Strategic Groups, Competition and Retail Food Prices

by

Bruce W. Marion, Keith Heimforth
and
Wiltse Bailey

WP 99   October 1991

I. Background

The concept of minimal service, low-price grocery retailing dates back to the advent of the supermarket in the 1930s. Independent grocers in selected areas have successfully operated warehouse stores for decades. However, it was not until the economically turbulent 1970s that the warehouse store began making significant inroads in a number of urban grocery markets. Early warehouse efforts by chains such as Penn Fruit, Thriftmart, Acme and A&P were primarily last-ditch attempts to save failing stores (Progressive Grocer 1972). Although many of those conversions ultimately failed, successful adaptation of the format throughout the 1970s and 1980s resulted in warehouse and super warehouse stores' capturing 30% or more of sales in some markets.

The latest addition to the economy type supermarkets are "hypermarkets," which are giant food and nonfood stores requiring a buying market of about 500,000 people within 20 miles. There were only an estimated 12 hypermarkets in operation in 1990 (Gilbert 1990). Throughout this paper, warehouse stores, super warehouse stores, and hypermarkets will be considered as different store formats and will be referred to separately by those names, and collectively under the rubric "depot stores." In total, "depot stores" accounted for 15 percent of U.S. supermarket sales in 1989. (Progressive Grocer, 1990).

In this article, we focus on the competitive impact of depot stores during the period 1977-1987. These stores represent new retail "formats" with substantially lower costs and prices than traditional supermarkets (Progressive Grocer 1985; Grocer's Spotlight 1985; Supermarket News 1986).

The significantly lower prices in depot stores has led to aggressive responses by some

conventional supermarkets when depot stores invaded their territory. A recent study of the Washington, D.C. market is a case in point. At Giant and Safeway stores not located near a warehouse store, prices were 13 percent higher than Shoppers Food Warehouse stores and nearly 20 percent above Food Lion, a new discount price entrant (Swisher 1990). However Giant and Safeway stores located near a depot store had prices that were 7 to 13 percent lower than their remaining stores. Zone pricing, as this type of geographic price discrimination is called in food retailing, has been used in response to depot stores in Indianapolis, Chicago, San Antonio, Atlanta and numerous other markets. In other markets, conventional supermarkets have avoided a price response and have countered depot stores by emphasizing quality and service attributes.
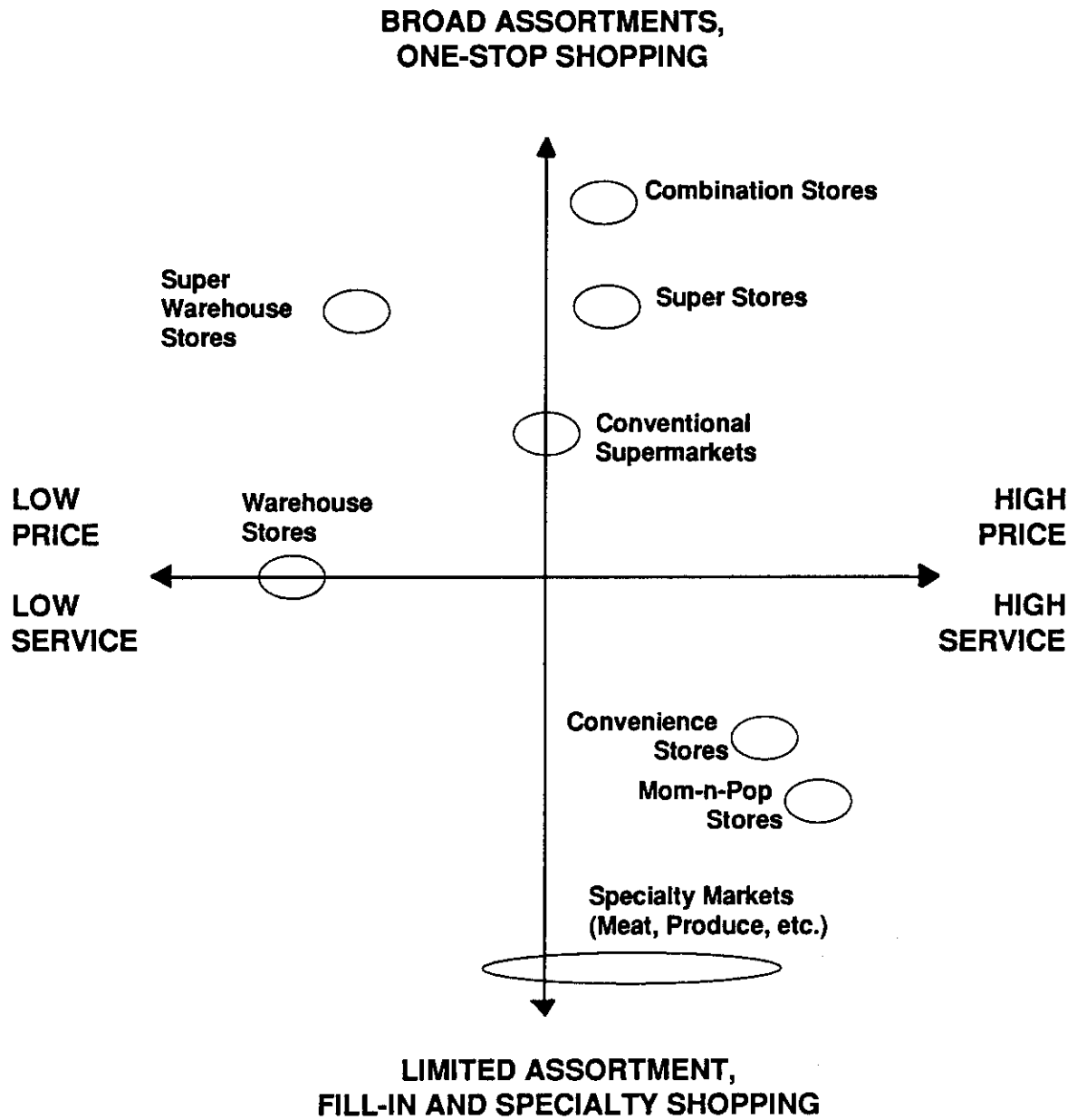
We believe that in most markets which depot stores have successfully entered, their presence will provide a downward pressure on market prices. This is the primary hypothesis that this study tested. Additional hypotheses tested are that when other factors are held constant, change in market concentration will be positively related to change in food prices, and denovo entry will be negatively related to change in prices.

