NEWP

WP-23

NE-165

PRIVATE STRATEGIES, PUBLIC POLICIES & FOOD SYSTEM PERFORMANCE

MARKET-STRUCTURE DETERMINANTS OF NATIONAL BRAND-PRIVATE LABEL PRICE DIFFERENCES OF MANUFACTURED FOOD PRODUCTS

by

John M. Connor and Everett B. Peterson*

WP-23 October 1991

WORKING PAPER SERIES

A Joint USDA Land Grant University Research Project

MARKET-STRUCTURE DETERMINANTS OF NATIONAL BRAND-PRIVATE LABEL PRICE DIFFERENCES OF MANUFACTURED FOOD PRODUCTS

by

John M. Connor and Everett B. Peterson*

WP-23 October 1991

* The authors are, respectively, professor of agricultural economics, Purdue University, and assistant professor of agricultural economics, Virginia Polytechnic Institute and State University.

This working paper has been scheduled for publication in The Journal of Industrial Economics in 1992. An earlier version of this paper with the same title was released as Purdue University, Department of Agricultural Economics Staff Paper 91-07 and is available from the authors. The staff paper contains 43 pages of appendix materials not reproduced herein.

We extend our appreciation to our colleagues James Binkley, Thomas Hertel, and Paul Farris as well as two anonymous reviewers for their constructive suggestions. Purdue Journal Paper No. 12,349.

MARKET-STRUCTURE DETERMINANTS
OF NATIONAL BRAND-PRIVATE LABEL
PRICE DIFFERENCES OF
MANUFACTURED FOOD PRODUCTS

John M. Connor

and

Everett B. Peterson

Abstract

This paper estimates the relationships between market structure and the Lerner index of monopoly constructed from price data on processed food products sold through grocery stores. A theoretical model of a differentiated oligopoly specifies two determinants of price-cost margins: the Herfindahl-Hirschman index of seller concentration adjusted for the elasticity of demand and the industry advertising-to-sales ratio. The results indicate that the three principal determinants of price-cost margin variation, in order of their impacts, are: advertising intensity, elasticity of demand, and concentration. Previous structure-performance studies that did not incorporate the elasticity of demand were probably misspecified.

I. Background

An interesting feature of manufactured food markets is the existence of parallel distribution channels for advertised manufacturers' brands and comparable private-label products. For most foods and beverages, supermarkets stock leading national or regional brands as well as its own store label in an adjacent shelf location. Private-label production of foods is substantial; measured in manufacturers' prices, private-label products accounted for 34% of the 1977 value of shipments of consumer food manufactures[1] [Connor 1982:Table 3]. The remaining 66% of consumer foods were shipped with the manufacturer's label; we call this the "national brand" channel.

Although the national brand and private label food channels are joined at the retail level, at the manufacturing level the two submarkets are distinct. In analytically significant ways, the two submarkets have different market structure characteristics that result in markedly different strategic groups. The industries that manufacture national brands of foods are characterized by high levels of sales concentration and product differentiation. For example, in 1980-81 the four leading national-brand manufacturers accounted for an average of 85% of U.S. retail sales of branded food products in 36 selected product classes, and none was less than 60% [Connor, et al. 1985:222]. Moreover, advertising and other selling expenses of leading food manufacturers averaged 13% of sales in the mid-1970s, twice the level of all manufacturers [ibid.:90]. The conduct of national-brand manufacturers is characterized by posted pricing and many nonprice strategies associated with imperfect competition [ibid.:218-23].

Private-label food manufacturers, on the other hand, operate in markets that have structural configurations that encourage vigorous price competition.[2] The market shares of private-label manufacturers are generally small. Among all U.S. warehoused food and beverage products in 1980, private-label products accounted for 40% or more of retail sales in only 39 of 378 product categories [ibid.:77]. More importantly, product differentiation is practically absent; private-label manufacturers have no incentive to advertise to consumers. Also, the minuscule selling effort on private-label products is provided by retailers in local newspapers, a form that emphasizes low price. Quality differences between retailers' first-line private labels and national brands as a group are minimal [Scherer and Ross 1990:581-82]. The technology of production has relatively small optimal scale and tends to be more standardized for categories in which private-label products are common. Finally, private-label manufacturers sell to retailers in large quantities under conditions of continuous price negotiations with professional retail buyers who are well informed about product quality and availability. For all these reasons, private-label prices are believed to approximate competitive prices of comparable national brands.

If one accepts these arguments, then it is possible to construct the Lerner [1934] index of monopoly *directly from price data*. The Lerner index is $(P_m - P_c)/P_m$, where P_m is the observed market price charged by a non-discriminating monopolist (or a collusive group of oligopolists) and P_c is the competitive market price. This index can also be applied to the performance outcomes of a wide range of noncollusive oligopoly models [Scherer and Ross 1990: Chapter 6]. The particular price-cost margin (PCM) employed here is (NB - PL)/NB, where NB is the observed retail price of "national brands" of processed foods and beverages, and PL is the price of equivalent "private label" products.[3] This PCM is a reasonable approximation of the Lerner index so long as market demand is downward sloping, X-inefficiency due to market power is absent or is equiproportional across industries, and the monopolist or collusive group actually exercise their market power through pricing conduct. This particular index was previously employed by Parker and Connor [1979] and Nickell and Metcalf [1978].

