

CHAPTER IV

DEMAND FOR AGRICULTURAL PRODUCT

1. *Demand for Pork.* As already mentioned, the abrupt decline in demand levels for most products during the past four years has emphasized the need for studying shifts in demand of products such as agricultural ones for which "laws" of demand were formerly known, as well as the relation between prices and quantities demanded. The precipitous decline has also provided a much better opportunity for studying these shifts.

Chart X presents a study of demand for pork made by G. B. Thorne and Preston Richards of the United States Bureau of Agricultural Economics. Correlations are based on data for the period 1921 to 1931 but the curve is satisfactory for the years 1932 and 1933 if the regression of price deviations on consumer incomes is extended. The data of the chart are percentages of the 1921-30 averages, not of trends, so that by multiplying by these averages, the ratios can be quickly converted to actual prices and quantities.* The prices used are money prices and not prices adjusted for changes in the price level. The retail price of pork is here shown to be very highly correlated with the consumption of pork and an index of consumer incomes.

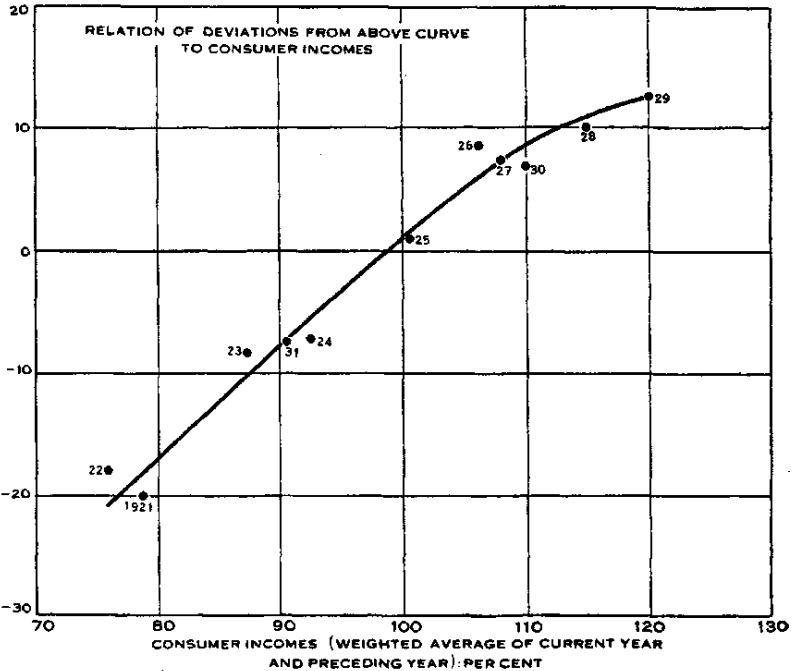
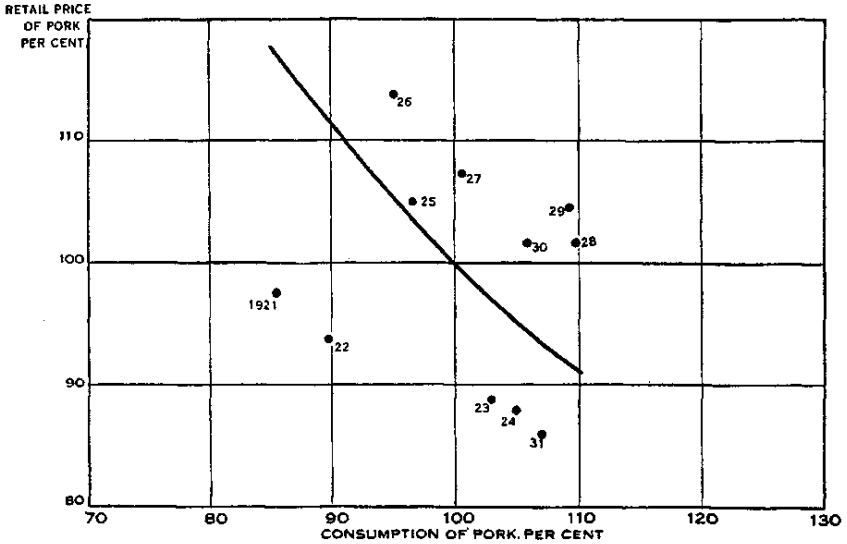
The term "money demand" may be used to mean the relation between quantities demanded and money prices. The term real demand may be used to indicate the relation between quantities demanded and real prices; that is, prices that have been adjusted for changes in the price level. As E. J. Working points out, in times of changing price levels it means nothing to say that demand has increased or that demand has decreased unless it is clear whether "money demand" or "real demand" is meant.

