Modern Markets and Market Power: Evidence From the Vermont Retail Food Industry

by

Ronald W. Cotterill

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The author is an Associate Professor, Department of Agricultural Economics and Rural Sociology, University of Connecticut, Storrs, Connecticut.

I. INTRODUCTION

The existence of empirical relationships between market structure and performance and the relevance of such relationships for public policy has been widely recognized. During recent years, however, industrial organization research has come under increasing scrutiny. Gale and Branch (1980,1982) conclude that firm market share and not concentration is the primary determinant of profitability, and that increased profits are due to share-related cost savings rather than the price enhancement effects of market power. Moreover, Gale and Branch report that quality factors, not market share, explain most price variation.

Industrial organization has also attracted a new generation of theorists who are providing new insights into the three way trade-off among product variety, economies of scale, and purity of competition. Schmalensee (1980,1982), Stiglitz (1979), Salop and Stiglitz (1977) and other economists have recently generalized neoclassical price theory to encompass what Schmalensee calls modern markets - markets characterized by product heterogeneity and imperfect information. A fundamental question appears to be whether the empirical findings based upon Mason and Bain's market structure, market conduct, market performance paradigm retain their robustness and usefulness for policy analysis when one specifies models, as modern market theorists do, that capture more of the detail of individual firms and industries.

This article addresses the impact of market power on performance and the question of the previous paragraph. Its context is an analysis of the price and profit performance in the Vermont retail grocery industry. The conceptual analysis and results however, have broader application. Since

Vermont has only one SMSA (Chittenden county which includes Burlington) this is the first study of market structure and grocery industry performance in nonmetropolitan areas. The issue is not trival. According to the 1980 census 57 million persons - 25 percent of the U.S. population - live outside of metropolitan areas.

The data that this research is based upon served as the basis for the author's testimony in behalf of the Attorney General of Vermont in a recent court case on the Vermont blue law. In addition to extensive materials obtained by subpoena from the state's major grocery chains, the Vermont Retail Grocers Association, which represents primarily the independents and small stores who supported the Sunday closing law provided detailed information on the grocery industry to the Attorney General. With this data set one can analyze:

1) How the price level of a firm in a market is related to measures of local market structure: concentration, market growth, and per capita income.
2) How the prices of firms are related to firm specific characteristics: market share, ownership structure, cost and quality factors.
3) Whether the intra-market price dispersion among firms is higher in less concentrated markets, as search theoreticians predict.
4) Which measure of market concentration performs best (Herfindahl, CR4, CR3, CR2, or CR1) how these measures compare to firm market share, and given the very concentrated nature of Vermont markets, the validity of the dominant firm pricing hypothesis.
5) How the statewide profit sales ratios of the leading firms correspond to their shares of state sales and their profits in other geographic areas.

The following section briefly reviews previous research on the market structure, price, and quality relationship. Section three builds upon previous empirical research methods and insights from the modern market theorists to specify a structural model of price determination for food retailing. It also explains the construction of variables used. Section four explains how product and geographic markets are defined. Section five reports the empirical results and section six summarizes major conclusions. An appendix contains the correlation matrix.

II. PREVIOUS RESEARCH

Although a large number of studies have analyzed the relationship between market structure and profitability, relatively few have examined the structure-price relationship, and only two econometric studies focus upon both relationships (Gale and Branch, 1982; Marion, et. al. 1979a). Clearly the bottleneck to market structure-price analysis is the need to examine different industries which requires, as Scherer notes, "encompassing the prices of apples and oranges" (Scherer, 1980,p.287). The most commonly recognized way around this dilemma is to select single industries such as finance, banking, gasoline, or food retailing for analysis because their products are sold in several geographically distinct local markets. According to the author's count, to date there have been eleven structure-price studies in finance or banking, one in gasoline retailing, and two in food retailing.

The methodology used in these local market price studies has closely reflected that employed in market structure-profit studies. Twelve of the fourteen studies employ markets as the unit of observation. Measures of local market structure, usually concentration ratios of the largest three or

four sellers, and control variables are then used to explain some measure of the market price level, usually an average price for firms surveyed in the market or a government price index taken from B.L.S. area price reports.

Price dispersion among firms in individual markets has attracted relatively little interest for possibly three reasons. First, from the standpoint of neoclassical theory if one assumes product homogeneity and perfectly informed consumers, markets in equilibrium have only one price. Price dispersion reflects transient adjustments to equilibrium. Secondly, industrial organization research has primarily been concerned with how market structure affects market performance. The demand of antitrust policy for economic guidance has undoubtedly influenced model construction. Thus many studies of both price and profit performance tend to regard performance variation among firms within a market as a noise. Such studies are interested only in average or aggregate market performance because the policy focus is upon competition as a regulator, not the fortunes of individual competitors.

