Market Power and the Demsetz Quality Critique: An Evaluation for Food Retailing

by
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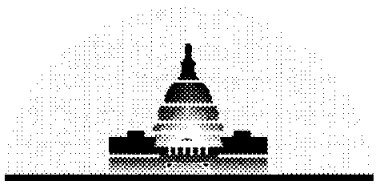

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Abstract

This study analyzes supermarket firm prices to determine whether prices are related to market structure and whether the Demsetz quality critique is valid. Factor analysis is used to identify five service factors that are modeled with price as endogenous variables in a simultaneous equations framework to test whether a more concentrated market structure is related to higher service levels which, in turn, are related to higher prices (the Demsetz hypothesis) and whether a more concentrated market structure is directly related to higher price (market power hypothesis). For this study of supermarkets in 34 local markets in six southwestern states, market share and concentration are not significantly related to any service factors. Concentration has a significant positive relationship with price in the full sample, and share also is significantly related to price in subsamples of large, leading firms. Thus, the Demsetz critique is rejected. Other factors that affect price include store format, whether a firm competes against warehouse supermarkets, store cost, and market demand factors.

Market Power and the Demsetz Quality Critique: An Evaluation for Food Retailing

1. Introduction

A positive relationship between market structure and price has been established in many local market industries including food retailing. The inference is that tight oligopolies exercise market power (Weiss 1989). The Demsetz critique, that high profits exist in more concentrated markets because costs are low rather than prices are high, was a major reason for the shift from profit to price analysis; however, the critique persists in another form. A firm with a large market share, or a set of firms in a highly concentrated market, may have higher prices because they offer more expensive, higher quality, differentiated products (Demsetz 1973, Buzzel and Gale 1987, Anderson 1990).[1]

Nearly all prior studies of the structure price relationship assume that products are homogeneous and, consequently, do not test the Demsetz quality hypothesis (Weiss 1989, Lamm 1981, Hall *et al.* 1979, Meyer 1983, Marion *et al.* 1979, 1993). Following work by Cotterill (1986) and Nelson *et al.* (1992), we specify a differentiated product model that tests the quality hypothesis. For supermarket retailers that sell well identified food products manufactured by other firms, service levels, including breadth of product line, are the primary vehicle for differentiation. The research questions are: do consumers in concentrated markets pay higher prices, and are those higher prices correlated with the provision of more costly services? We also evaluate whether unilateral or coordinated market power prevails in these differentiated markets. Unilateral market power occurs if large market share firms have high prices that are not due to higher service levels. Coordinated market power exists if market concentration rather than

[1] Anderson critiques prior structure performance studies in grocery retailing, writing: "If stores in more concentrated markets happen, on average, to provide more services and higher quality, prices may be higher in those markets, not because firms in those markets are exercising market power, but because they are incurring higher costs to provide higher quality" (Anderson, 1990, p. 5).

own share is related to higher prices that are not explained by higher service levels.

In the next section a reduced form model for price is specified. It is similar to the price equations estimated in previous empirical work. The price level is a consumption weighted average price index for a basket of grocery products. Using factor analysis we classify information on whether supermarkets provide one or more of 27 different services into five orthogonal service factors. Factor loadings are used to compute service factor scores for each supermarket observation. To test the Demsetz quality hypotheses we specify a recursive simultaneous equations model wherein the price level is a function of a subset of the explanatory factors and endogenous service factors. Each of the service factors is, in turn, a function of a subset of the market structure, firm characteristic, cost, and demand variables. This structural approach identifies and tests the indirect effect of market structure upon prices via more costly services (Demsetz quality hypothesis) as well as the direct (market power) effect of structure on prices. It also allows assessment of the direction and magnitude of bias that exists when one relies upon the reduced form coefficient as an estimate of the structural coefficient for market power.

The empirical analysis in section three is based upon an extensive food price and service level survey completed by the Arkansas Attorney General. It provides 107 observations that span 34 local markets in Arkansas and five surrounding states. Section four contains conclusions.

2. Model Specification

2.1 Reduced Form Price Model

Price determination in a competitive market is a function of cost and demand factors. However, in an oligopoly the organization and conduct of sellers also matters.[2] A supermarket's price level in a local market is expected to be positively related to its market share (SHARE) if unilateral power over price is significant or large share firms offer more costly services. Alternatively, if a supermarket's price level is

[2] Under Bertrand (price) competition one can derive relationship wherein a differentiated firm's price in equilibrium is a function of its market share, market concentration, cost, and demand conditions (Cotterill, 1993a, p. 8-13). For a game theory approach see Deneckere and Davidson (1985).

positively related to market concentration as measured by a concentration ratio (e.g., CR_3, CR_4) or the Herfindahl Index (HERF), then coordinated market power or the provision of more costly services in more concentrated markets is operative.

During the 1980s new supermarket formats with distinctly different price-service mixes became a significant competitive factor. Warehouse supermarkets limit services and labor intensive practices to provide consumers lower priced products. Thus, a binary variable identifying a supermarket as a warehouse operation (WRHS) is expected to register lower prices. Warehouse supermarket operations also may have forced other supermarket operators to be significantly more competitive on prices and to seek further differentiation in the nonprice dimension to insulate themselves from such direct price competition. A binary variable indicating that a supermarket competes against a warehouse operation (WIMPACT) will have a negative impact on prices in the reduced form model if the direct price competitive effect more than offsets costly nonprice service responses.

