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During late 1973 and the first half of 1974, the spread between farm and retail beef prices increased sharply to the highest levels of the last 10 years. A USDA report indicates that the spread between what the farmer received and what the consumer paid at the grocery store widened at a time when livestock prices were falling and retail meat prices were "sticking" at relatively high levels. In addition, it appears that this trend in marketing margins was not totally unprecedented. Cothern reports that, from 1964 to 1969, these margins were fairly stable; but prices rose very rapidly in the first half of 1969, peaking in June. Wholesale and farm prices soon fell, but retail prices rose in August leading to a much wider carcass-retail margin which was maintained until the first quarter of 1972 when another peak occurred. As farm and wholesale beef prices rose in the first quarter of 1972, farm-retail spreads did not contract but, instead, rose by about the same amount as did farm prices.

Changes in meat price spreads and general marketing costs reported by the USDA suggest that the profits for retailing meat increased sharply during the first half of 1974, and it appears that the increase in meat price spreads was caused partially by food retailers changing their pricing policies to increase profits in their meat departments. Since, from 1963, more than 90% of the increase in the farm-retail spread for beef has occurred in the wholesale-retail segment of the spread and since the ability of the food retailers to change their pricing policies to increase profits depends to a great extent on the relative competitiveness of the wholesale and retail

sectors, a purpose of this paper is to examine the structure of the wholesale-retail marketing of beef, emphasizing particularly the degree of buyer and seller concentration. Then an econometric model is constructed in order to determine the extent to which beef margins are influenced by concentration. There have been few attempts to relate structural variables, such as degree of concentration, in the retail meat sector to performance variables, such as marketing margins, although concentration in the retail sector has been recognized as a possible factor in explaining retail price changes as in the U. S. National Commission on Food Marketing study. But concentration or structural factors were not explicitly incorporated into a model explaining changes in retail-wholesale pricing.

Structural Characteristics of the Wholesale-Retail Meat Sector

It has been argued, for example, by Cothern and by Williams and Stout that competition is intense in the beef wholesale sector and that packers exist on a relatively narrow margin facing intraindustry competitive pressures in securing cattle and retail competitive pressures due to availability of alternative sources of supply. During the pre-World War II decade, using figures from Wilson, the four largest meat packing companies slaughtered about 45% of all the cattle and 43% of all the calves in the United States. However, Williams and Stout (pp. 375-401) indicate that, from 1948, (1) sales through packinghouse branches have dropped relative to the total volume provided by packers, (2) sales by independent meat wholesalers have increased relatively, and (3) direct sales by packers to retailers have also increased relatively and exceed all other channels in relative importance.

In 1929 the branch house system by which a packing plant distributes to its branches for wholesaling had grown such that these plants accounted for almost half the total sales by all packers, but by 1958 the number of packinghouse branches had fallen to less than one-half the number in operation in 1929 (Williams and Stout, p. 378). Although direct sales by packers increased from 38% to 47% of sales from 1948 to 1958, thus possibly contributing to higher concentration, this has been offset by the growth in the number of independent wholesalers. From 1950 to 1962, the percent of industry sales by the nine largest packers decreased from 63.5% to 51.9%; and sales of these nine packers relative to total industry sales have continued to fall (p. 356). The U. S. National Commission on Food Marketing found that the largest four packing firms (ranked according to red meat sales in 1963) produced 35% of commercial beef and veal in 1947 and 24% in 1964.

Competitive pressure on the wholesale sector is increased by the buying practices of the increasing number of food chains and supermarkets that often buy from centralized operations and in great volume for which they are able to extract substantial quantity discounts. There has been a shift to the "offer and acceptance" system in which suppliers make offers with respect to quantities and prices to buyers. The retailer prefers to receive all offers before any acceptances are made and may frequently refuse to bargain or provide an opportunity for the supplier to revise his bid. This provides the retailer with maximum opportunity to exploit the position of suppliers who may be heavily burdened with meat and those who cannot afford rejection. In addition, there is the growing tendency for chains to reduce the number of suppliers, thus making the suppliers more dependent on orders from one chain or supermarket so that the threat by the chain to

discontinue business becomes more severe. These trends, which have been noted by the U. S. National Commission on Food Marketing and by the American Meat Institute, appear to be widespread.

It may be hypothesized that, due to advantages gained through large-scale buying, the cost of meat from wholesalers to large chains and supermarkets is lower than the cost to the smaller grocery stores. The large chains and supermarkets with centralized buying operations may be able to price discriminate. Or, if the wholesale sector is more oligopolistically than competitively organized, the large chains may be granted discriminatory price concessions by the large packers selling direct from the plant who themselves exercise some degree of market power. (Price discrimination is profitable only when the seller enjoys some control over price. Atomistic sellers without this control can, by definition, sell as much as they wish at the prevailing price so there is no incentive to offer discriminatory price reductions.) Of course, if the price concessions offered by oligopolistic wholesalers are based on production or distributional economies of scale, then these price concessions cannot be criticized on efficiency grounds. However, whether or not these savings are passed on to the consumers or retained in the form of high profits depends on the structure of the retail sector.