A more general approach is to examine both firm and market performance. Agricultural economists studying the food industries pioneered the firm-in-market approach (FTC, 1969; Imel and Helmberger, 1971; Connor, 1977; Marion, 1977, 1979a, 1979b). Shepherd's study (1972) and work by the early business strategists (Buzzell,1975; Thorelli,1977) also introduced this approach. The firm-in-market method allows individual firm performance to vary based upon its market position, its strategies, and its relative competencies; however, it also identifies the common market conditions that influence the performance of all firms. A less recognized feature of this disaggregate empirical approach is its ability to evaluate the magnitude and determinants of price dispersion

that modern market theorists recognize as an equilibrium condition when there is product heterogeneity or imperfect information.

III. MODEL SPECIFICATION

In food retailing there is persuasive evidence for a modern market approach to price analysis. Case study research on the price levels of grocery firms in selected urban areas by Devine and Marion (1979), Boynton (1981) and others has invariably reported significant price dispersion among firms. Regarding information levels, Brown and Oxenfeldt found that food shoppers uniformly understate inter-firm price variation for identical food items (1972, p. 58). This suggests that since consumers underestimate the returns to search, they may remain loyal to their current choice when switching to another firm would provide more value.

In addition, product quality is heterogeneous. This is the case even when retailers provide the same product, for example Heinz catsup, because real and/or perceived service levels vary. Rather than describe this as product differentiation, retailing economists prefer to use the more accurate term enterprise differentiation. A retail outlet, which in the grocery industry can offer as many as 16,000 products, is differentiated by the product-service-price-mix it offers. Since the underlying heterogeneity in which we are interested is at the enterprise level, a measure of an enterprise's aggregate price level for a well identified set of supermarket items rather than individual item prices is the appropriate price variable.

Price Level Index

The current study of grocery prices in Vermont expands the grocery market basket employed by Marion et.al. to include frozen foods, dairy, and health

and beauty aid products. The products contained in the expanded sample and their proportion of total food sales are printed as Appendix B1 in Marion et.al. (1979a, p. 182-187). The sample covers product categories which account for approximately 50 percent of sales in supermarkets (Marion et. al. 1979a, p. 188) Missed categories include fresh produce, fresh meat and grocery product categories such as beer, wine, and tobacco.

Although firms did submit information in response to subpoena on the location of their price zones and price lists for each zone, the data produced a disparate patchwork of prices because different firms supplied different portions of their price books. Therefore the staff of the Vermont Retail Grocer's Association completed an in-store price survey in 32 of the state's 78 supermarkets on two consecutive days in August 1981. Survey stores were chosen so that in combination with the zone price information from chains it was possible to construct a sample of 35 firm-market observations. The sample represents 60 of the state's 78 supermarkets because firms often operate more than one supermarket in a market and price zones were market wide.

Product prices were aggregated into a price index as follows. Not all stores reported prices for all items, so a generalization of the weighted average procedure was developed. The store with the most complete response (121 items) was chosen as the benchmark store. A preliminary step, preferable even when all stores have the same number of items, is to divide the prices in other stores by the prices in the benchmark store to produce a price measure free of unit sizes such as pounds or ounces (Holdren, 1960,p.69). The next step was to normalize the weights for each store. Since in the current situation not every store reported prices for the same set of items the sales weights for each store were recomputed to sum to one by summing the weights for those

products that were available and dividing each weight by that sum. Then a weighted average price was computed for each store. The average number of items included in this computation was 115; the store with the lowest number of products contained 94 products. The approach makes more efficient use of available price information than the procedure followed by past researchers, including Marion et. al., who only included products that were available in all stores. It has the disadvantage that the price indices for different stores are based upon somewhat different groups of products.

Market Structure Variables

Since Cournot (1838) first presented a theory that explicitly relates the price level in a market to the number of sellers in that market, there has been an increasing number of more general models of oligopoly. Chamberlin (1935), Stigler (1964) and Schmalensee (1980), to mention some of the more salient attempts at deductive theory, have all produced models which predict that the price level in a market is positively associated with the number and size distribution of sellers. Adherents to Chamberlin's model have preferred concentration ratios, especially the four-firm ratio, as a structural measure and expect prices to be positively correlated with them. Stigler and Schmalensee's work suggests that the Herfindahl index is the appropriate structural measure. This research will report results for four-three-two and one-firm concentration and the Herfindahl.

Recently Salop and Stiglitz have presented an opposite prediction. They conclude that in markets where search is necessary and costly, price levels will be lower in more concentrated markets. As Stiglitz opines:

> "I hope I have convincingly shown that the traditional paradigms of competitive markets with perfect information...

> are not only not applicable, but may be seriously misleading... Attempts to promote competition by increasing the number of firms by removing barriers to entry may actually reduce effective competition, increase prices, and lead to lower efficiency. (Stiglitz, 1979, p. 344).

Stiglitz and others working on search models, essentially reach this conclusion because with fewer firms search is easier, and buyers switch to lower priced firms.

