SECTION 2

The Market as Equator of Demand and Supply

Agricultural marketing research is constantly looking for improvement — that is, for changes which will result in economic benefits. The aim may be to raise farm incomes, to reduce price fluctuations, to increase efficiency, to accomplish wider distribution, to increase food consumption, or to reach some other economic or social objective.

How can one judge the economic effectiveness of our present marketing system or the economic consequences of proposals to change market organization or market practices? This can be done only by economic analysis. It requires an understanding of economic theory and the ability to use the tools of economic analysis. So-called "practical" marketing experts occasionally disparage economic theory, saying, for example, that they "deal with facts, not with theories." But there is no conflict between facts and theories. Theory is the best available explanation of observed facts. Too much of our marketing research has been devoted to the gathering and tabulation of statistical facts, and too little to the careful analysis of facts in such a way as to help us understand them.

The economist who analyzes marketing problems needs to be especially familiar with such concepts as a demand curve and a supply curve. He must know how to estimate such curves from statistical data, and he must know how to use such curves in analyzing marketing problems.

The readings in Section 2 were selected with these needs in view.—EDITOR

2.1 Demand Curves and "Price Elasticity"

When an economist speaks of the demand for potatoes, he means a *demand curve* or a *demand schedule.* In market analysis we are often concerned with three kinds of demand curve or demand schedule: those showing the demand of a single family, those showing the demand in a segment of the market, and those showing the aggregate demand of all buyers in the entire market for a commodity.

The following excerpt is the classical discussion of demand schedules and demand curves of Alfred Marshall. —*Ed.*

2.1.1 Marshall, Alfred. *Principles of Economics.* 8th ed., Macmillan, London, 1936. Pp. 96–100.

To obtain complete knowledge of (an individual's) demand for anything, we should have to ascertain how much of it he would be willing to purchase at each of the prices at which it is likely to be offered; and the circumstance of his demand for, say, tea can be best expressed by a list of the prices which he is willing to pay; that is, by his several demand prices for different amounts of it. (This list may be called his demand schedule.)

Thus for instance we may find that he would buy

6 lbs. at	50d. per lb.	10 lbs. at	24d. per lb.
7 lbs. at	40 "	11 lbs. at	21 "
8 "	33 "	12 "	19 "
9 "	28 "	13 "	17 "

If corresponding prices were filled in for all intermediate amounts we should have an exact statement of his demand. We cannot express a person's demand for a thing by the "amount he is willing to buy," or by the "intensity of his eagerness to buy a certain amount," without reference to the prices at which he would buy that amount and other amounts. We can represent it exactly only by lists of the prices at which he is willing to buy different amounts.

When we say that a person's demand for anything increases, we mean that he will buy more of it than he would before at the same price, and that he will buy as much of it as before at a higher price. A general increase in his demand is an increase throughout the whole list of prices at which he is willing to purchase different amounts of it, and not merely that he is willing to buy more of it at the current prices.

So far we have looked at the demand of a single individual. And in the particular case of such a thing as tea, the demand of a single person is fairly representative of the general demand of a whole market: for the demand for tea is a constant one; and, since it can be purchased in small quantities, every variation in its price is likely to affect the amount which he will buy. But even among those things which are in constant use, there are many for which the demand on the part of any single individual cannot vary continuously with every small change in price, but can move only by great leaps. For instance, a small fall in the price of hats or watches will not affect the action of every one; but it will induce a few persons, who were in doubt whether or not to get a new hat or a new watch, to decide in favour of doing so.

* * *

In large markets, then—where rich and poor, old and young, men and women, persons of all varieties of tastes, temperaments and occupations are mingled together, — the peculiarities in the wants of individuals will compensate one another in a comparatively regular gradation of total demand. Every fall, however slight, in the price of a commodity in general use, will, other things being equal, increase the total sales of it; just as an unhealthy autumn increases the mortality of a large town, though many persons are uninjured by it. And therefore if we had the requisite knowledge, we could make a list of prices at which each amount of it could find purchasers in a given place during, say, a year.

* * *

There is then one general *law of demand*: — The greater the amount to be sold, the smaller must be the price at which it is offered in order that it may find purchasers; or, in other words, the amount demanded increases with a fall in price, and diminishes with a rise in price. There will not be any uniform relation between the fall in price and the increase of demand. A fall of one-tenth in the price may increase the sales by a twentieth or by a quarter, or it may double them. But as the numbers in the left-hand column of the demand schedule increase, those in the right-hand column will always diminish.

* * *

The demand prices in our list are those at which various quantities of a thing can be sold in a market *during a given time and under given conditions.* If the conditions vary in any respect the prices will probably require to be changed; and this has constantly to be done when the desire for anything is materially altered by a variation of custom, or by a cheapening of the supply of a rival commodity, or by the invention of a new one. For instance, the list of demand prices for tea is drawn out on the assumption that the price of coffee is known; but a failure of the coffee harvest would raise the prices for tea. The demand for gas is liable to be reduced by an improvement in electric lighting; and in the same way a fall in the price of a particular kind of tea may cause it to be substituted for an inferior but cheaper variety.

The French economist and mathematician Augustin Cournot developed, half a century before Marshall, the mathematical formulation of demand for a commodity as a function of its price. His presentation has the great merit of envisioning the statistical measurement of aggregate demand in a market, including such problems as use of annual average date and the characteristics of the total revenue function.

The reader not versed in mathematics should have no difficulty in understanding the following selections from Cournot if he keeps in mind:

1. that $F(p)$ is the demand curve, which states that consumption is a function of price
2. that $pF(p)$ — or price times quantity — represents total expenditures for a commodity or total returns to the seller of it
3. that $F(p) + pF'(p)$ represents marginal expenditures or marginal returns to the seller
4. that, while Cournot did not use the term *elasticity of demand,* he did discuss rising and falling returns curves, which is essentially the same thing and is much easier to understand. (The demand for a commodity is elastic if the total-returns curve is rising and inelastic if it is falling.)

The last paragraph of the following excerpt thus consists of a proposal for classifying all major goods into two classes — those with elastic demand and those with inelastic demand.—*Ed.*

2.1.2 Cournot, Augustin. *Mathematical Principles of the Theory of Wealth.* 1838, translated by Nathaniel T. Bacon, Macmillan, New York, 1929. Pp. 47–48, 51–53.

Let us admit therefore that the sales or the annual demand D is, for each article, a particular function F (p) of the price p of such article. To know the form of this function would be to know what we call *the law of demand* or *of sales.* It depends evidently on the kind of utility of the article, on the nature of the services it can render or the enjoyments it can procure, on the habits and customs of the people, on the average wealth, and on the scale on which wealth is distributed.

Since so many moral causes capable of neither enumeration nor measurement affect the law of demand, it is plain that we should no more expect this law to be expressible by an algebraic formula than the law of mortality, and all the laws whose determination enters into the field of statistics, or what is called social arithmetic. Observation must therefore be depended on for furnishing the means of drawing up between proper limits a table of the corresponding values of D and p; after which, by the well-known methods of interpolation or by graphic processes, an empiric formula or a curve can be made to represent the function in question; and the solution of problems can be pushed as far as numerical applications.

* * *

To define with accuracy the Quantity D, or the function F (p) which is the expression of it, we have supposed that D represented the quantity sold *annually* throughout the extent of the country or of the market under consideration. In fact, the year is the natural unit of time, especially for researches having any connection with social economy. All the wants of mankind are reproduced during this term, and all the resources which mankind obtains from nature and by labour. Nevertheless, the price of an article may vary notably in the course of a year, and, strictly speaking, the law of demand may also vary in the same interval, if the country experiences a movement of progress or decadence. For greater accuracy, therefore, in the expression F (p), p must be held to denote the annual average price, and the curve which represents function F to be in itself an average of all the curves which would represent this function at different times of the year. But this extreme accuracy is only necessary in case it is proposed to go on to numerical applications, and it is superfluous for researches which only seek to obtain a general expression of average results, independent of periodical oscillations.

Since [we assume that] the function $F(p)$ is continuous, the function $pF(p)$, which expresses the total value of the quantity annually sold, must be continuous also. This function would equal zero if p equals zero, since the consumption of any article remains finite even on the hypothesis that it is absolutely free; or, in other words, it is theoretically always possible to assign to the symbol p a value so small that the product $pF(p)$ will vary imperceptibly from zero. The function $pF(p)$ disappears also when p becomes infinite, or, in other words, theoretically a value can always be assigned to p so great that the demand for the article and the production of it would cease. Since the function $pF(p)$ at first increases, and then decreases as p increases, there is therefore a value of p which makes this function a maximum, and which is given by the equation,

$$(1) \qquad F(p) + pF'(p) = 0,$$

in which F' according to Lagrange's notation, denotes the differential coefficient of function F.

* * *

We may admit that it is impossible to determine the function $F(p)$ empirically for each article, but it is by no means the case that the same obstacles prevent the approximate determination of the value of p which satisfies equation (1) or which renders the product $pF(p)$ a maximum. The construction of a table, where these values could be found, would be the work best calculated for preparing for the practical and rigorous solution of questions relating to the theory of wealth.

But even if it were impossible to obtain from statistics the value of p which should render the product $pF(p)$ a maximum, it would be easy to learn, at least for all articles to which the attempt has been made to extend commercial statistics, whether current prices are above or below this value. . . .

We return to Marshall for the classical exposition of elasticity of demand.—*Ed.*

2.1.3 Marshall, Alfred. *Principles of Economics.* 8th ed., Macmillan, London, 1936. Pp. 102–4.

The Elasticity of Wants: We have seen that the only universal law as to a person's desire for a commodity is that it diminishes, other things being equal, with every increase in his supply of that commodity. But this diminution may be slow or rapid. If it is slow the price that he will give for the commodity will not fall much in consequence of a considerable increase in his supply of it; and a small fall in price will cause a comparatively large increase in his purchases. But if it is rapid, a small fall in price will cause only a very small increase in his purchases. In the former case his willingness to purchase the thing stretches itself out a great deal under the action of a small inducement: the elasticity of his wants, we may say, is great. In the latter case the extra inducement given by the fall in price causes hardly any extension of his desire to purchase: the elasticity of his demand is small. If a fall in price from say 16d. to 15d. per lb. of tea would much increase his purchases, then a rise in price from 15d. to 16d. would much diminish them. That is, when the demand is elastic for a fall in price, it is elastic also for a rise.

And as with the demand of one person so with that of a whole market. And we may say generally: — The *elasticity* (or *responsiveness*) of *demand* in a market is great or small according as the amount demanded increases much or little for a given fall in price, and diminishes much or little for a given rise in price.[1]

The price which is so high relatively to the poor man as to be almost prohibitive, may be scarcely felt by the rich; the poor man, for instance, never tastes wine, but the very rich man may drink as much of it as he has a fancy for, without giving himself a thought of its cost. We shall therefore get the clearest notion of the law of the elasticity of demand by considering one class of society at a time. Of course there are many degrees of richness among the rich, and of poverty among the poor; but for the present we may neglect these minor subdivisions.

When the price of a thing is very high relatively to any class, they will buy but little of it; and in some cases custom and habit may prevent them from using it freely even after its price has fallen a good deal. It may still remain set apart for a limited number of special occasions, or for use in extreme illness, etc. But such cases, though not infrequent, do not form the general

---

[1] We may say that the elasticity of demand is one, if a small fall in price will cause an equal proportionate increase in the amount demanded: or as we may say roughly, if a fall of one per cent in price will increase the sales by one per cent; that it is two or a half, if a fall of one per cent in price makes an increase of two or one half per cent respectively in the amount demanded; and so on. (This statement is rough; because 98 does not bear exactly the same proportion to 100 that 100 does to 102.)

rule; and anyhow as soon as it has been taken into common use, any considerable fall in its price causes a great increase in the demand for it. The elasticity of demand is great for high prices, and great, or at least considerable, for medium prices; but it declines as the price falls; and gradually fades away if the fall goes so far that satiety level is reached.

This rule appears to hold with regard to nearly all commodities and with regard to the demand of every class; save only that the level at which high prices end and low prices begin, is different for different classes; and so again is the level at which low prices end and very low prices begin. There are however many varieties in detail; arising chiefly from the fact that there are some commodities with which people are easily satiated, and others — chiefly things used for display — for which their desire is almost unlimited. For the latter the elasticity of demand remains considerable, however low the price may fall, while for the former the demand loses nearly all its elasticity as soon as a low price has once been reached.

Most discussions of elasticity are unnecessarily long, and most of them are inaccurate. Only those who understand the differential calculus have a real comprehension of the expression *coefficient of elasticity*. Those who use this term should be familiar with the precise mathematical definition. —*Ed.*

2.1.4 Allen, R. G. D. *Mathematical Analysis for Economists.* Macmillan, New York, 1939. P. 251.

Definition: The elasticity of the function y = f(x) at the point x is the rate of proportional change in y per unit proportional change in x:

$$\frac{Ey}{Ex} = \frac{d(\log y)}{d(\log x)} = \frac{x}{y}\frac{dy}{dx}$$

Waite and Trelogan make some interesting observations concerning factors affecting demand and also discuss the relationship between the demand curves for individual families and for the market as a whole.—*Ed.*

2.1.5 Waite, Warren C. and Trelogan, Harry C. *Agricultural Market Prices.* 2nd ed., John Wiley & Sons, New York, 1951. P. 43.

The factors which ordinarily influence the elasticity of demand for a particular commodity are three in number. The first is the *number of uses* for the commodity. Those commodities having many uses will tend to have more elastic demands. The second is the *number of substitutes,* those commodities for which there are many substitutes having the more elastic demands. Substitution is possible between many food products, and a number of such commodities as fruits and meats have considerable elasticity. The third factor is the *importance of the expenditure on the commodity relative to the consumer's income;* the greater the relative expenditure, the greater the elasticity is likely to be. This is a principal reason why the demand for a particular commodity is likely to be less elastic among high-income groups than among low-income groups.

Demand is, generally speaking, very inelastic for absolute necessaries and for some of the luxuries of the rich that do not absorb much of their income. The most probable assumption regarding the elasticity of the demand curve of an individual buyer of a particular commodity is that the curve would be inelastic at low prices and that the elasticity would be greater at high prices. The individual consumer is likely to reach a saturation point in his consumption at some low price, and even with still lower prices will not increase his consumption of the commodity. Whether the price is high or low is a relative matter which depends upon the income of the consumer and his spending habits.

The demand curve for the whole market will depend to a considerable extent upon the number of income classes in the market and the height of the price in relation to their respective income levels. If the market has a number of classes differing in income so that a fall in price not only results in larger purchases by present consumers but also induces new groups to purchase the commodity, demand will probably be elastic. The demand curve will be more elastic the larger the new groups are relative to the old. The importance of the number of families consuming the product at various income levels upon the increase in consumption of a commodity has already been illustrated. If the market were composed of buyers all alike in income and taste, elasticity would be likely to decline as price fell.

We have mentioned the distinction between the demand of an individual and the demand of the whole market. In marketing research we are often concerned with the demand for the products of a single firm. This concept is developed in the excerpt that follows. The last two paragraphs deal with "kinked" demand curves. This concept is useful in the analysis of problems of monopolistic competition discussed in Section 5.—*Ed.*

2.1.6 Waite, W. C. and Cassady, Ralph, Jr. *The Consumer and the Economic Order*. McGraw-Hill, New York, 1949. Pp. 163–65. Reprinted by permission.

Elasticity of Demand for the Industry and the Firm: There has been increasing recognition that the amounts of a commodity or product taken can be examined from several points of view. Thus, demand may be thought of as (1) a schedule of amounts taken at different prices by an individual buyer, (2) a schedule of amounts taken of a generic product by a group of buyers, or (3) a schedule of amounts taken of a particular brand of product by a group of buyers.

The first of these is not particularly useful in this connection except to emphasize the fact that the demand for any product is made up of the aggregate demands of many individuals; that is, schedules of amounts that would be taken at particular prices prevail for each of us, which in combination with those of others make up an aggregate demand situation. The last two are, however, very important both from a theoretical and from a practical point of view. What we are saying is that while the concept is important, one must proceed beyond a consideration of demand as the amounts taken of a general commodity (salt, say) if he is to obtain maximum value from a demand analysis. It is extremely useful to consider in addition the amounts taken of a particular seller's product ("Morton's Salt," for example), which might have entirely different characteristics.

* * *

The demand for a particular seller's product is a schedule of his share of total industry sales at various prices, given certain competitive price conditions; note that the individual seller's demand curve is conditioned by the existence of competitive offerings and the prices set thereon. Thus the response to one seller's price changes may be merely proportionate to the change for the industry or much more substantial, depending upon how competitors react.

This of course is a matter involving some rather subtle aspects of demand elasticity. The demand for the product of the industry might be quite inelastic providing there is intense need for the commodity and few substitutes are available, while the demand for the product of any one firm is highly elastic (assuming competitors do not meet the seller's price changes) because each seller's product is a perfect substitute for the others. Actually, under such conditions, sellers usually feel that they *must* meet rival prices.

Just one further point: under certain circumstances, at least, the demand curve of the individual seller is "kinked" or "bent" because if the seller drops his price competitors are likely to meet it, since otherwise they run the risk of losing the large proportion of their volume; but if the individual seller raises his price, rivals may *not* meet it (because they need not) and if not, he must retreat or be faced with a loss of much if not all of his volume. Thus, under certain conditions, the individual seller's demand curve possesses the same degree of responsiveness to price change as that of the industry curve *below* the prevailing price and flattens out *above* that price.

* * *

There is considerable evidence that businessmen are inclined to consider demand curves for their products more inelastic than they actually are and that vigorous action in drastically reducing prices well beyond previous levels uncovers a volume of purchases previously thought impossible. For example, "In November, 1938, as a promotion scheme, a New York newspaper offered classical albums to its readers at prices averaging about 49 cents per record. At a time when the record companies considered that the average sales of a classical album should be about 6,000 sets, and a sales volume of 10,000 sets, even over a period of two years, was extremely unusual, the newspaper sold more than 50,000 sets of a single symphony in a few weeks. . . ."

In many marketing problems it is necessary to use several demand curves to indicate demands in different segments of the total market for a commodity. Thus we may need the separate demand curves for fresh oranges and for frozen orange juice, the demand for oranges by weeks or by months during the season, or the demand for oranges in each of the principal cities of the United States.