A third binary variable (TRADIT) isolates traditional supermarkets; i.e., units that are not warehouse operations and do not have staff at counters to provide customized delicatessen, seafood, meat, or bakery products. Traditionally, supermarkets have been synonymous with self service. However, some small operators retained personal service and, recently, superstores—supermarkets over 30,000 square feet with an extensive product array—offer counter service. If counter service were the only service component, traditional supermarkets that do not offer that service would be expected to have lower prices. However, traditional supermarkets may offer other services that increase prices. Thus, the impact of TRADIT in the reduced form equation is ambiguous.

Cost factors that may influence retail price level include the average local market wage rate (MKTWAGE) for food retailing establishments. To the extent that a local market has higher retailing costs, as proxied by the local wage rate, then the prices of all firms in the market would have higher prices. Firm specific cost factors include the size of the supermarket (SQFT), whether a supermarket is unionized (UNION), the distance to its main distribution center (WAREDIST), and whether it is an independent supermarket (INDEPEND) that is unaffiliated with a wholesale buying group and, thus, has higher wholesale distribution costs. Store size in square feet measures diseconomies of small size. However, little research or market evidence exists to suggest that economies of size are significant

beyond 25,000 square feet.[3] Moreover, the increased services associated with the superstores may actually increase costs and prices in large supermarkets. A study of Vermont supermarkets found that a quadratic relationship exists between the price level and supermarket size in the reduced form price model (Cotterill 1986) and we hypothesize a similar relationship here.

Demand factors that may influence prices include growth in food sales over the previous five years in the local market area (GROWTH) and per capita income (INCOME) in the market area. Each is expected to be positively related to prices.

2.2 *Identification of Services and the Structural Model*

Respondents to the Arkansas survey indicated whether they offered 27 different services. We use factor analysis to group these services and find that five factors identify the major service strategies of supermarket firms.[4] The most important factor is labeled labor intensive services (LBRINT) because its top four loadings are: price marked on package, bagging, loading of groceries, and no checkout scanners. The second factor's top five loadings are delicatessens, bakeries, restaurants, service seafood, and pharmacy. It measures the breadth of the supermarket's product line (BROAD). The third factor loads primarily on unit pricing, handicap carts, express lane and no trading stamps. It is labeled consumer services (CONSER). The fourth factor loads primarily on phone ordering, home delivery, no uniforms and no name tags. It is called old time (OLDTIME). The fifth factor loads on continuity programs (for example, offering a set of dishes over time to repeat shoppers), contests, music, and trading stamps. We name it promotions (PROMOS).

Since the five service factor variables are orthogonal by construction, none is endogenous in other service structural equations. Thus, the reduced form and structural equation specification for each service factor equation are identical. Since services are costly, they are specified as endogenous variables in the structural equation for price and expected to have a positive impact on price.

[3] For a review of the research see Cotterill, 1993b p. 166-167.

[4] The scree plot (Appendix Figure 1) indicates that ten factors have eigen values above one and, thus, have more explanatory power than a single observed variable (Cattel, 1952). However, the first five clearly rank above the others. The list of services and factor loadings for the first five factors are reported in the Appendix Table 1.

In addition to the strong recursive feature of the system, the organization of the food retailing industry and the nature of the Demsetz hypothesis itself provide considerable guidance for assignation of the explanatory variables to the price and five service factor structural equations in a fashion that ensures the system is identified. Since we are interested in determining whether market structure is directly and positively associated with service levels as well as price, market structure variables must be specified in all structural equations.

In this industry store size (SQFT) is a very important determinant of the ability or need to offer services, so it is also specified in all the service equations. We leave the quadratic specification for store size (SQFTSQ) in the price equation, but expect that once the influence of store size on services is captured, it will lose significance. If economies of size exist, a negative relationship may exist between store size and price in the structural equation.

The binary variables indicating that a supermarket is a warehouse operation (WRHS) and that a supermarket competes against a warehouse operation (WIMPACT) are specified in the price equation to capture direct price effects. Since this format is a recent innovation, there may be significant excess demand for it which would suggest a direct positive effect on price for WRHS, and a direct negative effect for WIMPACT. Warehouse is also specified in the structure equations for labor intensive service (LBRINT), breadth of product line (BROAD), consumer service (CONSER) and old time service (OLDTIM). It is expected to have a negative impact on all of these service levels, and lower service levels lower price in the price equation. The warehouse impact variable (WIMPACT) is specified in the structural equations for breadth of product line (BROAD), consumer services (CONSER), and old time services (OLDTIM) because the industry's response to warehouse competition has often been to avoid direct price competition and offer services that satisfy segments of the population that do not like the warehouse shopping experience. This indirect impact on price is positive and may offset some or all of the direct negative effect of WIMPACT on price.

The traditional format binary variable (TRADIT) is not specified in structural equation for price because the primary distinction between traditional self service and more service oriented supermarkets is, in fact, service levels. It is included in the labor intensive service (LBRINT), the breadth of product line (BROAD), the old time service (OLDTIM), and the promotions (PROMOS) structural models. Traditional supermarkets are hypothesized to have more labor intensive services than other store formats and, thus, higher prices. Traditional supermarkets are also hypothesized to have 1) a narrower product line

with less counter service and lower prices 2) more old time consumer services and more promotions and, thus, higher prices. Whether prices are higher or lower in traditional supermarket depends upon the relative strengths of these individual effects and the impact of different levels of service on price.