Strategic Groups in Retail Food Markets

Porter (1979) comments: "An industry can...be viewed as composed of clusters or groups of firms, where each group consists of firms following similar strategies in terms of key decision variables....I define such groups as strategic groups" (p. 215).

Marion (1984) has suggested that each of the food store formats illustrated in Figure 1 is a strategic group. Each format offers a unique mix of price, service, and products. The eight strategic groups in Figure 1 fall into at least two relevant markets: those on or above the horizontal axis compete with each other for the major shopping trips of consumers; the remaining three groups

2

Figure 1. Retail Food Store Formats

BROAD ASSORTMENTS,
ONE-STOP SHOPPING

Combination Stores

Super Stores

Super
Warehouse
Stores

Conventional
Supermarkets

LOW
PRICE

Warehouse
Stores

HIGH
PRICE

LOW
SERVICE

HIGH
SERVICE

Convenience
Stores

Mom-n-Pop
Stores

Specialty Markets
(Meat, Produce, etc.)

LIMITED ASSORTMENT,
FILL-IN AND SPECIALTY SHOPPING

largely compete for fill-in shopping. The major shopping market can be labelled the "supermarket market". The stores in this market account for about 75% of food store sales and have the greatest effect on prices charged to consumers.

To have a positive effect on supermarket rivalry, depot stores must capture or be expected to capture a significant share of the "supermarket market." If they never capture more than 1 or 2 percent of a market's sales, depot stores would be part of the fringe that the major competitors can ignore. Some observers have estimated the market share potential of depot stores at 15-20% (Supermarket News 1983, 1984). Depot stores have already far exceeded this share in a few markets. Thus, these stores hold the potential of increasing the number of strategic groups and adding a significant competitor in many metropolitan areas. Those incumbent strategic groups that are strategically closest to the new group are expected to be affected the most and to respond the most aggressively.