The graphs in Reading 2.1.7 are based upon a study made by Stokdyk for the purpose of determining the most profitable distribution of Tokay grapes among eleven auction markets. Section 3 discusses the problem of distribution to several markets, including different geographic markets, different times, and different forms of a commodity. Here we are interested only in the fact that an aggregative demand curve can be broken down into segments.—*Ed.*

2.1.7 **Stokdyk, E. A. "Marketing Tokay Grapes,"** ***Calif. Exper. Sta. Bull. 558,*** **1933. P. 27.**

MARKET CAPACITY OF ELEVEN AUCTION MARKETS FOR TOKAY GRAPES, 1929–1931

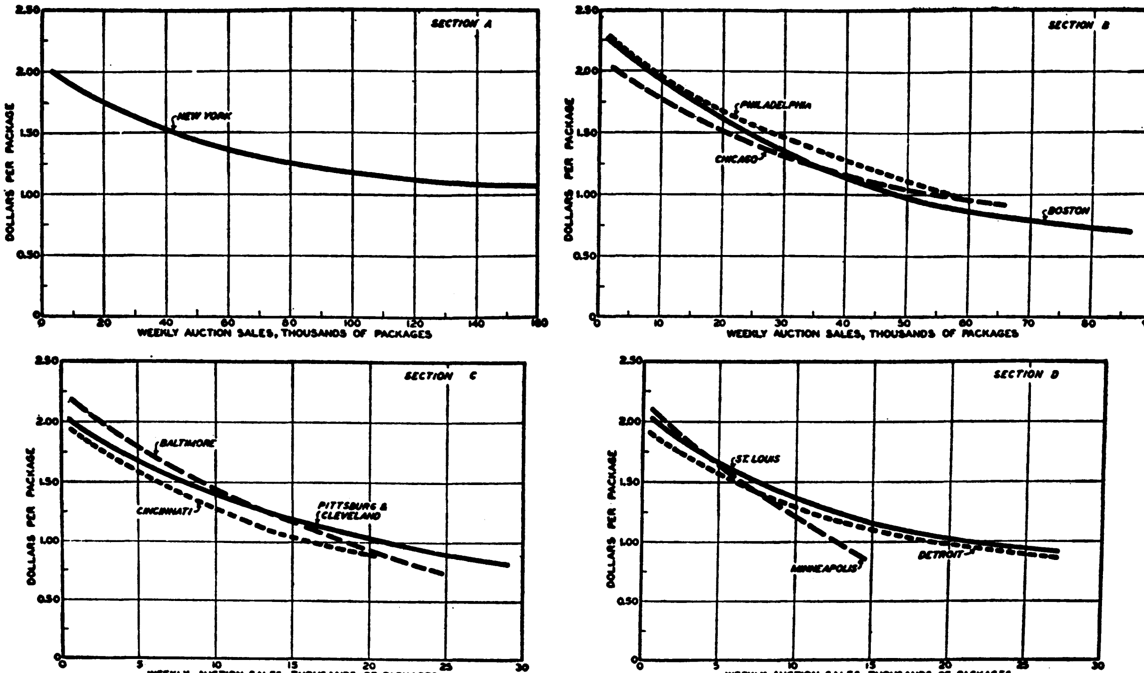


Fig. 6. The volume of Tokay grapes sold in each of the principal auction markets had an important influence on prices. This figure shows the average relation between the quantity sold and prices during the 1929–1931 seasons. A knowledge of such relations may aid in planning the distribution of supplies to obtain the highest total returns.

A major difficulty in agricultural marketing theory is the relationship between demand at the retail level and at the farm level. This usually is dealt with by subtracting from the retail price a "marketing margin," as described in the later section on derived demand. However, this merely glosses over important aspects of the problem.

One approach to the problem involves recognition of the fact that the consumer ordinarily is buying not just a commodity but also a group of associated services — ranging all the way from processing, transportation, and storage to the provision of convenience of location and courtesy and helpfulness of service in the retail store. From this fact arises the concept of a "demand for marketing services" as distinct from demand for the commodities with which the services are associated.

Practically no statistical measurements have been made of demand for marketing services, but the concept and some of the difficulties associated with it are here described.—*Ed.*

2.1.8 Black, Guy. "Product Differentiation and Demand for Marketing Services," *Jour. Marketing*, Vol. XVI, No. 1, July, 1951. Pp. 73, 75, 77, 78.

The entrepreneurial procedure carried on by most marketing firms consists of forwarding a product through time or space, breaking it down into smaller units, giving consumers a chance to examine and consider buying it, and making them aware of its existence and availability. There is little difference between the product received by the entrepreneur and the one he hands over to the consumer, except in terms of these services. The range of activity in which he operates is the additional services performed by his firm. The production function which applies to his firm is the production function for these additional services, and equilibrium of the firm must be stated essentially in terms of the production function and demand for these additional services.

* * *

Introducing the demand for service means injecting into the theory of markets a new element, where previously consideration of this element had been evaded by the use of a general and perhaps overly inclusive classification of product differentiation. In recasting the form of the theory, the problem is one of developing a treatment of production and demand effectively distinguishing commodities and services where they had previously been treated as one. The problem of where to draw the line of demarcation is essentially a problem of separating those characteristics which are part and parcel of the physical good, no matter where it is sold, and those which are exogenous, logically. This distinction has difficulties. A product, such as wheat flour, may be sold in 5-, 25-, and 49-pound bags, and in the physical sense it is essentially the same product. Yet the different sized packages are not perfect substitutes for each other, and the cross elasticity of demand might be expected to vary with income classes and the kinds of stores handling the flour. It is not easy to decide if container size is exogenous to the product, since the product could be packaged either by the miller or the retailer. Likewise, a manufacturer's guarantee, when applied to articles commonly sold in many retail stores, is hard to pigeonhole. It could also be argued that brand names are more an attribute of the seller than of the products. Some package for flour is essential but if the miller packaged the flour himself, packaging would be a service little related to the service functions of retailers. An abstract classification between service production and commodity production would cut across a classification based on industrial structure.

* * *

It is apparent that introducing the marketing service as a separate good means that we must consider demand and supply functions for this good as well as demand and supply functions for the commodities. . . .

Applying the theory of the firm to the marketing service problem is first of all a problem in joint supply and demand. There is a demand for several goods: the commodities, and marketing services. Demand for each can be described in the usual way. The peculiar relationship between marketing services and commodities gives reason for believing that the demand functions, particularly with regard to cross elasticities, might have special properties.

Several different supply situations suggest themselves also. It is possible for services to be so physically separate that they do not even need to be bought from the same person who sold the goods. There will often be economies of joint supply, so that the supply curves for services will be interrelated with the supply curves for commodities. We need to dig into the supply relationships for commodities and services because of the commonness of certain unexplained phenomenon. In marketing we find entrepreneurs deluging prospective customers not only with advertising but also with utility-creating services (advice, demonstrations, conveniences, etc.). Under theoretical treatments which lump all such activity as product differentiation or advertising, for which the customer pays when he buys goods, an important point is overlooked. Prospective customers (many never buy anything) are given economic goods free of charge, in the sense that they are given goods not contingent on any payment or purchase of commodities. The form of supply and demand curves for commodities and services under which a profit-maximizing firm would be led to this behavior is a nice point. Can we use our value theory adequately to explain such phenomena?

There are in addition many marketing services for which no price is charged, and which the customers do not buy, but obtaining them is contingent on purchase of goods. In buying goods the customer gets both goods and services. There can be quite separate demand functions for the commodities and services, which may influence entrepreneurial behavior, even if they have no chance to make themselves explicit in the market place. Commonly, marketing services and commodities are sold in the form of a "tie-in sale." This form of entrepreneurial behavior has never been analyzed, to the best of my knowledge, except under the conditions of shortages of one commodity. The nonexplicit nature of the tie-in makes it hard to recognize the separate existence of marketing services.

* * *

For the purposes of working with marketing firms there are good reasons for considering services as separate entities, and considering the theory of the marketing firm to be a case of the theory of multiple product firms. It is quite likely that studies of markets can be formulated along these lines, and there is every reason to expect that the understanding of the marketing process, the process by which the actual quantity and nature of services provided by retailers, wholesalers and others, is determined, can be better explained, or more precisely estimated, by this procedure.

2.2 "Engel's Curve" and "Income Elasticity"

The term *demand curve* is specifically used to name the relation of consumption to prices. But in a dynamic society such as ours, *changes* in demand are fully as important a field of study as the static demand curves themselves. Some of the factors underlying the characteristics of demand curves — and hence influencing changes in them — have already been discussed. The factor to which chief statistical attention has been given is income.

One of the first economists to make surveys of family consumption was Ernst Engel (not to be confused with Friederich Engels, Karl Marx's collaborator). Engel's name is customarily associated with the relationship that has generally been found to exist between the incomes of families and their expenditures for food and numerous other commodities.

The first of the following excerpts summarizes both the nature of Engel's findings with respect to food expenditure and some of the limitations of his famous law in relation to the study of demand for food. The second offers a critical appraisal of the present status of research in the field of family expenditures.—*Ed.*

2.2.1 Burk, Marguerite C. "A Study of Recent Relationships Between Income and Food Expenditures," ***Agr. Econ. Res.*****, Vol. 3, No. 3, July, 1951. Pp. 87–88.**

Let us begin by recalling the circumstances under which Engel developed his law. Ernst Engel studied the expenditures of families of all levels of income in Belgium and Saxony, in the middle of the nineteenth century. His data showed a consistently higher percentage of total expenditures going for food coincident with lower average incomes per family. He concluded, "The poorer a family, the greater the proportion of the total outgo that must be used for food." It is to be noted that Engel's analysis was confined to one period in time. The data on food expenditures which he examined included costs of alcoholic beverages, and the food purchases were almost entirely for home consumption. Furthermore, food commodities in that century were not the heterogeneous commodities they are today. Families bought raw food from rather simple shops or local producers and did most of the processing at home. Their food expenditures did not include such costs as labor and cooking facilities in the homes. Now, families have a wide choice of kinds of places to buy their food, of many more foods both in and out of season, of foods extensively processed into ready-to-serve dishes, and of eating in many kinds of restaurants. . . .

Such developments in food commodities and marketing might be expected to affect income-food expenditure relationships over time in the same way as at a particular period. Numerous other factors are present in the dynamic situation which do not enter into the problem at a given period and given place, although they are significant in place-to-place comparisons, which are considered only incidentally in this study. These dynamic factors include changes in the average level of income, distribution of income, the geographic location and the composition of the population, relative supplies of food and nonfood commodities, and changes in both the general price level and relative prices, and also changes in the manner of living that are independent of income. . . .

> It is generally agreed that the "income elasticity" for food is low; in other words, if incomes should rise one per cent, *and if food prices should remain constant,* the physical consumption of foods would increase by much less than one per cent.—*Ed.*

2.2.2 **Schultz, T. W. *Agriculture in an Unstable Economy*. Committee for Econ. Devel. Res. Study, McGraw-Hill, New York, 1945. Pp. 68–70. Reprinted by permission.**

From the preceding analysis it may be presumed (very tentatively indeed) that the income elasticity of farm products lies somewhere between .4 (based on expenditures for food, from the Consumer Purchase Studies) and about .1 (based on expenditures for farm products, from the rough historical data prior to World War I). To take the mid-point, namely, .25, is a crude way of ascertaining the approximate point.

Until more exhaustive studies have been made, we must draw upon qualitative analysis, turning principally on the supposition that people as they become richer increase their expenditures proportionately more for the nonfarm services in food than for the farm products in food. (For example, people eat more meals in restaurants and other public establishments as their incomes rise.)

Certain commodities tend to stay fairly constant in their physical composition as farm products, but may change substantially in value at the point at which consumers buy them, reflecting the amount and kind of nonfarm services added in processing, handling, delivering, and serving these products as food. Examining the expenditures for such products, we can obtain another approximation of the income elasticity of food products at the farm level. Cheese is a good example. Whether cheese is prepared as common Cheddar or whether it is eventually made into a highly refined Blue cheese, the raw materials do not vary greatly, nor, consequently, do the claims made on agricultural resources. In Table III, a number of commodities of this type have been selected, and their elasticities have been ascertained, both for physical consumption (quantity) and for value of consumption (quantity plus quality) against income. In each case the elasticity of physical consumption is less, and considerably less, than the elasticity of the value of consumption of the product. For the products listed, the average difference for the lower-income range (\$1,233–\$1,707) appears to be nearly 25 per cent, that is, the elasticity based on physical consumption is about a fourth less than it is when based on value of consumption.

A new index of consumption, prepared by the Bureau of Agricultural Economics, U. S. Department of Agriculture, attempts to establish the relationship between changes in income and physical consumption (again, however, in terms of retail sales). For the period 1929–1942 the elasticity of per capita consumption of food (physical volume) with respect to real per capita income was approximately .21. These various bits of information do suggest that the rough procedure of taking the mid-point, namely, .25, may not be very far wrong. At least it is not inconsistent with the evidence at hand.

One additional observation needs to be made: whatever the income elasticity of farm products is at a given level of incomes, there is a strong likelihood that as incomes rise further, this elasticity will become even less.

> The following excerpt discusses the elasticity of food expenditures with respect to incomes. Food prices are not held constant. For that reason, Miss Burk's findings differ from Professor Schultz's. Both are important.—*Ed.*

2.2.3 Burk, Marguerite C. "Changes in the Demand for Food From 1941 to 1950," *Jour. Farm Econ.*, Vol. XXXIII, No. 3, Aug., 1951. Pp. 281–82, 291, 294–95, 298.

Analyses of the relevant data, after appropriate adjustments, indicate that food expenditures in 1949 were about 10 to 15 per cent higher than would have been expected solely on the basis of prewar relationships between consumer incomes and food expenditures. Those relationships indicate that a one per cent increase in disposable income was associated with increased food expenditures of about 0.8 per cent. The higher level of postwar food expenditures is largely due to increased demand for services with food, extra purchasing power, and the change in the distribution of income.

Regression analyses of time series data on food prices and food consumption, as well as an income level analysis of the quantity of food consumed per capita, support the conclusion that food prices paid and quantities of food consumed (after postwar adjustments had been made) are well in line with prewar relationships to disposable income per capita. Retail food prices have almost unit elasticity (1.0) with disposable income when the supply of food is held constant. The analyses indicate a 0.2 increase in food consumption with one per cent increase in disposable income, holding retail food prices constant, which is mathematically consistent with the elasticity of food expenditures of 0.8 mentioned earlier.

These conclusions suggest that much of the discussion of the inelasticity of demand for food based on physical needs and static family expenditure data has been misleading. The demand for food in terms of price and quantity through time is surprisingly responsive to income.

* * *

To summarize the above calculations: (1) on the basis of changes in average income and in the distribution of income, but with no change in static income-elasticity of demand, we would have expected food expenditures to take 24 per cent of income in 1948, and about the same proportion in the following two years. (2) Use of postwar average incomes per capita with the patterns of relationships of food expenditures to disposable income in prewar years 1929–41 indicates that food expenditures in 1947 were roughly 25 per cent higher than expected (comparing percentages in Tables III and IV); in 1948, 20 per cent; in 1949, 15 per cent; but in 1950, only about 10 per cent. The gradual reduction in the gap between actual and estimated food expenditures leads to the hypothesis that the relatively high levels of food expenditures in 1946–48 may have been temporary.

* * *

All three of the series on food expenditures in terms of current dollars indicate that such expenditures per person increased more between 1941 and 1949 than did disposable income. On the basis of the prewar dynamic pattern of income-food expenditure relationships, taking the level of real income into account, we would expect food expenditures to have averaged about 23.5 per cent of disposable income in 1949 or $295 per person. We have accounted for most of the difference between this and the actual expenditure of approximately $335 (the average of the three series) as follows: (1) change in distribution of income,

$7; (2) extra purchasing power from use of liquid assets and consumer credit, $8; (3) expenditure for additional processing outside the home and public eating places, $5; (4) rural-urban shift in prices paid for food, $7; (5) increased costs of eating away from home, $8. These adjustments account for $35 of the $40 difference between estimated and actual expenditures.

A rather clear way of indicating the net change in the level of food expenditures in postwar years is to add 1949 and 1950 to [the regression of] adjusted Department of Commerce statistics of food expenditures against disposable income [1929–41]. This raises the dynamic income elasticity of food expenditures from 0.8 to 1.0. The fact that this change arose principally from increased marketing services can be demonstrated in a similar manner by comparing the elasticity of price times quantity with a change in disposable income from a regression for the years 1922–41 with another using the same factors but adding 1949 and 1950. The coefficients or elasticities are virtually equal — 0.8.

The magnitude of the elasticity of the latter measure of food expenditures with respect to disposable income has an important bearing on the demand for farm food products. Because of the relative constancy of marketing margins for farm products, it appears likely that the elasticity of cash receipts by farmers for food products to a one per cent change in average disposable income is higher than 0.8 per cent. This indicates a much greater degree of income elasticity of demand for farm food products than the .25 estimated by T. W. Schultz in 1945. In fact, the elasticity of .25 is remarkably close to the income elasticity of the quantity of food purchased as measured by the quantity index of per capita food consumption, holding price relationships constant. But it is the combined elasticities of quantity and price (0.8) which have most economic significance — for farmers are interested in total receipts, not just in quantities demanded.

* * *

From this discussion we may conclude that the combination of the rates of food consumption and levels of retail food prices in 1949 and 1950 were quite close to what would be expected from prewar relationships to income, if the extra purchasing power is taken into account for 1949. The greater variation between expected and actual per capita food consumption and retail food prices in 1947 and 1948 apparently arose from the lag in adjustment of food expenditures to the rapidly changing price and income situation, and to the nonavailability of much wanted durable goods, as noted above. Accordingly, it appears that the dynamic income-elasticity of demand for food commodities has remained substantially unchanged. In other words, the quantity of food demanded per person and retail food prices combined have followed in the later two years approximately the same pattern of relationship to available purchasing power as in prewar years. From this conclusion, it follows that factors other than income which might have affected the per capita demand for food over the same 10 years have either offset each other or have had relatively little effect.

2.3 Joint Effects of Prices and Incomes

Most studies of demand concern themselves with only one aspect. Some concentrate upon the effects of changes in price, and some upon variations in income. In the actual market both prices and incomes vary at the same time. Yet we know very little about the joint effects of prices and incomes upon demand.

For example, does the demand for any specific commodity become *more* elastic or *less* elastic as incomes rise? Bowley and Allen answer "*more* elastic." The editor believes that the Bowley and Allen findings apply only to inferior goods. *—Ed.*

2.3.1 Allen, R. G. D. and Bowley, A. L. *Family Expenditure.* King & Son, London, 1935. P. 125.

The price elasticity of demand is, however, dependent on the level of income or total expenditure, amongst other factors. But, in our linear case, the first term k_r is unaffected by income changes and the price elasticity of demand is only modified by changes in the substitution factor as income changes. It is to be expected, moreover, that substitution becomes more easy for most goods as income rises. The larger expenditure is spread over a wider range of items and the possibilities of substituting other items for a given item are thereby increased. It follows that the elasticity of demand for any item with respect to changes in its price is likely to increase with income. Demands tend to become more elastic as the income level rises.

The opposite conclusion was reached by Harrod in *The Trade Cycle,* namely, that demand becomes *less* elastic as incomes rise. The editor believes that the "Harrod Law" applies to most commodities, and that the Allen-Bowley statement applies only to inferior commodities, that is, commodities which are bought as substitutes for more desirable ones.

To study the joint effects of prices and incomes upon demand we need either a three-dimensional diagram or a set of "indifference curves." We shall not take the space here to explain indifference curves in any detail, but refer the reader to standard sources such as Hicks' *Value and Capital,* Oxford, 1939. Indifference curves can be very useful in the analysis of marketing problems. A good example is the following ingenious analysis of the economics of various forms of "food stamp plans."—*Ed.*

2.3.2 Southworth, Herman M. "The Economics of Public Measures To Subsidize Food Consumption," *Jour. Farm Econ.,* Vol. XXVII, No. 1, Feb., 1945. Pp. 48–50.

For analysis of effects on individual participants, indifference curves provide a useful tool. Diagram 1 represents relationships between food consumption (measured horizontally, in terms of a suitable index of physical volume) and money (measured vertically) as representative of consumption of all other goods and services. Each of the curved lines (indifference curves) connects a series of points representing levels of consumption jointly of foods and other goods that the family considers equally desirable. Successive indifference curves from left to right represent increasingly desirable levels of consumption.

The diagonal straight lines represent what the family can buy at two different incomes, unsubsidized and subsidized, assuming that the price of food is the same in both cases. The lower price line starts at the original level of income (vertical axis) and ends on the quantity of food (horizontal axis) that the family could buy by spending all its income. Each intermediate point along the line shows how much money the family will have left after buying an intermediate quantity of food at the given price. Thus the price determines the slope of the line, the original income its position. The upper price line, having the same slope, represents the same price of food but shows the alternative levels of food purchase open to the family starting with the subsidized level of income.