The purpose of this paper is to determine the relationship between market structure and the pricing performance of branded manufactured food products using the national brand-private label price difference as an approximation to the Lerner index. A theoretical model is adopted that specifies two elements of market structure: the Herfindahl index of concentration adjusted for elasticity of demand and industry advertising intensity. Previous researchers have been concerned about the omission of demand elasticities in empirical market structure-performance studies.[4] In our model, the own-price elasticity of demand is specified endogenously. This paper also addresses two measurement issues that arise when the data set used to construct price differences is from a highly disaggregated, commercial price reporting source. Finally, we implement some modest improvements in the measurement of concentration and advertising.

II. Theoretical Model

Following Cowling and Waterson [1976] and Nickell and Metcalf [1978], consider an industry with n profit-maximizing firms that produce similar but not identical products under conditions of varying marginal costs (c_i). Each firm's product is differentiated in the sense that there may exist price differentials between different firms' products. However, consumers perceive these goods as broad substitutes, so an increase in production by one firm will reduce the prices of all firms in the market. We assume that by increasing unit advertising expenditures (a_i), a firm can increase the price (p_i) of its product relative to industry average price ($\bar{p}$). From the first-order conditions of a Cournot equilibrium, aggregated to the market level, one can derive [Connor and Peterson 1991: Appendix A] the following equation:

$$\frac{\bar{p}-\bar{c}}{\bar{p}} = \frac{H}{|E_d|} + \frac{\bar{a}}{\bar{p}} \tag{1}$$

where $\bar{c}$ is average industry marginal cost and $\bar{a}$ is industry advertising expenditure for the average firm. The left-hand side of equation (1) is an industry price-cost margin. The right-hand side shows that the margin is positively related to the Herfindahl-Hirshman index H, inversely related to the absolute value of the own-price elasticity of demand E_d, and positively related to the industry average advertising-to-sales ratio ($\bar{a}/\bar{p}$). While our theoretical model posits that high advertising intensity increases the difference between national-brand and private-label prices, the mechanism behind this association is subject to several interpretations that are discussed in Section V below.

III. Empirical Model

Equation (1) is a testable model that relates the degree of market power to market structure in an industry where firms maximize profits under conditions of differentiated oligopoly. The model provides a theoretical justification for using industry aggregate data. Moreover, it also specifies a particular concentration measure (H) and justifies the inclusion of E_d as an adjustment on concentration rather than as an exogenous factor. However, several further adjustments need to be made to aggregate industry concentration and advertising before empirical testing can proceed.

First, corrections need to be made because available industry concentration data are national in scope, whereas many food manufacturing markets are subnational. A variable measuring the geographic dispersion of production (GEOG) is included to correct for understatement in the national concentration indexes. GEOG is constructed by taking the regional differences between the percentage of production and percentage of population and summing the absolute differences. When GEOG is low, H is understated, but when GEOG is high, H is correctly measured. In our model formulation, the uncorrected concentration index is interacted multiplicatively with geographic dispersion to create H * GEOG [see Scherer and Ross 1990:424]. Thus, H * GEOG is expected to be inversely related to national brand-private label price margins.

Second, when consumers are supplied partly by imports, market shares calculated from domestic shipments are overestimated, whereas net exports tend to have the opposite effect. Thus, net imports divided by industry output also corrects for overstatement of published national concentration indexes and, likewise, the relationship of H * IMP to the PCM should be negative.

A third adjustment on published concentration ratios is an attempt to reduce the inevitable understatement due to noncompeting product subgroups within an SIC product class. Most food product classes contain mixtures of products sold to farmers, to other manufacturers, to the foodservice industry, and to food stores. We have attempted to mitigate this measurement error by using the narrower five-digit product class definitions and by including only predominantly consumer-product classes. However, even the most consumer-oriented food industries contain foodservice and producer goods; in breakfast cereals, for example, significant shipments of puffed rice are sold as ingredients for the candy industry [Connor, et al. 1985:59]. Therefore, the percentage of shipments destined for food stores (FS) is interacted with H. When FS is 100 percent, H is correctly measured. However, but when FS is low and concentration within the food store segment is not much lower than the other segments, H is understated. As these two conditions are rarely observed, the resulting variable (H * FS) is expected to have a negative relationship with our measures of PCM.