Ultimately the nature of the relationship between concentration and the level of price in modern markets is an empirical question, for one set of theories predicts a positive relationship and the other a negative relationship.

With respect to price dispersion, search theoreticians predict that it will diminish as concentration increases. Industrial organization economists, concerned primarily with price level performance in markets, have said little about intra-market price dispersion and its relationship with market concentration. In sum, then, the search literature suggests that models predicting firm price levels will be heteroskedastic with respect to concentration.

Market demand conditions, most notably the price elasticity of demand and growth in demand, also have a theoretical justification for inclusion in structure-price models. Profit maximizing firms facing inelastic market demand curves have more incentive to raise price, ceteris paribus. Since the current study is only of the retail grocery industry in Vermont, the price elasticity of demand is probably quite uniform across markets. To the extent that it is not, variations may be directly related to per capita income, i.e. markets with high per capita income will tend to have more inelastic demand curves for food because food represents a smaller portion of a high income person's expenditures.

Since demand for food may be less sensitive to food price changes in high per capita income markets, prices are hypothesized to be higher in high income markets. Price would also be higher in high income markets if such consumers demand costly extra services, i.e. a higher quality shopping experience.

Market growth, measured by the growth in population between 1970 and 1980, has a short and long run effect on prices. In the short run firms experiencing robust growth may be able to raise prices to ration available grocery capacity. In the long run, however, growth may attract new entrants into the market. The expansion of capacity would tend to lower prices. The net impact of market growth upon prices therefore is uncertain.

Firm Structure Variables

By definition market share is a hybrid variable. It simultaneously measures market structure and a firm's position within that structure. In this study market share is measured in several alternative ways: share of sales in the market (MS), and MS divided by four-three-two- and one-firm concentration which give four measures of relative market share, RMS4, RMS3, RMS2 and RMS1. Relative market shares will be used in models that include concentration ratios because RMS is less colinear with the concentration ratio than MS and has generally been regarded as the appropriate theoretical counterpart of concentration (Marion et. al. 1979a, p. 71, Gale, 1979).

According to dominant firm pricing theory, the market share of the leading firm in the market would be positively related to the observed market price level. One firm rather than four-firm concentration would then be the appropriate structural measure. Since the Herfindahl index is a more sensitive measure of firm dominance in highly concentrated markets it might be expected to be

more closely related to market price levels. Dominant firm pricing theory however, is not useful for predicting variation in price among firms in a market. It assumes that fringe firms will charge the same price as the dominant firms.

One justification for specifying a market share measure to explain different firm prices within a market is that larger share firms may enjoy more enterprise differentiation and therefore may be able to charge higher prices (Marion, et. al., 1979a, p. 71). Alternatively Salop and Stiglitz (1977) demonstrate that larger, lower cost, profit maximizing firms in markets with imperfect information and positive search costs will, in equilibrium, charge lower prices than small high cost firms. Since different theories predict different relationships between share measures and price, the sign of the share coefficient is indeterminant, a priori.

There are other structural features that may influence the price level of a firm. Food retailers, independent of market share, can exhibit distinctly different cost and enterprise differentiation levels for several reasons. They may have different management or wholesaling arrangements. They may operate different sized stores. They may enjoy different levels of capacity utilization, and they may be at different distances from wholesaling centers. From the standpoint of management and wholesaling arrangements the primary distinction in food retailing is between chain stores (firms with 11 or more stores) and independents (firms with 10 or fewer stores). Independent owner-managers are more in touch with the particular needs of consumers in their market area, and they have the managerial flexibility to meet special local preferences. Concomitantly independents often must pay more for wholesaling and distribution services than fully integrated chains. This would

especially be true for small independent supermarkets in rural towns such as those in Vermont. Combining their strategic information and local management advantage with their higher wholesaling costs suggests that independents who survive do so by attaining a significant level of enterprise differentiation. These firms are predicted ceteris paribus, to have higher prices than chain stores.

Research by the National Commission of Food Marketing (NCFM) found that store size and capacity utilization have a significant impact on unit costs levels (NCFM, 1966,p.149). Stores ranging to 16,000 square feet enjoyed lower expenses as a percent of sales; and, for a store of a given size, unit costs were quadratically related to sales per square foot, a measure of capacity utilization. The store size-cost relationship is a long run cost curve because it allows for capacity adjustment; the capacity utilization-cost relationship is a short run curve. Subsequent work by Marion found that there is not significant relation between store size and unit costs for stores between 13,000 and 30,000 square feet but that costs in these larger stores are significantly and quadratically related to sales per square foot (Marion et.al., 1979a, p. 79).

This research on cost conditions in supermarkets suggests that in the short run firms experiencing increases in capacity utilization will be able at first to lower prices, ceteris paribus, but when utilization reaches high levels they will raise prices to ration capacity and cover costs. Capacity utilization therefore may not be significantly related to prices when introduced in a linear specification but may be quadratically related to a firm price level.