At each level of income the family will plan to buy the quantity of food indicated by the intersection of the price line with the highest indifference curve that it reaches; this will represent the most desirable consumption pattern available. At the unsubsidized level of income, this will be the point marked "original consumption." With the subsidized income, it will be the point marked "cash grant." Thus the effect of the subsidy will be to increase somewhat the family's food consumption (by an amount represented by the bar at the bottom of the chart)

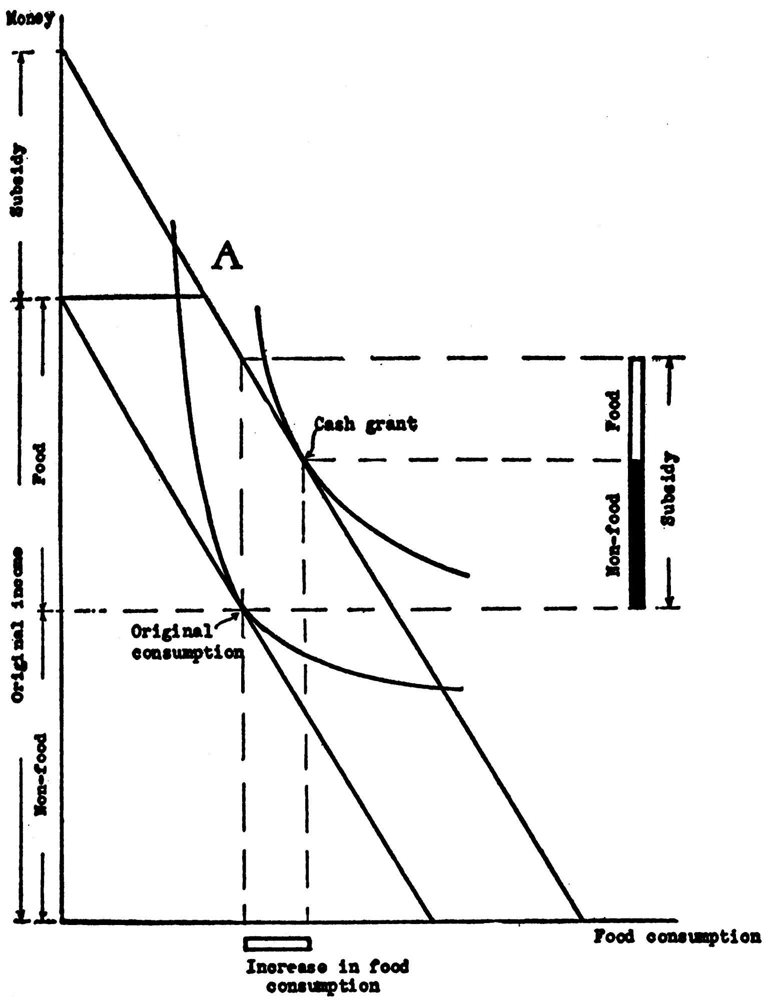


Fig. 1. Effects of subsidy in the form of cash grant on consumption of an individual family.

but also to increase its expenditure for non-food items. The division of the subsidy between additional money spent for food and additional money spent for nonfood items is indicated by the bar at the right of the chart.

2.4 The Supply Function in Agriculture

A demand curve shows how much consumers would buy at various prices. A supply curve shows how much producers would sell at various prices.

Supply curves for farm products are quite different from the supply curves for many industrial goods. Some interesting comparisons are shown below.

2.4.1 **Schultz, Theodore W. *Production and Welfare of Agriculture.* Macmillan, New York, 1949. Pp. 67–70.**

It is obvious from an inspection of these data that American agricultural production *taken as a whole* is remarkably stable.

TABLE I

Change in Production From the Preceding Year (*Percentages*)	Agricultural Production* 1910–1946 (*No. of Years*)	Industrial Production† 1919–1945 (*No. of Years*)
+26 to +30	....	2
+21 to +25	....	3
+16 to +20	....	4
+11 to +15	1	2
+ 6 to +10	4	4
0 to ± 5	29	4
− 6 to −10	2	1
−11 to −15	....	1
−16 to −20	....	2
−21 to −25	....	3
Average Variation (*Percentage*)	3.9	15.0

* This is based on production for sale and consumption. It gives the best measure of the current year volume of farm products which enter the marketing system and thus contribute to gross cash or realized farm income. See U.S.D.A., "Farm Production in War and Peace," F. M. 53, by Glenn T. Barton and Martin R. Cooper, 1945. Especially pp. 66 to 71.

† From Federal Reserve Board Bulletin.

Only twice during the last three and a half decades did aggregate output fall more than 5 per cent from the preceding year, namely 10 per cent in 1921 and 6 per cent in 1932. In both cases the drop was caused by what happened in crops, for livestock output stayed almost constant. The sharp depression of 1920–21 may have been a minor factor although the total crop acreage did not change appreciably, suggesting that a drop in yields was the main cause. In the other case, the crop acreage actually increased between 4 and 5 million acres. Accordingly it is hard to ascribe even these relatively small decreases to the downward shift in aggregate demand.

The data in Table II seem to support the following tentative inferences:

1. The aggregate output of American agriculture is, if anything, conspicuously stable.

2. It is not affected adversely in the short run by a drop in aggregate demand such as occurred in 1920–21, 1930–33, and 1937–38.

TABLE II

Change in Production From Preceding Year (*Percentages*)	All Farm Commodities (*No. of Years*)	All Livestock and Livestock Products (*No. of Years*)	All Crops (*No. of Years*)
+16 and more	....	....	3
+11 to +15	1	....	5
+ 6 to +10	4	7	5
from 0 to ±5	29	27	12
− 6 to −10	2	1	6
−11 to −15	....	1*	4†
−16 and less	....	....	1‡
Average Variation (*Percentage*)	3.9	3.6	9.5

* 1935.
† 1913, 1916, 1932, and 1934.
‡ 1921 dropped 22 per cent.

3. Nor, contrary to general opinion, is the aggregate output of agriculture affected substantially from year to year by changes in weather.

4. The aggregate production effort (input of resources) in agriculture is probably even more stable than is the aggregate output (production for sale and consumption).

It may be observed that the aggregate output of agriculture in the United States provides consumers about the same volume of farm products during a depression as in prosperous years; that "big crops" do not come along to "help" business recover from a depression; that attempts to make agricultural production a variable, even on such a colossal scale as that of the AAA in the thirties, did not reduce agricultural output as a whole; and that the adverse effects of business depressions creep into agriculture and seriously upset prices and income but not production as a whole. Thus far, at least, farmers have not responded to a cyclical decline in the aggregate demand for farm products by curtailing the employment of land and labor.

This does pose a significant issue: Why is the aggregate output of agriculture in the United States so stable, despite the vagaries of weather and of business cycles? More particularly in this context, why is agriculture so immune to the cycle virus? If we can identify the causes for this immunity, may it not suggest an antitoxin for what now plagues so much of our non-agricultural economy?

If these observations create the impression that each of the several parts of agriculture also has a stable production record, it needs to be corrected. In fact, agricultural production as an aggregate hides a lot of "costly" variability, so much that one might well ask what meaning can be attached to the aggregate. The Bureau of Agricultural Economics (Glen T. Barton and Martin F. Cooper already cited) has developed a set of indices for *gross farm production* by geographic regions which show three regions (New England, Pacific, and Middle Atlantic) with average mean deviations from 3.2 to 4.4 per cent; four additional regions (East North Central, Mountain, South Atlantic and East South Central) falling between 6.7 and 8.1 per cent; and the West North Central at 10.7 per cent, with the West South Central having the most extreme record, namely a mean average deviation of 11.7 per cent. The year to year variations in gross farm production from 1919 to 1945 are given in Table III.

It is also plain from the data that particular farm products are far from stable in output. Moreover, these fluctuations give rise to specific problems. These fluctuations in product output are mainly caused by variations in yields. The situation in feed crops is striking, and because of the importance of feed in the agricultural economy of the United States there is a strong presumption that it deserves serious attention. Furthermore, it should be noted that although the aggregate output of agriculture is notably stable, a fortunate situation from the point of view of the economy as a whole, the variations in production on individual farms is a basic consideration to the farm family concerned. These variations from farm to farm are obviously hidden by a national average. We may presume, however, that in the main they are not caused by the periodic rise and fall of the aggregate demand but by technical production circumstances such as weather, disease, insects, damage and others.

It may well be true that a few particular products will, upon closer analysis, show expansion and contraction characteristics over the cycle akin to those of industry. The principal policy consideration for agriculture taken as a whole, however, is not one of achieving tolerable production stability but to maintain that which has developed.

> Various explanations have been offered why the response of supply to price change in agriculture is so different from that in much of the industrial sector of the economy, particularly with respect to the maintenance of agricultural production during depression. The papers from which the following two excerpts are taken explore various of the suggested explanations. The first, by Galbraith and Black, is concerned specifically with the depression situation, and the analysis is reproduced here rather fully. The second, by Gale Johnson, written a decade later, had the benefit also of our wartime experience of increased production. The excerpt from Johnson presents only his major conclusions. *—Ed.*

2.4.2 Galbraith, John K. and Black, John D. "The Maintenance of Agricultural Production During Depression: The Explanations Reviewed," *Jour. Pol. Econ.*, Vol. 46, No. 3, June, 1938. Pp. 307, 308, 311, 313, 314, 316–22.

Two matters of a preliminary sort must be cleared up at the outset. In the first place, in terms of conventional equilibrium analysis the factors which cause agriculture to maintain its output must have to do with the supply curve. Certain popular discussion runs in terms of a "stable" demand for agricultural products during depression, which is met in turn by a stable flow of supplies. But such an argument is tenable only if the demand is effective in maintaining stable prices. Actually farm prices tend to fall more quickly and farther than the prices of other products; it is in face of this that supplies tend to remain fairly constant, and hence our analysis has to do with the supply price of farm products.

* * *

. . . The first explanation to be considered relates to certain physical or technological peculiarities of agricultural production. These can mostly be included under two heads: (a) a long production period and (b) the "accidental" effects of weather. The most obvious consequence of both of these is that farmers cannot adjust their production programs promptly or certainly to changing prices. . . .

* * *

In the statistics of agricultural production in recent years around 15 per cent of the value of net agricultural output has commonly been assigned to consumption by the households of the farms on which it is produced. Obviously this 15 per cent, or whatever more than this that a better job of valuation would report, is likely to be a more stable physical volume than that which is produced for market. But how stable is it during a depression? And how large a factor is it in the maintenance of total output at such times? Clearly its importance is not great, but a few aspects of it are somewhat interesting to explore.

* * *

We may next examine what is doubtless the most popular lay explanation of maintained agricultural production — that the farmer instead of reducing production because of lower prices may actually seek to increase it because of the higher marginal utility of his diminished income. In the common expression, he works harder to "make up" for the lower price he is receiving for his product. . . .

. . . In simple language, if the farmer is more influenced by his need for increased money revenue he will increase his own expenditure of effort. If he is more impressed by the meagerness of the return he will decrease his expenditure of effort. This carries the matter a step beyond the movement of income at which Mr. Harrod leaves it, and casts some doubt on his hypothesis that a diminution of return to the self-employed operator leads to an increased expenditure of effort. And, more important, the increased effort, because it may be only a substitution for other factors, need not lead to increased output.

* * *

1. *Rent-capitalization costs* are those expenditures which relate to the farmer's investment in a given grade of land and location. If this is a past investment without recurrent charges, it has no bearing direct or indirect on the maintenance of production. But taxes must be paid currently, and well over half of the farms in the country must meet a contractual annual charge in the form of rent or interest. To the individual entrepreneur struggling to maintain possession of his property, interest and taxes represent no less urgent disbursements than seed or fertilizer. They may affect the level of output in two possible ways. As already suggested, these charges, by acting to increase the marginal utility of money, may lead to a larger input of noncash factors. On the other hand, the effect may be directly

to decrease the input of cash factors; the farmer with limited cash resources available at a given time may devote these to interest and taxes rather than to fertilizer. In any particular situation, one or the other of these effects may be the more important.

2. The same analysis may be extended to *recurrent-overhead charges* against capital equipment which is durable beyond the period of time under consideration.

3. Rent-capitalization charges and overhead do not vary with the level of production, and the same is true of the next category of agricultural costs, which have been labeled *joint-prime costs.* There is nothing particularly novel about this class of costs; they are an inevitable part of the process of combining several lines of production in the farm business. Where a variety of products are combined, the prime-cost factors employed in one line of production may also be used and behave as overhead costs for another line of production. Thus on farms where crop production is dominant, the livestock production makes use of the same labor supply during "off" seasons. No reduction in the amount of livestock maintained would alter the marginal cost of labor; the size of the labor force is governed by the crop production. And even should labor employed in the crops be curtailed in response to a changed marginal cost-price relationship, the labor demands of the subsidiary livestock production will often be sufficiently modest and supplementary so that no change in it is necessary.

Every diversified farm provides examples of these prime costs which behave as overhead costs for certain lines of production. Their effect is that certain agricultural products — those that occupy a subsidiary role — may be produced with few or no variable costs. Consequently, reduction of the price of these products will have no effect, or a diminished effect, on output.

4. As to *prime cost proper* — i.e., costs which vary with the scale of production — the first distinction of importance in agriculture is between cash and noncash costs. So far as noncash costs are concerned, there is little to add to earlier discussion. The most important by far of these is the input of the entrepreneur's own labor together with that of his family. We have seen that we cannot be certain, on a priori grounds, whether there will be a decrease or an increase in this input with falling prices.

Within the category of cash-prime costs it is necessary to distinguish between *lumpy* and *smoothly variable costs.* Lumpiness is important in agriculture as in other small-scale enterprise, but especially so because the same unit of a factor may be used on several products. Thus a man is a small unit of cost in an automobile factory; on a farm he may be the entire purchased labor input for several lines of production. Partly for this reason and partly because of the technical character of the industry, a number of types of agricultural costs must be incurred *en bloc* if there is to be any production at all within a given season or short-run period. . . .

To be sure, lumpy costs need not of themselves maintain the volume of factors employed with a fall in price; but in agriculture the lumpiness for important factors is such that withdrawal may mean either a cessation of production or a general reorganization of the combination of factors. Such a step is likely to be delayed under any circumstances; and in a depression which is assumed to be temporary it is not likely to be taken at all.

We now turn to divisible or *smoothly variable costs* — the costs of those factors presenting no physical barrier to the exact equating of marginal costs and marginal returns. But even here one must distinguish between what have been termed *recovery costs* and *planning costs*. The distinction is necessarily somewhat vague, for it depends to a considerable extent on the way in which the entrepreneur is assumed to behave in planning his production. Nonetheless, it is of some importance. By recovery costs in agriculture are meant those costs which must be incurred to protect or recover an investment already made within a given process or period of production. When production is under way the costs which are incurred are governed not so much by the relation of these costs to returns as by the amount of the previous expenditure on production. The wheat-grower's expenditure on twine is governed not by the relation of this outlay to price but by the necessity for cutting and binding the crop if he is to recover earlier expenditures. Likewise, the fruit-grower makes an expenditure for picking that is set by his earlier expenditure, even within the season, upon pruning, spraying, and similar cultural practices.

It is apparent that if all costs are forecast in advance no distinction can be drawn between planning and recovery costs. But it is precisely this need for forecasting which would appear to make the distinction of importance in agriculture. The period of production under the purview of one entrepreneur is longer in agriculture than in most industry — or such seems to be a common assumption. It may reasonably be argued that the longer the period the greater the likelihood that forecasts will not be made; or that the conditions upon which the forecasts are based will change. Furthermore, of course, the amount of the recovery costs will vary with yields.

Finally, we are left with a class of prime-cash costs which are susceptible to variations in accordance with the farmers' forecast of cost-price relationships: the costs which presumably will be curtailed in the face of declining prices if the producer keeps marginal costs in line with price. It is adjustment in these costs which governs adjustment in output. The most important question concerning these costs is their quantitative importance in agricultural production. This, obviously, is a question of fact. If these costs are small or insignificant in the short-run period, as seems possible, they will be an important element in the explanation of the maintenance of agricultural production. For to say that the costs that can be reduced in the face of falling prices are small or insignificant is of course to say that the curtailment of factor inputs is small or insignificant and that output is likewise changed but little. Or, in technical terms, while the marginal smoothly variable cash costs may be reduced to equal the price which obtains after a fall in demand, these are related to output by so nearly vertical a curve (in the conventional schemata) that the output is changed but slightly. As in the case of fertilizer on the cotton crop in 1931, it is quite possible that the effect of change in smoothly variable inputs may be insufficient to escape the disguising influence on yields of weather or pests.

There is one further explanation of maintained production in terms of costs which deserves mention. It is that the prices of the variable cash-cost factors themselves declined sufficiently during the depression so that the depression adjustment of marginal cost to price was at an output approximating the 1929 level. It is true, of course, that prices of these cost factors did decline during the depression, but not so much as prices of farm products. The Department of Agriculture's index of prices of commodities used by farmers in production was 83 per cent of 1929 in 1931 and 73 per cent in 1932. Prices received by farmers were 60 per cent of 1929 in 1931 and 45 per cent in 1932. It is entirely possible that with an appropriately shaped cost curve a small percentage decline in costs would be sufficient to maintain production in face of a relatively much larger decline in price. But in this case the disparity seems to be too large, although it is obvious that such decline in prices of cost factors as occurred did assist farmers in maintaining former levels of production. In this particular connection labor costs need to be distinguished from costs of commodities used in production. Farm-labor wage rates did drop significantly during the depression. In 1931 they were 68 per cent of 1929, and in the next year 51 per cent of 1929. The relative decline in farm wage rates was much greater than the decline in industrial wage rates. It was sufficiently great, in fact, so that real farm wages in terms of agricultural output increased but moderately between 1929 and 1932. In comparison with industrial production, the flexibility of farm wage rates may perhaps be considered an important factor in the maintenance of agricultural production.

We are now in a position to make a few comments about the current explanations of the behavior of agricultural production in depression in terms of differences between the markets in which agricultural and industrial producers sell their products and the "rigidity" of prices in the markets. It is apparent from the foregoing survey that no simple statement in terms of agriculture as "pure" competition and industry as "imperfect" or "monopolistic" competition will suffice as an explanation of agricultural behavior during depression. There are peculiarities of agricultural enterprise which would work on the side of high aggregate production during depression quite without reference to the character of the market. But it also seems clear that no explanation of the differences in behavior between agriculture and industry generally can overlook the differences in competitive organization between the markets in which the products are sold. These differences need no elaboration at the present stage of economic thinking on this subject — the theoretical framework of the analysis, at least, seems fairly clear. Through much of industry it is possible for the individual producer to support marginal revenue by curtailing output. Large-scale units or oligopoly, or product differentiation or a combination of the two, provide the opportunity for such action. In the purely individual agricultural economy there is not such opportunity of supporting marginal returns by curtailing production. Likewise, we need not elaborate on the further influence on industrial production of rigid prices and capricious price movements which are sanctioned by monopoly power in an industry. These may have an even greater effect in reducing output than will controlled prices so adjusted as to maximize current income. But the effect of monopoly power in the industrial market is to sharpen the contrast between industrial and agricultural behavior during depression rather than to explain agricultural behavior itself. The absence of monopoly elements makes it impossible for agriculture to behave as does industry generally, but agriculture also deviates from the behavior which would be expected of a perfectly competitive industry with mobile and divisible factors. It is with such deviations, so far as they are toward maintained production, that our first five explanations deal.

Our analysis must have made apparent that the behavior of agricultural production in depression arises from a complex set of relationships, including, among others, the six that have been discussed. Of these, the nature of cost in agriculture and the technical peculiarities of agricultural production, including its long period of production and its dependency upon the weather, probably emerge as the more important. Any definite conclusions as to the relative weight to be assigned to various elements, or even as to the combined weight and effect of all, must, however, wait upon quantitative analysis that is mostly still in the offing.

2.4.3 Johnson, D. Gale. "The Nature of the Supply Function for Agricultural Products," *Amer. Econ. Rev.*, Vol. 40, No. 4, Sept., 1950. Pp. 546, 548, 563.

Summary of the explanation: Most of the preceding explanations of the difference between the behavior of output in agriculture and in non-agriculture must be rejected. High fixed costs, the importance of subsistence production, technological conditions are clearly invalid explanations. The differences in the competitive structure of agriculture and industry in the degree of enterprise monopoly is a superficially more plausible explanation, yet I believe it, too, is invalid. An enterprise monopoly faced with the same factor supply conditions as agriculture would, in my view, react in much the same way as a competitive firm.