New strategic groups may provide a means of circumventing entry barriers, at least in the short-run. Because depot stores represent a significant innovation in the retailing of food with particular appeal to price-oriented customers, they provide a means of overcoming the significant barriers to entry into the supermarket sub-market of many metropolitan areas.[1]

Thus, depot stores may enhance rivalry in the supermarket sub-market for several reasons: 1) they represent a means of circumventing entry barriers so that denovo entry by depot stores is more likely than denovo entry by conventional supermarkets or superstores, and 2) they represent

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[1] The development of a new strategic group in a market requires denovo entry and capacity expansion in many cases. This has been true with depot stores in some MSA's, although in the majority of MSA's examined, depot stores were first introduced by supermarket firms already in the MSA.

4

new strategic groups which are likely to reduce the ability of incumbent supermarkets to coordinate their competitive actions. Because depot stores emphasize low prices, their presence is likely to stimulate price rivalry rather than non-price rivalry.

The first factor--lower entry barriers for depot stores--will affect market rivalry primarily during the period of entry and market penetration. Although the existence of warehouse store companies "waiting in the wings" could also affect competition in markets they have not yet entered, we believe potential entrants are more likely to affect the competitive behavior of incumbent firms in the same strategic groups (i.e., other depot stores), than stores in other strategic groups. Thus, we hypothesize that the prices of incumbent superstores and conventional supermarkets will mainly be affected by actual entry of depot stores as compared to potential entry.

Significant denovo entry is normally expected to affect market rivalry simply because of the addition of capacity and the resulting displacement effect of the new entrant. The entry of depot stores is expected to have an additional impact on market prices because of the substantially lower prices of these firms.

Whether depot stores have a negative influence on market prices beyond the entry and market penetration period remains to be seen. If Porter is correct, oligopolistic coordination will be more difficult where depot store strategic groups exist; rivalry will be greater and prices lower. However, this is a hypothesis that remains to be tested. In addition, depot stores are likely to reduce average market prices vis a vis markets in which there are no depot stores because of the lower prices in depot stores. Even if market segmentation in a new equilibrium results in conventional supermarket and superstore prices returning to levels similar to markets in which depot stores are not present, depot stores are expected to continue to charge lower prices. Their

5

effect on average market prices would depend upon their market share.

There are few markets (if any) where depot stores have achieved their market share potential and a new equilibrium has emerged. Thus, for the period examined in this study, we will primarily be examining the price effects of depot store introduction and expansion.

Assessing the Impact of Warehouse and Super Warehouse Stores on Retail Food Markets

When warehouse or super warehouse stores or hypermarkets enter a market, we expect them to reduce the prices paid by consumers in two ways. First, since these stores carry significantly lower prices than conventional supermarkets, consumers who shop at depot stores receive directly the benefits of their lower prices. In addition, we expect the entry of depot stores to trigger price reductions by some incumbent retailers. Consumers shopping at the latter stores receive the "indirect" benefits of depot stores. Both sources of price reduction must be combined to understand the full impact of depot stores on market prices.

Unfortunately, data appropriate to assess both effects are unavailable. First, the most accurate and readily available price data, the Consumer Price Index (CPI) published by the U.S. Department of Labor, Bureau of Labor Statistics (BLS), do not allow meaningful comparisons of price levels across metropolitan areas. (U.S. Department of Labor 1984, p. 6) Thus, it is necessary to restrict interarea analyses to comparisons of price changes over time. Second, the CPI does not capture the full effects of depot stores on area prices because BLS methodology intentionally obscures the "direct effect" of new outlets. Since BLS procedures are not widely understood and have a major influence on the meaning of the CPI for food consumed at home, we digress briefly to examine BLS methodology.

A. The Food At Home Component of the CPI

The primary objective of BLS in calculating the CPI is to measure changes in price for a fixed basket of goods and services, not to measure the prices consumers actually pay in the market. Stated differently, the intent is to create a price index, not a cost of living index. Thus, to maintain comparability of the CPI over time, BLS attempts to "filter out" what it perceives as qualitative changes in the goods and services being priced.

To obtain a representative sample of food and other items with which to monitor price changes in an area, BLS combines information from two surveys, the Consumer Expenditure Survey (CE) and the Continuing Point of Purchase Survey (CPOPS). The CE has been conducted approximately once every ten years, and provides information on the absolute and relative amounts spent by consumers on various categories of goods and services in different BLS regions. The CPOPS has been conducted since 1977, and is intended to provide data for periodically updating the sample of outlets at which CPI items are priced; each year, one-fifth of the 87 metropolitan areas regularly surveyed by BLS are updated.