With regard to store size, the evidence on costs suggests a modest negative relationship between square feet of selling space and the price level; however,

there is an additional consideration. Large supermarkets differentiate themselves from small ones by providing additional departments such as an instore bakery, delicatessen, pharmacy, houseplant shop, or a limited line of clothing. To the extent that larger stores can provide one stop shopping, they may be able to exert some market power in the product dimension to raise prices. A can of Green Giant peas, for example, may command a higher price in a 20,000 square foot supermarket than in a 10,000 square foot store because one can also buy fresh baked bread and socks at that store. Therefore, a quadratic relationship may exist between store size and price levels. This would be the case if (1) small supermarkets are able to pass on higher costs, (2) intermediate supermarkets enjoy lower costs but little departmental differentiation so their prices are low, and (3) larger supermarkets attain a substantial amount of enterprise differentiation, allowing them to raise prices and earn positive long run profits. Both linear and quadratic specifications will be tested.

The price level of a supermarket in Vermont may be explained further by its distance from its wholesale distribution center. Grand Union stores, for example, are supplied from a regional warehouse in Glens Falls, New York. The hypothesis is that stores more distant from distribution centers may have higher prices to cover the extra transportation costs.

Wage rates might be included to measure more precisely a firm's cost conditions. They were not collected for Vermont supermarkets; however, all stores included in this analysis are nonunion. Also, 26 of the 35 observations come from the two leading chains, Grand Union and P&C, whose wage policies are uniform across stores. The model will be estimated for each of these chains to control for possible variation in wage rates and other firm characteristics not captured by the specified variables.

IV. PRODUCT AND GEOGRAPHIC MARKET DEFINITION

Before proceeding to estimate the structure-price model, the product and market context of this research must be explained. Supermarkets are defined in this study as stores with more than 5,000 square feet of selling space, which sell at a minimum grocery, fresh produce, fresh meats, and bakery products. When analyzing competition among the leading firms in the grocery industry, a relevant product market is supermarket sales. Supermarkets are the major segment of the grocery industry and overall market performance depends primarily upon interaction among supermarkets, rather than between supermarkets and small stores. The supermarket product market definition was not disputed in the Vermont blue law case. Grand Union testified that they do price checks only on other supermarkets, not small stores, "because we [Grand Union] do not consider them our competitors" (Chevalier, p. 40). Marion et. al. (1979a, p. 109) reports that supermarket measures predict market performance more strongly than grocery store measures; however, in a recent major food retailing merger case the Federal Trade Commission chose grocery sales as the product market definition (F.T.C., 1983). For this reason, two models using grocery stores as opposed to supermarket data will be estimated to gain some insight on the importance of product market definition.[1/]

In 1980 Grand Union operated 33 supermarkets and sold $135 million, capturing nearly 26 percent of the Vermont grocery store sales and 39 percent of supermarket sales. P&C with 17 supermarkets and nearly $78 million in sales, ranked second accounting for 14.7 percent of state grocery store sales and 22.3 percent of sales by supermarkets. Thus, the two leading chains accounted for over 60 percent of Vermont supermarket sales in 1980. First National and A&P were considerably smaller with 7 and 4 supermarkets respectively.

Consumers purchase food in distinctly local markets. Observers of the Vermont grocery industry, including executives from Grand Union and P&C, maintain that very few Vermonters travel more than 15 miles to purchase groceries (Chevalier, p. 37-40, Cashman, p. 15). In urban areas most travel less than 3 miles. Commuting and employment patterns also help to define local markets. The Vermont Department of Employment Security identifies twelve cities as labor market centers based on commuting patterns (Vermont Planning, table 9). Finally, the topography of Vermont provides guidance.

To define market areas a circle with a 15 mile radius was circumscribed around each labor market center. The twelve inscribed areas tended not to overlap each other, and they respected the state's border with New York, Massachusetts,and Canada quite well. New Hampshire, however could not be ignored because the White River and Brattleboro employment centers lie on or near the Connecticut River. Also the Lebanon/Hanover urban area lies just across the river from White River with direct highway access. These two geographical markets therefore were defined to include areas of New Hampshire.

Because Vermont is so rural, the twelve market areas did not include all of the state. It was possible to define three additional 15 mile radius areas centered upon small towns which the state planning document found too small to merit "employment center" status. Finally, three other markets were defined that were outside or near the boundary of a 15 mile radius area, and that were distinct trading centers. The 18 local markets range in size from Burlington/Chittendon county with 115,534 persons and 17 supermarkets, to Wilmington, a rural area nestled in the Green Mountains with 4,136 residents and 1 supermarket. Table 1 reports

Table 1. Selected Market Data for 18 local Grocery Market Averages in Vermont, 1980.