The belief that farm workers may work harder during periods of low income cannot be rejected on the basis of existing data, and this hypothesis is consistent with actual behavior.

* * *

Summary: The theory presented in this article to explain the output behavior of agriculture rests on two major assumptions: (1) That farmers are profit-maximizing entrepreneurs and (2) that the supply functions of factors to agriculture have certain characteristics. These characteristics are: (a) The labor supply function shifts with changes in the general level of business activity and unemployment (reflecting the alternatives to farm employment) and for any level of business activity, unemployment and nonfarm wage rates, the price elasticity with respect to labor returns in agriculture is small enough to lead to essentially full employment of labor. (b) The land supply function has a very low price elasticity in the short run in part due to the lack of alternative uses outside of agriculture and due to small changes that can be made in the quantity of land through investment and disinvestment. (c) The supply function of capital assets has a very small price elasticity for downward movements in prices since the quantity of such assets existing at any one time can achieve higher returns in agriculture than elsewhere; in response to upward movements in prices, the price elasticity is higher as new investment becomes profitable to farmers.

* * *

These conditions of supply would mean that during a major prolonged decline in business activity that (1) farm prices, farm wage rates, and land rents would fall in about the same proportion and (2) the employment of land, labor, and machinery would not change appreciably. Condition (2) might prevail without (1) if the resources had to be used in fixed proportions or if one of the resources had a fixed coefficient of production, conditions that seem less plausible than the conditions of supply outlined above.

* * *

This theory, simple as it is, seems to be consistent with the observed phenomena. The theory seems much more useful in understanding the behavior of agricultural output under various sets of circumstances than other explanations that have been offered. The high fixed cost explanation of constancy of output during a depression not only has the defect of being inconsistent with the observed behavior of the employment of hired labor and rented land, but high fixed costs are not an explanation at all of output responses to rising real output prices. Nor does the competitive structure of agriculture seem to have much relevance to output behavior. Other explanations — the length of the production process and the importance of subsistence production — have been found to be unsatisfactory. The effect of the real wage upon the amount of effort a given labor force will exert is an explanation of behavior that seems consistent with observed phenomena. It is a hypothesis that deserves further investigation. The hypothesis is not inconsistent with the theory expounded here. If we knew more of its relevance and significance, it would be possible to specify with greater accuracy the nature of the labor supply function.

> Statistical derivation of supply curves for agricultural commodities has been sadly neglected in recent years. A paper by Louis Bean in 1929 summarized the information then available; and the reader would still do well to turn to his paper for analysis in this field. We present here some of his conclusions concerning the supply of potatoes. *—Ed.*

2.4.4 Bean, Louis. "The Farmers' Response to Price," ***Jour. Farm Econ.,*** **Vol. XI, No. 3, July, 1929. Pp. 377–78, 379, 381.**

Other evidence pointing to the reasonableness of results presented here is found in the regional differences in prices of potatoes associated with acreage stability. Usually prices received by growers in New York are above the general average for the country as a whole, while in Michigan and Idaho they are below the average, these relationships reflecting largely freight differentials and location with respect to consuming markets. As might be expected from these price differences, it is found that for the country as a whole the price associated with acreage stability is about $1.00, for New York, $1.11, for Michigan, 85 cents and for Idaho, 63 cents.

* * *

Examining first the data for potatoes, it will be seen that with price 10 per cent below the equilibrium point, acreage tended to be reduced the first year 7 to 8 per cent in each area, and with price 20 per cent below the equilibrium point, acreage tended to be reduced 9 to 10 per cent below in New York, Michigan and the United States, but 15 per cent in Idaho. With prices 10 per cent above the equilibrium price, acreage increased 5 to 7 per cent in New York, Michigan and the United States, and 9 per cent in Idaho, while prices 40 per cent above resulted in a 15 per cent increase in acreage in Idaho but only 7 to 9 per cent in the other areas. In each of the areas the additional increase in acreage for prices 40 per cent above was only slightly greater than for a price 10 per cent above, except in Idaho. In the latter state, potato acreage appears to be more sensitive, the response to a given price high or low, being greater than in the other three areas.

2.5 Derived Demand for Farm Products and the Incidence of Marketing Charges

The usual textbook theory suggests that prices are established at the intersection of a demand and a supply curve. This simple relationship exists in the case of direct barter between producer and consumer. But in most agricultural marketing, the price the consumer pays and the price the farmer receives are separated by substantial marketing costs. As was pointed out in the introduction, the "farmers' share" of the consumer's dollar currently averages around 50 cents for foods, although it varies a good deal from one commodity to another.

This section is concerned with the relationships that exist between demand at the retail level and the prices that the farmer can get for his products at the farm. It explains why demand at the farm level is ordinarily much less elastic than demand at the retail level. It also points out the effects of changes in marketing charges upon the prices that consumers pay and the prices that farmers receive.

We start with a general discussion of derived demand.—*Ed.*

2.5.1 Thomsen, Frederick L. *Agricultural Marketing*. McGraw-Hill, New York, 1951. Pp. 171–73. Reprinted by permission.

Derived Demands for Farm Products. — If there were no consumer retail demand for fresh foods and for processed products made from agricultural raw materials, there would be no demand for the fresh products in wholesale markets and no demand for agricultural raw materials in processing markets. Nor would there be a demand for the services of various types of middlemen found in the marketing system. All of the latter demands, therefore, are derived demands, just as the demands for bricks, lumber, and other building materials are derived from the consumer demand for houses and commercial building facilities.

Since the demand for farm products in various types of wholesale markets, including the local farm market, is derived from consumer demand, it has many of the characteristics of consumer demand for the finished product. Thus, the demand for salt at the mines and refineries is inelastic because the consumer demand for salt is inelastic. The demand for strawberries in local growers' markets of Florida or Arkansas is more elastic than the demand for potatoes at shipping points in Maine because strawberries are a luxury food, whereas potatoes are a staple item of diet, and consequently the consumer demand for strawberries is more elastic than for potatoes.

However, the derived demands for fresh products and raw materials differ from the corresponding consumer demands in some important respects, owing to the intervening marketing operations and charges.

The differences between consumer demands for fresh or processed products and the demands for agricultural commodities from which they are derived arise mainly from three factors:

1. *The demand for products at the farm end of the marketing system consists of consumer demand* (i.e., prices which consumers will pay for different quantities) *minus a schedule of marketing charges* (i.e., per unit marketing margins associated with different quantities marketed). These marketing charges are determined largely by conditions divorced from consumer demand and hence cannot be expected to change in complete harmony with changes in the retail prices and quantities of commodities marketed.

If the marketing charge is a flat rate per unit, regardless of the price paid by consumers or the quantity marketed, the prices received by farmers in local farm markets for different total quantities marketed would be a uniform absolute amount less than the price paid by consumers for such quantities. If the consumer demand curve is a straight line, the demand curve for the local farm market would be parallel to and below (or to the left of, depending on which scale is considered the base) the consumer demand curve. This means that the farmers' demand curve would be *less* elastic for the same quantity than the consumers' demand curve.

If the total marketing charge per unit is a constant percentage of the retail price regardless of the quantity marketed, the demand curve for the local farm market would have a slope less steep than that of consumer demand, which would make for a farm market demand having the same elasticity as consumer demand. However, such a situation is very improbable. Transportation and many other charges are generally on a flat-rate basis. Retailers' and wholesalers' margins, on the other hand, frequently are based on a percentage markup or margin, so that we should expect per-unit marketing charges to be about halfway between a flat rate per unit and a percentage basis. This conclusion is borne out by studies of the Bureau of Agricultural Economics. . . .

* * *

2. *The demands for various commodities in farm markets reflect the differing seasonality of production and consumption* of those products which can be stored, and hence the demand in farm markets would fluctuate during the year even if there were no change in consumer demand. The amount of fluctuation normally to be expected from this factor would be the amount of seasonal change in the over-all marketing margin attributable to the differences in storage charges.

3. *Wholesale-market dealers anticipate changes in retail demand.* Even if marketing costs including storage costs were zero, the demand for farm products in local assembly and other wholesale markets would not coincide with consumer demand, because middlemen in the wholesale markets recognize impending changes in retail demand and adjust their offering prices for different quantities accordingly.

> The relative instability of farm prices is due in part to the rigidity of marketing charges. This point was emphasized by Warren and Pearson.—*Ed.*

2.5.2 Warren, G. F. and Pearson, F. A. *Interrelationships of Supply and Price.* Cornell Univ., Agr. Exper. Sta. Bull. 466, March, 1928. Pp. 143–44.

Consumption of that part of the supply which is used on the farm is affected by farm prices, which fluctuate violently. Consumption of that part of the supply which sells at retail is affected by retail prices, which fluctuate little. Consumption of that part of the supply which sells in tin cans is affected by prices of canned goods, which fluctuate still less. Consumption of that part of the supply which is consumed in hotels is affected by prices on the bill of fare, which are practically indifferent to supply.

The statement is constantly reiterated that supply and demand govern prices. The assumption is made that all prices are thus explained. If this were true, low prices would be explained either by high supply or by low demand. Consumers' prices are governed by supply and demand. Prices paid to farmers are consumers' prices less the cost of distribution. They may be low because supply or demand has made consumers' prices low, or they may be low, in spite of high consumers' prices if distributing charges have risen.

* * *

The producer pays the freight and all other distributing costs until such a time as he is able to reduce production and so pass on a part of these charges to the consumer. If retail prices were raised because handling charges were raised, the consumer would not take all the product and prices would have to be lowered. For most farm products a number of years are required in order to reduce production and pass on part of the distributing charges.

* * *

The violence with which farm prices fluctuate was becoming an important national problem even before the war. Eating in restaurants, stabilized retail prices, increased use of package goods, commercialized agriculture, specialized farming, and living in large cities rather than in small villages, all tend to make farm prices fluctuate violently.

> Cassels' analysis of the costs of marketing fluid milk brings out not only that there is no reason to expect absolute marketing margins to decrease when farm prices go down but that they may, under some circumstances, move in the opposite direction.—*Ed.*

2.5.3 Cassels, John M. *A Study of Fluid Milk Prices.* Harvard Economic Studies, Vol. 54. Harvard Univ., Cambridge, Mass., 1937. Pp. 44–45.

If the consumers' demand for fluid milk is inelastic, that part of the dealers' demand which is derived from it will certainly be inelastic in an even higher degree. As was indicated above, the dealers' demand is a composite demand derived from two different underlying demands, one the consumers' demand for fluid milk and the other the demand for the dairy products into which the milk in excess of fluid sales is manufactured. In studying the character of the total dealers' demand we naturally consider first the effects of its dependence on the ultimate demand for fluid milk.

The prices f.o.b. city plants at which dealers will buy different quantities of milk depend on the prices at which they can sell it and the margins that they themselves demand for the services they perform in distributing it. It must be recognized that the presence of monopoly elements in the distribution field will tend to make these margins wider than they would be under conditions of pure competition, but what is most important to note in the present connection is that even under conditions of pure competition there would be no necessary tendency for proportionate relations to be maintained between prices and margins. Still less, of course, would there be any such tendency when the competition among the dealers is imperfect. The price of milk depends on the conditions of supply and demand for that commodity, while the margins depend in a similar way on the conditions of supply and demand for distributors' services. These two sets of conditions are, to a considerable extent, independent of one another. The factors which cause a shifting to the right or left of the producers' supply curve for milk may be of such a nature as to cause no corresponding shifts in the supply curve for the dealers' services. Technical or economic changes might cheapen the production of milk on the farms without affecting in the least the costs of retail distribution. On the other hand, economies might be introduced in the methods of retail distribution while the costs of farm production underwent no reduction. Indeed it seems that changes such as these might well have opposite effects on the prices paid to producers and the margins taken by the dealers. The increase in the volume of milk marketed by farmers as a result of the cheapening of production would actually constitute an increased demand for the services of distributors and would (in the absence of conditions of constant or decreasing costs) tend to widen the margins going to the dealers. In a similar way the narrowing of the margins through the introduction of economies in distribution would increase the derived demand for milk and tend to raise the prices received by the producers.

On the basis of this analysis, it is evidently a mistake to suppose that overproduction in the milk industry and the low prices to producers which result from it should necessarily be accompanied, for any economic reasons, by low margins to the distributors. And, if the operation of a freely competitive pricing system is accepted as the best means of directing and adjusting production, it would be undesirable to have the middlemen sacrifice (out of generosity) any of their share in the retail price for the benefit of the farmers. It is the farmers' output which is in excess of the equilibrium amount and which should be cut down, according to this view, through the impact upon them of the full effects of the price decline brought about by their misdirected efforts. This is pointed out here, not because the writer accepts this as the best method of directing production, but merely to show that neither the principles nor the philosophy of the laissez-faire system require that dealers' margins should be proportionate to producers' prices. It must be recognized, however, that conditions of decreasing costs, excluded from consideration above, will frequently prevail in the businesses of milk distribution, and that in such cases the increase in volume which lowers the price will also tend to lower to some extent the dealers' margins.

Most statistical studies of the demand for farm products have been made on the basis of farm or central market prices, rather than retail prices. Some typical findings regarding demand elasticity are shown below. It should be noted that the estimates were made by different economists, using different methods, and studying different periods of time. Thus, they are not comparable with one another, but they do give some idea of the scope and diversity of available estimates of the elasticity of demand for farm products. *—Ed.*

2.5.4 **Waite, Warren C. and Trelogan, Harry C. *Agricultural Market Prices.* 2nd ed., John Wiley & Sons, New York, 1951. Pp. 46–47.**

TABLE 8

ELASTICITIES OF DEMAND DERIVED IN CERTAIN STATISTICAL STUDIES IN THE UNITED STATES

Commodity	Market	Elasticity	Years
Milk	Boston, Class I	0.07	1922–31[a]
Milk	Several markets, fluid	0.27	1934–35[b]
Sugar	U. S.	0.31	1915–29[c]
Wheat	Chicago	0.36	1896–1913
Wheat	Chicago	0.24	1921–34[d]
Wheat	U. S. Farm	0.21	1921–34[c]
Lemons	California	0.33	1910–37[e]
Potatoes	Minneapolis	0.46	1902–24[f]
Potatoes	U. S. Farm	0.30	1915–29[c]
Barley	U. S. Farm	0.53	1915–29[c]
Oats	U. S. Farm	0.60	1915–29[c]
Corn	Chicago	0.59	1897–1926[g]
Corn	U. S. Farm	0.70	1921–38[h]
Rice	New Orleans	0.65	1914–30[i]
Coffee	Import price	0.75	1881–1913[j]
Pork	U. S. Farm	0.65	1921–37[k]
Pork	U. S. Retail	0.93	1922–30[l]
Cranberries	Wholesale, fresh	0.80	1931–41[m]
Peaches	U. S. Farm	1.20	1910–15 and 1921–25[n]
Apples	New York, wholesale	1.42	1898–1914[o]
Veal	U. S. Farm	1.50	1921–41[p]
Tokay grapes	Auction market	1.40	1921–31[q]
Lambs	....	1.58	1907–26[r]
Bananas	New York, wholesale	2.56	1897–1914[s]

[a] John Cassels, "Fluid Milk Programs of the AAA," *Jour. Pol. Econ.*, Vol. 43, p. 416 (1935).

[b] E. W. Gaumnitz and O. M. Reed, "Some Problems in Establishing Milk Prices," *U. S. Dept. Agr.* DM-2, p. 44.

[c] Henry Schultz, *The Theory and Measurement of Demand*. University of Chicago Press, 1938.
[d] H. Working, "The Elasticities of Demand for Wheat," *Econometrica*, Vol. 5, No. 2, pp. 185–86 (1937).
[e] H. Wellman and E. Braun, "Lemons," *Calif. Agr. Exper. Sta. Bull. 460*, p. 20.
[f] H. Working, "Factors Affecting the Price of Minnesota Potatoes," *Minn. Agr. Exper. Sta. Tech. Bull. 29*, p. 13.
[g] R. W. Cox, "Factors Influencing the Price of Corn," *Minn. Agr. Exper. Sta. Tech. Bull. 81*, p. 23.
[h] G. Shepherd, "Controlling Corn and Hog Supplies and Prices," *U. S. Dept. Agr. Tech. Bull. 826*, pp. 18–19.
[i] C. E. Campbell, "Factors Affecting the Price of Rice," *U. S. Dept. Agr. Tech. Bull. 297*, p. 20.
[j] E. W. Gilboy, "The Leontieff and Schultz Methods," *Quar. Jour. Econ.*, Vol. 44, p. 233 (Nov., 1930).
[k] G. Shepherd and W. W. Wilcox, "Stabilizing Corn Supplies by Storage," *Iowa Agr. Exper. Sta. Bull. 368*, p. 337.
[l] E. J. Working, "Changes in Demand," *Jour. Farm Econ.*, Vol. 14, p. 246.
[m] C. D. Hyson and F. H. Sanderson, "Monopolistic Discrimination in the Cranberry Industry," *Quar. Jour. Econ.*, May, 1945, p. 342.
[n] E. M. Daggit, *Yearbook of Agriculture*, 1936, p. 566.
[o] G. F. Warren and F. A. Pearson, *N. Y. State Coll. Agr. Farm Econ. 48*, p. 777.
[p] M. Ezekiel, (reported by Warren and Pearson), "Interrelationships of Demand and Supply," *Cornell Univ. Agr. Exper. Sta. Bull. 466.*
[q] E. A. Stokdyk, "Marketing Tokay Grapes," *Calif. Agr. Exper. Sta. Bull. 558*, p. 17.
[r] M. Ezekiel, "Factors Relating to Lamb Prices," *Jour. Pol. Econ.*, Vol. XXXV, p. 241 (April, 1927).
[s] G. F. Warren and F. A. Pearson, *op. cit.*, p. 778.

Who pays the cost of marketing? Who is benefited by a reduction in marketing charges? Who bears the burden of an increase? These questions are currently important. Freight rates and other marketing charges have been rising, and further increases are likely. Will this reduce farm incomes, raise the bill of consumers, or both?

A partial answer to such questions is given in the following excerpt from Shepherd.—*Ed.*

2.5.5 Shepherd, Geoffrey S. *Agricultural Price Analysis*. 3rd ed., The Iowa State College Press, Ames, Iowa, 1950. P. 212.

This chapter can be summarized in these words (the statement is put in terms of a decrease in middleman's margin; the effects of an increase in middleman's margins is the converse of these): A decrease in middleman's margins (1) increases production and consumption (by the same amounts, since what is produced is consumed, no more and no less); and (2) both lowers prices to consumers and raises prices to producers, by amounts which added together equal the decrease in the middleman's margin. The division between the producer and consumer depends upon (is inversely proportional to) the relative elasticities of their supply and demand; the one with the more elastic curve gets the smaller share.

Results such as those stated by Shepherd are subject to two qualifications. First, they are based upon the assumption that the demand for and the supply of the commodity or group of commodities are both independent of the prices of all other commodities. When several commodities compete in consumption, in production, or both, the incidence may be very different. In fact, Hotelling showed in "Edgeworth's Taxation Paradox, . . ." *Jour. Pol. Econ.,* Vol. 40, 1932, that a tax on a particular commodity (or an increase in the cost of marketing it) might lower the retail prices both of that commodity and competing commodities. Second, Shepherd's statement in terms of the relative *elasticities* of demand and supply holds when both curves are in terms of retail prices – or both in terms of farm prices. Shepherd's analysis is consistent on this point, since the two curves are in terms of the same prices. But if the supply curve is in terms of prices received by producers, and if the demand curve is in terms of prices paid by consumers, it is the relative *slopes* that count – not relative *elasticities.– Ed.*

2.6 The Market as Equator of Demand and Supply

The purpose of markets is to provide for the exchange of goods between buyers and sellers. The terms on the basis of which buying and selling occur are prices. Hence, a main function of markets is price-making.

