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SUPERMARKET PRICES REDUX

R. Chi

W. Lesser

Department of Agricultural Economics
Cornell University
Ithaca, NY 14853

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Helpful comments were made by Lois Willett, who bears none of the responsibility for remaining errors of analysis or logic.

* Respectively former MS student, Department of Agricultural Economics, Cornell University, presently with Columbia House and Professor of Marketing, Cornell University. This Article is derived from Chi (1992).

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ABSTRACT

This study attempts to reconcile divergent results between two previous studies of CR/price affects for supermarkets. A more complete data set from Kaufman and Handy is used in an earlier model by Marion *et al.* to determine if the differences are attributable to (1) model specifications, (2) interim structural change or (3) role of leading firm compared to all firms. The first two comparisons were indeterminate but the third provides some support for the CR/price hypothesis compared to the size economy/service explanations. While not conclusive, these results argue for caution in rejecting SMSA supermarket concentration as an influence over prices.

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Of all the studies done by agricultural economists, perhaps the most controversial have been evaluations of the impacts of food store market structure on performance, especially prices. Indeed, one such study achieved the notoriety of a scathing *Wall Street Journal* editorial.

That study (Marion *et al.* 1979) had found a strong positive relationship between market dominance at the SMSA level, as measured by four firm concentration ratios and relative firm market share, and both firm profits and prices. Such findings are not uncommon in the literature, dating back to before the National Commission on Food Marketing in 1966. Indeed, since 1960, over a dozen major studies of food store performance have been completed[1] and only three, Gorman and Mori (1966), Grinnell *et al.* (1976), and Kaufman and Handy (1989), have reported insignificant and negative relationships between structural variables and retail food prices. The earlier studies can be faulted for using simple correlation techniques and/or inappropriate CPI data or other notable limitations, but the Kaufman and Handy study presents a more complex matter to reconcile with the body of earlier work.

A reconciliation is especially important because, in a detailed literature review, Anderson (1990, p. 77) concludes:

> "Our review of the studies of grocery prices showed that all of the studies suffer from a failure to control adequately for services and quality differences among local retailing markets. ... The finding that prices are higher in more-highly concentrated

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[1]Studies not otherwise cited include Lamm (1981,1982), Cotterill (1983, 1984, 1986), Hall et. al. (1976), FTC (1960), Mueller and Garoian (1961), Padberg (1992) also reviews prior to 1960.

> markets may rather reflect higher costs or higher quality and more services in more concentrated markets. The study that does the best job of dealing with these problems -- [Kaufman and Handy 1989] -- finds that prices are not higher in more concentrated markets."

Padberg raises a similar question in terms of the "regularities" or "generalizability" of industrial organization (IO) studies. Thus he is searching for what Schmalensee and Willig (1989, p. 1000) refer to as "empirical regularities" and Weiss (1971, p. 363) identifies as the "set of generalizations." This is no easy matter in studies which differ over time and in methodologies and data sources assembled with none of the natural scientist's regard for replication. And as Padberg notes, there is little theoretical basis for hypothesizing the observed relationships in retail markets as opposed to the "theory of one price" for commodities.

The purpose of this article is to explore the generalizability issue in more depth by examining further the two most detailed yet controversial studies, Marion *et al.* representing the classical IO methodology, and Kaufman and Handy the new thinking, cost-based approach. Attention is on price/structure (as opposed to profit/structure) analysis because results are less sensitive to store size-related costs although, as Anderson (1990, pp. 28-29) points out, adjustments must still be made for input cost, service and quality differences.

The methodology employed here is essentially to re-estimate the Marion *et al.* model using Kaufman and Handy data. In this way the discrepancy in the results can be attributed to either (a) model specifications or (b) variable measurement/data sources. Our re-evaluation indicates that market power/market structure cannot be dismissed as a causal component in local food pricing.

Study Summaries of Marion *et al.* and Kaufman and Handy

Marion *et al.*: Marion and his co-authors were commissioned by the Joint Economic Committee (JEC), giving them subpoena rights for data collection not available from public sources and leading to a more detailed study than typical. Considering only price analysis, the model used is (1979, p. 429):

$$C = \beta_0 + \beta_1 RFMS + \beta_2 CR_4 + \beta_3 SS + \beta_4 MG + \beta_5 MSZ + \beta_6 MR + \beta_7 WG + \varepsilon$$

Where:

RFMS = Relative Firm Market Share (MS_i/CR_4), a measure of the market power of the ith firm. $\beta_1>0$.

CR_4 = Four Firm Concentration, a measure of market power of the four largest firms in an SMSA. $\beta_2>0$.

SS = Mean store size by SMSA, in sales dollars, an adjustment for the importance of supermarkets. $\beta_3<0$.