	Population	Number of Supermarkets	Supermarket Herfindahl	Supermarket CR-ONE	Supermarket CR-FOUR	Number of Obs. in Data Set
Burlington	115,534	17	.263	40.9	90.4	2
Rutland	58,347	8	.266	49.4	100.0	1
Montpelier-Barre	58,334	9	.300	39.3	97.7	3
White River-Lebanon	51,055	8	.227	36.1	80.7	3
Middlebury	29,406	3	.501	53.0	100.0	1
St. Albans	27,709	2	.528	61.7	100.0	1
Brattleboro	25,794	4	.267	32.1	100.0	3
Bennington	23,885	8	.193	26.7	80.5	3
St. Johnsbury	22,653	5	.438	58.9	100.0	3
Newport	21,919	3	.362	45.1	100.0	3
Morrisville	20,961	3	.557	66.9	100.0	2
Springfield	16,046	2	.517	59.2	100.0	2
Randolph	11,588	2	.513	58.0	100.0	2
Manchester	9,460	2	.507	56.1	100.0	2
Windsor	6,884	2	.578	69.8	100.0	1
Bradford	6,169	1	1.000	100.0	100.0	1
Ludlow	5,739	1	1.000	100.0	100.0	1
Wilmington	4,146	1	1.000	100.0	100.0	1
Total	495,229	81*	-	-	-	35
Average	27,513		.501	63.5	96.1	

* The number of supermarkets sums to more than the 78 supermarkets in Vermont because the White River, Vermont- Lebanon, New Hampshire market includes supermarkets from New Hampshire.

the salient structural features of these markets and indicates the number of firms in each market that were included in the sample of 35 observations. Smaller towns clearly have fewer supermarkets and higher levels of concentration. In general, however, concentration is high in all Vermont markets. Supermarket four-firm concentration (CR-FOUR) averages 96.1 percent in Vermont with all markets having higher values than the national 1977 SMSA average of 71.3 percent. If one considers a leading firm market share of 50 percent or higher to indicate the presence of a dominant firm, then 11 of the 18 food markets in Vermont are supplied by dominant firms.

V. EMPIRICAL RESULTS

Descriptive statistics for the sample and variables employed in this analysis are displayed in table 2. The prices of stores were indexed relative to the lowest priced store which was assigned a value of 100. The maximum price index value was 111.82, giving an 11.82 percent range in prices among Vermont supermarkets. The average Vermont supermarket contains 11,973 square feet of selling space, enjoys $8.25 sales per square foot per week, is located 94.9 miles from its wholesaling center, experienced an average 15.4 percent growth in local market population between 1970 and 1980, and sold groceries to households whose average per capita income was $5,958 in 1980.

Table 3 displays estimated coefficients and accompanying statistics for several alternative specifications of the structure-price model. The underlying product market definition is supermarket sales for equations 1 through 6. In equation 1, the coefficient for the Herfindahl index is positive and significant at the one percent level. The ability of firms to exercise market power, as predicted by Cournot and more recent industrial organization theorists, is confirmed by the results. Stiglitz's prediction that prices are higher in more

Table 2. Descriptive Statistics for the Price, Market Structure, and Firm Structure Variables.

	Average	Standard Deviation	Minimum	Maximum
Price Index	107.01	2.39	100.00	111.82
Herfindahl Index	.427	.217	.193	1.000
Supermarket CR FOUR	96.1	7.01	80.5	100.0
Supermarket CR THREE	90.3	12.2	67.5	100.0
Supermarket CR TWO	80.6	18.6	48.4	100.0
Supermarket CR ONE	51.8	19.4	26.7	100.0
Supermarket Mkt. Share	42.2	23.6	12.5	100.0
Supermarket RMS Four	43.3	23.0	13.1	100.0
Supermarket RMS Three	45.5	22.1	13.1	100.0
Supermarket RMS Two	50.8	21.1	15.1	100.0
Supermarket RMS One	79.8	24.4	22.2	100.0
Independent	.171	.382	0.0	1.0
Square Feet of Selling Area	11,973	4618	4,850	23,800
Sales/Sq. Foot	8.25	3.35	4.09	20.61
Warehouse Distance	94.9	52.5	0	225
Pop'n Growth	15.4	6.3	4.9	29.3
Per Capita Income	5,958	1203	4,368	9,096
Grocery Mkt. Share	27.3	13.7	8.5	63.5
Grocery CR FOUR	70.5	13.7	51.8	99.3

Table 3. Multiple Regression Equations Explaining the Price Level of Vermont Supermarkets with Alternative Structural Measures 1981.