We have a fairly simple theoretical model of how prices adjust under competitive conditions so as to equate demand with supply and "clear the market." We also have numerous descriptive studies of markets for particular commodities that indicate substantial departures from this simple model. We are short on analytical studies that appraise the prevailing institutional arrangements and pricing practices from the standpoint of efficiency of the price-making process.

The readings in this subsection start with Clark and Weld's brief description of the "equalization" process as it should work ideally in markets for agricultural commodities.–*Ed.*

2.6.1 Clark, Fred E. and Weld, L. D. H. *Marketing Agricultural Products in the United States.* Macmillan, New York, 1932. P. 13.

Here occurs what may be termed a process of "equalization." The wholesale market may be looked upon as a reservoir. The supplies that flow into this reservoir are more or less fluctuating in quantity and quality. Some products are intensely seasonal in character; others, even though they are grown throughout the year, come to market in irregular quantities, due to weather changes, condition of country roads, price changes, or the whims of shippers and buyers. On the other hand, demand is constantly changing. By releasing the supply so there can be an adequate flow to users, by keeping the markets in balance through interchange of information, and by directing commodities to those localities where demand is the greatest; in short, by adjusting a fluctuating supply to a constantly changing demand, the great wholesale reservoirs perform an indispensable equalizing process.

> Many farm products are sold at auction both in the United States and elsewhere, and the operation of auction markets has been a subject of a good deal of study. An interesting account of auction pricing in the Netherlands and Belgium has been given by Riddell. (A similar system, without the mechanical accouterments, is used in the Baltimore fruit auction in this country.) Such a market is clearly competitive. The reader is left to ponder, however, the relationship of the range of prices that result with this selling procedure to the idealized intersection of a supply and demand curve in the economists' competitive model.—*Ed.*

2.6.2 Riddell, G. E. "Farmers in Low Countries Sell by the Clock," ***News for Farmer Cooperatives,*** **U. S. Farm Credit Admin., Sept., 1950. P. 3.**

Agricultural cooperatives in the Low Countries of Holland and Belgium have developed "sales line" marketing comparable in efficiency to "production line" manufacturing in this country. They do it primarily through auctions that move along smoothly, quietly, and swiftly. Several things enter into this systematized operation.

First of all, the auction method differs essentially from that prevailing in our country in that the sale is made on the first bid — the top price anyone is willing to pay. This is really "auction in reverse."

* * *

. . . These buyers had already examined and tasted the samples from the various lots to be sold before coming in to the auction room.

* * *

The sale began with a brief announcement by the auction manager of the maximum and minimum number of 30 kilogram boxes to be allowed on a single sale. The manager called the first "lot" number and the great hand or pointer started moving slowly counterclockwise to the numbers indicating prices on the border of the dial. When the hand reached a price acceptable to some buyer he pushed the electric button at his seat and the hand stopped. His number lighted up on the board. He indicated the number of cases by holding up the corresponding number of fingers. The amount was then called off and recorded by the sales assistant. The sale was completed.

The hand returned rapidly to the top of the dial, or to a point well above the probable sale price, and started down again. The auction manager called the next lot number and another sale was under way. These auctions sell much faster than our own fruit and vegetable ones. The products that feed into this and other auctions come from an agriculture that differs from ours in many ways but also ranks high in efficiency.

> Section 5 will deal with conditions of imperfect competition and monopoly, but we shall include an excerpt here to show how imperfect competition affects pricing in some agricultural markets.—*Ed.*

2.6.3 Nicholls, William H. "Market-Sharing in the Packing Industry," *Jour. Farm Econ.*, Vol. XXII, No. 1, Feb., 1940. Pp. 234–37. (As corrected in *Jour. Farm Econ.*, Vol. XXII, No. 2, May, 1940. P. 497.)

Time will not permit the detailed demonstration of the theory of market-sharing here, although the writer has tentatively worked out what he believes is a valid theoretical analysis of the problem. This analysis may be summarized in the following way.

First, it should be said that, when only two or a few large firms buy in a market, the supply curve of (say) hogs to any one (and hence all) of them depends not only upon the market supply curve but also upon the buying policies of its few rivals. Thus uncertainty as to its rivals' future policies would lead to uncertainties as to the conditions of supply which face this company. The same would be true of demand conditions on the selling side. If a certain percentage division of the buying and selling markets becomes recognized as "fair," however, the uncertainties as to one's rivals' policies largely disappear, and its own supply and demand curves tend to become merely proportional parts (say 40 per cent) of the market curves. What price and production policies might be expected under such conditions of market-sharing?

If the marginal costs of processing and distribution were identical among the few large firms for every possible total volume so shared, hog prices and pork prices (and hence the spread) would be in no wise different from that of outright collusion. Total excess profits would be shared in the same proportion as total volume, the few firms all being equally satisfied with the sharing arrangement. Although the market could be shared in given proportions at any price level from the monopoly level to that of pure competition, presumably each firm would realize that any endeavor to increase its own relative volume of purchases by price competition would only reduce its own profits, due to inevitable retaliation by its competitors.

Once we drop the highly restrictive assumption of identical marginal costs among the few firms, however, no one total volume, and hence buying or selling price, would be equally acceptable to all of them. It can be shown that, in this situation, the most efficient of the few firms would be the price leader. This firm would determine the prices which would maximize its own profits on its recognized share of the business. The less-efficient firms will find themselves accepting the leader's price. At this price they may conceivably choose to buy less than their "fair" share, in which case the leader will gain a growing percentage of the market.

If this analysis is valid, what are the implications when we extend it to the realities of fluctuating hog supplies? It is almost inconceivable that the marginal cost of processing of two or a few packers would be identical for a given sharing of all possible total hog receipts (as we first assumed). Yet apparently over considerable periods of time — at least in individual markets — we find actual packers' percentages very stable. This might indicate a certain equalizing of cost between firms by non-price competition — such as advertising and other selling costs — in the short run.

Over a longer period of time, on the other hand, there have been significant shifts in the national importance of the "Big Four" packers relative to each other. If, as is commonly asserted by those familiar with the packing industry, Swift is the most efficient, as well as the probable price leader, of the "Big Four," its gradual gains over its closest rival, Armour, since the War might corroborate our theory. Rapid gains on Swift's part would doubtless be prevented by fear of anti-trust action, even if such were possible on the basis of relative costs. Differing cost conditions among a few firms, however, by leading to different preferences as to price and volume policies, apparently favor farmer and consumer somewhat in the long run compared with identical cost conditions, under which identity of interests would be complete.

We have so far assumed that a few firms handle the entire supply of hogs. Actually, however, there are a few dominant packing firms, undoubtedly too large to ignore their own influence on prices, and a considerable number of firms so small that they can ignore their effect on prices. Where a few firms dominate both the buying and selling markets, although they may not possess complete control of either, they may be able to establish the level of buying and selling prices — and hence the spread — in such a way as to maximize their joint profits, if the smaller firms "follow the leader." The essence of price leadership is that the dominant firms are not aggressive, that is, they take what is left over by the small firms at the price which the large firms dictate.

It is important to note that while, in their relationship to each other, a few dominant firms may have to recognize the most efficient of their number as their leader, the dominant firms — regardless of efficiency — may assume a position of leadership relative to the rest of the industry by the nature of their size alone. The dominant firms may be expected to take the initiative in making price changes as they seek to maximize their profits under varying market conditions. To each new position taken by the dominant firms the small ones will tend to adjust on the basis of competitive behavior. The largest units have the greatest interest in preventing price competition, and their greater amount of unused capacity and financial resources are such as to enable them to enforce their policy on others if necessary. Finally, the smaller firms are likely to regard the large firms as better equipped to frame a satisfactory policy for the whole industry. Our over-all theory, then, would lead us to expect that prices throughout the industry would tend to be established at such a level as to maximize the profits of the most efficient of the dominant firms.

While such price policies might result in excessive profits in the short run, the long-run effect might be quite different. It appears to be a common fate of price leaders to suffer a decline in their proportion of the total business. The fact that independent packers have grown rapidly since the War would indicate that prevailing spreads were sufficient for handsome profits on the part of smaller firms not burdened by considerable overcapacity. The four major packers, although their own capacity was already underutilized, have been able to prevent smaller firms from taking over an even greater share of the market by buying out some of these firms, often closing down the acquired plants, and redirecting the additional volume through their old plants. While this "rationalization" process was partly forced upon them by the shift away from the terminal markets as a source of supply, the failure to use price competition as an alternative means of gaining needed volume is liable to lead to *chronic* overcapacity, if there is a failure of price competition to act as a corrective. Thus, ultimately high costs may bring only a normal or even a sub-normal return on the large firms' investment and yet the farmer and consumer suffer as much as if the industry were fully monopolized.

It has not been the purpose of this section to present an analysis of the actual price and production policies of the dominant firms in the packing industry. The intent has rather been to show that both constant purchase percentages and marked shifts in the relative national positions of the leading packers, such as we noted earlier, may be fully consistent with the existence of imperfectly competitive conditions in the industry.

> Agricultural supplies do not come into immediate adjustment with market prices. While "there is always one more apple on the tree" that the farmer might be induced to pick if the price were high enough, and while, if prices are sufficiently low, it may not pay him to pick his apples at all, for the most part the farmer can respond to increases or decreases in price of a crop only by increasing or decreasing his acreage of the commodity in the following year. In the case of most livestock products — meat animals and milk — it takes a still longer time to change the level of production substantially. In the case of orchard fruits, five or ten years may elapse between the time that farmers set out new orchards and the time that these trees come into heavy bearing.
>
> This lag in the response of production to price change sets in motion forces that frequently lead to cycles. One of the most familiar is the hog cycle, described in the following excerpt from Nicholls. The theoretical model developed to explain this type of phenomenon is called "The Cobweb Theorem." The classic description of this process is that of Ezekiel, presented in the succeeding excerpt.—*Ed.*

2.6.4 Nicholls, William H. *A Theoretical Analysis of Imperfect Competition With Special Application to the Agricultural Industries.* The Iowa State College Press, Ames, Iowa, 1941. Pp. 310–11.

Most of the variations in the production of field crops are of an annual nature. It requires only one year to increase or decrease production in response to price changes and weather conditions are so irregular as frequently to counterbalance the actions of producers in increasing or decreasing acreage. But for agricultural products which take a longer time for adjustment in response to price, such as livestock and orchard fruits, a tendency toward more or less regularly recurring "production cycles" has long been recognized. For hogs a cycle of 2–3 years each of increasing and decreasing production has usually been indicated; for beef cattle, 6–9 years; for sheep, 3–5 years; and for horses (in pre-tractor days), 10–15 years. The production of strawberries, wheat, apples and other orchard fruits, and many other agricultural products, has also been alleged to move in cycles.

Probably the most famous production cycle is that of hogs, largely due to the fact that it is short enough in span to have

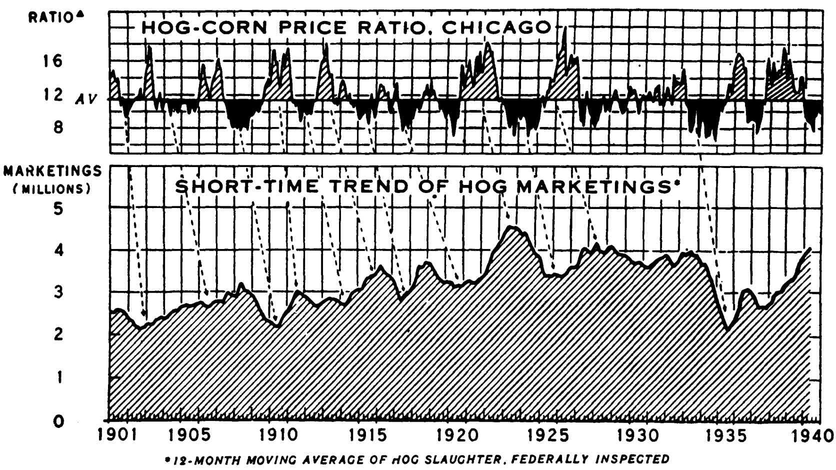


Fig. 39. Changes in corn-hog price ratio and subsequent marketing of hogs.

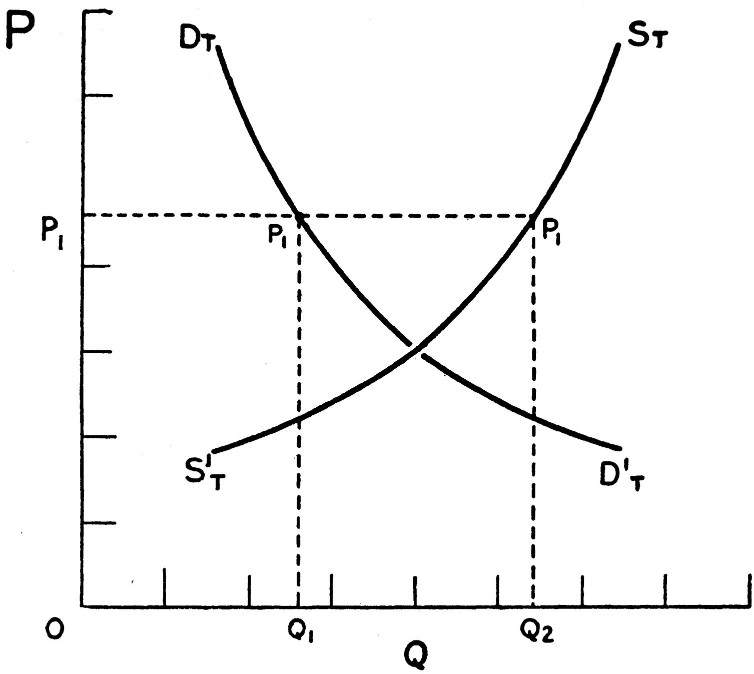
shown persistent recurrence over the past 80 years. Some 15 such cycles have occurred since 1860. These changes in hog production have been closely associated, not with hog prices alone, but rather with the relation between hog prices and the price of corn, the principal feed. This relation is termed the corn-hog price ratio. It represents the price of hogs per hundred pounds divided by the price of corn per bushel. When corn is relatively cheap and hogs relatively high, the corn-hog ratio is high and hog feeding is profitable. When corn is relatively dear and hogs relatively cheap, the ratio is low and feeding becomes unprofitable to most farmers.

The effect of the changing corn-hog ratios on the marketing of hogs one or two years later is shown in Figure 39. The upper part of the chart shows the corn-hog ratios drawn above and below the average line, and the lower part shows the changes in hog marketings with the seasonal variation removed. Comparison of the upper part of the chart with the lower shows how a period of greater than average corn-hog ratios causes an increase in hog marketings a year or two later, while a period of less than average ratios causes a decrease in marketings a year or two later. For example, the high prices of hogs in 1921 resulted in a relatively high ratio and increased marketing by 1923 from 61.5 to 77.5 million hogs. The low ratio of 1923-24 in turn brought decreased marketings in 1925 and 1926 (62.6 million hogs). In 1935, due to the combined effects of drought and a production-control program, hog marketings fell to the lowest figure since 1910, 46.2 million.

2.6.5 Ezekiel, Mordecai. "The Cobweb Theorem," *Quar. Jour. Econ.*, Vol. 52, No. 2, Feb., 1938. Pp. 262–66, 268–70, 272.

The "Cobweb Theory": The phases of the cobweb theory which have already been stated by others may first be briefly summarized:

Case 1, continuous fluctuation. In the lower portion of Figure 2, the series of reactions is portrayed for the curves shown in the upper portion of the figure. The quantity in the initial period (Q_1) is large, producing a relatively low price where it intersects the demand curve, at P_1. This low price, intersecting the supply curve, calls forth in the next period a relatively short supply, Q_2. This short supply gives a high price, P_2, where it intersects the demand curve. This high price calls forth a corresponding increased production, Q_3, in the third period, with a corresponding low price, P_3. Since this low price in the third period is identical with that in the first, the production and price in the fourth, fifth, and subsequent periods will continue to rotate around the path Q_2, P_2, Q_3, P_3, etc. As long as price is completely determined by the current supply, and supply is completely determined by the preceding price, fluctuation in price and production will continue in this unchanging pattern indefinitely, without an equilibrium being approached or reached. This is true in this particular case because the demand curve is the exact reverse of the supply curve, so that at their overlap each has the same elasticity. This case has been designated the "case of continuous fluctuations."



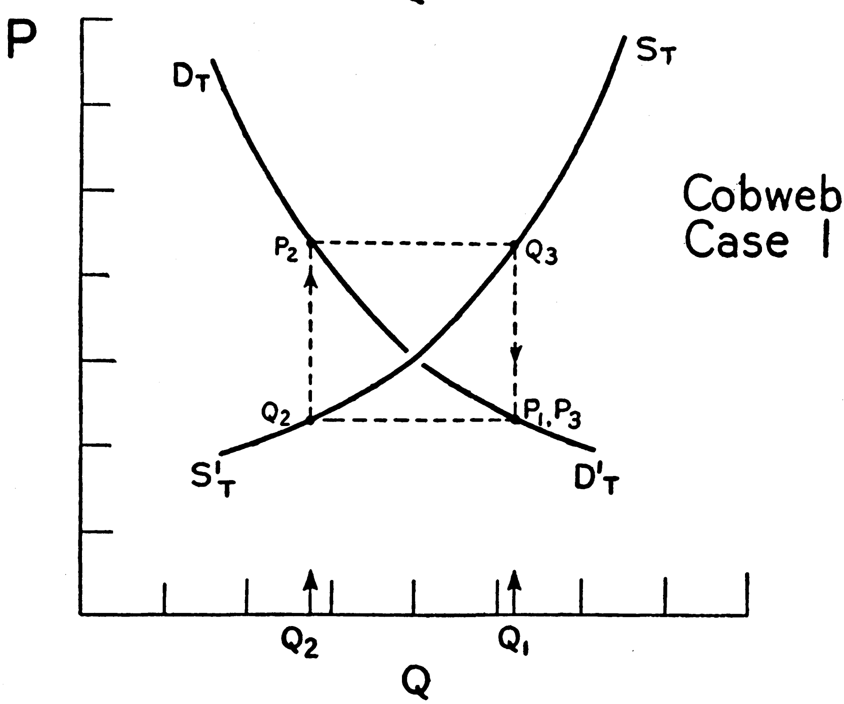
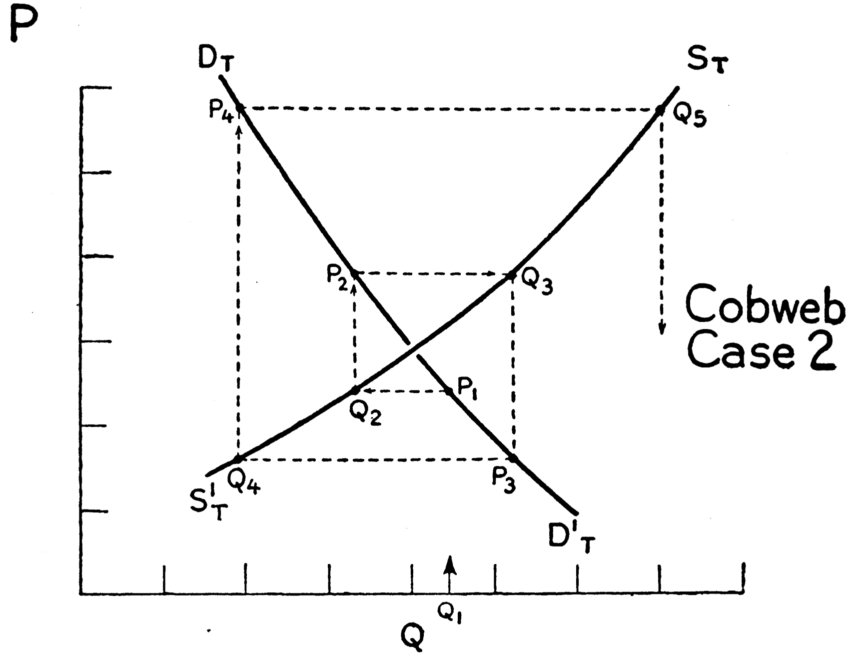


Fig. 2. Curves and series of reactions for Cobweb Case 1.

