Elmer Working: The Demand for Meat

A Review by Harold F. Breimyer

The last few years have seen a resurgence of creative effort in commodity price analysis, following a decade or so when analysts exploited but did not greatly extend the brilliant achievements of the 1920's and early 1930's. Much of the current research is the product of new talent. Some, however, including the publication reviewed here, is contributed by members of the original school. This study reflects insight and maturity gained from long experience. It also presents some new viewpoints and techniques in an always challenging area.

IN ANY RANKING of factors that affect the prices of farm products, the elasticity of demand stands high. American agriculture, distinguished as it is by a relatively uncontrolled and variable output, is highly subject to the degree of elasticity or inelasticity characterizing its market. Statistical studies have shown the demand for most farm products to be inelastic, and the clash of ever-changing supply meeting inelastic demand explains much of the instability in prices for those products. Even the farm programs devised to smooth out price movements are by no means free of the limitation imposed by the particular demand elasticities for various products.

A second concept basic to price analysis is income elasticity—the relation of nonfarm price and income levels to demand for farm products. Estimating this relationship has engaged the energies and ingenuities of economists for a generation.

The companion principles of price elasticity and income elasticity of demand are treated expertly by Professor Elmer Working in his report *Demand for Meat*, recently published by the Institute of Meat Packing at the University of Chicago.[1] Professor Working, formerly of the University of Illinois, is now head of the Department of Agricultural Economics of the State College of Washington. His bulletin is one of the best studies in price analysis to appear since the end of the war.

As befits a skilled and veteran analyst, in his new research Professor Working eschews mere repetition of conventional price studies. His special concern is with the "dynamics" of demand.

By this term, he means not longtime evolutions in tastes, population, or other factors, but "situations where a change in a causally important variable has a different effect depending upon its rate of change or upon the length of time which has elapsed since the change occurred." As variables "causally important" to meat prices he considers the quantity of meat consumed, the general price level, and the real income of consumers.

Major findings of his dynamic analysis are set forth in the introductory "Highlights." First, "There is a difference between the short-run and the long-run elasticity of demand for meat. . . . In the short run the demand for meat is somewhat inelastic. . . . The long-run demand for meat at retail is elastic." Second, "Changing price levels influence the real demand for meat." During inflation or deflation, meat prices outrun the general level of commodity prices. Third, "Demand for meat is more affected by long-continued changes in real incomes than by equal changes in shorter duration." (p. xi)

In this study, Working fulfills promises he made to himself 28 years ago, and those of other authors as well. In his classic "What Do Statistical Demand Curves Show?" he had pondered the terms "static" and "dynamic," without clear resolution.[2] In an article published in 1932 he emphasized distinctions between "market demand curves, short-time normal demand curves, and long-time normal demand curves."[3] Mighell and Allen, in

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[1] Available from the Institute at $1 per copy.

[2] WORKING, E. J. WHAT DO STATISTICAL "DEMAND CURVES" SHOW? Quart. Jour. Econ. 41: 212–35. 1927.

[3] WORKING, E. J. INDICATIONS OF CHANGES IN THE DEMAND FOR AGRICULTURAL PRODUCTS. Jour. Farm Econ. 14: 239–55. 1932.

1939, elaborated the thesis, observing that all demand analysis to that date had been "cast in terms of instantaneous or short-time schedules." By this they meant the customary analysis of annual data. No work, they said, had "given us an adequate approach to . . . consumers' response to price over more than the short term." And, "use of a short-time curve . . . underestimates the extent of the response when . . . new prices are to be in effect for a period of years." [4]

Working's analysis of dynamic and of long-time influences in demand for meat has a significance far transcending that commodity. Insofar as his conclusions are valid for meat, they probably have bearing on all farm products. And they are weighty.

For not only have price analysts been chained to 12-months-total data in their statistical investigations, but policy makers, accepting the statisticians' results, have been similarly bound. If there are "dynamic" relationships not revealed in the more routine analyses, this is important knowledge.