MG = Market Growth, 1967-74 % growth in SMSA deflated grocery store sales, a measure of ease of entry or greater capacity utilization. $\beta_4 \neq 0$.

MSZ = Market Size, 1974 SMSA size measured by grocery store sales, accounts for very large SMSAs which constitute multiple submarkets. $\beta_5 \neq 0$.

MR = Market Rivalry, $|1972CR_4 - 1974CR_4|$, greater change indicates a more competitive environment. $\beta_6<0$.

WG = Wages, weighted average of 1974 union wages for meat cutters, clerks and checkers, a measure of market-specific costs. $\beta_7>0$.

C (dependent variable) = Weighted Market Basket Cost, national and private label product prices for 94 items for October 1974 for three large chains in 32 SMSA's.

The results for the "best" (highest R^2) model are shown in Table 1, Column 1. These support the researchers' expectations, especially regarding the signs and magnitudes of the market structure variables, which are interpreted to show

the existence and use of market power. Other variants of the model give similar results. The analysis is, however, in Anderson's (1990) assessment, limited by the single market-specific cost differential (WG) and absence of quality/service measures. The dependent variable can also be criticized for the limited scope of the market basket which, by allowing only frozen food, dairy and grocery items, excludes 50% of expenditures in supermarkets. Moreover, the included items were not systematically chosen for representativeness.[2]

Kaufman and Handy: This study was undertaken to correct for the shortcomings of earlier studies (1989, pp. 2-3). Special emphasis was put on the collection of food prices which ultimately involved a random selection of 28 SMSA's stratified by concentration levels. Within each SMSA, one or more supermarkets were randomly selected from the six leading firms, with an additional five randomly selected firms representing all other supermarkets. Random selection allowed the choice of multiple stores from the same firm within a SMSA. Items were selected from all food departments and soaps/toiletries. Procedures were used to standardize product quality and compensate for missing items. In total, prices were selected from 616 supermarkets in 321 firms over three "waves", February, April and May 1982 (1989, pp. 4-7 and Appendixes). The following model was analyzed in log linear form:

$$PI = \beta_0 + \beta_1 MS + \beta_2 H_4 + \beta_3 SALES*SIZE + \beta_4 FI + \beta_5 OCCST + \beta_6 SERV + \beta_7 WAGE + \beta_8 WARESTR + \beta_9 MR + \beta_{10} MT + \beta_{11} MG + \beta_{12} ME + \varepsilon$$

Where:

MS = Market Share, firm market share by SMSA. A market power as well as a firm size economy measure. $\beta_1 \neq 0$.

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[2]The data in fact are drawn from store-initiated price comparisons. Marion et al. 1979, p. 421.

H_4 = Four firm partial Herfindahl. $\beta_2 \neq 0$.

SALES*SIZE = Sales times Size, a store level size economy measure. $\beta_2<0$.

FI = Firm Integration, a binary (1= with warehouse) proxy for multistore economies. $\beta_3<0$.

OCCST = Occupancy Cost, index of rental rates and utility costs as a proxy for cost differences within and between SMSA's. $\beta_5>0$.

SERV = store services, index of services (eg., deli department). $\beta_6>0$.

WG = Labor Compensation, average hourly wage bill per employee. Do to different competitive conditions, $\beta_7 \neq 0$.

WARESTR = Warehouse Store, binary variable (1=with) indicating firm has low price and service warehouse store in SMSA. $\beta_8<0$.

MR = Market Rivalry, sum of MS changes of six leading firms 1979-81, an indication of competition. $\beta_9<0$.

MT = Market Turbulence, subjective binary measure. $\beta_{10}<0$.

MG = Market Growth, real food sales growth by SMSA, 1977-81. With short term fixed capacity, growth allows price increases. $\beta_{11}>0$.

ME = Market Entry, sum of 1982 MS of leading firms entering a SMSA 1977-81, where high entry is expected to increase competition. $\beta_{12}<0$.

PI (dependent variable) = Price Indexes, firm level price indexes by SMSA, data collected as described above (1989, pp. 8-9 and Appendixes).

The results are shown in Table 1, Column 2. As the market power measures (MS and H_4) are both negative and statistically insignificant at standard levels while efficiency factors (sales*size) and service measures (SERV) have the expected signs and are significant, the authors conclude that "... oligopolistic firm market power did not play a significant price determining role." (1989, pp. 29-30). While not without its faults, Anderson found this study more complete than Marion *et al.*'s and the dependent variable measured more systematically, leading to his conclusion that market power is not implicated in

supermarket firm pricing decisions.