Since the market wage level (MKTWAGE) is constant for all firms in a market, it provides little explanation of an individual firm's price-service mix. It is specified only in the price equation as a proxy for the level of local retailing costs. The distance to warehouse (WAREDIST) variables is an instrument for distribution costs so it also is specified only in the structural equation for price. Unions, however, may enhance prices via their impact on service levels. Unionized supermarkets are expected to be older established firms with work rules that result in more labor intensive services (LBRINT). We also hypothesize that unionized supermarkets, similarly, may offer more consumer services (CONSER), and promotions (PROMOS) to offset less flexible labor policies.

Market growth (GROWTH) and per capita income (INCOME) in the local market area may influence price levels primarily through their impact on supermarket service levels. Rapidly growing markets offer more opportunity for the construction of new larger supermarkets that offer broad product lines. Thus, GROWTH is specified only in the BROAD service level equation and expected to have a positive sign. Per capita income is specified in the consumer services (CONSER) and old time services (OLDTIME) equations because higher income consumers are most likely willing to pay for them.

The last explanatory variable, independent (INDEPEND), indicates whether a supermarket is an independent as opposed to a chain or affiliated independent supermarket. Since these locally owned and operated supermarkets must be distinctly different to survive, INDEPEND is expected to have a positive influence in all service equations. However, it is expected to have its most significant positive effect on the old time service factor.

3. Empirical Results

The Arkansas Food Price Project staff selected cities and supermarkets and collected store format, price, and service information via a direct in-store survey on May 6-8, 1982 for 34 cities and towns. Little Rock (population 406,100), Fayetteville (188,100), and Fort Smith (138,600) are the only cities above 100,000 population. Price and service data for 147 supermarkets yield 107 firm-in-market

observations once multiple stores for a firm in a local market are aggregated to a single observation.

The price index is computed from the store surveys and is for a market basket of 115 specific products; e.g., Minute Maid Frozen Orange Juice, from 75 product classes (e.g., frozen orange juice) that were selected to reflect consumer purchase patterns. Market shares, concentration measures, and store size (square feet of selling space) were computed from the *Progressive Grocer* Retail Data Base. The Research and Analysis Section of the Arkansas Employment Security Division provided market area wages paid to retail food workers in the fourth quarter of 1981 and the hours worked by retail food workers so that we are able to compute a market area average wage for retailing. The 1981 Sales and Marketing Management county level survey of population and disposable income enables computation of the per capita income variable. The market growth variable is the percent change in food store sales between 1977 (Census of Retail Trade) and 1981 (Sales and Marketing Management).

Table 1 reports descriptive statistics. For the 107 firms in market observations, the price index is calibrated so that the sample average is 100.0. The price index ranges from 83.033 to 113.80. Except for the Vermont study (Cotterill 1986) prior studies do not report a comparable statistic. The range here is twice as large as in the Vermont study and is probably larger than in other studies because this sample is more heterogeneous; i.e., analyzes different formats, sizes and affiliations than Cotterill 1986, and Marion *et al.* 1979. Moreover, Hall et al. (1979), Lamm (1981), and Marion *et al.* (1993) analyzed aggregate market price levels rather than firm price levels. Finally, since this price index is for point in time (May 6-8, 1981) short run "sales" or "harvests" add variation to the index.

Market share for the firms in the sample ranges from 2.55 to 62.5 percent of supermarket sales and averages 22.4 percent. The Herfindahl Index with minimum value 1,225, average value 2,456, and maximum value 5,313, indicates that these markets are very concentrated. Changes in concentration at the lower end of this range are generally recognized as most important for the achievement of market power (Merger Guidelines). Thus, we will use the natural logarithm of the Herfindahl (LOGHERF) and concentration ratios in our empirical work. Concentration ratios are, in fact, a stronger version of logarithmic specification. In this sample four firm concentration equals 100 for 30 of the 107 observations. The markets that have $CR_4 = 100$ are 30 of 31 markets with HERF above 2700. The CR_4 specification effectively truncates the distribution at that value. $CR_3 = 100$ truncates the Herfindahl distribution at a higher level. For

Table 1 Descriptive Statistics: Full Sample, 107 Observations

VARIABLE	MEAN	STD DEV	MIN	MAX
PRICE	100.0	4.7751	83.033	113.80
SHARE	22.4353	11.9473	2.5500	62.5000
HERF	2456.3600	786.4778	1225.0000	5313.0000
LOGHERF	7.7559	0.3240	7.1107	8.5779
CR_4	85.789	13.044	57.50	100.0
CR_3	75.351	15.268	45.00	100.0
WRHS	0.0280	0.1659	0.0000	1.0000
WIMPACT	0.2243	0.4191	0.0000	1.0000
TRADIT	0.6542	0.4779	0.0000	1.0000
SQFT	20.7183	10.3148	5.0000	60.0000
MKTWAGE	4.9365	0.7829	3.6410	7.4380
WAREDIST	108.1	65.7322	10.0	320.0
UNION	0.4112	0.4944	0.0000	1.0000
GROWTH	57.6442	14.3056	32.5539	81.6074
INCOME	6432.2200	988.2211	4433.1900	8572.2700
INDEPEND	0.0748	0.2643	0.0000	1.0000
LBRINT	0.8420	0.2870	-0.3403	1.1355
BROAD	0.5517	0.4040	-0.0155	1.5172
CONSER	0.4698	0.4456	-0.4617	1.2325
OLDTIME	-0.1809	0.3037	-0.6294	0.9950
PROMOTS	1.1538	0.4295	0.2968	2.0426

this sample, CR_4 averages 85.7 percent and CR_3 averages 75.3 percent. For 1987 supermarket four firm concentration in 244 U.S. standard metropolitan areas averaged 77.6 percent (Franklin and Cotterill 1993).