Sample	Structural Measure Name	Explanatory Variables: Structural Measure	Independent Supermarket	Square Feet (thousands)	Square Feet Squared (millions)	Sales/ Square Foot (Thous. annual)	Distance to Warehouse (miles)	Population Growth 1970 - 1980 (%)	1980 Per Capita Income (thousands)	Intercept	R^2 No. of OBS.	F-Ratio
1. All Firms	Supermarket Herfindahl	8.912 (5.49)**	2.241 (2.72)*	.0067 (.82)		4.665 (2.10)*	.0019 (.33)	-.017 (.36)	.044 (.17)	99.837	.626 35	6.46**
2. All Firms	Supermarket Herfindahl	7.779 (5.37)**	2.068 (2.51)*	-.730 (2.37)*	.0268 (2.35)*		.0017 (.30)	-.041 (.87)	.175 (.82)	107.091	.639 35	6.82**
3. All Firms	Supermarket Market Share	.061 (4.19)**	2.128 (2.28)*	-.821 (2.37)*	.0274 (2.13)*		.0042 (.67)	-.036 (.69)	.065 (.22)	109.169	.547 35	4.66**
4.Chains	Supermarket Herfindahl	7.881 (5.33)**		-.840 (2.42)*	.0278 (2.26)*		.0058 (.91)	-.047 (.98)	.254 (.90)	107.456	.656 29	6.99**
5. Grand Union	Supermarket Herfindahl	6.657 (5.08)**		-.846 (1.81)+	.0257 (1.72)					110.415	.757 14	10.40**
6. P&C	Supermarket Herfindahl	6.790 (3.56)**		-2.274 (3.02)*	.0945 (2.83)*					116.013	.768 12	8.81**
7. All Firms	Grocery Mkt. Share	.079 (2.92)**	1.868 (1.80)+	-.711 (1.84)+	.0234 (1.64)		.0004 (.06)	.003 (.05)	-.123 (.38)	109.858	.431 35	2.93*
8. All Firms	Grocery CRFOUR	.036 (1.10)	1.293 (1.13)	-.572 (1.32)	.0191 (1.19)		-.0020 (.26)	.006 (.09)	-.291 (.80)	109.826	.285 35	1.53

Significance Levels: ** = 1 percent * = 5 percent + = 10 percent.

competitively structured markets is not accepted. The binary variable identifying independent supermarkets is positive as hypothesized and significant at the five percent level. Independents' prices were, ceteris paribus, 2.24 percent higher than chains. When introduced in a linear specification, store size (measured in square feet) is not statistically significant. Sales per square foot, a measure of capacity utilization, has a postive relationship to prices and is significant at the five percent level. Capacity utilization was not significantly related to price when introduced as a quadratic. Warehouse distance, population growth, and per capita income have negligible effects on price and are not statistically significant. The model explains 62.5 percent of the variation in price, has an F-ratio equal to 6.46, and is significant at the one percent level.

In equation 2, square feet is specified quadratically and sales per square foot is removed from the model because of multicollinearity problems between the two cost measures.[2/] The Herfindahl and the binary variable for independent supermarkets continue to perform as expected. Prices are quadratically related to store size and the relationship is significant at the five percent level. Small and large supermarkets tend to have higher prices than intermediate supermarkets. The quadratic attains its minimum at approximately 13,600 square feet. As hypothesized, it appears that small supermarkets attain a level of enterprise differentiation, possibly a more convenient location, that enables them to pass on their higher costs, and the largest stores in the 16,000 square feet plus range are able to charge higher prices than intermediate supermarkets because they have differentiated themselves by offering a wider array of products. The remaining variables in equation 2 continue to be insignificant. At .639, R^2 is slightly higher than in equation 1, as is the F-ratio.

Equation 3 is comparable to equation 2 except that the firm's market share rather than the market-based Herfindahl index is specified as the structural measure. It has a strong positive and statistically significant effect on a firm's price level. Increasing a firm's share of supermarket sales 10 percentage points increases its prices approximately .61 percentage points. Market share and Herfindahl are not specified jointly because they are collinear by definition. Their correlation in this sample is .87. The remaining variables perform as they do in equation 2; however, the R^2 and F-ratio are considerably lower, registering .547 and 4.66 respectively.

Equation 4, 5, and 6 in Table 3 test the model's sensitivity to sample composition. The six independent supermarkets are removed from the sample to estimate equation 4. The results are nearly identical to those for equation 2 suggesting that the binary variable, independent supermarket, adequately captures the divergence in performance between chains and independents. Equations 5 and 6 are for the Grand Union and P&C subsamples respectively. The control variables that were previously insignificant are dropped from these models to conserve degrees of freedom. In both models the Herfindahl index and the quadratic specification for store size perform as they do in the full sample except that the size quadratic is weakly significant for Grand Union.

Equations 7 and 8 test sensitivity of the model to product market definition by using grocery market share and grocery four-firm concentration as structural measures. In equation 7 grocery store market share has a significant impact on price, but it is less strongly related to price than supermarket share. None of the variables in equation 8 are statistically significant. Clearly the corresponding supermarket models, equation 3 of this table for market share, and equation 1, Table 3 for four-firm concentration, out-perform the grocery store models.