Two variables capturing the influence of advertising are included in our model. Because our PCM is restricted to consumer food products distributed through grocery stores, it seems appropriate to relate advertising expenditures to a similarly narrow concept of sales. Most previous research has divided advertising expenditures by total industry shipments. However, advertising by food manufacturers is directed almost solely toward branded products sold in grocery stores. The denominator of the advertising-to-sales ratio (ADBFS) uses sales estimates of branded foods sold in food stores only. Thus, the denominator eliminates shipments of producer goods, food for the away-from-home trade, foods that are unbranded, and net exports. In addition, we attempt to account for variations in the mix of media employed. Porter [1976] has argued that electronic mass media are more effective than print media in creating consumer loyalty. The ratio of network television to total advertising expenditures (TVAD) is used to capture the degree of "image" or "persuasive" content in advertising messages. Thus, both ADBFS and TVAD should have positive impacts on the national brand-private label price margins.[5] Finally, our model includes a variable for growth in shipments (GRO7782) in order to control for transitory (nonstructural) sources of variation in price-cost margins.

In summary, the model that is to be empirically estimated is:

$$
\begin{aligned}
PCM = \beta_0 + \beta_1 (H/|E_d|) + \beta_2 ADBFS + \beta_3 TVAD + \beta_4 (H*GEOG) \\
+ \beta_5 (H*IMP) + B_6 (H*FS) + \beta_7 GRO7782 + e,
\end{aligned}
\tag{2}
$$

where:

PCM = national brand-private label price margin and

e = error term.

Note that equation (2) does not contain a control variable for the capital/sales ratio. As is well known, under competitive conditions the PCM should, in the long run, be equal to the required rental rate on assets employed per dollar of sales [Schmalensee 1989:960-61]. However, because our measure of costs is the selling price of direct rival firms, such price data already include the costs of capital. To the extent that private-label producers face the same risk as their national-brand counterparts, controlling for variation in interindustry risk is also unnecessary.

IV. Data Sources and Measurement Problems

This study utilizes three similar dependent variables (PCM79, PCM80, and PCM7980) to examine the relationships between market structure and national brand-private label price margins. The dependent variables were constructed from finely matched item-level observations (e.g., 8-ounce cans, low calorie, chocolate-flavored topping) of retail prices reported by the Nielsen Early Intelligence System (NEIS) for April and May of 1979 and 1980.[6] This data system has many admirable features for price analyses of many kinds, including representative national sample coverage of bimonthly transaction prices and sales of more than 50,000 warehoused grocery items.[7]

A "matching problem" occurs because our units of observation (five-digit SIC product classes) are typically more broadly defined than the NEIS product categories. There were about 100 SICs of predominantly consumer food product classes in 1977, whereas the NEIS classified retail product prices into approximately 320 food and beverage categories [Connor and Peterson 1991: Appendix Tables 2 and 3]. Some of these product classes contain industrial food ingredients or nonwarehoused foods, which lie outside the scope of the NEIS. Therefore, some of the calculated price margins are not representative of the market structure variables in the sense that there is not a complete correspondence between the two. However, in this study, each of the 1979 price margins (PCM79) was constructed to have at least a 50% coverage to the corresponding SIC product class. (Another related matching difficulty was initial uncertainty about the proper SIC category into which a few NEIS categories should be placed.) For PCM79, product class price differences were calculated for 1,043 item prices in 153 NEIS product categories. Thus, the PCM79 data are fairly representative of the SIC definitions used for the independent variables.

A second concern about this PCM is possible differences in quality between national brands and private label products. Is it reasonable to compare the prices of national-brand products with the prices of all private-label products in the same product category? There are arguments on both sides of this issue. The specificity of most NEIS categories (e.g., canned asparagus) and private-label procurement practices [Hamm 1981] do much to minimize quality differences. Numerous, authoritative, but dated studies have concluded that average quality differences between national brands and first-line private-label products are negligible. A careful review of several such studies found that "... distributors' and manufacturers' brands are essentially equal in quality" [Applebaum and Goldberg 1967, p. 47]. On the other hand, there are some categories that do contain national brand items that are only partially matched by equivalent private-label items. If the unique national brand items are newer, higher value added items, the calculated price difference will be exaggerated. This is especially problematic given evidence that new product introductions are systematically related to markets characterized by differentiated oligopoly [Connor 1981]. Moreover, Wills [1984] found that 1980 NEIS prices of branded processed foods were significantly and positively related to ratings of quality by blind consumer taste panels. To address this concern, the price margins for 1980 (PCM80) were constructed to try to eliminate those categories judged to contain private-label products with significant quality differences compared to the national brands in that category [see Wills 1983]. PCM80 was assembled from about 1,400 grocery-item prices spanning 145 NEIS categories. PCM79 and PCM80 are highly correlated.

Finally, we created a third dependent variable (PCM7980) that averages the price-cost margins across the two years of data. This averaging procedure should help bring out long-term structural determinants more clearly and is akin to the multi-year averaging recommended in the case of accounting profits. Moreover, because PCM7980 was constructed for only those product classes for which <u>both</u> PCM79 and PCM80 were available, the PCM7980 sample has the additional advantage of addressing both the matching problem and the quality heterogeneity problem simultaneously. For both these reasons, we expect models based on PCM7980 to exhibit superior goodness of fit compared to the single-year price-cost margins.