Measures of Nonfarm Demand

Agriculture has been notoriously subject to the exhilaration of an upsurging general price level and industrial boom. It has been equally sensitive to a general decline in nonfarm prices and income. All analyses of prices of farm products, whether aggregative or individual, employ some measure of nonfarm demand conditions as an indicator of demand for farm products. In multiple correlation analysis this becomes a demand shifter. Years ago the wholesale commodity price index was the favorite statistic for the purpose. Later, such series as factory workers' payrolls were popular. More recently, disposable income of consumers has been widely accepted as a demand shifter.

Yet the precise connection between farm and nonfarm prosperity continues to baffle analysts and laymen alike. The jump in farm product prices and incomes after World War II to positions "off the chart" was perplexing. Now, in 1955, agriculture is scarcely participating in an industrial boom. Working's study of the demand

for meat offers some interesting new ideas on the nature and measurement of nonfarm demand.

Though the terms are not used, Working seems to recognize two basic, and conflicting, features of demand relationships: First, the relatively volatile free-market behavior of farm product prices, in contrast with more inflexible and established prices for many nonfarm commodities and most services; and second, the familiar Engel's law, which observes that a smaller percentage of consumers' incomes is spent for food at the higher than at the lower income levels. Opposing effects of the two characteristics are seen during an inflationary upswing, when the first gives an extra lift to demand for farm products, but the second is a restraining influence.

How can these two factors be handled statistically? Working's answer is: just treat the price-behavior element as a function of the general price level, and treat Engel's law as relating to real income. Other analysts have done this, yet the method is found in few published price analyses. The analytical procedure is to separate the series for disposable income of consumers into its price level and its real income components. Each becomes an independent variable. In Working's correlations the coefficient for the effect on meat prices of a 1-percent change in the consumers' price index is found to be 1.18. This is a high responsiveness, and is consistent with the close relation often observed between farm-product prices and the general price level. For a 1-percent change in real income, on the other hand, Working's coefficient is 0.73. This is at least in the lower direction that would be suggested by Engel's law.

To make the analysis dynamic, Working considers next the effect of an abrupt change in the price level. For a separate factor, the ratio of the consumers' price index for a given year to its average of the preceding 5 years, he obtains a sizable coefficient. This is statistical evidence of the sensitivity of meat prices to inflationary or deflationary price trends, apart from their basic relationship to the level of commodity prices. Or, as Working concludes, "given equal deflated per capita incomes in 2 years, the per capita demand curve for meat will apparently be higher when the Consumers' Price Index has been rising than when it has been falling."

A hypothetical example will illustrate. If, after

[4] MIGHELL, R. L. and ALLEN, R. H. DEMAND SCHEDULES—"NORMAL" AND "INSTANTANEOUS." Jour. Farm. Econ. 21 : 555-69. 1939.

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a period of stability, the general price level increases 1 percent owing to inflation, without any rise in real product of the economy or real income, by Working's simpler analysis of price levels the price of meat would increase 1.2 percent. But by this "dynamic" analysis it would rise 1.4 percent the first year. If the new conditions remained unchanged, the price would settle back to a net gain of 1.0 percent after the fifth year.

Regrettably, in his dynamic analysis Working did not continue to separate current disposable income into its two parts of price level and real income. When this reviewer made this refinement, he found the first-year effect to be not 1.4 percent but 1.8 percent. And the net elevation after 5 years to be 1.1 percent.

In this last analysis the regression on real income is only 0.54—a reasonable figure that is even more in accordance with Engel's law and budget studies than is Working's factor of 0.73.

Thus a 1-percent increase in real income enhances the price of meat much less than does a comparable increase in the price level. But, to be sure, each gain in price from the former source is a "real" gain to producers of meat, for the purchasing power of meat is equally enhanced. Moreover, if a higher real income persists, its benefits continue to grow. Working finds in still another correlation that after 10 years of a new level of real income, 1 percent greater than the old, the price of meat would finally have reached a point probably more than 1.1 percent above its starting value. This is a greater gain, over time, than from price inflation! To meat prices, inflation may be the hare; and the increase in real income may be the victorious turtle.