Case 2, divergent fluctuation. Where the elasticity of supply is greater than the elasticity of demand, the series of reactions works out as shown in the upper portion of Figure 3. Starting with the moderately large supply, Q_1, and the corresponding price, P_1, the series of reactions is traced by the dotted line. In the second period, there is a moderately reduced supply, Q_2, with the corresponding higher price, P_2. This high price calls forth a considerable increase in supply, Q_3, in the third period, with a resulting material reduction in price, to P_3. This is followed by a sharp reduction in quantity produced in the next period to Q_4, with a corresponding very high price, P_4. The fifth period sees a still greater expansion in supply to Q_5, etc. Under these conditions the situation might continue to grow more and more unstable, until price fell to absolute zero, or production was completely abandoned, or a limit was reached to available resources (where the elasticity of supply would change) so that production could no longer expand. The case has been designated the "case of divergent fluctuation."

Case 3, convergent fluctuation. The reverse situation, with supply less elastic than demand, is shown in the lower portion of Figure 3. Starting with a large supply and low price in the first period, P_1, there would be a very short supply and high price, Q_2 and P_2, in the second period. Production would expand again in the third period, to Q_3, but to a smaller production than that in the first period. This would set a moderately low price, P_3, in the third period, with a moderate reduction to Q_4 in the fourth period; and a moderately high price, P_4. Continuing through Q_5, P_5, and Q_6 and P_6, production and price approach more and more closely to the equilibrium condition where no further changes would occur. Of the three cases considered thus far, only this one behaves in the manner assumed by equilibrium theory; and even it converges rapidly only if the supply curve is markedly less elastic than the demand curve. The case has been designated "the case of convergent fluctuation."

To this point this paper has merely reviewed the points developed in earlier papers on the theory of price analysis and on the cobweb theory. As thus developed, the cobweb theory explains swings in production and price in successive production periods, but does not fully explain the long cycles observed in many commodities. The following portions of this paper present a further extension of the cobweb analysis that may be



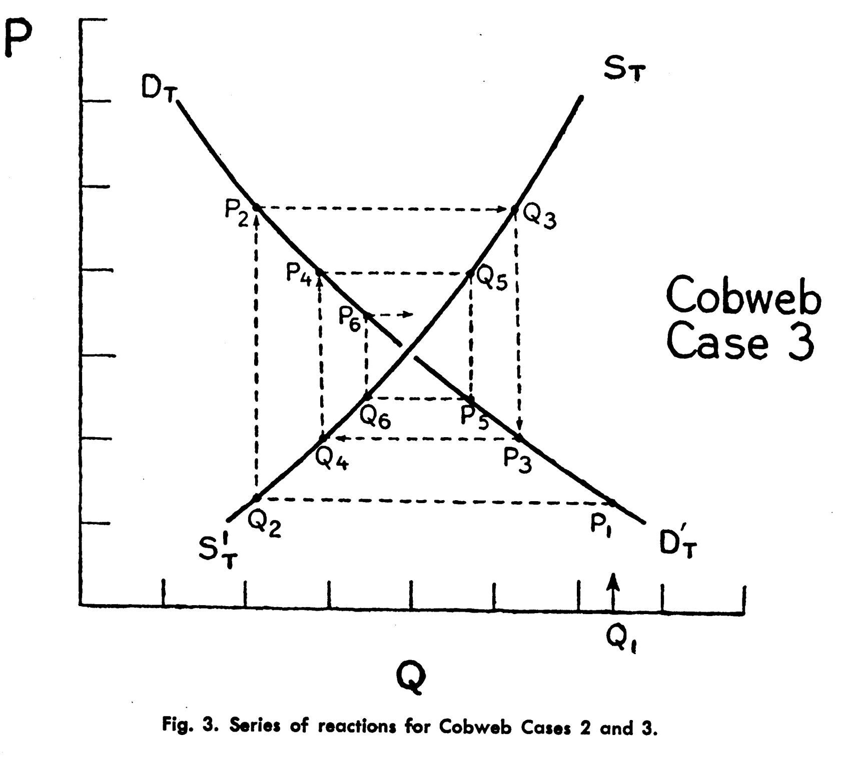


Fig. 3. Series of reactions for Cobweb Cases 2 and 3.

useful as a theoretical framework for the investigation of such long cycles.

* * *

The time series traced by price and production. A time-series

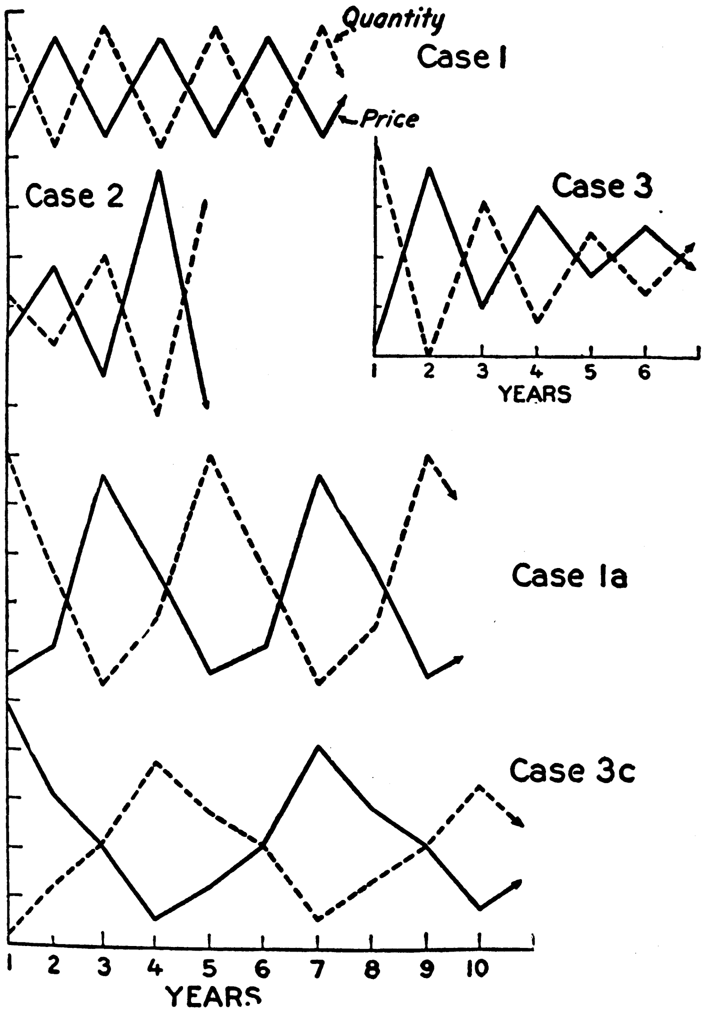


Fig. 5. Time series of price and quantity.

chart of prices and production in the successive periods shown in Figures 2 and 3, reveals more clearly the cyclical character of the resulting processes, as shown in Figure 5. Cases 1, 2, and 3, with a one-year lag in response, all produce two-year cycles. The continuous, divergent, and convergent character of the three cases is clearly evident, both in production and in price. Case 1a, with a two-year lag in production, has a four-year period from peak to peak; and Case 3c, with a three-year lag, a six-year period. The continuous character of the cycle in Case 1a, and the slow convergence of the cycle in Case 3c, are also apparent.

While it is evident that these synthetic time series have been constructed under highly rigid assumptions, it is interesting to compare them with some actual price and production cycles. . . . Figure 6 shows the prices of cows and cattle corrected for changes in wholesale prices; . . . The changes in the adjusted prices of cattle and milk cows both reflect the underlying cycle in cattle numbers. The similarities are evident; it is also apparent that the actual cycles are more irregular, both in length and in shape, than are the cycles based upon the fixed periods of the theory.

Limitations of the Cobweb Theory: The cobweb theory can apply exactly only to commodities which fulfill three conditions: (1) where production is completely determined by the producers' response to price, under conditions of pure competition (where the producer bases plans for future production on the assumption present prices will continue, and that his own production plans will not affect the market); (2) where the time needed for production requires at least one full period before production can be changed, once the plans are made; and (3) where the price is set by the supply available. Obviously commodities where either price or production is set by administrative decisions (i.e., where monopolistic competition prevails), or where production can respond almost immediately to changed demands, cannot be expected to show the cobweb reaction.

The attempt to introduce dynamic elements into the supply-price analysis has been carried further by Cochrane.

The Cobweb Theorem explains how the lag in production responses to price changes can give rise to cycle fluctuations. But the Cobweb Theorem, like the static analysis, assumes that both the demand curve and the supply curve are fixed. Actually, both the demand curve and the supply curve are likely to change over a period of time. Demand varies in an irregular fashion due to such factors as depressions and wars. In our generation, these changes in demand have been sudden, violent, and unpredictable.

It has sometimes been assumed that the supply curve for

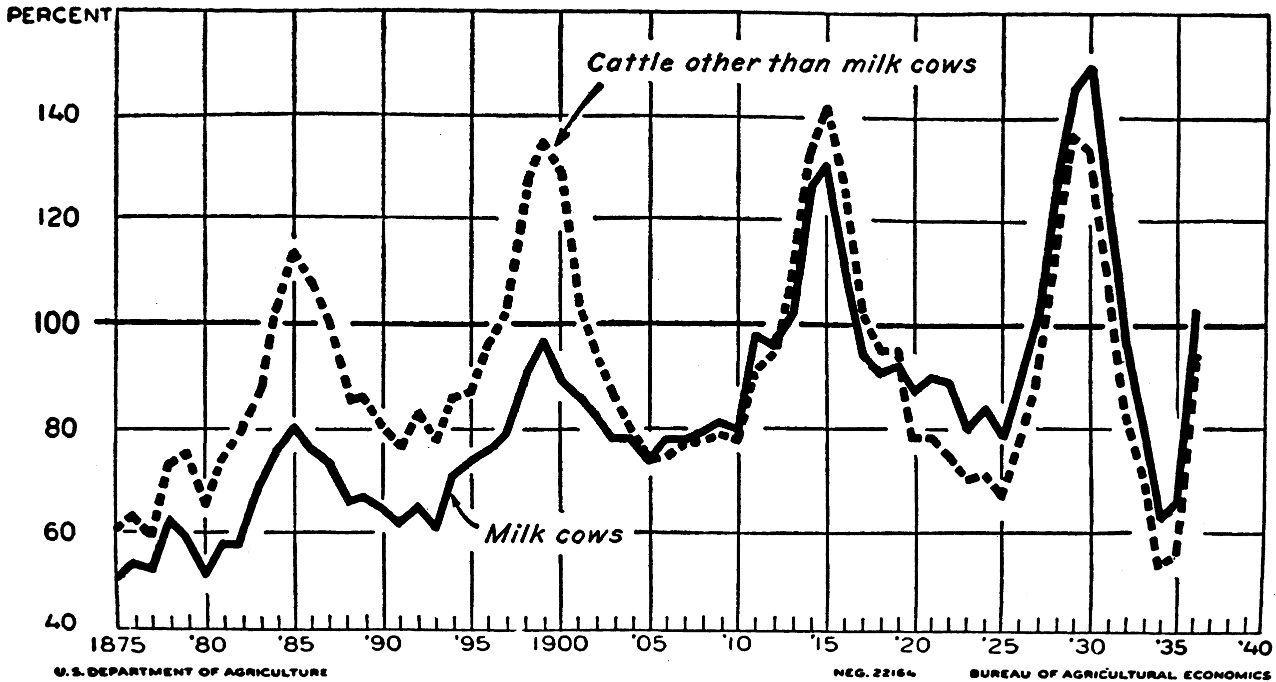


Fig. 6. Purchasing power per head of milk cows and cattle other than milk cows, 1875 to date. Index numbers (1910—14 = 100).

agricultural products is more stable, changing only gradually as farmers adopt new production methods. Cochrane has presented evidence that the supply curve, as well as the demand curve, may increase suddenly and substantially—and that once it shifts to the right, it does not shift back again. Such shifts in demand and supply help explain the instability of prices in agricultural markets.

Cochrane's discussion is in terms of aggregate supply and demand for all farm products (or for all food) rather than for individual commodities.—*Ed.*

2.6.6 Cochrane, Willard W. "Farm Price Gyrations — An Aggregative Hypothesis," *Jour. Farm Econ.*, Vol. XXIX, No. 2, May, 1947. Pp. 386, 388–89, 391–92, 394.

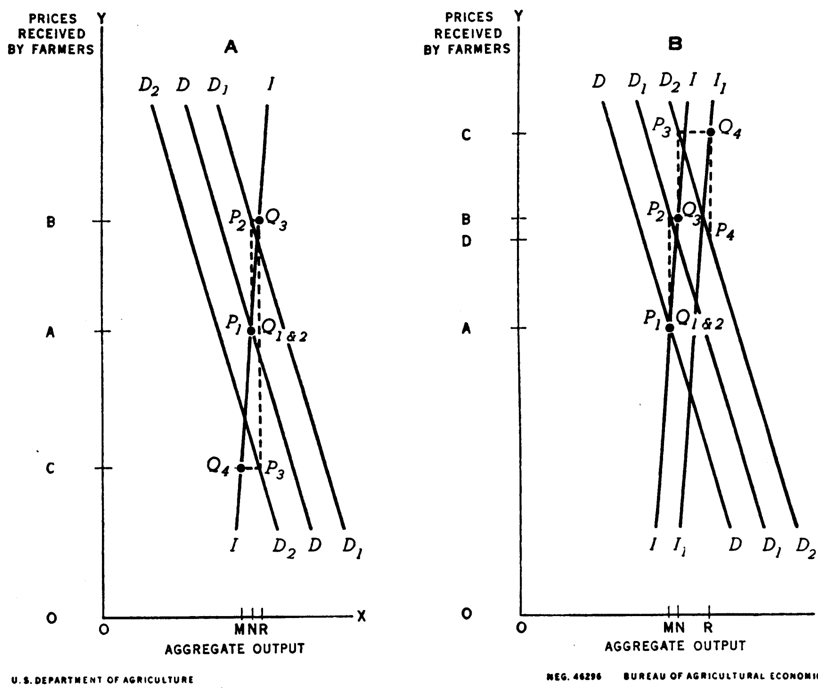


Fig. 1. A working hypothesis regarding the slope and relationship of the aggregate demand curve to the aggregate output curve.

The logic of the shift to the right in the position of the aggregate output function in response to an increase in demand is evident if we reflect for a moment on the relationship of technological change and the introduction of innovations to demand and price conditions. In the first place, the output curve shifts to the right as output per unit of input increases. And the output per unit of input usually increases as new technologies are incorporated into the production process. But if demand is not expanding — that is, if the curve DD is not shifting to the right thus creating a favorable economic milieu — most farmers would not have (1) the optimistic price expectations and (2) the financial resources to introduce labor saving or capital saving innovations into their farming operations even though the introduction of those innovations would reduce unit costs in any period. Farmers, like other businessmen, tend not to make net investments in machinery and equipment when their outlook is dampened by currently depressed prices and their sources of credit are restricted; they tend to invest when the future looks bright and credit is easy.

In a period of stationary or contracting demand, "know how" and enhanced physical productive capacity accumulate, so to speak, in an unused pool. Now given an expansion in demand, output increases as known technologies are put into practice, with the result that the aggregate output curve jumps to the right or drifts to the right through a succession of temporary positions, taking up a new fixed position defined by a new productive organization centered around the technologies recently placed in operation. But once the pool of unused technologies are incorporated into the production organization, limited always by the labor force on family farms, further increases in demand fail to increase productivity — shift the output curve further to the right. Further increases in demand simply develop a stimulus-response sequence centered around the inelastic output curve (I_1I_1 in Fig. 1, Chart B) yielding substantially higher prices and inconsequential quantity increases. In general terms then, an increase in demand may, in one phase, increase price and not output, and, in another phase, may increase output and not price.

The skipping action described above, however, is not readily reversible. If, for example, the aggregate demand curve DD moves sufficiently to the right in the necessary technological context to cause the output curve to also shift to the right, the output curve does not shift back to the left with a contraction in demand. The demand curve will rather initiate a stimulus-response sequence centered around the output curve I_1I_1 wherein prices fall precipitously and quantity changes almost not at all. For the behavior of aggregate output in the field of agriculture following a general price decline is not one of contraction. On the contrary, it is one of sustained output. Once the output function (schedule of intentions to produce) has shifted to the right, it remains fixed in that inelastic position until some new demand stimulus causes it once again to shift to the right.

* * *

When we relate an index of aggregate food output to an index of "responsible prices" over the historical period 1912–

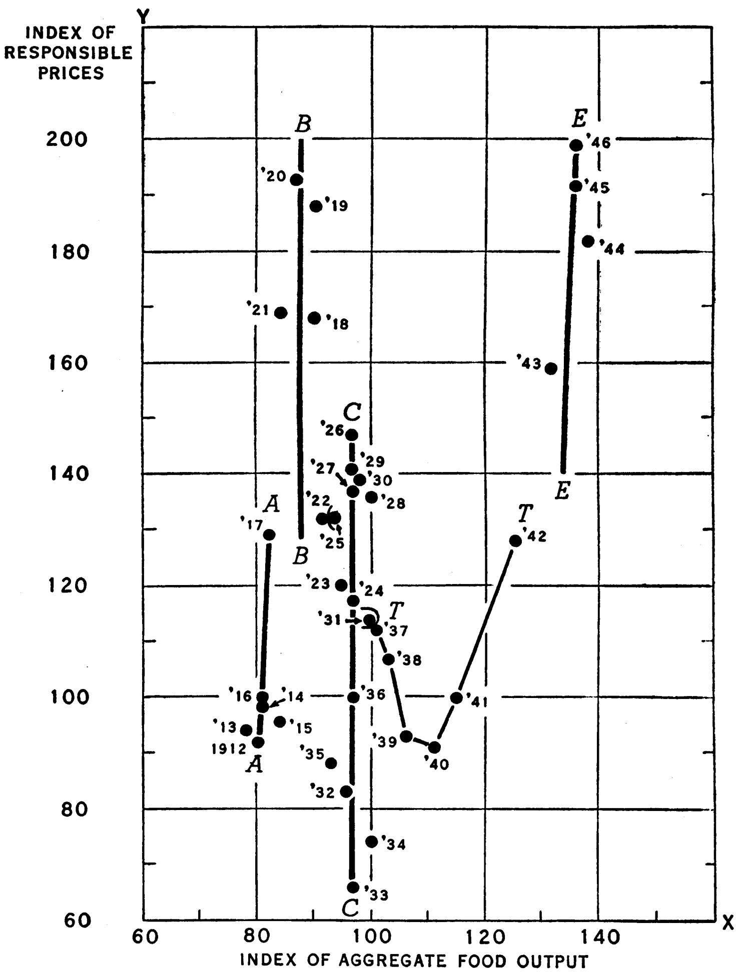


Fig. 2. The index of aggregate food output is plotted against the index of responsible prices to yield a nest of aggregative output curves. These curves are historical in the sense that they emerge through time. But the quantity points through which the curves are drawn are a function of prices (responsible prices); thus in those cases where the schedule of intentions to produce remains unchanged throughout the phase (1912–17, 1918–22, 1923–36, and 1943–46) the fitted curves must be the true output curves.

46, the resulting price quantity points fall into a definite and meaningful pattern (see Fig. 2). In appraising the configurations of Figure 2, however, it must be constantly held in mind that the years (e.g., 1944, 1945, and 1946) associated with particular points refer only to realized output. The responsible prices — the prices that induced these outputs — are of an earlier date corresponding to the beginning of the production process. The movement in demand and the stimulus-response sequences centered around the demand curve are simply assumed here, with only the "end product" realized output taking on concreteness in the form of a quantity point. And from these realized output points which differ from the original intentions only by the modifying factors at work during the production process we derive the output curve.