The Herfindahl-Hirschman index of concentration (H) was first published by the U.S. Bureau of the Census [1986] for the year 1982. The value of H was used in its ratio form such that monopoly is represented by H equal to one and atomism by H approaching zero. The Herfindahl-Hirschman index is adjusted for the degree of demand responsiveness by dividing by $|E_d|$, the absolute value of the own-price elasticity of demand.[8] These elasticities have the advantage of being measured at the manufacturing level (rather than the usual household level).

The degree of product differentiation is modeled by two variables: ADBFS, the 1977 six-media advertising expenditures for all brands in the product class divided by 1977 shipments of branded products sold in food stores [Connor 1982] and TVAD, the ratio of network television to total six-media advertising expenditures in 1977, expressed as percentages [Parker and Connor 1979]. The variable GRO7782 is the five year (1977-1982) growth rates in the value of shipments from the U.S. Census of Manufactures.

V. Results

Equation (2) was estimated using an ordinary least squares (OLS) procedure for each of the dependent variables. The results for each equation are given in Table I. All coefficients are significant (at 10% or better) and have the expected signs. The coefficient of the Herfindahl-Hirschman index of concentration adjusted for the own-price elasticity of demand is positive and significant at the 1% level in all models.[9] As the level of concentration increases or as the own-price elasticity of demand decreases (i.e., demand becomes more inelastic), the price margin between national brands and private label products increases. The significance of H/E_d is surprising in light of several studies of U.S. manufacturing that found that the concentration-profitability relationship essentially vanished during the inflationary period of the 1970s [Schmalensee 1989:975].

[Table I]

The two variables representing product differentiation are both positive and highly significant in all equations.[10] For a one percent increase in ADBFS, the national brand-private label price difference widens by about two percentage points. Also, in markets where half the advertising of processed foods is on network television, the price margin is about 5 percentage points higher than when none is used. The appropriate test for significance of ADBFS requires some attention. The t-statistics reported for β_2, the regression coefficients of ADBFS in Table I, are based on the alternative hypothesis that the coefficient is strictly greater than zero. Because private-label manufacturers do not advertise, the PCM includes the costs of advertising by national brand manufacturers. Hence, the appropriate critical value of β_2 would be unity [Scherer and Ross 1990:436]. Under this more stringent test, ADBFS is still significantly different from one.

The strong findings of the effect of advertising on price-cost margins are open to varying interpretations. The influential work of Comanor and Wilson [1974] that hypothesized that advertising intensity represents Bainsian barriers to entry is certainly consistent with the spirit of our theoretical model. An alternative, but equally consistent interpretation is a generalization of the Dorfman-Steiner [1954] theorem. Whether a joint-profit-maximizing group, a Cournot-Nash oligopoly, or oligopoly with retaliation among rivals, advertising intensity is positively related to achieved price-cost margins [Scherer and Ross 1990:592-95]. To the extent that observed advertising intensities contain some introductory advertising, a number of theoretical models that show that pioneering brands give permanent first-mover advantages to later entrants may be relevant [Schmalensee 1986:387-92]. In brief, first movers may use image advertising or real physical differentiation as the basis for high price-cost margins, which in turn will encourage more intensive advertising.

The national-brand products in our sample are nearly all "experience" goods sold through self-service retailers in small unit values. Such goods are not only prime candidates for first-mover advantages, but also, according to Nelson's [1974] informal model, the kind that prompt manufacturers to signal high quality with high (even purely persuasive) advertising intensity. If Nelson's hypothesis is true, then the positive association of advertising intensity with prices could be due to the fact that advertising signals quality differences. Evidence presented by Wills [1984] on about 50 processed food products shows that the upward bias in the advertising-price relationship due to quality differences is at most 10%.

However, even though *prices* may be weakly related to product quality, one may reasonably expect unit *costs* to rise with quality as well. Thus, Nelson's theory provides no expectation concerning the effect of advertising intensity on price-cost margins.

The three control variables included in the model to adjust published concentration data all behave as anticipated. Import competition is not terribly important for most U.S. food manufacturing industries. For our samples, net imports average only 2.5% to 3.0% of domestic supply, but it should be noted that the categories with the highest degree of penetration (beef, alcoholic beverages) are out of sample. Nevertheless, H * IMP displays the expected negative sign in the two models containing 1980 price data.

Second, the variable that captures the understatement inherent in published national concentration ratios when regional markets are present (H * GEOG) has the expected negative coefficient. The large number of subnational markets in food manufacturing makes correction of published concentration data imperative. Previous researchers have either corrected the concentration index directly (which is not feasible for the Herfindahl index) or indirectly by including some measure of geographic extent of markets as an additional variable.[11]

Third, we tried to correct for understatement in published H values due to noncompeting product subgroups by including the variable H * FS. However, H * FS consistently displayed an unexpected positive sign in all models. The positive sign is puzzling. Most of the variation in H * FS is due to variation in FS rather than H. We can only speculate after the fact that FS is serving as a proxy for the well-known consumer good/producer good distinction that has so often proven significant in market structure-performance studies. We had expected that sampling procedures and the ADBFS and TVAD variables would have captured most of the consumer/producer variation. Perhaps, for a given level of seller concentration, a low FS signals more effective bargaining strength (i.e., lower seller margins) among industrial and foodservice buyers than among food store operators.