The reported mean values for WRHS is .028 indicating that only 2.8 percent of the sample (3 observations) are warehouse operations. This is somewhat low since nationally 6.3 percent of supermarkets were warehouse operations in 1980 (Cotterill 1993a, 29). However, 22.4 percent of the sample competes against a warehouse operation (mean value for WIMPACT = .224).

The traditional format binary (TRADIT) has mean value .6542. Thus, 65 percent of this sample has this format. The 31.8 percent of the sample that are not warehouse or traditional format supermarkets offer counter service.

The supermarkets in this sample had an average 20.7 thousand square feet (SQFT) and ranged in size from 5 to 60 thousand square feet. The fourth quarter 1981 market area average wage for retail food workers averages $4.93 for this sample and ranges from $3.93 to $7.43. The distance to warehouse averages 108.1 miles. The average value for the union binary indicates that 41 percent of the stores are unionized. Sales growth for the 1977-1981 four year period averages 57.6 percent in this sample. Per capita disposable income (PCI) averages $6,432. The average value for the independent supermarket binary (INDEPEND) indicate that only 7.48 percent of the sample (8 observations) are so classified.

The last set of variables in Table 1 are the service factors. The levels of these variables by themselves have no economic meaning. However, each does exhibit significant variation indicating that service levels do vary among the supermarkets in this sample.

Turning to hypothesis testing, ordinary least squares is used to estimate the reduced form model and three stage least squares is used for the structural equation system. Market share is not significantly related to price in the reduced form equation, nor is it related to price or any service level in the structural model. Thus, unilateral market power and/or share related costly services do not seem to exist. Subsample analysis, however, will temper this conclusion.

Concerning the alternative measures of market concentration, CR_3, CR_4, and LOGHERF, all provide quite similar results. For the reduced form model, F tests indicate that CR_3 and CR_4 are preferred to LOGHERF at the one percent level, but one cannot distinguish between them. When comparing the system R^2 for the structural models, however, LOGHERF (R^2 = 0.4366) performs better than CR_3 (R^2 = 0.4269) and CR_4 (R^2 = 0.3973). Since CR_3 has a higher system R^2 in the structural model and a higher t-ratio than CR_4 in the reduced

form model, Table 2 reports model estimation results for the with CR_3. Corresponding tables for CR_4 and LOGHERF are provided as appendix tables 2 and 3.

In the reduced form model (column 1) CR_3 has a positive impact on price as hypothesized and is significant at the 1 percent level. In prior research this has been regarded as support for the coordinated market power hypotheses. However, the Demsetz quality critique suggests that consumers may pay higher prices in more concentrated markets because more services accompany the grocery products. The coefficient for the warehouse binary, WRHS, is negative as expected and significant at the 1 percent level. Warehouse supermarkets prices are on average 8.8 percent lower than other supermarkets. The coefficient for the warehouse impact variable WIMPACT is significant at the 5 percent level and indicates that the prices for supermarkets who compete against warehouse operations are, on average, 2.66 percent lower than those that do not. The traditional format binary (TRADIT) has a positive coefficient but is not significant. Store size, specified as a quadratic is statistically significant. Small stores have higher prices, lowest prices occur in stores of approximately 36,700 square feet and prices rise thereafter. A similar quadratic relationship in a reduced form model was also reported in a study of Vermont supermarkets (Cotterill 1986). Contrary to accepted opinion, retail food prices, unadjusted for service levels, are not lowest in the largest supermarkets. Of the three cost measures, MKTWAGE, WAREDIST, and UNION, only the last is statistically significant (5 percent level) and it has the hypothesized positive sign. Unionized supermarkets on average have prices 2.17 percent above other stores. Market growth is not statistically significant. Per capita income is significant at the 10 percent level. A $1,000 increase in income is associated with a 1 percent increase in prices. The independent affiliation variable has negative coefficient and is almost significant at the 10 percent level. The model's R^2 is 0.2891 and it is significant at the 1 percent level.

The structural model (columns 2 through 6 in Table 2) allows us to evaluate the Demsetz quality critique. Price is now modeled as a function of the five endogenous service factors, as well as exogenous variables. Examining the endogenous variables first, consumer services (CONSER) and old time services (OLDTIME) have small negative coefficients that are not significantly different from zero. The labor intensive (LBRINT), breadth of product line (BROAD) and promotions (PROMOS) service all have positive coefficients as hypothesized. BROAD and PROMOS are statistically significant at the 5 and 1 percent level, respectively. The powerful effect of promotions on price levels corroborates a similar finding by the National Food Commission

Study of Retailing in the 1960s when such practices were very popular marketing devices (NCFM 1966, p. 462).