Using data prepared by a grocery trade publication, Supermarket News, the percent of the market occupied in terms of market sales by the top four chains or supermarkets in 23 standard metropolitan statistical areas (SMSA) ranged from 33% to 73.5%, averaging 51.4% in 1967, and from 26.7% to 81%, averaging 52.9% in 1973. If it is assumed that sales of meat by a grocery store are in constant proportion to all store sales, then a proxy for the

percentage of meat sold by the top four chains or supermarkets can be the percentage of all grocery sales by the top four chains or supermarkets.

Theoretical Model and Implications

A pricing model for the retail meat industry might be that of price leadership by dominant oligopolists, recognizing some degree of interdependence among themselves, with a competitive fringe following. If an oligopolistic organization is assumed (composed, for example, of three or four firms) with homogeneity of product, identical cost structure, joint profit maximization, and a relatively competitive fringe of firms with higher costs (due, for example, to their inability to extract cost concessions from wholesalers), the joint profit maximization solution for the oligopolists can be determined by equating the marginal cost for a representative oligopolistic firm to the marginal of the residual demand curve which has been derived by subtracting the competitive fringe's supply curve from total demand at each price.

Such a solution is greatly complicated, however, by differing costs among the oligopolists and determination of the proportion each is to supply. Some type of joint pricing decision is necessary if there is to be a stable solution from the oligopolists' viewpoint. Further, in a static framework, it is not possible to determine the relative efficiencies and optimality of pricing under a dominant oligopoly and under a purely competitive industry. Without knowing conditions of and barriers to entry, long-term pricing optimality cannot be determined.

But the hypothesis that whether or not dominant firms do act to raise prices without corresponding cost increases and/or lower costs without passing these savings on to consumers, thus increasing their price-cost margins,

can be tested. If the structure of the wholesale sector is competitive, a positive correlation between the degree of market concentration in the retail sector and wholesale-retail price-cost margins may mean that (1) high concentration at the retail level allows price to be set above marginal cost and above "normal" profits to be earned at the expense of the consumer; (2) high retail concentration enables retailers to buy from wholesalers at a price below marginal factor cost, thus exploiting the wholesalers--atomistic sellers with no control over price cannot offset the buyers' bargaining advantage with countervailing power; or (3) some combination of (1) and (2).

If the wholesale sector is itself more oligopolistically organized, price concessions are more likely to be granted to oligopolistic retailers; and price discrimination is profitable when sellers enjoy some control over price. It is possible that these price concessions may reflect real production and distribution economies associated with large-scale ordering and/or production. But these lower transfer prices may or may not be passed on to consumers. A positive correlation between retail concentration and wholesale-retail price-cost margins would mean that they are not being passed on, high concentration enabling retailers to increase prices and profits at the expense of consumers.

Econometric Model

An empirical test was made of the proposition that concentration is positively correlated with price-cost or marketing margins. Collins and Preston (1966, 1968) have developed in several studies the use of price-cost margins as a performance measure and tested its association with several structural variables including concentration and capital intensity

across industries. The present study uses a variant of this model to some extent having as a dependent variable the retail-wholesale marketing margin per head for beef cattle.

However, where Collins and Preston tested structural-performance hypotheses for data across industries, the hypothesis tested here is for only one industry--the retail meat industry--across regions. There are advantages to studying one industry using regional data provided that the data can be obtained. It is true that factors other than concentration level are relevant to the "power relation" among sellers and buyers in a certain market, particularly the rate of growth of demand over time, the rate of technological change, and the extent of product differentiation. But when examining the same industry across regions, some of these factors may be assumed to be the same in each region making it unnecessary to include them in the model. In addition, the use of regional data for the same industry makes it less necessary to take into account differing capital requirements since it can be assumed that relatively the same capital requirements for retailing meat exist across regions.

Data were collected for 19 different SMSA's for a period of seven years, 1967-1973; and a model was developed to investigate the effects of wages and concentration ratios on retail beef price margins. The model examined is one in which cross-section and time series data are combined, thus broadening the data base. Furthermore, the use of a time series of cross sections eliminates the possibility, common to cross-sectional analysis alone, that one is observing a short-run rather than a long-run effect since high margins may reflect the initial stages of competitive adjustment rather than stable oligopolistic or monopolistic conditions.

Two approaches for combining the data in this way are (1) the method of dummy variables to account for constant effects associated with both time and cross-sectional units not easily attributable to identifiable causal variables and (2) the use of variance or error components in which the regression error is assumed to be composed of three independent components--one associated with time, another with cross-sectional units, and the third an overall component variable, both in the time and cross-sectional dimensions.

In the problem under investigation, the constant effects associated with the cross-sectional units (the SMSA's) as being due to differences in taste and demand for different types of meat and the effects associated with time as being due to changes in both relative prices and in the general price level can be postulated.