The fourth and final control variable is 1977-1982 shipments growth in the relevant product classes (GRO7782). Growth has the anticipated positive impact on margins only in 1979. Although a positive coefficient is a very common finding in studies of U.S. manufacturing [Schmalensee 1989:972], growth was not significant in eight previous studies of profitability or Census PCMs among the food manufacturing industries [Connor, et al. 1985:335-40]. One can only speculate as to the reasons for the poor showing for growth: the relatively low variation in annual production in food manufacturing, the choice of initial or terminal years, or differences in macroeconomic conditions are all possibilities.

Differences in the estimated coefficients between PCM79 and PCM80 can be attributed to two factors: (1) differences in the samples and (2) differences in the method of computation of the dependent variables. Structural data were available for 102 SIC consumer product classes, but only 42 (in 1980) or 50 (in 1979) of these could be used due to the limited coverage of the price data. For the combined 1979-1980 data, the overlap was 39 product classes. The inclusion or exclusion of certain SIC categories could have had an impact on the estimated coefficients for any one equation.[12] Secondly, there was considerable variability in the methods used to develop the price differences reported by the PCM79 and PCM80 dependent variables. This variability certainly could have caused some of the variability in the estimated coefficients. We are comforted by the fact that the combined 1979-1980 sample has the closest fit of the three regressions shown. The superior fit of the two-year sample may be attributed in part to the averaging itself, a procedure that should allow structural determinants to emerge with greater force. However, the closeness of fit of the 1979-80 data also suggests that estimated price-cost margins from product classes that minimize the matching problem as well as avoid heterogeneous quality classes offer the best prospects for uncovering market structure-performance relationships.

VI. Summary and Conclusions

The regression results reported in this paper demonstrate a relationship between industry price-cost margins and industry concentration and advertising. They also justify the use of the own-price elasticity of demand as an adjustment for market concentration. As the level of market concentration increases or the market elasticity of demand decreases, the national brand-private label price margins widen. The positive relationship between concentration is similar to the findings of previous studies using price-cost margins. However, this paper found that the elasticity of demand plays a larger role than market concentration in determining the price difference between national brands and private label products (Table II). When demand is relatively elastic ($|E_d| = 0.381$), varying the concentration level makes virtually no difference in predicted price-cost margins. However, when demand is quite inelastic ($|E_d| = 0.065$), high concentration (H = 0.235) yields predicted PCMs about 4 percentage points higher than when H is low (0.035).

[Table II]

Product differentiation plays an even more powerful role in determining the difference in national brand and private label prices. Comparing product classes with a media advertising-to-sales ratio that is one standard deviation below the mean (ADBFS = 0.4%) with a ratio one standard deviation above the mean (ADBFS = 6.0%) results in predicted PCMs that are approximately 12 percentage points apart. As mentioned above, the market power effect of advertising intensity may be overstated by these results. First, the PCM is affected by differences in selling costs between national brand manufacturers and private-label manufacturers, the latter performing virtually no media advertising. If media advertising were perfectly positively correlated with other selling costs, then the estimated coefficient of ADBFS (2.21) implies that advertising-induced profits rise 1.21% of sales for each 1% of advertising-to-sales. However, although media advertising and other selling costs are significantly correlated, the correlation is not perfect [Connor and Weimer 1986]. Moreover, media advertising accounts for only 30% to 50% of total selling costs in food manufacturing [Connor, et al. 1985]. Therefore, the true market power effect of ADBFS on price-cost margins is a point estimate in the range of 1.1 to 1.6. In this case, contrasting low with high ADBFS results in differences in price-cost margins of from 6.1 to 9.1 percentage points. Even when demand is highly inelastic, varying advertising intensity has a considerably stronger effect on price-cost margins than varying concentration in a comparable manner.

This study has attempted to address some of the limitations of previous research using national brand-private label price margins to approximate the Lerner index, namely, the "matching" problem and the effects of quality differences between national brands and private label products. Despite these improvements, there are a several limitations remaining for structure-performance tests that use cross-sectional data on national brand-private label price margins. First, coverage is limited to warehoused grocery products that have comparable private label offerings (about 45 percent of food and beverage sales in grocery stores). For most fresh meat and produce items, there are no national brands. Also, the warehouse-withdrawal system does not record shipments of grocery products that are delivered to stores by manufacturers or specialty wholesalers. However, recently introduced systems using electronic check-out data can provide such data. Second, in order to ensure that the matching problems have been eliminated, market structure measures would have to be developed for the generally finer NEIS categories instead of the broader SIC categories. Developing NEIS-based Herfindahl indexes and advertising expenditures appears feasible [Connor 1988:375-80].