There is, of course, no danger of confusing terminology if one uses a mathematical analysis such as that given in the preceding chapters. Again it might be emphasized that an important advantage of the mathematical method over the literary one is that the mathematical method is a precise one and concepts can therefore

*The use of ratios of this nature is to be commended for purposes of curve fitting. Errors due to weighting are avoided in this way.

RELATION OF RETAIL PRICE OF PORK TO CONSUMPTION OF PORK AND TO CONSUMER INCOMES IN THE UNITED STATES, 1921-1931

CHART X



be defined without ambiguity. Thus, if p represents money price, the equation of demand can be taken as

$$y = ap + b$$

and a depends upon an index of price levels, I , whereas if the equation is desired to express real demand it may be written in the form

$$y = a_1P + b$$

where $P = F(p, I)$ or more simply if $P = p/I$, $a_1 = aI$. A similar analysis can be applied to b . Just how the correction for price levels is to be made is discussed briefly in the next section.

2. *Graphical Curvilinear Correlations.* In correlations made by the Bureau of Agricultural Economics a graphical method developed by Mordecai Ezekiel is used.* The method is essentially that of drawing a free hand curve to approximate a relationship between two variables such as cotton consumption and prices of cotton, plotting the residuals (actual consumption minus consumption represented by the free hand curve) against a third variable such as industrial activity and drawing a free hand curve to represent a relationship between the residuals described above and industrial activity. In the case of cotton it is then found that the residuals from the industrial production curve have a secular downward trend, due to factors not taken into account. This secular trend is then removed by plotting the residuals against time and drawing a line. To obtain a second approximation, consumption "due" to industrial activity and trend are subtracted from actual consumption and the residuals plotted against price. A slightly different curve is suggested for the regression of consumption on price. From this point the procedure just stated may be carried through to obtain second approximations to express the effects of industrial production, etc.

In the method just outlined it is implicitly assumed that the effect of each factor, price, industrial activity and trend is additive. This, of course, may or may not be true. In the case of automotive demand previously discussed it was not considered desirable to introduce each factor in an additive way. In Chapter VI a modification of the Ezekiel method for use in approximating multiplicative

*Mordecai Ezekiel, *Methods of Correlation Analysis*, New York, 1930, pp. 235-241.

factors is given. The problem of determining in advance whether effects are additive (addition or subtraction) or multiplicative (multiplication or division) is a theoretical one that will probably not be completely solved. However, prices are ratios and from a mathematical point of view it would seem desirable to correct prices for changes in price level by multiplicative processes. General rules cannot be laid down for physical factors and other economic ones. Individual judgments must be made here even as they are in the physical sciences. Any judgment regarding form is better than no judgment.

3. *Demand for Wheat — An International Commodity.* As E. J. Working has pointed out,* “it is not always possible to explain cyclical shifts in demand on the basis of changes in industrial production, consumer income or similar indexes of United States conditions”.

