis or forecasts of demand we must have data as to consumption by population or income groups. We know that New York consumes a very large quantity of oranges. The effect of changes in supply or of industrial and financial conditions upon prices and consumption of oranges in New York will depend to some extent upon who consumes oranges and the elasticity of the demand of the several classes of consumers. At present an analysis of consumption by population and income groups can be made only upon the basis of special surveys which classify consumers and obtain estimates of consumption by these classes at various prices. Such studies seem likely to prove fruitful sources of data for determining the relation of consumption to price.

Highly specialized local surveys, however, are a slow method of accumulating data as to the consumption of commodities. The Bureau of Labor Statistics has done some good work in this field, and its activities ought to be extended. The survey of food consumption per capita made in 1918 or 1919 ought to be repeated and elaborated so as to show per capita consumption of important commodities by sections of the United States, regions and localities, and, if possible, by income groups.<sup>4/</sup> If the Bureau of Labor Statistics continues to limit its activities to the collection of data in cities, some other agency, possibly the Department of Agriculture, should undertake to supplement these data by collecting similar and comparable data as to rural consumption.

In considering consumption and demand, we must not overlook the fact that a considerable percentage of the commodities produced in this country are consumed abroad. This calls for the collection of data as to consumption and factors that affect the consumption of our products in foreign countries as well as in the United States.

Price data seem to be abundant. We have more of this kind of stuff than of anything else, but the analyst frequently finds that his price data are inaccurate, poorly defined, or not specifically enough related to the commodity or market with which he is concerned. The price reporter, the price collector, and the price analyst need to get closer together to remedy these defects.

We need more data as to the prices of some commodities in foreign markets, and in localities between the producer or the consumer and the

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<sup>4/</sup> Cost of Living in the United States. Bulletin of the U. S. Bureau of Labor Statistics. No. 357, May 1924.

wholesale market. Time will not permit me to dwell at length upon a program for the collection of more and better price data, but I do want to say a few words about retail prices.

In measuring demand we must use retail prices in relation to consumption. The use of wholesale market prices may give misleading results because the spread between the retail and wholesale price of a commodity is not a constant proportion of the retail price. The available retail price data are collected mainly for the purpose of constructing index numbers of the cost of living. The price analyst has not used them for all that they are worth but when he turns to their use he will find that they also need improvement for his purpose. He will want more data and with more specific descriptions as to just what they represent.

Since one of the first steps taken in price analysis is to deflate the actual price to some common base, it is desirable to give some consideration to the character of the deflator to be used. Suppose, for example, we want a deflator which represents as accurately as possible changes in general price level, independent of other price factors. Let me set up two requirements: First, it shall be as free as possible from the effects of shifts and changes in the supply or demand for specific goods or services. Second, that it shall represent competitive prices as free as possible from the stabilizing influences of monopoly, custom or contract. I believe that these are reasonable requirements. Have we a deflator that meets these requirements? I know that I am treading on dangerous ground in questioning the universal value of some of our best known index numbers. Of course, for rough analysis almost any good general index number may be satisfactory. I merely want to suggest that precise analysis requires care in the selection of the proper price index series to be used, and that perhaps we need more and better general price indices.

Now let me conclude by saying that the lack of adequate information in the hands of producers and the want of a sound basis for interpreting facts are in large measure responsible for recurring cycles of over- and under-production and the unwise marketing of commodities. The effects of maladjustments in production extend far beyond the producer, for the recurrence of these maladjustments increases the cost of distribution and creates economic disturbances that are carried through our whole economic system. The first step in remedying the situation is in the compilation of comprehensive data as to production, consumption and prices, and information as to other factors that may affect prices, as a basis for interpreting the current and prospective situations to producers, distributors and consumers, who are concerned. The most effective interpretation of these data is in terms of prices and the man who plans his business for tomorrow must have price forecasts.