Perhaps the most serious limitation is that the price margins used in this paper are retail-level price differences. Therefore, the margins include the gross margins of national brand manufacturers, wholesalers and retailers. If distributors' margins are equiproportional across product classes, or if they are positively correlated with manufacturers' margins, our results remain valid. Limited evidence from the food industry supports the view that gross margins of food manufacturers are significantly positively correlated with the mark-ups of grocery wholesalers and grocery retailers [Connor and Weimer 1986]. Within product categories, most evidence suggests that grocery retailers place higher retail margins on their private-label products than on the comparable national brands [Albion 1983]. If this is true, using retail prices may have biased downward our results for manufacturer concentration and advertising. A more direct test would involve using price margins at or near the manufacturer level.[13]

Table I. Regression Results Explaining National Brand-Private Label Price Differences Among Manufactured Foods, 1979 and 1980.

Independent Variables and General Statistics	Dependent Variables		
	PCM79	PCM80	PCM7980
	Equation 1.1	Equation 1.2	Equation 1.3
	Estimated Coefficients (t-statistics)		
Intercept	-1.547 (-0.27)	7.892[a] (3.42)	7.344[a] (3.01)
Concentration $(H/\lvert E_d \rvert)$	1.305[a] (4.31)	1.473[a] (2.74)	1.441[b] (2.42)
Advertising intensity:			
ADBFS[d]	2.288[a] (5.61)	1.887[a] (6.07)	2.207[a] (6.70)
TVAD	0.099[c] (1.41)	0.121[b] (2.14)	0.109[b] (1.73)
Adjustments on concentration:			
Net imports (H*IMP)	--	-0.748[b] (-2.25)	-0.502[c] (-1.45)
Regional markets (H*GEOG)	-0.608[a] (-2.86)	-0.462[a] (-2.71)	-0.489[a] (-2.74)
Consumer products (H*FS)	0.515[a] (3.96)	0.304[b] (2.45)	0.391[a] (3.03)
Growth (GRO7782)	0.067[c] (1.96)	--	--
Corrected coefficient of determination $(\overline{R}^2)$	0.51	0.56	0.62
F-test	8.61[a]	8.61[a]	10.10[a]
No. of observations	45	37	34

d = significance from 1 at the 1% level; calculated t-values are 3.16, 2.85, 3.66.

Note: Numbers in parentheses are t statistics. Superscripts a, b, and c represent statistical significance from zero at the 1%, 5%, and 10% levels, respectively. Except for GRO7782, one-tailed tests are used.

Table II. Predicted 1979-1980 Price-Cost Margins for Processed Food Products Under Alternative Structural Configurations.

Industry Advertising Intensity (ADBFS)	Relatively Inelastic Demand $\lvert E_d \rvert = 0.065$			Relatively Elastic Demand $\lvert E_d \rvert = 0.381$		
	Concentration (H)			Concentration (H)		
	Low (0.035)	Average (0.135)	High (0.235)	Low (0.035)	Average (0.135)	High (0.235)
	Percent					
Low (0.40%)	13.6	15.9	18.1	13.0	13.4	13.8
Average (3.19%)	19.8	22.0	24.2	19.2	19.5	19.9
High (5.97%)	25.9	28.2	30.4	25.3	25.7	26.1

Note: Point estimates of PCM7980 are predicted from Equation 1.3 in Table I holding all independent variables other than $H/\lvert E_d \rvert$ and ADBFS at their means (see Appendix Table 8). "Low" structural levels are one standard deviation below the mean, whereas "high" levels are one standard deviation above.

Footnotes

[1] Food stores are not unique in offering private-label equivalents. Clothing and drug stores also have private-label programs. However, grocery stores are probably unique in having private-label alternatives for nearly all branded products.

[2] Private-label food manufacturing by national-brand firms is rare [Connor, et al. 1985:220-223]. Thus, the firms (or their divisions) that sell manufacturers' brands are different from those that pack private-label items.

[3] Most previous market structure-performance studies have calculated price-cost margins from census data that aggregate establishment shipments and variable costs across four-digit SIC industries. While incorporating many advantages over accounting profits data, this PCM may be distorted by multiple-product establishments, inter-industry variation in depreciation rates, and overly broad market definitions [Schmalensee 1989:960-62].

By "national brands", we mean brands owned by the manufacturers, whether the brand is distributed nationally or, as is often the case, regionally. "Private labels" are brands owned by grocery retailers (also called "store brands") or grocery wholesalers (also called "controlled brands").

[4] Developments in the theory of barriers to entry by Bain [1956], Sylos-Labini [1962], and Bhagwati [1970] suggest that the entry-deterring price is positively related to the inelasticity of demand. In an early theoretical treatment, Johnson and Helmberger [1976] showed that a given price increase in an industry with a homogeneous product and Cournot behavior has relatively larger effects on economic profit than when demand is relatively elastic.

[5] TVAD is unrelated to the industry advertising-to-sales ratio $\bar{a}/\bar{p}$, unless significant pecuniary economies exist in the purchase of TV

advertising. The simple correlation coefficient between the TVAD and ADBFS in our sample is -0.15.

6 Of course, manufacturers' prices would be preferred, but these are not available. Unexplained variance may be attributed to distributors' margins, differences in quality between national and private-label brands, measurement errors, and experimental errors. Therefore, only that *portion* of the variation in PCM that is attributable to variation in *manufacturers'* market structure and conduct can be interpreted as an outcome of the exercise of market power by food processors.