It will be observed that there are five historical phases (1912–17, 1918–22, 1923–36, 1937–42, and 1943–46) through which curves are drawn in Figure 2. It is our contention that four of those curves (AA, BB, CC, and EE) are true output functions. No significant change in productivity (output per worker) occurred in agriculture during any one of those phases, although it certainly changed — increased — as between the delineated phases (see Table 1). Nothing changed technologically within each of the phases under consideration to cause farmers in the aggregate to plan to produce more product at the same price in the succeeding year than in the current year. Consequently, the shifting demand curve *within each phase* traces out an output curve which is representative of the aggregate schedule of intentions to produce.

The disastrous effects upon farm income of violent fluctuations in farm prices have come to be a matter of considerable public concern. A wide variety of legislation has been enacted providing for price supports, marketing agreements, marketing quotas, and other marketing devices for preventing severe drops in farm prices. While these are dealt with more fully in Section 6, three readings are inserted here. The first raises some fundamental questions both regarding the effect of our policy objectives on the efficiency of prices in equating demand and supply, and regarding the efficiency of performance of this function by free market prices in an unstable economy. The others discuss in some detail the rather elaborate system that has been developed for determining the minimum price for fluid milk under federal regulation in the Boston market. —*Ed.*

2.6.7 **Schultz, T. W. *Production and Welfare of Agriculture.* Macmillan, New York, 1949. Pp. 71–75.**

Our quest is for an efficient pricing system, efficient in performing several functions that integrate major economic processes. As policy with regard to farm prices has taken shape, four fairly distinct functions have come to the forefront, namely: (1) prices to guide the allocation of resources in production; (2) prices to channel products into trade both at home and abroad; (3) prices to distribute income from farming over time; and (4) prices to distribute income among persons.

Can a pricing system be "efficient" in all these functions at one and the same time? Are we not putting altogether too big a burden on the pricing system and thereby weakening it and making it less efficient than it otherwise would be in performing the more limited tasks that are appropriate to its capacity? The answer to the latter question appears to be strongly in the affirmative, both on theoretical grounds and from the lessons taught to us by experience.

Let me make explicit at this point that the formulation of the pricing problem that follows is based on the belief that prices are not an appropriate means for "stabilizing" the income from farming over time, and also that they are not suited to lessen the inequality in the personal distribution of incomes. Moreover, I shall assume that the main positive role of the pricing system is to guide production and to channel products into trade for domestic and foreign use. To take still another step, given the existing state of our political economy — chiefly the prevailing attitudes toward economic policy, the nature and capacity of economic institutions, and the type of development that characterizes our economy — it is my belief that that part of the pricing system on which agriculture depends most directly *will not be permitted* (politically and institutionally) to perform its production and marketing functions efficiently, unless ways and means are first found (1) to make the flow of farm income much steadier than it has been from one year to another and (2) to reduce substantially the inequality in income among families. The first of these is, politically, much the more urgent of the two. Plainly we came out of the inter-war period and World War II with a price policy for agriculture designed primarily to attain the objective of stabilizing farm incomes over time. If this appraisal proves to be correct, it follows that a high priority should be given to inquiry for finding ways and means that will free the pricing system from the two income burdens described above, especially that of putting the flow of farm income on a steadier basis.

Let us then proceed by leaving the income problems aside, which means that we shall assume at this point that the pricing system is freed so that it can concentrate on the first two functions outlined above, namely guide agricultural production and channel farm products among their various uses. How efficient would such a pricing system be? When put this way, there is still a strong presumption in my judgement, that the pricing system would prove to be quite inefficient under conditions of the kind that have prevailed since 1910-1914.

This takes us to the heart of the difficulty because there can be little doubt that it has been the unstable character of the economy that has undermined the pricing system. In its simplest terms what appears to have been happening has been a breaking apart of the network of prices connecting the decisions to utilize resources for production and the decisions to utilize products for consumption. This separation has come about as a result of inconsistencies that have emerged between the long and the short run when the aggregates of an economy are fluctuating widely. The commitments with regard to factors to achieve allocative efficiency in farming involve production plans that are essentially long run in nature relative to the kind of commitments that arise when processors and other handlers buy farm products with a view of marketing them to consumers. In an economy with a steady rate of development and with relatively little economic uncertainty — like the years, say, from 1895 up to World War I — these two sets of decisions may be sufficiently integrated by the pricing system to give satisfactory results, approximating the economist norm based on a stationary state in equilibrium. Since 1910–14, however, the economy has been so unstable, economic uncertainty has bulked so large, and the fluctuations in farm prices have been so violent and great that the pricing system could not integrate these two sets of decisions. As a consequence a gap has appeared in the network of prices. In short, conditions have been such that the pricing system has not been able to guide the allocative process in production efficiently and at the same time keep farm products moving into foreign and domestic markets at a rate consistent with short-run developments.

Minimum prices to farmers for milk going into different uses have for many years been established under federal marketing agreements and orders in a number of the major fluid milk markets in the United States. These orders commonly establish higher prices for milk for fluid use (Class I) than for "surplus" milk going into manufactured dairy products. In 1948, a new type of formula was introduced in the Boston market for determination of the Class I price. It represents an ingenious attempt to provide automatic changes in the price in response to the same major factors that would influence prices in a competitive market, while still maintaining a price differential for Class I milk.—*Ed.*

2.6.8 Welden, W. C. "Formula Pricing of Class I Milk Under Market Orders," *Jour. Farm Econ.*, Vol. XXXI, No. 1, Pt. 2, Feb., 1949. Pp. 420, 422–23.

Efforts to stabilize our agricultural economy in recent years have involved a substantial amount of commodity price-fixing by governmental agencies. Success in the eyes of the public has been relatively elusive in this job. This has sharpened the interests of economists in the subject of administered prices and has made each new line of effort a topic of lively discussion.

* * *

It should be possible to make automatic or formula prices for Class I milk as logical and as understandable to dairy farmers as fixed or pegged prices. Sound formula prices provide an infinitely greater guarantee of security to farmers and of fair and reasonable prices to the public than prices fixed at any specific level for an advance period. It is most important to recognize also that if an obvious defect develops in the formula or if it needs to be amended temporarily to meet a special local situation, then a formula can be amended after a public hearing just as quickly and just as easily as a price level can be changed in a fixed-price type of order. The formula, therefore, is in no respect more fixed or rigid than a pegged price, but does guarantee timely price changes in the interim between public hearings.

Briefly the new Boston formula provides that the Class I milk price shall vary in accordance with changes in a composite formula index calculated on a 1925–29 base. This index is the simple average of (a) the latest monthly index of all wholesale commodity prices in the United States as published by the Bureau of Labor Statistics, (b) the average of the last three monthly indices of Department Store Sales in New England as published by the Federal Reserve Bank, and (c) a joint index of the latest available costs for farm labor and for dairy feeds in New England as calculated by the Market Administrator each month from regularly published figures. The basic Class I price varies in intervals of 22 cents per 100 pounds in accordance with bracketed changes in this composite formula index.

Super-imposed on this basic price structure is a seasonal pattern which provides a price 44 cents per 100 pounds above the basic level in the 4th calendar quarter, and 44 cents below the basic level in the 2nd calendar quarter each year. An additional seasonal safe-guard prevents any price increase from March through June and any price drop from September through December each year.

Also super-imposed on the basic price is a provision whereby the Class I price is automatically lower by 44 cents as soon as and so long as the percentage of surplus in the market for the most recent 12 months is above the critical level defined as 41 per cent. Similarly the critical level on the low side is 33 per cent, which calls for a price 44 cents higher than otherwise provided so long as the shortage continues. Only such part of this supply-demand adjustment can operate as will not cause a price change from the same month a year earlier of more than 88 cents per 100 pounds.

The three basic factors in the formula are designed to reflect local supply, local demand, and general economic conditions. The three are given equal weight for reasons of simplicity and logic, and also because the results met the empirical test. So far this has had very popular appeal. With a relatively inelastic demand and with delayed if not inelastic supply responses, this equal weighting might not have been necessary to meet some of the objectives, but it is fair and reasonable and is safeguarded by the supply-demand adjustment. Also, the weightings might not have been equal if the results of detailed statistical and correlation analysis of factors affecting the Class I price had been adopted. The objectives called, however, for a more general empirical analysis with logic and equity and sound public policy as the standards.

The wholesale price level represents a basic tie-in with the whole economy of the nation, measuring the level of general economic conditions as reflected on a composite basis in the primary wholesale markets. In any analysis of factors affecting Class I prices, the first step would probably be to deflate the price series by this wholesale price level, just as for resale price analysis the series might first be deflated by the consumer price index.

Grain and labor costs reflect the main cash cost items in milk production in New England. Changes in such costs may not forecast precisely changes in the supply on a short-run basis, but a stable relationship between these costs and milk prices is necessary to a stable milk supply. Changes in these costs, also, must be important factors in the timing and degree of milk price changes if such milk prices are to bring economic stability to the farmer. Total production costs are more difficult to measure. Also, they are partly reflected by the wholesale price index.

The demand factor used in this new pricing formula has probably created more comment than any other factor. The index of New England Department Store Sales was selected as a measure of changes in New England consumer purchasing power.* It comes closer to measuring changes in the disposable income than any other factor available — payrolls, industrial activity, or others. It is available monthly, whereas actual income figures regionally are available only on an annual basis and are not available on an annual basis until August of the following year.

There is available, of course, a current monthly figure on the amount spent for milk. To use such a figure as the demand factor, however, would be to flaunt public interest and potentially at least exploit the inelastic demand for milk. It would be comparable to using the farm value of all the milk produced as an index of the supply part of a pricing arrangement. It would be circular reasoning of the worst type. If the supply were inelastic this value would change only after a price change rather than before. The same would be true of the money spent for milk if demand were inelastic.

This index of consumer purchasing power does not necessarily measure or forecast in any precise or accurate manner changes in the sales of milk at various prices. This need not be its restricted purpose, however, in the pricing formula. It is the key factor on the demand side, fundamentally affecting the price consumers will pay for milk and the amount they will purchase, and thus the basic factor in the reasonableness of milk prices from a public interest standpoint. The formula recognizes that changes in income-price relationships will affect sales just as changes in cost-price ratios will affect production, and that sound orderly prices require a balanced relationship to both incomes and costs. This balancing job may change in character if there is a basic change in milk using habits or in the techniques of milk production. Any formula may need basic changes accordingly.

---

* ED.—Since this was written, a derived index reflecting per capita disposable income in New England has been substituted for Department Store Sales. The supply-demand adjustment and base period have likewise been modified.

The special seasonal pricing provisions are designed to encourage a return to the more normal pre-war seasonal pattern of milk production. Short-season market receipts in Boston in recent years have been only about half of flush season receipts, as compared with 60 to 65 per cent before the war. Emergency imports from as far west as Minnesota have been necessary in four of the last five short seasons in order to meet sales needs, and in two of these four years milk sales actually had to be restricted because the milk could not be obtained. Last year's imports were close to 20 million pounds. Yet in June this year Class I sales were less than 50 per cent of market receipts.

The special supply-demand adjustment is a basic safeguard and an integral part of the entire program. The critical limits of 41 and 33 per cent surplus on an annual basis are designed to correspond to 25 and 15 per cent necessary operating reserve in the short production months. The mid-point of 37 per cent annually would normally provide a 20 per cent operating reserve to cover day to day fluctuations and thus insure an adequate supply in the shortest month of production.

2.6.9 Johnson, Stewart. "Formula Pricing of Class I Milk Under Market Orders," *Jour. Farm Econ.*, Vol. XXXI, No. 1, Pt. 2, Feb., 1949. P. 430.

. . . Considering the prime movers only, two of the three are local factors. If similar formulas were adopted in all other markets, inter-market differentials would be adjusted from month to month on the basis of differences in movement in these two factors. The escape provision might cause counter movements in the differentials after several months had elapsed, but the initial and continuing adjustors would be the two prime movers which are local factors.

It is extremely doubtful if changes in inter-market price differentials resulting from the adoption of this formula in some or all of the other 27 federal order markets would be logical or reasonable, judged either from the empirical record or from the standpoint of economic theory.

The record indicates that department store sales in various markets have followed widely different courses from month to month and from year to year. Such differences have not been associated with varying rates of fluid milk consumption. . . .

Historical data thus suggest that automatic adjustment of inter-market price differentials would result in pricing chaos if the model now used in federal order markets in New England should be adopted in other markets. That such would result is also in line with what would be expected on the basis of economic theory.

Determining changes in inter-market differentials by these factors assumes that fluid milk consumption is closely related to department store sales, and that fluid milk supply is closely related to feed-labor costs. Since there are so many factors affecting fluid milk consumption and supply, these assumptions would not be expected to be true. . . .

2.7 Methods of Measuring Demand

Reasonably accurate demand curves are essential in the analysis of many marketing problems. The market analyst must know approximately how many pounds of beef the American public would buy in 1952 if the average retail price were 40, 50, or 60 cents a pound; or how much milk could be sold in the Boston market area if the price were 18, 20, or 22 cents a quart.

Since the days of Cournot considerable progress has been made toward the statistical measurement of demand. Under the leadership of Dr. O. C. Stine, a wide variety of demand studies have been carried out in the Bureau of Agricultural Economics. These analyses are basic to the Outlook reports and to the periodic Situation reports.

The student who wants a detailed discussion of statistical methods used in demand analysis should consult Henry Schultz, *The Theory and Measurement of Demand,* Chicago, 1938; Mordecai Ezekiel, *Methods of Correlation Analysis,* New York, 1941; and several publications of the Cowles Commission in Chicago.

Our first selection presents three statistical approaches to demand analysis.—*Ed.*

2.7.1 Fox, Karl A. "Relations Between Prices, Consumption, and Production," ***Jour. Amer. Stat. Assoc.*****, Vol. 46, No. 255, Sept., 1951. Pp. 325, 327–29.**

. . . At the present time persons doing applied work in demand analysis may be divided into three groups. The first group carries on in the tradition of Moore and Ezekiel, using the single equation, least squares approach and relying upon judgment to cope with pitfalls such as multicollinearity and nonidentifiability. The second group supplements this approach with the application of bunch map analysis to select "useful" variables and to avoid multicollinearity. The third, centering around the Cowles Commission, uses a multiple equation approach and takes explicit account of the so-called "identification problem." The methods used by the three groups were largely developed in three successive decades.

* * *

The two monuments of the first group were Ezekiel's "Methods of Correlation Analysis" (1930) and Schultz's "The Theory and Measurement of Demand" (1938). Schultz's applied work belongs with this group although some of his theoretical chapters go beyond the usual scope of its interests.

The second group doing work on demand analysis relies on methods developed by Ragnar Frisch (1929, 1934). Frisch was concerned with the danger of obtaining spurious results due to the combined (and unrecognized) effect of random errors and high inter-correlation between the explanatory variables. He believed that this situation was very common in practice, and wrote that "a substantial part of the regression and correlation analyses which have been made on economic data in recent years is nonsense for this very reason." To cope with this problem, Frisch developed his method of "statistical confluence analysis by means of complete regression systems." This technique was used extensively by Tinbergen in business cycle analysis (1939) and by Stone (1945) and Prest (1949) in the analysis of price-consumption relationships.

The third group is largely identified with the Cowles Commission and is almost wholly a development of the past decade. Marschak traces the systematic consideration of the identification problem back to an unpublished memorandum by Frisch in 1938. The first major article on what is frequently called the Cowles Commission technique was published by Haavelmo in 1943. The main feature of the Cowles Commission approach is its emphasis upon the simultaneous determination of interdependent relationships. Moore and other analysts had used two or more equations to indicate an equilibrium solution, for example, the intersection of a supply and a demand curve to determine price. Tinbergen calculated large numbers of equations which were theoretically interdependent, but his method of fitting assumed that each of them was statistically independent.

* * *

The "identification problem" is inherent in the nature of economic data. A set of simultaneous price-quantity observations describes the points of intersection of a supply curve and a demand curve. Unless additional information is available (for example, on the variables causing shifts or "disturbances" in each curve) we do not know whether a curve fitted to the observations is a demand curve, a supply curve, or some uninterpretable combination of the two.

. . . Fortunately, the "identification problem" can be readily solved for an important class of agricultural commodities. For many of these, particularly annual crops, current production is not influenced by current price. Hence, a net relation between production and current price will approximate a demand function. In Marschak's terminology this demand function will be a "uniequational complete model." Most applications of the single equation approach which have yielded useful results relate to this model.

> The problem of "identification" was pointed out in 1927 by Elmer Working. Since then the Cowles Commission has done a great deal of work on the subject, but we shall not take the space to report their studies here.—*Ed.*

2.7.2 Working, E. J. "What Do Statistical 'Demand Curves' Show?" *Quar. Jour. Econ.*, Vol. XLI, No. 2, Feb., 1927. Pp. 218–23.

But what of statistical demand curves in the light of this analysis? If we construct a statistical demand curve from data

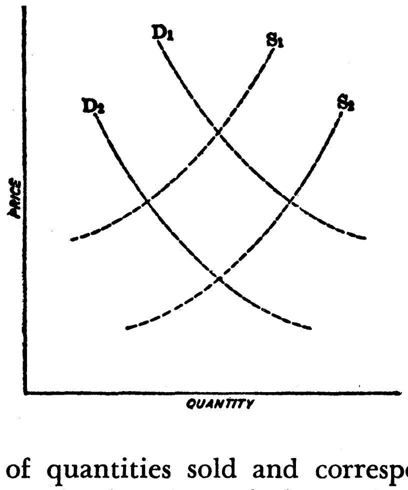


Fig. II. Chart showing approximately equal shifting of demand and supply curves.

of quantities sold and corresponding prices, our original data consist, in effect, of observations of points at which the demand and supply curves have met. Altho we may wish to reduce our data to static conditions, we must remember that they originate in the market itself. The market is dynamic and our data extend over a period of time; consequently our data are of changing conditions and must be considered as the result of shifting demand and supply schedules.

Let us assume that conditions are such as those illustrated in Figure II, the demand curve shifting from D1 to D2, and the supply curve shifting in similar manner from S1 to S2. It is to be noted that the chart shows approximately equal shifting of the demand and supply curves.

Under such conditions there will result a series of prices which

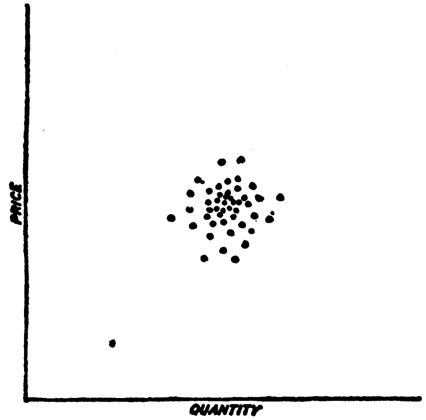
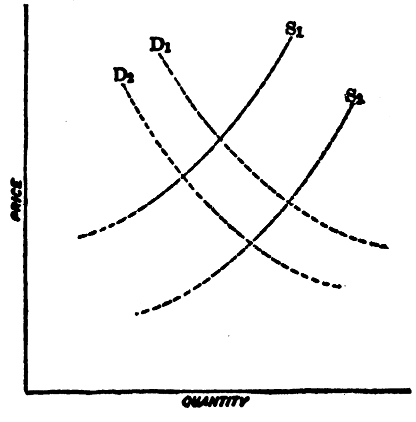


Fig. III. Price series resulting from conditions represented in Figure II.

may be graphically represented by Figure III. It is from data such as those represented by the dots that we are to construct a demand curve, but evidently no satisfactory fit can be obtained. A line of one slope will give substantially as good a fit as will a line of any other slope.

Fig. IV. Chart showing a shifting of the supply curve greater than that of the demand curve.