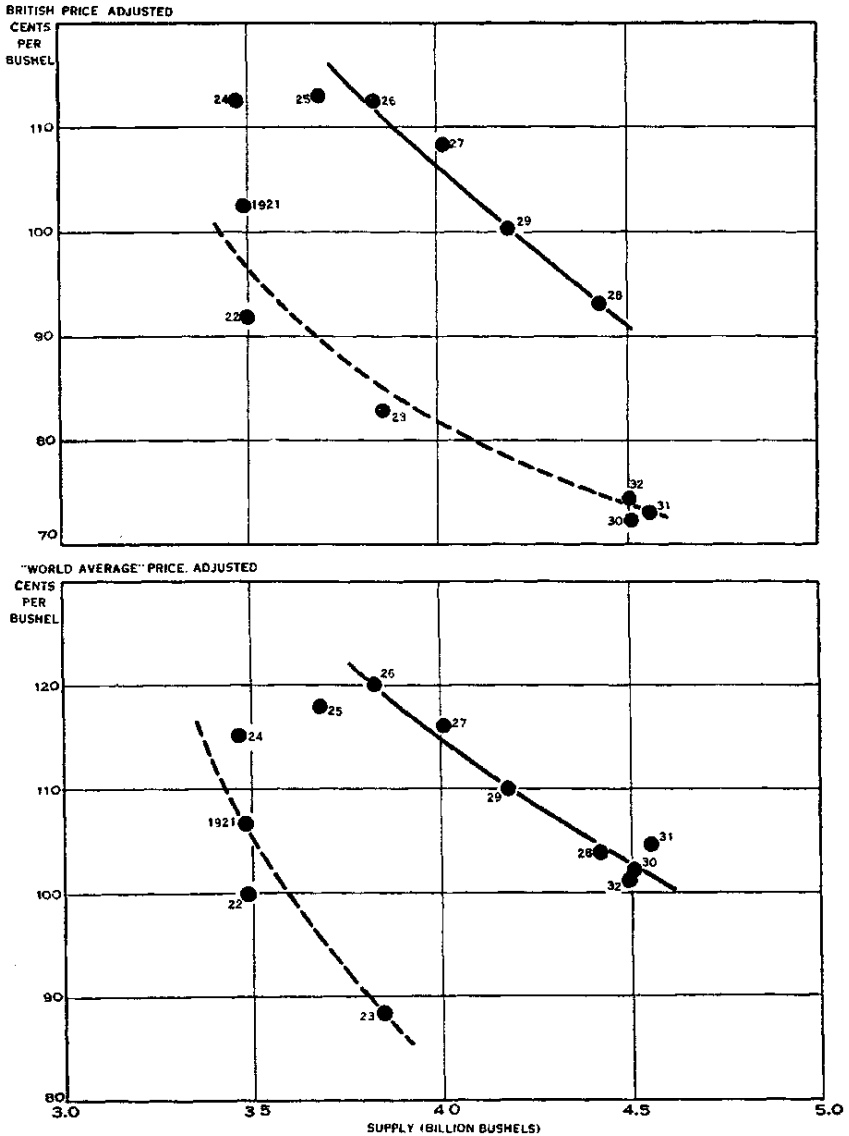
Indexes which are closely associated with the conditions of demand for domestic commodities are likely to be inadequate for use in analyzing shifts of demand for international commodities. A case in point is wheat. Chart XI shows certain price and supply relationships for that commodity. The upper section shows the relation between the price of wheat in Great Britain, adjusted for the British price level; and the estimated supply of wheat for the world excluding Russia and China. The section is somewhat similar to the upper section of the pork chart in that there tends to be two distinct groupings of the price-quantity observations. The data for the crop years 1921-22 to 1923-24 and for 1930-31 to 1932-33 group themselves fairly closely about what might be termed a “low demand curve,” while the data for the other years are fairly close to the “high demand curve.”

In view of the fact that the data on the wheat chart refer to calendar years rather than to July to June crop years, it may appear that these data would lend themselves to the same type of analysis as that employed in the pork price study. As a matter of fact, a procedure similar to that used in the pork price study does yield a high correlation. To quote: “the careful price analyst will not, upon obtaining such a correlation, rush forth with the explanation that the price of wheat at Liverpool is determined by the sup-

*E. J. Working, “Studies in Demand During Periods of Rapid Economic Changes,” — paper presented to the Econometric Society, December 28, 1933. See *Econometrica*, Vol. 2, 1934, pp. 140-151.

WHEAT: SUPPLY AND PRICE, WORLD
(EXCLUDING RUSSIA AND CHINA)

CHART XI



ply of wheat in the world (outside Russia and China) and industrial production in the United States. A partial explanation of the high correlation is, of course, to be found in the fact that the fluctuations in business activity of the more important wheat-consuming countries of the world have been quite closely correlated in the past 15 years."

This explanation is not satisfactory since, as Working points out, there are a number of important wheat consuming countries in which wheat prices have not followed a curve parallel to that of British wheat prices in the past four years. In some of these countries "money prices" are now as high and real prices are higher than in 1926-27.