Table 1: Results of Marion *et al.* and Kaufman and Handy Studies

	1	2
Variables	Marion et. al.	Kaufman and Handy[3]
RFMS	6.426 (2.932)	
CR_4	16.545 (5.256)	
SS	-.006 (-3.070)	
MSZ	-.082 (-4.169)	
MR	-.501 (-5.154)	-.016 (-2.130)
WG	.666 (.662)	-.002 (- .184)
MS		-.003 (-1.174)
H_4		-.008 (-1.574)
Sales*Size		-.015 (-5.184)
FI		-.001 (-.81)
OCCST		.055 (3.233)
SERV		.045 (3.874)
WARESTR		-.059 (-4.695)
MT		-.005 (-.682)
MG		.381 (3.716)
ME		.002 (2.731)
R^2	.70	.35
N	39	321

Notes: t-statistics in parentheses.

Sources: Marion *et al.* 1979, Table 3, equation 1f; Kaufman and Handy 1989, Table 10

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[3]MG coefficient in K-H corrected according to 3/90 errata letter from Kaufman..

Evaluation

While it is tempting to accept Anderson's assessment, it is important to consider the numerous differences between the two studies other than in variables and the efficiency/service measures. Here we investigate three factors: (1) model differences, (2) changes in industry structure over the intervening period, and (3) leading firm role. The approach used is to re-estimate the relationships using the Kaufman and Handy data[4] (K-H).

Variable Measurement: The two studies did not use identically defined variables, leading to the possibility that model differences caused the contrary results. To test that possibility, the original Marion *et al.* (M) model was rerun using the K-H data, and in more complete form with services and occupancy costs added. The results (Table 2, Columns 1 and 2) do not differ appreciably from the K-H results, suggesting that small differences in variable definitions are unimportant.

Structural Changes: While only eight years elapsed between the data collection for the two studies, they were years of major innovation in supermarkets. In particular, the period marked the rise of warehouse stores from 250 in 1976 to 1800 in 1982 and superstores (1982 sales > $8 M) from 750 to 3400 over the same period (*Prog. Grocer* 1983, p.8). This change is especially important because M assert as supermarkets "...set the competitive tone in most markets, and compete only indirectly with smaller grocery stores, concentration in the supermarket sector is a better indicator of market power conditions than concentration within all grocery stores" (1979, p. 423). The increase in larger stores over the eight year period suggests a greater concentration within

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[4] Dr. Handy generously provided a copy of the data set on diskette. As a first step, the reported results were replicated.

supermarkets which, if the M hypothesis is correct, should indicate stronger market power effects. This possibility was tested by partitioning the K-H data set and analyzing only the supermarket and larger subset (n=269). The results, shown in Table 2, Column 3, show no notable statistical differences from the full sample (Table 1, Column 2). This result is not unsuspected because supermarkets dominate the sample (84%) so that this approach is not a real test of the M hypothesis of the role of supermarkets. Indeed, with the position of supermarkets now so dominant in grocery sales in communities of any size, the issue may be mooted.

A further partitioning of the data set into superstores only was attempted (Table 2, Column 4) (n=96 or 30%). This subsample of the largest stores in the most rapidly growing class effectively focuses on a different hypothesis, the one of size economies. If, in fact, large stores are more efficient, then the sales*size variable, the size economy proxy, should be negative and significant, which it is weakly. Regrettably, this variable is a poor proxy for size economies, especially as the National Commission on Food Marketing determined back in the mid-1960's that utilization is far more important to unit costs than is size itself (1966, Chap. 7). Alternatively, the market power variables remain insignificant so that there is no support for the M type hypothesis.

The results have several other changes from the base case which are difficult to explain and complicate the interpretation. For example, occupancy costs are negative and insignificant (opposite the hypothesized case) while labor costs are both positive and significant. Store services are insignificant (at the 5% level, one tailed test), but that is likely because all stores of this size have the full set of available services. Additionally, market growth and rivalry are insignificant, a change from previous results. Clearly the competitive dynamics

for these very large operations are not well understood, but size economies are, at most, but one of the aspects.

Anderson (1990, p. 40) raises the possibility that concentration, store size and service levels all tend to be correlated, leading to a spurious relationship between prices and concentration. While there is no evidence for that relationship in the K-H sample (correlation coefficient r=.12 for H_4 and SERV), it is not clear how a strong relationship would be interpreted. Anderson (1990, p. 36) describes several service enhancements like better product selection and double coupons use as a competitive tactic. Yet Marion and the NC117 Committee (1985, p. 297) characterize them as forms of non-price competition, which is more likely to arise in mature markets dominated by a few firms. Thus, whether more services leading to higher prices can be described as a cost-for-service factor or as an indirect consequence of non-price competition cannot be resolved from this data set.