Turning to exogenous variables in the price structural equation, at .178 the estimated coefficient for CR_3 is more than twice as large as the reduced form coefficient, and it is significant at the 5 percent level. Thus, controlling for quality effects does not, as the Demsetz quality critique predicts, destroy the relationship between market concentration and price. To the contrary, it strengthens it. Looking across the table, one sees that the CR_3 is not significantly related to any of the service factors.

The warehouse binary variable (WRHS) has positive but insignificant impact on price in the structural model. This suggests that the impact of the new format on its prices is fully captured by its impact on service levels. Looking across Table 2, note that WRHS has a highly significant negative impact on the level of labor intensive services (LBRINT) and breadth of product line (BROAD. These, in turn, lower price levels.

The warehouse impact variable (WIMPACT) behaves as expected. Firms that compete against warehouses have significantly lower prices (5 percent level) independent of changes in the service mix. WIMPACT also registers a positive and significant impact (10 percent level) on breadth of product line (BROAD). Thus, firms respond to warehouse competition by expanding services not offered by warehouses as well as lowering prices.

Traditional format (TRADIT) supermarkets have significantly (1 percent level) narrower product lines and offer significantly more (1 percent level) promotions. Traditional supermarkets have no significant impact on labor intensive services (LBRINT) and old time services (OLDTIME).

The quadratic relationship between price and store size is not significant in the structural equation. The linear term (SQFT) decreases from the 1 percent to the 5 percent significance level and the quadratic term (SQFTSQ) decreases from the 5 percent level in the reduced form to insignificance in the price structural equation. Note that store size is specified in all service equations but it only has a significant (1 percent level) positive impact on breadth of product line. This supports our hypothesis that the quadratic relationship in the reduced form price equation is related to the broader product lines available in larger superstores. As a strategic group they seem to be differentiated and charge higher prices. The persistence of a negative relationship between store size and price, however, suggests that economies of size do exist at the store level. As industry analyses have concluded, superstores seem to be able to generate high profits because

Table 2 Reduced Form and Structural Model Estimation Results: 107 Observations

	Reduced Form Price Eq.	Structural Model PRICE	LBRINT	BROAD	CONSER	OLD TIME	PROMOS
INTERCEPT	90.5620	7.4725	0.8773	0.7489	-0.1943	-0.1837	1.1229
CR_3	0.0886	0.1780	0.0009	-0.0018	0.0014	9.1 10-5	-0.0035
	(2.779)***	(2.574)**	(0.576)	(-0.820)	(0.561)	(-0.046)	(-1.261)
WRHS	-8.8302	61.0322?	-0.9793	-0.8020	0.2166	0.2175	
	(-2.965)***	(1.441)	(-7.194)***	(-3.847)***	(0.994)	(1.296)	
WIMPACT	-2.6602	-7.5836		0.1490	-0.0342		0.0328
	(-2.175)**	(-2.343)**		(1.761)*	(-0.429)		(0.342)
TRADIT	1.0986		-0.0081	-0.3322		-0.0459	0.3057
	(1.022)		(-0.150)	(-4.355)***		(-0.801)	(3.100)***
SQFT	-0.4842	-1.0425	-0.0054	0.0122	0.0047	-0.0022	0.0049
	(-2.803)***	(-2.037)**	(-2.031)**	(3.290)***	(1.221)	(-0.683)	(0.998)
SQFTSQ	0.0066	0.0105					
	(2.359)**	(1.552)					
MKTWAGE	0.4413	0.2515					
	(0.652)	(0.230)					
WAREDIST	-0.0008	0.0076					
	(-0.113)	(1.068)					
UNION	2.1711		0.1021		0.5672	-0.0974	-0.0191
	(2.148)**		(2.056)**		(7.784)***	(-1.631)	(-0.215)
GROWTH	0.0009			-0.0020			
	(0.025)			(-0.903)			
INCOME	0.0010				3.3 10-5	1.3 10-5	
	(1.793)*				(0.840)	(0.418)	
INDEPEND	-2.8685		0.0210	0.1415	0.1965	0.4759	-0.1224
	(-1.619)		(0.238)	(1.088)	(1.465)	(4.513)***	(-0.749)
LBRINT		42.9303					
		(1.215)					
BROAD		30.4991					
		(2.400)**					
CONSER		-0.9112					
		(-0.147)					
OLD TIME		-5.2181					
		(-0.615)					
PROMOS		34.2654					
		(3.531)***					
F VALUE	3.185***						
R^2	.2891	System					
Adj R^2	.1983	R^2					
		.4269					

*** Significant at 1%
** Significant at 5%
* Significant at 10%

of their ability to control costs and elevate prices (Mandel and Heinbockel, 1989).

The average market wage (MKTWAGE) and warehouse distance variables are insignificant in the price structural equation as they were in the reduced form equation. The union binary variable has positive and significant impact (5 percent level) upon labor intensive services as hypothesized. Unionized stores also offer significantly higher levels of the consumer service factor. However, unionization is not significantly related to old time service or promotions. The two consumer demand variables GROWTH and INCOME continue their weak performance with coefficients that are not significantly different from zero in all structural equations. Independent supermarkets (INDEPEND) have no significant service level differences except that they tend to offer more old time services than affiliated or chain store supermarkets.

To explore the possibility that some excluded explanatory variable should be included in the service factor equations we also regressed each service factor on all explanatory variables. In fact, none of the excluded variables is significantly related to a service factor. Thus, the reported specification seems, from an empirical perspective, to be sufficiently general to capture the primary relationships among these variables.