To test the hypothesis that price dispersion is inversely related to market concentration, equations 1 and 2 of Table 3 were examined to see if the residual variance was related to the Herfindahl index. The correlation was negative, but the relationship was not significant. There appears to be little support for the prediction by the search theoreticians that price dispersions increases in more competitively structured markets. This sample, however does not have several unconcentrated markets.

Table 4 displays coefficient estimates and related statistics for alternative model specifications which employ concentration ratios and relative firm market shares to measure the market structure and a firm's position within it. Equations 1 through 4 introduce CRFOUR to CRONE respectively as structural measures. CRFOUR in equation 1 has a positive and statistically significant impact (five percent level). For CRTHREE, CRTWO, and CRONE, each is more significant than the former. As one shifts from a four-firm to a one-firm concentration ratio the other variables in the model also become more powerful predictors of firm price level. Absent precise theoretical grounds for choosing among alternative concentration ratios, the one-firm ratio appears to be most appropriate for rural markets.

Equations 5 through 8 in Table 4 introduce the appropriate measure of relative firm market share with the different concentration ratios. Because supermarket concentration is so high and often 100 percent in these rural markets, RMS4 is nearly identical to market share. Their correlation coefficient is .99. RMS4 is also collinear with CRFOUR which explains why CRFOUR loses

Table 4. Regression Equations Predicting the Price Level of Vermont Supermarkets with Supermarket Concentration Ratios and Relative Market Share as Structural Measures: 1981.

	Explanatory Variables												
Concentration Ratio Name	Concentration Ratio	Relative Market Share Name	Relative Market Share	Independent	Square Feet (thousands)	Square Feet Squared (millions)	Distance to Warehouse (miles)	Population Growth 1970-1980 (%)	1980 Per Capita Income (thousands)	Intercept	R^2	F-Ratio
1. FOUR FIRM	.167 (2.70)*			1.196 (1.16)	-.381 (.95)	.0127 (.86)	-.0032 (.45)	.006 (.11)	.002 (.07)	93.277	.411 35	2.69*
2. THREE FIRM	.101 (2.88)**			1.245 (1.22)	-.577 (1.49)	.0212 (1.48)	-.0045 (.63)	-.039 (.57)	.008 (.23)	101.461	.429 35	2.89*
3. TWO FIRM	.066 (3.08)**			1.762 (1.73)+	-.576 (1.51)	.0215 (1.53)	-.0029 (.42)	-.049 (.84)	-.004 (.13)	106.080	.447 35	3.11*
4. ONE FIRM	.081 (4.81)**			1.867 (2.16)*	-.791 (2.43)**	.0294 (2.42)**	-.0026 (.00)	-.040 (.81)	.007 (.25)	107.358	.598 35	5.73**
5. FOUR FIRM	.089 (1.49)	RMS-FOUR	.052 (3.02)**	1.952 (2.07)*	-.678 (1.85)+	.0226 (1.69)	.0023 (.35)	-.021 (.39)	.176 (.56)	99.360	.564 35	4.21**
6. THREE FIRM	.056 (1.53)	RMS-THREE	.047 (2.59)*	1.946 (2.02)+	-.765 (2.13)*	.0262 (2.00)+	.0018 (.26)	-.037 (.70)	.157 (.48)	103.80	.546 35	3.91**
7. TWO FIRM	.048 (2.23)*	RMS-TWO	.040 (2.19)*	2.11 (2.18)*	-.756 (2.07)*	.0259 (1.94)+	.0020 (.29)	-.044 (.79)	.010 (.31)	105.42	.533 35	3.71**
8. ONE FIRM	.080 (4.55)**	RMS-ONE	.005 (.35)	1.933 (2.15)*	-.803 (2.41)*	.0293 (2.38)*	.0006 (.10)	-.040 (.80)	.009 (.32)	106.971	.600 35	4.87**

Significance Levels: ** = 1 percent; * = 5 percent; + = 10 percent.

statistical significance in equation 5. RMS-FOUR is positively and significantly related to price at the one percent level. R^2 increases from .411 for equation 1 to .564 for equation 5 when RMS4 is introduced to the model.

As one shifts the specification towards CRONE and RMS-ONE in equations 5 through 8 in Table 4, the concentration ratio becomes more significantly related to the firm price level. Conversely, relative market share declines in its effect. In equation 8 the coefficient for CRONE is significant at the one percent level; the coefficient for RMS-ONE is not statistically significant. These results are not unequivocable, but they do suggest that the position of the dominant firm as measured by CR-ONE or the Herfindahl index explains how market power affects the prices of individual firms as well as the market price level. Dominant firms appear to establish a price umbrella for all firms in the market.