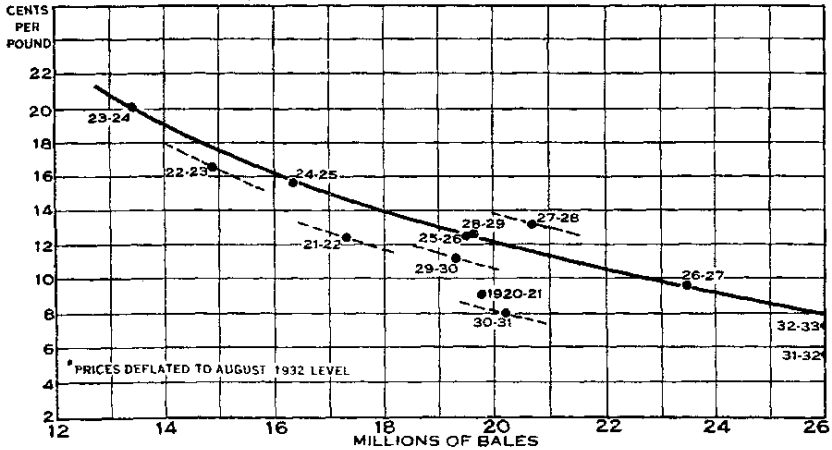
To bring the above situation out more clearly Working computed a "world" average "real" price of wheat. This was done by first adjusting for the price level the money price of wheat in seven important wheat consuming countries and converting these adjusted or real prices to terms of gold cents per bushel at the par of exchange. A weighted average of these seven series was then computed — the weighting being in proportion to the wheat consumption of the regions for which the original price series were deemed to be representative. The resulting prices as plotted against the wheat supply of the world (excluding Russia and China) are shown in the lower half of Chart XI.

From this study it appears that the price of an international commodity such as wheat is essentially a gold price. The question of whether one should use "money prices" or "real prices" in measuring demand has been a matter of general concern among agricultural price analysts for some years. This question was discussed in Chapter II. Another question that has recently arisen is: "Should the prices used be currency prices or gold prices?" Working answers this question as follows:

"In order to make the question more concrete, let us consider this chart (Chart XII) which shows the deflated price of cotton (the price adjusted for price level changes) in relation to the supply of American cotton. Assume for sake of simplicity that, in so far as past analysis indicates, demand conditions for the 1933-34 season are expected to be similar to those of 1926-27. Under such conditions and with a supply of about 24.8 million bales, what price is to be expected? The chart would indicate about 9 cents per pound as the deflated price, but these prices on the chart all refer to years when a dollar was worth approximately

RELATION BETWEEN PRICES AND SUPPLIES OF AMERICAN COTTON

CHART XII



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as much as one-twentieth ounce of gold. With it now worth about one thirty-fourth as much as an ounce of gold, will the money price be increased accordingly?

“The answer is not the same for all commodities. In the case of such commodities as beef and pork merely taking account of prospective changes in the “all commodity” price level should give the approximate result. On the other hand, in the case of a commodity such as wheat one should estimate what the price level would have been if the United States had remained on the gold standard, adjust for that change from the August 1932 level and then multiply the result by about 1.69 or whatever is deemed to be the probable ratio of the price of gold this year to the old price of \$20.67 per ounce. In the case of cotton one would come nearer the truth to adopt the procedure outlined for wheat.”

The study of gasoline demand in the preceding chapter and the various studies of demand for agricultural products presented in this chapter* indicate that there is a great deal to learn about the

*Attention is also called to the now classical study of demand for potatoes made by Holbrook Working. See Holbrook Working, “The Statistical Determination of Demand Curves,” *Quarterly Journal of Economics*, August 1925, Vol. XXXIX, pp. 503-543.

behavior of prices and demand other than that "demand varies inversely with price" as is often naively stated in text books.

All the studies presented so far refer to demand for consumer goods. When attempts are made to determine the demand for capital goods new problems are met. Some of these are difficult to solve, but like so many difficult things they seem to offer a gold mine of fundamental information. In the following chapter a theory of demand for capital goods is presented and in Chapter VI a statistical verification of this theory is offered.