To explore the sensitivity of our results to sample composition we estimated the reduced form model and structural equations model for chains and affiliated supermarkets (no independents). Since Old Time services are associated only with independents, that factor was also removed from the structural model. These results are reported in Appendix Table 4. Aside from an increase in R^2 on the reduced form model to .3537 and a decrease in the system R^2 to .379 in the structural model the statistical results remain essentially as reported in table 2.

Results reported in Table 3 further analyze the reduced form model's robustness. Only key market structure variables, the size quadratic, warehouse distance, income, and warehouse are included in the model to conserve degrees of freedom. When the eight independent observations are dropped, the model for chains and affiliated independent supermarkets improves. Market share now has a positive coefficient and is significant at the 5 percent level. Alternatively, CR_3 is significant at the 1 percent level. Thus, the inclusion of the independent observations destroys the own share effect. This does not imply that independents make markets more competitive. If the maverick ways of independents were, in fact, a disciplining force upon others, then none of the structural variables would be significant in the reduced form equation (or structural price equation) in the full sample or any subsample. It appears that the independent observations, whose

Table 3 Subsample Analysis of Reduced Form Price Equation

	Chains + Affils		Chains		Safeway		Kroger	
INTERCEPT	104.3198	96.2952	100.2055	93.9480	100.1913	88.2317	99.7012	98.6648
SHARE	0.0927		0.1443		0.0838		0.1183	
	(2.317)**		(3.816)***		(1.841)*		(1.726)	
CR3		0.0934		0.0960		0.1017		0.0555
		(3.047)***		(3.028)***		(2.698)**		(1.311)
SQFT	-0.4823	-0.4378	-0.2994	-0.2707	-0.4823	-0.4067	-0.2303	-0.3011
	(-3.021)***	(-2.845)***	(-1.779)*	(-1.549)	(-1.441)	(-1.318)	(-0.752)	(-0.963)
SQFTSQ	0.0073	0.0066	0.0041	0.0038	0.0078	0.0070	0.0032	0.0040
	(2.658)***	(2.516)**	(1.507)	(1.327)	(1.223)	(1.206)	(0.722)	(0.882)
WAREDIST	7.9 10-6	-0.0011	0.0093	0.0036	0.0214	0.0220	0.0351	0.0349
	(0.001)	-0.179	(1.595)	(0.615)	(2.358)**	(2.635)**	(2.468)**	(2.338)**
INCOME	3.5 10-5	0.0004	-1.3 10-5	0.0004	0.0004	0.0012	-0.0002	-9.5 10-5
	(0.078)	(0.932)	(-0.032)	(0.922)	(0.694)	(2.076)*	(-0.451)	(-0.165)
WRHS	-11.0143	-12.2290	-6.3707	-9.2557				
	(-4.139)***	(-4.637)***	(-2.346)**	(-3.174)***				
F VALUE	4.992***	5.810***	4.465***	3.416***	2.482*	3.604**	3.965**	3.463**
R^2	.2456	.2748	.3123	.2578	.4220	.5145	.5861	.5529
ADJ R^2	.1964	.2275	.2423	.1823	.2520	.3717	.4383	.3932
OBS	99	99	66	66	23	23	20	20

*** 1 %
** 5%
* 10%

market shares range from 7.6 percent to 62.5 percent, and price indices range from 86.84 to 109.32, simply inject a lot of unexplained price variation into the model.

When one examines the chain supermarket subsample (66 observations), both SHARE or CR_3 are significant at the one percent level. For the 23 Safeway observations SHARE is significant at the 10 percent level, and CR_3 is significant at the 5 percent level. For the 20 Kroger observations, share is nearly significant at the 10 percent level and CR_3 loses significance. Both structural variables in the Kroger subsample, however, are significantly correlated with price at the 5 percent level, but suffer from multicollinearity with other variables in the model. Note that the R^2 for the Kroger equations are higher than those for Safeway but the Kroger model have fewer significant coefficients.

One can conclude that there is a clearly discernable share effect for the chains and affiliated stores. However, results for the concentration variables suggest that all supermarkets in more concentrated markets, including independents, have higher prices due to coordinated effects primarily instituted by the larger multi-store firms (chains and affiliated independents). The quadratic relationship for store size remains strong in the chain and affiliated independent subsample. However, it is insignificant in the smaller subsamples, possibly because individual firms tend to operate similar sized and merchandised stores.

Note that distance from warehouse becomes statistically significant (5 percent level) in the Safeway and Kroger samples and has the expected positive effect on prices. Income, a demand shift measure, is only significant (10 percent level) in the Safeway sample when CR_3 is specified. Since none of the Kroger or Safeway observations are warehouse operations, WRHS is not specified in those models. However, it has the expected significant negative impact in the larger samples. R^2, on an adjusted basis to control for different degrees of freedom, improves when one shifts to smaller firm specific samples. This suggests that the model explains large and leading firm conduct more completely than fringe firm conduct.

4. Conclusions

In summary, service levels do affect price levels with in-store promotions and breadth of product line being most significant. Store format, store size, independent status, and unionization significantly influence one or more service levels. Supermarkets that compete

against warehouse supermarkets as measured by the warehouse impact variable, do so by offering a wider product line as well as lower prices.