7 Parker and Connor [1979] used a similar, but more aggregated, data source from Selling Areas-Marketing, Inc. (SAMI), which approached being a monthly census of grocery products.

8 For the definitions and sources of the independent variables, see Appendix B of Connor and Peterson [1991]. Five product classes in SIC 2099 could not be included because the own-price elasticity of demand was not calculated for this NEC industry. The mean elasticity values from Pagoulatos and Sorenson [1986] were used in this study.

9 In order to compare our model with previously published studies, in regressions not shown here, we substituted CR4 and $CR4^2$ for $H/|E_d|$. The estimated coefficients were significantly different from zero at the 5% level or better and were positive and negative, respectively. The models with $H/|E_d|$ reported in this paper had considerably higher coefficients of determination. Moreover, higher t-values for the coefficient of ADBFS suggest that for previous structure-performance models that omitted E_d, the variation in advertising-to-sales ratios may have been partially confounded with variation in the omitted E_d.

10 This model has specified ADBFS and TVAD as independent, additive terms, partly because our theoretical model specifies advertising intensity only and partly from the belief that the determinants of advertising

intensity are distinct from those that drive the advertising mix. However, the two advertising variables might act interactively. In regression runs not shown here, we replaced ADBFS and TVAD with ADBFS * TVAD. The results were not encouraging. The t-statistic for ADBFS * TVAD was high enough (3.68 to 4.97), but there was pronounced collinearity with several other variables in the model.

[11] Most previous regression analyses of the market structure determinants of price-cost margins in food manufacturing have employed GEOG [Connor, et al. 1985:337], even though it may have been misspecified as an additive shifter. An alternate measure of geographic market size has been suggested by Weiss [1972]. We calculate the average radius that accounted for 80% of tonnage shipped in 1977 from various food manufacturing plants (MILES) [Connor 1983:143-47]. In regressions not shown in the present paper, we replaced the variable H * GEOG with H * MILES. Although H * MILES is conceptually superior to H * GEOG, collinearity with other independent variables in our sample (especially H * CONS and GRO7782) drastically reduced its explanatory power [Connor and Peterson 1991, Appendix Table 6].

[12] Sample and out-of-sample means for the independent variables are shown in Appendix Table 7 of Connor and Peterson [1991]. The sampled classes are very similar for both years. However, compared to nonsampled classes, the sampled classes are more concentrated, more inelastic, more heavily advertised, have larger scale economies, and (by construction) smaller shares of private label products.

[13] We attempted to test our model against 1979-1980 wholesale-level price differences developed for the authors by Robert Wills. For reasons we do not fully comprehend, these data fit our model very poorly. Only 37% of the variation in price-cost margins is explained by the same independent variables used in Equation (2). The small sample size (N = 26) may be responsible.

AUTHORS

John M. Connor

Department of Agricultural Economics

Krannert Building

Purdue University

West Lafayette, IN 47907

Everett B. Peterson

Department of Agricultural Economics

Virginia Polytechnic Institute and State University

Blacksburg, VA 24061

References

ALBION, M. S., 1983, *Advertising's Hidden Effects: Manufacturers' Advertising and Retail Pricing*, (Auburn House, Boston, MA).

APPLEBAUM, W. AND R. A. GOLDBERG, 1967, *Brand Strategy in United States Food Marketing*, (Harvard University Graduate School of Business, Boston, MA).

BAIN, J. S., 1956, *Barriers to New Competition*, (Harvard University Press, Cambridge).

BHAGWATI, J. M., 1970, 'Oligopoly Theory, Entry Prevention, and Growth', *Oxford Economic Papers*, 22, pp. 297-310.

COMANOR, W. S. AND WILSON, T.A., 1974, *Advertising and Market Power*, (Harvard University Press, Cambridge).

CONNOR, J. M., 1981, 'Food Product Proliferation: A Market Structure Analysis', *American Journal of Agricultural Economics*, 63, pp. 607-17.

__________, 1982, *Estimates of Manufacturers' Food and Beverage Shipments Among Major Marketing Channels, 1977*, Staff Report No. AGES820416, (ERS-USDA, Washington, DC).

__________, 1983, *Structural Adjustment of the Food Industries of the United States*, Staff Report No. AGES820723, (ERS-USDA, Washington, DC).

__________, 1988, *Food Processing: An Industrial Powerhouse in Transition*, (Lexington Books, Lexington, MA).

__________ AND PETERSON, E. B., 1991, *Market-Structure Determinants of National Brand-Private Label Price Differences of Manufactured Food Products*, Staff Paper 91-07, (Department of Agricultural Economics, Purdue University, West Lafayette, IN).

__________ AND WEIMER, S., 1986, 'The Intensity of Advertising and Other Selling Expenses in Food and Tobacco Manufacturing: Measurement, Determinants, and Impacts', *Agribusiness*, 2, pp. 293-319.

__________, ET AL., 1985, *The Food Manufacturing Industries: Structure, Strategies, Performance, and Policies*, (Lexington Books, Lexington, MA).