Retail Profits in Vermont

The data on profit performance in Vermont are aggregate and available only for A&P, P&C, and Grand Union, but they give insight into the impact of grocery chain pricing practices in rural markets. For comparison Progressive Grocer reports an industry before tax profit to sales ratio of 1.46 percent for 1980 (Progressive Grocer, 1982, p. 34). A&P's before tax profit-sales ratio for all sales in Vermont averaged 2.25 percent in 1980. P & C's store-door contribution ratio for all sales in Vermont averaged 7.05 percent. Using the industry average figure for unallocated corporate overhead and warehouse charges as reported by Progressive Grocer (1979, p. 158) to estimate P & C's before tax profit-sales ratio, one obtains approximately 3.55 percent. This is as high as that predicted for the most monopolistic firms in SMSA's by Marion et. al.(1979a, 151).

Grand Union submitted company records which indicate that its average before tax profit-sales ratio for Vermont in 1980 totaled 5.95 percent. By comparison the company earned only 1.30 percent of sales before tax in areas other than Vermont during 1980 (Cavenham, p. 3). Stated in another fashion Grand Union made 3.7 percent of its total sales in Vermont during 1980 but 15.1 percent of its before tax profits came from the state. In the parlance of strategic marketing, Vermont is clearly a "cash cow." For firms with large market shares profits flow like milk from Vermont.

VI. CONCLUSIONS

The two major conclusions of this investigation are as follows. First different firms in the same market charge different prices that are based upon firm specific characteristics and the fact that consumers have imperfect information on retail food prices. Important firm specific characteristics include organizational form (chain-independent), capacity utilization, store size, distance from warehouse, and the level of enterprise differentiation. Secondly, after controlling for variation in these conditions, market concentration has a significant impact upon firm price levels. Market power is being effectively exercised in many Vermont markets.

Space precludes detailed discussions of the strategic marketing and public policy implications of this research. Many are straightforward. Of a more subtle character is the possibility of using this approach to analyze the price minimizing configuration of supermarket numbers and size in markets where the market power-scale economy dilemma is serious. The data and estimated models suggest that a Vermont town, for example, will have lower food prices if it has three or four separately owned small supermarkets with their attendant higher costs rather than one moderately sized supermarket that has lower costs

and little enterprise differentiation but substantial market power due to a dominant market share. This type of price analysis can give considerably more guidance to public policy than has heretofore been forthcoming from industrial organization research.

FOOTNOTES

1/ The grocery store market share data are less accurate than the supermarket data because total grocery store sales for each geographic market had to be estimated by prorating grocery store sales over the population. The sales of individual supermarkets by comparison were provided directly by firms, or by the Vermont Retail Grocers Association.

2/ For correlations between all variables see the appended correlation. matrix.

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Appendix Table 1: Correlation Matrix for Variables Employed in the Analysis: 35 Observations.

Herfindahl	Super CR Four	Super CR Three	Super CR Two	Super CR One	Super Mkt. Share	Super RMS Four	Super RMS Three	Super RMS Two	Super RMS One	Independent	Sq. Feet	Sales/ Sq. Foot	Warehouse Dist.	Pop'n Growth	Per Capita Income	Groc. Mkt. Share	Groc. CR Four	
.613	.572	.529	.479	.575	.477	.437	.400	.323	.062	.335	-.211	.122	-.010	-.052	-.321	.395	.311	Price
	.538	.695	.796	.978	.868	.846	.798	.655	.246	-.140	-.234	-.297	-.063	.131	-.350	.662	.297	Herfindahl
		.866	.748	.550	.432	.357	.303	.193	.115	.229	-.146	-.057	.142	-.089	-.527	.391	.361	Super CR Four
			.926	.735	.552	.493	.405	.253	.088	.137	-.248	-.179	.208	.151	-.535	.523	.455	Super CR Three
				.817	.649	.602	.621	.327	.139	-.076	-.301	-.185	.084	.246	-.371	.564	.338	Super CR Two
					.851	.827	.773	.630	.196	-.123	-.235	-.334	-.015	.141	-.313	.667	.311	Super CR One
						.996	.983	.921	.663	-.230	-.046	-.409	-.120	.074	-.262	.861	.272	Super Mkt. Share
							.993	.941	.686	-.258	-.033	-.418	-.140	.085	-.223	.858	.248	Super RMS Four
								.969	.736	-.280	.012	-.426	-.172	.049	-.181	.848	.169	Super RMS Three
									.822	-.250	.128	-.454	-.171	-.029	-.163	.781	.118	Super RMS Two
										-.251	.296	-.381	-.143	-.049	-.114	.681	.090	Super RMS One
											-.039	.248	.181	-.148	-.239	-.161	.138	Independent
												-.472	.324	.216	.107	.030	.071	Sq. Feet
													-.293	-.131	.062	-.241	.197	Sales/Sq. Feet
														.070	-.216	-.034	.107	Warehouse Dist.
															-.040	-.114	-.286	Pop'n Growth
																-.223	-.332	Per Capita Income
																	.638	Groc. Mkt. Share