But what happens if we alter our assumptions as to the relative shifting of the demand and supply curves? Suppose the supply curve shifts in some such manner as is indicated by Figure IV, that is, so that the shifting of the supply curve is greater than the shifting of the demand curve. We shall then obtain a very different set of observations — a set which may be represented by the dots of Figure V. To these points we may fit a curve which will have the elasticity of the demand curve that we originally assumed,

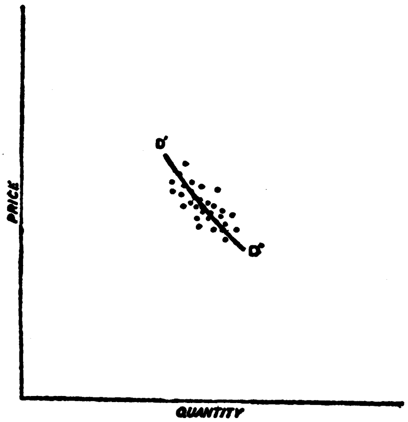
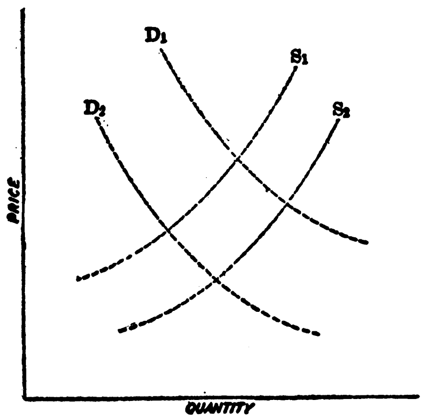


Fig. V. Price series resulting from conditions represented in Figure IV.

and whose position will approximate the central position about which the demand curve shifted. We may consider this to be a sort of typical demand curve, and from it we may determine the elasticity of demand.

Fig. VI. Chart showing a shifting of the demand curve greater than that of the supply curve.



If, on the other hand, the demand schedules of buyers fluctuate more than do the supply schedules of sellers, we shall obtain a different result. This situation is illustrated by Figure VI. The resulting array of prices and quantities is of a very different sort from the previous case, and its nature is indicated by Figure VII.

A line drawn so as most nearly to fit these points will approximate a supply curve instead of a demand curve.

If this analysis is in accord with the facts, is it not evident that Professor Moore's "law of demand" for pig iron is in reality a "law of supply" instead? The original observations of prices and corresponding quantities are the resultant of both supply and demand. Consequently, they do not necessarily reflect the influence of demand any more than that of supply. The methods used in constructing demand curves (particularly if the quantity data are of quantities sold) may, under some conditions, yield

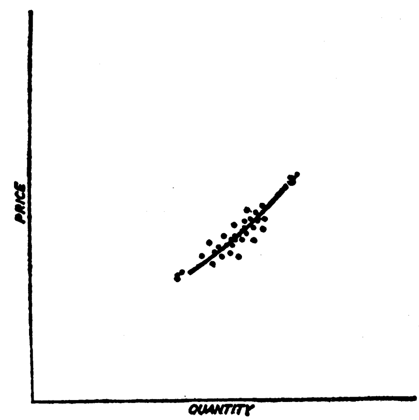


Fig. VII. Price series resulting from conditions represented in Figure VI.

a demand curve, under others, a supply curve, and, under still different conditions, no satisfactory result may be obtained.

> Statistical research in demand has followed the lead of Cournot and Marshall rather than that of Walras, Pareto, and Hicks. The distinction was pointed out by Moore, one of the great pioneers in the statistical anlysis of demand. —*Ed.*

2.7.3 Moore, Henry L. *Synthetic Economics.* Macmillan, New York, 1929. Pp. 27–28.

If one employs the postulate of the negligibility of indirect effects, a first approximation to the laws of demand and supply may be obtained by representing both demand and supply as functions of a single variable. This is the course followed by Cournot and Marshall. If, on the other hand, one aspires to explain general economic equilibria, and to follow out the oscillations about the general equilibria, the *liaisons* among all the elements of the systems must be known, and the indirect effects of perturbations become the conditions of the explanation of oscillations. The point of departure for this undertaking is to represent demand and supply not as functions of a single price but as functions of all prices. This is the course followed by Léon Walras and his disciples of the Ecole de Lausanne.

> Although all statistical analysis in the field of demand is based upon aggregates (instead of the elaborate equations of Walras), there is now great interest in the possibility of analyzing large sets of "inter-industry" equations to get a more basic understanding of the forces underlying demand and supply. Several industries can be studied together by means of simultaneous equations. This requires an enormous amount of computation, but can be done with modern computing machinery. The Bureau of Labor Statistics has recently solved a set of 196 equations with 196 unknowns (one equation for each of the 196 industries) using the electronic computer.
>
> Leontief, the pioneer in this field, has written a popular article describing the method. We reproduce a portion of that article below.—*Ed.*

2.7.4 Leontief, Wassily W. "Input-Output Economics," *Scientific American*, Vol. 185, No. 4, Oct., 1951. Pp. 15, 18–20.

This article is concerned with a new effort to combine economic facts and theory known as "interindustry" or "input-output" analysis. Essentially it is a method of analysis that takes advantage of the relatively stable pattern of the flow of goods and services among the elements of our economy to bring a much more detailed statistical picture of the system into the range of manipulation by economic theory. As such, the method has had to await the modern high-speed computing machine as well as the present propensity of government and private agencies to accumulate mountains of data. It is now advancing from the phase of academic investigation and experimental trial to a broadening sphere of application in grand-scale problems of national economic policy. The practical possibilities of the method are being carried forward as a cooperative venture of the Bureau of Labor Statistics, the Bureau of Mines, the Department of Commerce, the Bureau of the Budget, the Council of Economic Advisers and, with particular reference to procurement and logistics, the Air Force. Meanwhile the development of the technique of input-output analysis continues to interest academic investigators here and abroad. They are hopeful that this method of bringing the facts of economics into close association with theory may induce some fruitful advances in both.

* * *

The essential principles of the method may be most easily comprehended by consulting the input-output table on the past two pages.* This table summarizes the transactions which characterized the U. S. economy during the year 1947. The transactions are grouped into 42 major departments of production, distribution, transportation and consumption, set up on a matrix of horizontal rows and vertical columns. The horizontal rows of figures show how the output of each sector of the economy is distributed among the others. Conversely, the vertical columns show how each sector obtains from the others its needed inputs of goods and services. Since each figure in any horizontal row is also a figure in a vertical column, the output of each sector is shown to be an input in some other. The double-entry bookkeeping of the input-output table thus reveals the fabric of our economy, woven together by the flow of trade which ultimately links each branch and industry to all others. Such a table may of course be developed in as fine or as coarse detail as the available data permit and the purpose requires. The present table summarizes a much more detailed 500-sector master table which has just been completed after two years of intensive work by the Interindustry Economics Division of the Bureau of Labor Statistics.

* * *

. . . there is a fundamental relationship between the volume of the output of an industry and the size of the inputs going into it. It is obvious, for example, that the purchases of the auto industry (column 18) from the glass industry (row 13) in 1947 were strongly determined by the number of motor vehicles produced that year. Closer inspection will lead to the further realization that every single figure in the chart is dependent upon every other. To take an extreme example, the appropriate series of inputs and outputs will show that the auto industry's purchases of glass are dependent in part upon the demand for motor vehicles arising out of the glass industry's purchases from the fuel industries.

These relationships reflect the structure of our technology. They are expressed in input-output analysis as the ratios or coefficients of each input to the total output of which it becomes a part. . . .

* * *

The ratios shown in these two tables are largely fixed by

* ED.—The table is too large to reproduce here, having 42 rows and 42 columns. A general idea of the table is given in this paragraph.

technology. Others in the complete matrix of the economy, especially in the trade and services and households sectors, are established by custom and other institutional factors. All, of course, are subject to modification by such forces as progress in technology and changes in public taste. But whether they vary more or less rapidly over the years, these relationships are subject to dependable measurement at any given time.

Here we have our bridge between theory and facts in economics. It is a bridge in a very literal sense. Action at a distance does not happen in economics any more than it does in physics. The effect of an event at any one point is transmitted to the rest of the economy step by step via the chain of transactions that ties the whole system together. A table of ratios for the entire economy gives us, in as much detail as we require, a quantitatively determined picture of the internal structure of the system. This makes it possible to calculate in detail the consequences that result from the introduction into the system of changes suggested by the theoretical or practical problem at hand.

In the case of a particular industry we can easily compute the complete table of its input requirements at any given level of output, provided we know its input ratios. By the same token, with somewhat more involved computation, we can construct synthetically a complete input-output table for the entire economy. We need only a known "bill of final demand" to convert the table of ratios into a table of magnitudes. The 1945 estimate of post war steel requirements, for example, was incidental to a study of the complete economy based upon a bill of demand which assumed full employment in 1950. This bill of demand was inserted into the total columns of a table of ratios based on the year 1939. By arithmetical procedures the ratios were then translated into dollar figures, among which was the figure for steel, which showed a need for an absolute minimum of 98 million ingot tons. Actual production in 1950, at the limit of capacity, was 96.8 million tons.

* * *

A demonstration of input-output analysis applied to a typical economic problem is presented in the table on the opposite page, which shows the price increases that would result from a general 10 per cent increase in the wage scale of industry. Here the value of the matrix distinguishing between direct and indirect effects is of the utmost importance. If wages constituted the only ultimate cost in the economy, a general 10 per cent rise in all money wages would obviously lead to an equal increase in all prices. Since wages are only one cost and since labor costs vary from industry to industry, it can be seen in the chart that a 10 per cent increase in wages would have decidedly different effects upon various parts of the economy. The construction industry shows the greatest upward price change, as it actually did in recent decades. For each industry group the chart separates the direct effect of increases in its own wage bill from the indirect effects of the wage increase in other industries from which it purchases its inputs. Giving effect to both direct and indirect increases, the average increase in the cost of living is shown in the chart to be only 3.7 per cent. The 10 per cent money-wage increase thus yields a 6.3 per cent increase in real wage rates. It should be noted, however, that the economic forces which bring increases in wages tend to bring increases in other costs as well. The advantage of the input-output analysis is that it permits the disentanglement and accurate measurement of the indirect effects. Analyses similar to this one for wages can be carried through for profits, taxes and other ultimate components of prices.

Leontief's conception of "inter-industry relations" involves a substantial amount of aggregation. Thus, instead of starting with a set of equations for each individual, Leontief starts with equations for industries. The Cowles Commission approach, commonly called "structural analysis" involves still more aggregation. But, like the Leontief analysis, it is based upon a model of the economy expressed in terms of simultaneous equations.

We shall not attempt in this book to cover the highly technical mathematical discussion of methods which have been developed to measure structural coefficients. Instead, we give a very brief quotation from Marschak indicating the general nature of the problem.—*Ed.*

2.7.5 Marschak, Jacob, *Statistical Inference in Dynamic Economic Models*, edited by Koopmans, T. C., John Wiley & Sons, Inc., New York, 1950. Pp. 3–4.

The role of simultaneous equations is familiar to economic theorists. But it has often been forgotten by economic statisticians who tried to estimate a single stochastic relation as if no other such relations had taken part in determining the observed values of the variables. On the other hand, economic theorists are apt to forget that the observed economic variables are, in general, stochastic. To be susceptible of empirical tests an economic hypothesis must be formulated as a statistical one, i.e., be specified in terms of probability distributions.

The statistical problem of the economist is complicated by the fact that many an economic relationship connects current and past values of the same or other variables involved. The economic structure determines, accordingly, not a set of constant values, one for each variable, but a set of probable paths, one for each variable, provided certain initial values are given. This dynamic character of economic structure creates, in the absence of experiments, further statistical difficulties: many economic data have the form of time series in which successive items are not independent. Statistical inference from time series of this kind involves further new problems.

Thus, economic data are generated by systems of relations that are, in general, stochastic, dynamic, and simultaneous. Occurring jointly, these three properties give rise to unsolved problems of statistical inference from the observed data to the relations. Yet these very relations constitute economic theory and knowledge of them is needed for economic practice.

> There may be many different approaches to demand analysis. An ingenious new approach is described below.—*Ed.*

2.7.6 Tolley, George. "Short Run Demand and Supply in the Hog Market," *Jour. Farm Econ.*, Vol. XXXII, No. 4, Pt. 1, Nov., 1950. Pp. 624–25.

The purpose of this paper is to suggest a simple method that may sometimes be useful for obtaining information about economic variables from unusual circumstances which occur in the economy and to present some results obtained by applying this method in a study of the economic effects of the 1948 Packinghouse Workers' strike. . . .

If price and quantity in a market are considered to represent the point of intersection of the market supply and demand curves during the time period for which they are computed, estimation of elasticities of the curves becomes a problem in inferring their shapes from the price-quantity observations which they generate as they shift through time. A familiar way to go about this is to set up a complete econometric model and then to apply modern statistical techniques in solving for the parameters which describe the curves. If, however, there is a disturbance — such as a strike — which causes a shift in only one of the curves, it may be possible to estimate the slope of the other one directly. For when the values that the price and quantity would have taken in the absence of the disturbance are known, two points are given — price and quantity in the absence of the disturbance, and observed price and quantity during the period of the disturbance — which lie on the curve which was not affected. From these two points the slope of this curve may be computed.

The 1948 strike of Packinghouse Workers lasted from March 16 to June 9, although a number of plants had resumed operations by the latter part of May. The strike was nationwide, and about 150 packing plants were shut down at the outset of the strike. Although the retail price of meat did not appear to rise as a consequence of the strike, the price of livestock dropped markedly. Unstruck packers expanded output, and farmers held over some of their hogs until June, when the strike was over and livestock prices rose to approximately their previous level. Farmers were responding to a fall in price during the strike by curtailing marketings, and unstruck packers were responding to an increased margin by expanding slaughter.

These were the facts that suggested that it should be possible to estimate short run elasticities of supply and demand in the hog market. The strike was a disturbance which caused a shift in the packers' demand for hogs. By isolating the price and quantity change attributable to the strike, the elasticity of supply of hogs by farmers can be measured, for the price and quantity change must have been along this supply curve. . . .

> The following excerpts from a recent paper by Staehle are included here for two reasons: first, his comments on the treatment of trend; and second, his comments on the current neglect of prices because of the fashion for the Keynsean analysis of aggregates.—*Ed.*

2.7.7 Staehle, Hans. "Relative Prices and Postwar Markets for Animal Food Products," *Quar. Jour. Econ.*, Vol. LIX, Nov., 1944. Pp. 258, 277.

. . . no attempt has been made to eliminate the trends from the time series, although both consumption and price show a marked tendency, the former to fall, and the latter to rise. It used to be the practice, with much less provocation than this, to begin every sort of statistical investigation by eliminating the influence of "time." (The Department of Commerce, in its work discussed above, still cherishes it.) To this, the writer has never ceased to object on the ground that "time" has no economic meaning. Though its inclusion as an independent variable may in many cases improve the statistical fit of a regression equation, the improvement thus obtained is totally empty of meaning as long as the factors which gave rise to the trend-like development are not identified. And if they have been identified, they may as well be taken into consideration directly. Moreover, the trend device completely destroys the value of predictions based on interpolations that have been "improved" with its assistance. No trends have therefore been eliminated anywhere in this paper. The fact that, in the case here under study, the historical path of the observed points in Figure III does not follow only one direction eliminates, or at least reduces, the danger of "trend correlation." The long-run decline of meat consumption occurred *as if* it were in response to a long-run price increase. All inference based on historical observations is necessarily of this nature.

* * *

The point to be made here, however, is quite different. The above results should serve as a warning to all those who believe that prices have lost all their significance, and are indeed by their variation a mere nuisance, impairing "security," causing "pockets of unemployment," and so forth. Consumers, up to 1939 at least, still seem to have reacted to price changes with quite obstinate consistency. And planners might as well realize that, to have a world in which they can work with impunity and in perfect infallibility, they must do away with free markets.

> The analysis of marketing problems can benefit greatly from techniques and approaches developed outside the field of economics. Engineers, including those working with time and motion studies, accountants, nutritionists, and psychologists are some of the specialists who have much to contribute to marketing research. A recent book by Katona suggests a number of phases of economics to which the psychologist can contribute. Some of his comments regarding the theory of demand and market equilibrium follow.—*Ed.*

2.7.8 Katona, George. *Psychological Analysis of Economic Behavior*. McGraw-Hill, New York, 1951. Pp. 6, 224, 225, 237–38. Reprinted by permission.

Although economic analysis in the main continues to disregard empirical psychological studies, it is not devoid of psychological assumptions. Most commonly it proceeds on the premise that human beings behave mechanistically. If it were true that human beings could be counted on to show invariably the same reactions to the same developments in the economic environment, the human factor could rightfully be excluded from economic studies. If human beings were automatons, so that if the same stimuli prevailed the response would necessarily be the same, psychology could, indeed, be thrown overboard. It is this "mechanistic psychology" — the assumption that under given external conditions, human reactions are entirely determined by those conditions — which has led economic analysis to what may be called the reification of economic data. Supply, demand, income, and capital are then viewed as the things themselves with which economics is concerned. The "behavior of money" and the "behavior of prices" are studied as if money and prices themselves were the actors influencing developments, and not the human beings who have the money or set the prices.

* * *

It was argued before that businessmen have reason to consider increasing their prices a risky matter. Similar considerations apply with greater force to a reduction of prices. Many businessmen think, so it appears in the light of answers received in some recent surveys, that their customers' reaction to lowering prices cannot be foreseen. It is uncertain how customers will respond because they may respond in many ways, including the two extreme and opposite ways, namely, by increasing their purchases or by reducing them to the point of ceasing to buy. . . .

In studying these and many other less extreme instances, it appears that the major difference between them may not be found in the type of product, in the type of customer (whether the product is purchased by consumers or by other businessmen), or in the size of the price reduction. The buyers' frame of reference and their expectations appear to account for the difference. A price reduction may be considered as leading to further price reductions; buyers may believe that the market has broken and a trend toward lower and lower prices has begun. Then price reductions may become a signal for abstaining from buying and for waiting for still lower prices. On the other hand, it is possible that a price reduction may be looked upon as temporary and therefore as providing a unique opportunity to purchase. Or buyers may assume that, with the reduction, prices have reached a new, attractive level at which they will stay. Again the buyers' reaction will be generally favorable.

Far too little is known about the underlying factors which determine the one or the other attitude. In some instances, the attitude may originate in the circumstances of the price reduction. Regular clearance sales or seasonal rebates may be cited as examples. But in other instances, it is the general economic outlook which seems to determine the perception and the meaning of the price reduction. The perception of a part of the field — for instance, the reduction of the price of lead — is dependent on its whole, perhaps on the belief that a general deflationary trend prevails. We shall come back to the discussion of cumulative as against noncumulative expectations in later chapters. At this point it suffices to note that businessmen often have ample reason to consider the reactions of their customers to price reductions as uncertain.

* * *

Neither our description of genuine decision making nor the emphasis placed on habitual behavior is necessarily opposed to traditional economic analysis. As argued in Chapter 4, it is probable that rules of thumb and habitual standards are carried over from earlier genuine decisions, and those may have been intended to increase profits. But the present analysis differs from certain underlying assumptions of traditional theory. First of all, tenets of mechanistic psychology have no place in the analysis of business decisions. Only if it were true that there is necessarily a one-to-one correlation between a given stimulus and a given response can such "laws" as "the lower the price the larger the quantity demanded" be generally valid. Business firms are, however, not machines that react in a uniform manner to the same changes in their environment. Therefore, an analytical framework that considers a few factors only, and always the same few factors, can hardly be sufficient. Furthermore, in studying business decisions, it is necessary, and possible, to take uncertainty into account. Uncertainty means not only absence of knowledge about prevailing and expected conditions, or lack of experimentation with different possibilities, but also awareness of the possibility that the same action may have different results. For instance, some businessmen's decisions were found to be influenced by their opinion that their consumers and competitors might react in any of several ways to changes in prices. It is probable that when businessmen believe they know what the reactions to their actions will be, they will change their course of action more radically than when they are uncertain about those reactions. This conclusion again must be taken as a hypothesis that may be useful in future studies of business behavior as well as of economic policy.