Ignoring services and related nonprice competition, a reduced form model establishes, as prior published research has, that firms in more concentrated markets charge higher prices. Coordinated (market concentration) effects seem to prevail over unilateral (market share) effects in the full sample. However, as one would expect, when one examines subsamples that identify the large, leading firms, the market share effect becomes as strong as the concentration effect. The unilateral power of the large chains is empirically equivalent to coordinated power in concentrated markets because large shares create high concentration. The fact that concentration out performs market share in the full sample suggests that interfirm coordination may be more important than unilateral differentiation effects for food price determination in concentrated local markets. Finally, the Demsetz critique, that higher prices in more concentrated markets are due to the provision of more services, is rejected. To the contrary specifying a structural model that controls for the effect of service levels on price strengthens the market power effect.

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Table A1 Factor Loading for Top Five Services

SERVICE	LBRINT	BROAD	CONSER	OLDTIME	PROMOS
PRICEMRKD	0.84013	-0.04721	-0.08046	-0.03067	-0.18128
BAGGING	0.79535	0.21024	0.02713	0.07081	0.22352
LOADING	0.79118	0.25299	0.01744	0.03557	0.24808
CHKCASH	0.41847	-0.19110	-0.18543	0.18543	0.16024
SCANNERS	-0.69062	0.28868	0.04727	0.10793	0.18699
DELI	0.00157	0.82816	0.01708	-0.17873	-0.00243
BAKERY	0.08459	0.80847	0.17944	-0.17309	-0.09212
RESTAUR	-0.11846	0.63534	-0.05259	0.02264	0.01499
SERVSEAFD	0.04688	0.57825	0.05687	0.29480	-0.09356
PHARMCY	-0.02160	0.48501	0.10393	0.03272	0.12366
UTILBIL	0.03490	0.21909	-0.06622	0.03725	0.15481
UNITPRICE	-0.17584	0.14956	0.78202	0.00728	0.02155
HDCPCART	0.13179	-0.25470	0.70257	-0.10622	0.23869
XPRSLANE	0.34831	0.32003	0.65390	-0.22358	-0.01614
TRASTAMP	0.14690	-0.11266	-0.66263	0.02307	0.37191
PHONORDER	0.08937	0.12045	-0.08503	0.73088	-0.01466
DELIVER	0.07906	-0.06161	-0.05484	0.63888	-0.01702
SVMEAT	0.07211	0.12016	0.11888	0.43581	0.14738
OFFSTREEPARK	0.03327	0.09937	-0.09579	-0.11580	0.02177
NAMETAGS	0.32340	0.05220	0.23637	-0.52080	0.08538
UNIFORM	0.07804	0.15436	0.14296	-0.54703	0.25023
CONTINPROGS	0.12972	-0.09517	-0.04363	-0.11134	0.76125
CONTESTS	0.13991	-0.29831	-0.23323	0.00483	0.61436
MUSIC	-0.01813	0.18659	-0.02398	0.02596	0.46874
COUPONS	-0.04482	0.09097	0.13845	-0.04027	0.28392
CHARGACCT	0.14281	0.10757	0.21077	0.24135	0.26306
FOODSTAMP	-0.06534	0.09848	0.11453	-0.09692	0.12983

Table A2 Reduced Form and Structural Model Estimation Results: Full Sample (107 OBS) Concentration = CR4

	Reduced Form Price Eq.	Structural Model					
		PRICE	LBRINT	BROAD	CONSER	OLD TIME	PROMOS
INTERCEPT	87.3041	35.0625	0.8919	0.7012	0.0335	-0.0430	1.0858
CR_4	0.1146	0.1611	0.0006	-0.0012	-0.0005	-0.0012	-0.0026
	(3.080)***	(2.304)**	(0.347)	(-0.475)	(-0.172)	(-0.499)	(-0.813)
WRHS	-8.7461	32.7216	-0.9771	-0.8104	0.2318	0.2232	
	(-2.967)***	(0.870)	(-7.197)***	(-3.881)***	(1.066)	(1.339)	
WIMPACT	-2.3112	-6.3944		0.1459	-0.0320		0.0282
	(-1.916)*	(-2.301)**		(1.705)*	(-0.401)		(0.289)
TRADIT	1.1060		-0.0086	-0.3317		-0.0465	0.3071
	(1.038)		(-0.158)	(-4.339)***		(-0.811)	(3.099)***
SQFT	-0.4890	-1.0476	-0.0055	0.0124	0.0046	-0.0022	0.0051
	(-2.854)***	(-2.339)**	(-2.059)**	(3.317)***	(1.196)	(-0.698)	(1.039)
SQFTSQ	0.0068	0.0096					
	(2.432)**	(1.585)					
MKTWAGE	0.4089	0.4764					
	(0.610)	(0.458)					
WAREDIST	-0.0014	0.0050					
	(-0.205)	(0.713)					
UNION	2.1597		0.1023		0.5677	-0.0972	-0.0198
	(2.155)**		(2.060)**		(7.786)***	(-1.629)	(-0.222)
GROWTH	-0.0083			-0.0018			
	(-0.244)			(-0.807)			
INCOME	0.0011				2.1 10-5	5.6 10-6	
	(1.995)**				(0.524)	(0.179)	
INDEPEND	-2.6610		0.0247	0.1311	0.2123	0.4821	-0.1372
	(-1.529)		(0.280)	(1.013)	(1.59)	(4.602)***	(-0.840)
LBRINT		18.8056					
		(0.578)					
BROAD		25.0788					
		(2.401)**					
CONSER		2.9362					
		(0.502)					
OLD TIME		-4.5396					
		(-0.599)					
PROMOS		28.9658					
		(3.655)***					
F VALUE	3.376***						
R^2	.3012	System					
Adj. R^2	.2119	R^2					
		.3973					