Working still is not completely satisfied. Looking for a more streamlined analysis of demand, he sees in the improvised techniques just described a suggestion of a "possibility of using some simple index of demand shifts which will reflect both changes in (real) disposable income and effects of a changing price level." Further, "the Consumers' Price Index is composed of some prices which are more flexible than others. If we divide per capita disposable income, not by the entire price index, but by an index of the slower-moving components, perhaps we should have an approximation of the desired single index of demand shifts for meat."

The languid components of the consumers' price index he chooses as a deflator are rent; fuel, electricity, and ice; and miscellaneous. The specially deflated income he calls Demand Index A. In essence, this index is a measure of income in terms of those consumers' cost items that advance most slowly during inflation and fall most slowly during deflation, but that creep upward during a period of stable price level and rising real income. Use of Demand Index A is a recognition of a fundamental difference in price-making behavior between commodities whose price response is volatile, and those whose prices are not only slow-moving but semi-contractual in nature.

There is perhaps more empiricism than sophisticated theory in the construction of Demand Index A, and more pragmatism than rationalization in its application. When it is used to account for prewar prices of meat, it works. And when it is modified into Demand Index B by substituting consumers' expenditures for disposable income, it explains the otherwise inexplicable postwar prices, at least through 1952.

The Elmer Working techniques for relating price of meat to nonfarm prices and incomes are not the final word. Doubtless, their author would not claim them to be. Nonetheless, the general attack and its implications are to be taken seriously. Perhaps it is hard to explain just why a new level of prices or real income that lasts 24 months has a materially different effect on the price of meat than one that endures only 12 months. But most students of Marshallian principles recognize a valid distinction between long-run and short-run influences. And to all observers of the economic scene, a rather unsteady economic relation between farm and nonfarm economies is all too obvious. Working's techniques may need revision and improvement, but their results merit attention.

Dynamics in Price Elasticity

Dynamics of price elasticity of demand also are investigated by Working. To his basic analysis, he adds first the 5-year history of meat consumption, and as a later variation, the previous 10-year average. Whereas he gets a price-flexibility factor of about -1.3 for current year's consumption, the factor for 5-year average consumption is -1.05, and the factor for 10-year

average consumption is -0.81.[5] Thus, he says, "we may presume that in the long run the demand for meat is less inelastic than in the short run." The factor of -0.81, of course, is decidedly on the elastic side.

These results corroborate theoretical hypotheses and much popular opinion that consumers are slow to react to a change in supply or in price of certain commodities, particularly staples regarding which there is much habit or custom in consumption. Only after a new abundance or a new scarcity has lasted a while do consumers adjust fully. Examples are legion of extremely inelastic response to very short-run changes in supply, for every marketer of farm products has seen short dips and rises out of all proportion to the level of supply. Working demonstrates the opposite reaction over a long period of time.

Here again the technique is not above question, but the results cannot be disregarded. Many farm policies are built in part on the inelasticity of demand reported by statisticians from their analyses—all of short-term nature. When a price gain is achieved by lowered supply, is it enduring? According to Working's analysis, if the consumption of meat is reduced 1 percent, the price will increase 1.3 percent the first year. It will sag thereafter; after 5 years it will be 1.0 percent above its starting point, and after 10 years it will be only 0.8 percent up.

The foregoing numerical derivations made by the reviewer from Working's equations are believed correct. A further interpretation is more difficult. Working is willing to regard the factors for 5- and 10-year consumption histories as "a closer approximation to a long-run demand curve." But remembering the author's pioneering study "What Do Statistical Demand Curves Show?" it is surprising to find no attempt here to disassociate curve description from curve shifting. Do the values for 5- and 10-year consumption describe new long-run curves, or only a shifting of annual curves?