Leading Firm Role: The M and K-H models actually test quite different hypotheses. By selecting the sample within SMSA's to include firms with a range of market shares, the K-H tests emphasize the impact of MS and CR on **within** SMSA price levels rather than **between** SMSA's. That is, their 321 observations represent only 28 SMSA's so that most of the explanatory power is for within SMSA differences. This may also explain why K-H found firm-specific cost/service variables to have such statistical significance. In contrast, M chose leading firms and investigated their exercise of market power **across** SMSA's. Since it can be argued that the impact of market power is best reflected in the between market actions of leading firms, or in Weiss' (1971, p. 365) words, the hypothesis "does not refer to fringe firms," it is important to evaluate the leading firm segment of the K-H data set. As shown in Table 2, Column 5, there are indeed important differences, most notably that a market share variable (RFMS)

does have the positive sign and statistical significance (at about the 6.5% level, one-tailed test) associated with the exercise of market power.[5] The other major differences from the base model (Column 2) are the reduced significance for MG, MR, SERV and WARESTR. The results for SERV are likely attributable to the low variability among the large, leading stores. These factors suggest that the leading firms are somewhat isolated from market dynamics, which of course is one of the attributes (and goals) of market power. Thus market power may exist among the market leaders, where it affects the bulk of shoppers.

Table 2: Variants of the Kaufman and Handy Model

	1	2	3	4	5
Variable	M Model/K-H Data	M Model Enhanced/ K-H Data-	K-H Model Supermarket subset	K-H Model Superstores subset	M Model/K-H Data-Leading Firms subset
RFMS	-.009	-.008			.060
	(4.71)	(3.33)			(1.61)
CR_4	-.031	-.023			-.006
	(2.12)	(1.67)			(.15)
MS			-.003	-.005	
			(1.39)	(1.21)	
H_4			-.005	.002	
			(1.00)	(.23)	
Sales*Size			-.01	-.01	

[5] Anderson (1990, pp. 60-61) criticizes the use of RFMS. It is included here rather than MS to enable a direct comparison between the results of the M and K-H studies. However, because of the additional variables used by K-H, some of Anderson's criticisms of M do not apply to the Table 2 results.

			(4.38)	(1.49)	
Sales/sqft	-.006	-.013			-.02
	(.72)	(1.78)			(1.08)
MG	.28	.32	.22	-.13	.31
	(3.01)	(2.90)	(2.19)	(.87)	(1.07)
MSZ	.002	-.004			.015
	(.39)	(.75)			(1.00)
MR	-.002	-.019	-.016	.007	.017
	(.21)	(1.69)	(2.24)	(.62)	(.55)
SERV		.033	.058	.027	.005
		(2.70)	(4.75)	(1.40)	(.09)
OCCST		.056	.278	-.031	-.02
		(3.04)	(1.64)	(1.16)	(.36)
MT		-.006	-.017	-.019	-.04
		(.72)	(2.31)	(1.93)	(1.46)
FI		-.002	-.004	.0004	-.06
		(.28)	(.52)	(.03)	(.93)
WARESTR		-.063	-.059	-.066	.008
		(4.72)	(4.76)	(3.53)	(.23)
ME		.002	.002	.002	.001
		(2.63)	(2.75)	(1.97)	(.61)
WG	-.0005	-.009	-.006	.03	.056
	(.05)	(.86)	(.64)	(1.94)	(1.09)
R^2	13	30	36	34	55
N	310	310	269	96	27

Notes: t-statistics in parentheses.

Denver observations are omitted because the market size variable was unavailable.

Conclusions

This article compares two conflicting studies of retail food prices, one which concludes that market power has a strong positive effect on prices (Marion *et al.* 1979) and one which finds that efficiency and service level differences are the causal factors, not market power (Kaufman and Handy 1989). This comparison is important for the industry under study as well as the broader debate in industrial organization over the role of market power vs. service and efficiency. A decomposition of the more complete K-H data set leads to different conclusions. While the specific form of the equations is not of great consequence, the aggregation of store types by K-H masks competitive differences among store formats. Perhaps more important, an analysis using only leading firms indicates that market power as measured by share does indeed influence pricing. Thus the new thinkers in industrial organization need to reflect more carefully before discrediting the substantial early work showing positive structure-performance relationships.

How general are these results for food prices? That is difficult to say, for there are period-specific aspects of the data which cannot be separated from the results. In particular, the Marion *et al.* study was conducted during a period of high food price inflation and a price freeze.[6] The profitability of supermarket chains during inflationary periods suggests that they benefit when prices are rising. Perhaps that is why Marion *et al.* got such strong market power results. But the K-H results relate to a more stable period that cannot be so easily ignored. Relevence to the 1990's is another question. In the intervening period there have been numerous changes in the industry of which slotting allowances and increased use of computers for shopping pattern analysis and shelf inventory

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[6] The food CPI in 1974 rose by 14.3% compared to 4.1% in 1982. Statistical Abst. 1984.

control are but two. The relationships of these factors to store/firm size and market concentration have not yet been explained.

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