*** Significant at 1%
** Significant at 5%
* Significant at 10%

Table A3 Form and Structural Model Estimation Results: Full Sample (107 OBS) Concentration = LOGHERF

	Reduced Form Price Eq.	Structural Model					
		PRICE	LBRINT	BROAD	CONSER	OLD TIME	PROMOS
INTERCEPT	74.2459	-74.0460	0.8773	1.1692	-0.2598	-0.4706	2.4345
	(5.076)	(-1.033)	(1.538)	(1.315)	(-0.254)	(-0.572)	(2.346)
LOGHERF	3.1141	10.3108	0.0087	-0.0710	0.0271	0.0325	-0.2009
	(2.028)**	(2.515)**	(0.122)	(-0.669)	(0.234)	(0.352)	(-1.552)
WRHS	-8.6133	75.1808	-0.9737	-0.8030	0.2221	0.2096	
	(-2.842)***	(1.345)	(-7.147)***	(-3.845)***	(1.016)	(1.248)	
WIMPACT	-2.6606	-8.0411		0.1515	-0.0321		0.0337
	(-2.128)**	(-2.111)**		(1.789)*	(-0.401)		(0.354)
TRADIT	1.1487		-0.0081	-0.3341		-0.0440	0.2996
	(1.045)		(-0.148)	(-4.366)***		(-0.765)	(3.045)***
SQFT	-0.4749	-1.0233	-0.0056	0.0122	0.0047	-0.0020	0.0044
	(-2.700)***	(-1.756)*	(-2.084)**	(3.258)***	(1.226)	(-0.630)	(0.896)
SQFTSQ	0.0066	0.0112					
	(2.289)**	(1.405)					
MKTWAGE	0.4375	0.1501					
	(0.634)	(0.130)					
WAREDIST	-0.0014	0.0089					
	(-0.207)	(1.231)					
UNION	2.1643		0.1035		0.5670	-0.0979	-0.0196
	(2.103)**		(2.083)**		(7.776)***	(-1.640)	(-0.222)
GROWTH	0.0013			-0.0021			
	(0.037)			(-0.938)			
INCOME	0.0008				2.7 10-5	1.6 10-5	
	(1.433)				(0.689)	(0.553)	
INDEPEND	-2.6957		0.0267	0.1409	0.2040	0.4688	-0.1144
	(-1.487)		(0.300)	(1.079)	(1.519)	(4.446)***	(-0.703)
LBRINT		55.6548					
		(1.245)					
BROAD		32.5304					
		(1.954)*					
CONSER		-2.9431					
		(-0.417)					
OLD TIME		-5.6102					
		(-0.606)					
PROMOS		37.1130					
		(2.802)***					
F VALUE	2.794***						
R^2	.2629	System R^2					
Adj R^2	.1688	.4366					

*** Significant at 1%
** Significant at 5%
* Significant at 10%

Table A4 Reduced Form and Structural Model Estimation Results: Chains and Affiliated Independents (99 OBS)

	Reduced Form Price Eq.	Structural Model				
		PRICE	LBRINT	BROAD	CONSER	PROMOS
INTERCEPT	94.7880	45.5501	0.8831	0.7946	-0.2164	1.1781
CR_3	0.0960	0.2043	0.0010	-0.0015	0.0014	-0.0040
	(3.196)***	(2.731)***	(0.651)	(-0.660)	(0.558)	(-1.448)
WRHS	-9.6394	16.7732	-0.9881	-0.8115	0.2308	
	(-3.482)***	(0.578)	(-7.140)***	(-3.874)***	(1.029)	
WIMPACT	-2.3454	-6.0830		0.1500	-0.0500	0.0297
	(-2.061)**	(-2.166)**		(1.767)*	(-0.547)	(0.315)
TRADIT	0.4616		-0.0203	-0.3622		0.3071
	(0.447)		(-0.352)	(-4.618)***		(3.038)***
SQFT	-0.5913	-0.9127	-0.0058	0.0110	0.0045	0.0042
	(-3.481)***	(-3.078)***	(-2.106)**	(2.881)***	(1.126)	(0.862)
SQFTSQ	0.0083	0.0072				
	(3.051)***	(2.013)**				
MKTWAGE	0.0513	0.3134				
	(0.081)	(0.350)				
WAREDIST	0.0004	0.0052				
	(0.059)	(0.779)				
UNION	2.3390		0.1005		0.5672	-0.0143
	(2.492)**		(1.986)**		(7.725)***	(-0.163)
GROWTH	-0.0158			-0.0024		
	(-0.475)			(-1.082)		
INCOME	0.0010				3.8 10-5	
	(1.811)*				(0.930)	
LBRINT		5.3575				
		(0.238)				
BROAD		23.1247				
		(2.191)**				
CONSER		5.4754				
		(1.197)				
PROMOS		28.8250				
		(2.464)**				
F VALUE	4.329***					
R^2	.3537	System				
Adj. R^2	.2720	R^2				
		.3790				

*** Significant at 1%
** Significant at 5%
* Significant at 10%

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