Mighell and Allen [6] contend the interpretation does not matter. For some purposes this is true. But this reviewer is not satisfied. He believes

that: (1) It is even harder to separate demand curves from supply curves in a long-run than in a short-run analysis; (2) the values of -1.05 for a 5-year average and -0.81 for a 10-year average are *terminal* values; they show the net result at the end of that period. This is not the same as an *average* 5-year or 10-year curve. This reviewer admits a preference for the curve-shifting view. Without belaboring the issue, he prefers to think that continuation of a supply level itself acts as a demand shifter.

Other Findings Reported by Working

Numerous other findings are reported by Working, most of them of less import than those we have mentioned. He finds the elasticity of demand for beef and for pork not much different from unity. He differs from most analysts, who have reported a moderately inelastic short-run demand. Like others, he discovers evidence of a long-time upward trend in the demand for beef relative to that for pork, particularly the fat cuts of pork.

In methodology, Working insists that the price influence of a competing meat should be allowed for by holding constant the consumption of the meat, not its price, as it is the consumption that is regarded as predetermined for both meats. In connection with this plausible rule he makes a verbal slip—rare in this report. Starting with an increase in the price of pork he observes that a rise in either the price or the consumption of other meats would follow unless there were a concurrent increase in incomes of consumers. He should have said a concurrent *decrease* in incomes.

In analytical technique, Working takes note of the theorem that even random errors in x's will affect the slope of the regression of y on x (random errors in y have no such effect). He tries to compensate for this defect by separately calculating regression curves to minimize deviations from each of the variables in succession, and then striking a geometric mean of the coefficients. He maintains that where there is uncorrelated error in each of the variables the results of his single-equation, geometric-mean-of-regressions method are closely comparable with those from a system-of-equations method. Working's choice of curve fitting is defensible and accurate for most of his analyses, where R's are high. It may be questioned whether they are equally applicable to instances where

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[5] Price flexibility as used here is the percentage change in price accompanying a 1-percent change in consumption. It is the reciprocal of price elasticity.

[6] Op. cit.

errors in data are sizable and not of equal magnitude for each of the variables.

Working, a painstaking and patient investigator, sets a standard high above that of the calculating-machine analysts of the grind-'em-out-fast school. He examines his basic data meticulously. His proliferation of separate correlations is not a mad pursuit of high R's, but rather an adaptation of various types of analyses to many separate questions and to several commodities. In these respects, Working meets criteria of excellence set up by F. V. Waugh in a recent review, wherein he asks us to "keep our methods flexible" and to "try to understand the economics of each commodity and use whatever methods are appropriate to a particular case."[7]

Perhaps the most disappointing note in the entire Working study is a series of comments in Chapter I. "In the light of present circumstances [1952 shortages and high prices] it may seem almost unbelievable that 20 years ago . . . it became a part of our national policy to restrict the production of meat animals. . . . Whether farmers really benefited . . . was . . . open to question. Then,

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[7] WAUGH, FREDERICK V. BOOK REVIEW: THE MEASUREMENT OF CONSUMERS' EXPENDITURE AND BEHAVIOUR IN THE UNITED KINGDOM, 1920–38. VOLUME I. BY RICHARD STONE. Agr. Econ. Res. 7: 23–24. 1955.

too, the program was clearly bad for consumers and for workers and management of the meat industry.

"The recent policy of placing direct price controls on meat and livestock appears quite as ill advised as was the former policy of restraining livestock production. It fails to deal with the fundamental cause of the current high meat prices. . . ."

The comments may be correct. Certainly the author has the privilege of making them. As a broad precept it is not only acceptable but desirable to attempt to apply results of research to policy. But in this report it is doubtful whether the subsequent research findings are themselves conclusive substantiation of the observations, for other considerations are involved in such policy decisions. Moreover, the prominence of the comments, coming as they do before the analytical data, is somewhat unfortunate.

The study was stimulated and financed by Oscar G. Mayer, a leader in the meat-packing industry. Industry sponsorship of farm price research is infrequent, and is a practice to be commended. It is essential that research so financed not be related to any need to support or confirm the donor's viewpoints. This is merely an academic interpolation; no lack of objectivity appears in *Demand for Meat*. It is an excellent piece of work.