The basic model can be set up as:

$$y_{it} = \alpha + \sum_{j=1}^{p} \beta_j X_{jit} + \varepsilon_{it} \tag{1}$$

$$\varepsilon_{it} = U_i + V_t + W_{it} \tag{2}$$

where y_{it} is an observation on an independent variable for the ith cross-sectional unit for the tth time period and X_{jit} is an observation on the jth nonstochastic regressor for the ith cross-sectional unit for the tth time period. $E(U_i) = E(V_t) = E(W_{it}) = 0$ and are independent of each other with variances σ_u^2, σ_v^2, and σ_w^2. It is further assumed that $E(U_i U_{i'}) = 0$, $i \neq i'$, $E(V_t V_{t'}) = 0$, $t \neq t'$, $E(W_{it} W_{i't'}) = E(W_{it}, W_{it}) = E(W_{i't} W_{it}) = 0$ for $i \neq i'$, $t \neq t'$. It is also assumed that no lagged endogenous variables are used

and that the data are balanced. Both the least-squares dummy variable (LSDV) method and the error components method, using a generalized least-squares (GLS) estimation procedure, were used in the estimation of the model and compared.

The specific model used in the estimation of the beef wholesale-retail price-margin model is

$$\ln y_{it} = \alpha + \ln X_{1it}\,\beta_1 + \ln X_{2it}\,\beta_2 + \varepsilon_{it}$$

$$i = 1, \ldots, 19$$

$$t = 1, \ldots, 7$$

where

y_{it} = wholesale-retail price spread per head for cross-sectional unit i at time period t

X_{1it} = retail food store wage level for cross-sectional unit i at time period t

and

X_{2it} = percentage of the market occupied by the top four food chains for cross-sectional unit i at time period t.

For the LSDV model, dummy variables were added to account for the constant effects associated with the cross-sectional units and for those associated with time.

ε_{it} = random error term = ε for OLS and LSDV estimation

$\varepsilon_{it} = U_i + V_t + W_{it}$ for the error components model and GLS estimation

where

U_i = cross-sectional effect

V_t = time period effect

and

W_{it} = purely random effect.

In addition, each variable was weighted by the population of the cross-sectional unit i for time period t.

Data Sources:

The wholesale-retail price spread per head was obtained by calculating the difference between the value of a 600-700 pound steer carcass at wholesale and the value of retail cuts per head (U. S. Economic Research Service; U. S. Bureau of Labor Statistics).

The wage data were obtained from U. S. Bureau of the Census.

The percentage of the retail food market occupied by the top four chains was obtained from "Distribution of Food Store Sales" prepared by Supermarket News.

Results and Conclusions

OLS:	α = -.240792	β_1 = .461529	β_2 = .371291
	(-2.107803)	(6.221872)	(5.854350)

R^2 = .847 F statistic = 361.7642

LSDV:	α = 1.291174	β_1 = .492560	β_2 = -.081349
	(2.117871)	(3.111471)	(-1.215082)

R^2 = .99 F statistic = 406.8241

GLS/error components:	α = .21444	β_1 = .50868	β_2 = .32453
	(1.83175)	(7.11179)	(5.36776)

(t statistics are in parentheses)

In the above models it is seen that OLS and GLS estimates are quite close due to the fact that the estimated variance components calculated from the OLS residuals were quite small though all were positive. Since Maddala and Mount found that negative variances occurred only when the measures of the weight given to between-group variation and between-time-period variation were sufficiently close to 1, in which case an OLS estimation does not result in any significant loss in efficiency, it may be inferred that, since no negative variances were calculated, the measures were not close to 1 and thus OLS was not the best estimation procedure.

The LSDV estimates and the GLS estimates differ primarily with regard to α and β_2 so that, even though LSDV and GLS are asymptotically equivalent, they differ rather substantially in this finite sample case.

Although Wallace and Hussain concluded that, for known variances, the GLS and LSDV estimators are in one sense asymptotically equivalent, even though the GLS estimators are more efficient in the small sample case, Maddala points out that the dummy variables or LSDV technique eliminates a major portion of the variation among both the explained and explanatory variables if the between-firm and between-time-period variation is large. There is also the basic problem that it is rarely possible to give meaningful interpretation to the dummy variables. In the LSDV method the between-firm and between-time-period sources of variation are ignored; in the OLS procedure the sources of variation are added up. Thus, the GLS procedure can be looked upon as being a compromise solution between the OLS and LSDV methods and as being the best method to use in the small sample case.

In the error components model, using the GLS estimation procedure, β_1 and β_2 are significant at the .05 level of significance although these tests apply only asymptotically. Because of the use of logarithms, some elasticity interpretation may be made. That is, a 10% increase in the wage level would cause, by itself, an increase of 5% in the retail price margin. An increase of 10% in the concentration level would, by itself, cause an increase of a little over 3% in the price margin so that an increase in concentration level is nearly as important a factor as is the wage level in contributing to increases in the retail price-cost margin.

In conclusion, the degree of concentration existing in a market does appear to be an important factor affecting the price-cost marketing margin in a particular region. Whether the margin is high because of the ability of an oligopolistic group of food chains to depress wholesale price or raise retail price to the consumer, this particular statistical study does not answer. It does, however, seem clear that rather highly concentrated groups of food chains or supermarkets do have the ability to increase their marketing margins by one means or another and that they do, in fact, do so.

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