COWLING, K. AND WATERSON, M., 1976, 'Price-Cost Margins and Market Structure', *Economica*, 43, pp. 267-274.

DORFMAN, R. AND STEINER, P., 1954, 'Optimal Advertising and Optimal Quality', *American Economic Review*, pp. 826-836.

HAMM, L. G., 1981, *Food Distributor Procurement Practices: Their Implications for Food System Structure and Coordination*, Ph.D. Dissertation, (Michigan State University, East Lansing, MI).

JOHNSON, A. C., JR. AND HELMBERGER, P., 1967, 'Price Elasticity of Demand as an Element of Market Structure', *American Economic Review*, 62, pp. 1218-1221.

LERNER, A. P., 1934, 'The Concept of Monopoly and the Measurement of Monopoly Power', *Review of Economic Studies*, 1, pp. 157-175.

NELSON, P., 1974, 'Advertising as Information', *Journal of Political Economy*, 82, pp. 729-754.

NICKELL, S. AND METCALF, D., 1978, 'Monopolistic Industries and Monopoly Profits or, Are Kellogg's Cornflakes Overpriced?', *Economic Journal*, 88, pp. 254-268.

NIELSEN EARLY INTELLIGENCE SYSTEM, 1980, *Supermarket Directory: April/May 1980*, (A. C. Nielsen Co., Northbrook, IL).

PAGOULATOS, E. AND SORENSON, R., 1986, 'What Determines the Elasticity of Industry Demand?', *International Journal of Industrial Organization*, 4, pp. 237-250.

PARKER, R. C. AND CONNOR, J. M., 1979, 'Estimates of Consumer Loss Due to Monopoly in the U.S. Food-Manufacturing Industries', *American Journal of Agricultural Economics*, 61, pp. 628-639.

PORTER, M. E., 1976, 'Interbrand Choice, Media Mix and Market Performance', *American Economic Review Proceedings*, 66, pp. 398-406.

SCHERER, F. M. AND ROSS, D., 1990, *Industrial Market Structure and Economic Performance*, Third edition, (Houghton Mifflin Co., Boston).

__________, 1991.

SCHMALENSEE, R., 1986, 'Advertising and Market Structure', in STIGLITZ, J. E. AND MATHEWSON, C. F. (eds.), *New Developments in the Analysis of Market Structure*, (The MIT Press, Cambridge).

__________, 1989, 'Inter-Industry Studies of Structure and Performance', in SCHMALENSEE, R. AND WILLIG, R. D. (eds.), *Handbook of Industrial Organization: Volume II*, (North-Holland, Amsterdam).

SYLOS-LABINI, P., 1962, *Oligopoly and Technical Progress*, (Harvard University Press, Cambridge).

U. S. BUREAU OF THE CENSUS, 1986, *Concentration Ratios in Manufacturing*, (U. S. Department of Commerce, Washington, DC).

WEISS, L. W., 1972, 'The Geographic Size of Markets', *Review of Economics and Statistics*, 54, pp. 245-266.

WILLS, R. L., 1983, *The Impact of Market Structure and Advertising on Brand Pricing in Processed Food Products*, Ph.D. Dissertation, (University of Wisconsin, Madison, WI).

__________, 1984, *Advertising and Quality as Sources of Price Heterogeneity Among Brands of Food Products*, Working Paper No. 77, (North Central Regional Research Project NC-117, Madison, WI).

NE-165

PRIVATE STRATEGIES, PUBLIC POLICIES & FOOD SYSTEM PERFORMANCE

Working Paper Series

Purpose: The NE-165 Working Paper Series provides access to and facilitates research on food and agricultural marketing questions. It is intended to be a publication vehicle for interim and completed research efforts of high quality. A working paper can take many forms. It may be a paper that was delivered at a conference or symposium but not published. It may be a research report that ultimately appears in full or abbreviated form as a journal article or chapter in a book. Using the working paper series enables a researcher to distribute the report more quickly and in more extensive detail to key research users. A working paper may also be an end product in itself, for example, papers that collate data, report descriptive results, explore new research methodologies, or stimulate thought on research questions.

Procedures: Working papers may address any issues in the food and agricultural marketing area as described in the NE-165: Private Strategies, Public Policy and Food System Performance, project statement. This research agenda is available from Professor Ronald Cotterill, Chair of NE-165 at the address given below. A prospective working paper should be forwarded to the Chair who will coordinate a review of the paper by two research peers. Alternatively authors may submit two independent peer reviews with their paper. Based upon independent reviewer comments the Chair may accept, accept with revisions, or reject the submission. If accepted the Chair will issue working paper covers, and a mailing list to the author who shall have responsibility for preparing and distributing copies to all persons and organizations on the mailing list. Additional copies of working papers are available from the author or from the Food Marketing Policy Center at The University of Connecticut.

Professor Ronald W. Cotterill, Food Marketing Policy Center.
Department of Agricultural Economics and Rural Sociology
Box U-21
The University of Connecticut
Storrs, Connecticut 06269-4021
Tel. No. (203) 486-4394