When the CPOPS updates the sample of outlets (and, hence, the specific items priced), it is necessary for BLS to "blend in" the price data obtained based upon a new CPOPS sample. To do so, in one month the BLS obtains prices for both the old and the new samples of outlets and items for the area being updated. Published CPI figures for that month are based on the price relative from the preceding to the current month in the old sample only; in the following month the CPI is based on the price relative in the new sample only. Using this procedure, BLS is able to blend in the price data from the new sample without directly comparing the price levels of the two different samples. A stylized example is:

Market Basket Cost	April	May	June
Old Sample w/o Depot Stores	$110	$121	----
New Sample w/ Depot Stores	----	$100	$110
CPI	100	110	121

Continuity of the CPI is maintained since BLS computes the CPI by a "chaining process" using price relatives, not price levels. In this process, the price relatives from the new sample are multiplied by the estimates (based on the old sample) of the previous month's expenditures in the stratum. Thus, in the above example, the CPI change from April to June is 21 percent.

In general, then, published CPI figures conceal reductions in area price levels that directly result from depot store entry. In the above example the published CPI figures would accurately reflect the monthly 10% increase in prices, but they would hide the lower level of prices in the new sample. Furthermore, the BLS holds weights given to different outlets constant between CPOPS surveys. So, even though depot stores might be represented in the BLS sample, the CPI would conceal any effect on area price levels due to increases in the market share of depot stores.

Note, however, that the CPI does capture the extent to which depot stores affect the prices charged by incumbent supermarkets--what we refer to as the indirect effect.[2] This price effect is the main one we will examine since data don't exist on the CPI of depot stores alone.

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[2]Since the relative weights given different outlets are held constant between CPOPS surveys, if warehouse stores are eroding the market position of incumbent supermarkets the indirect effect of depot stores on changes in market prices may be somewhat overstated.

B. The Model

Our analysis focuses on changes in food prices across markets. We limit our attention to large, urban metropolitan areas for which BLS data are available.

The model empirically tested is of the form:

$$Y = \alpha + \beta_i X + \beta_j Z + e$$

where the dependent variable (Y) is the percentage change in the BLS Food- at-Home Price Index, X represents a set of binary variables reflecting depot store activity, and Z are control variables suggested by economic theory that affect changes in retail food prices. The analyses are performed on two data sets. One is a set that pools annual percentage price change observations from 1977-1987 across 25 Metropolitan Statistical Areas (n = 249). The second set contains the percentage price change during the ten year period, 1977-1987, for 25 MSAs (n = 25).

1. The Variables and Their Measurement in the Pooled Data Set

Change In Food Prices: The annual percentage change in the BLS CPI for Food-at-Home for each MSA was calculated from the average annual price index published for each of 25 MSAs in the CPI detailed reports. These data are based on a sample of all food stores, and thus include a number of store types (e.g., convenience stores, meat markets, produce markets) that ideally would be excluded for purposes of this analysis. However, the prices of small stores and specialty markets receive relatively little weight in nearly all MSAs.

Depot Share Variables: Our hypothesis is that the emergence of a strong depot store strategic group(s) in a market results in lower food prices in that market. Since the lower prices charged by depot stores is not directly captured by BLS data, and since we are restricted to analyzing food price changes (not levels), our testable hypothesis is that markets with strong depot groups

experience a reduction in food prices or a smaller increase in food prices compared to markets

without a significant depot store presence.

To test this hypothesis, five binary "dummy" variables were constructed to reflect the depot

share[3] in a market in year t:

$$1\% < D_1 \le 5\%$$
$$5\% < D_2 \le 10\%$$
$$10\% < D_3 \le 20\%$$
$$20\% < D_4 \le 30\%$$
$$30\% < D_5$$

Change in Concentration: The linkage between market concentration and market prices has been

well established by over 75 studies in a wide variety of industries (Weiss, 1989). The relationship

between change in concentration and change in price has received much less attention. However, at

least one study has found evidence of a long run relationship between changes in concentration and

changes in prices in the food and tobacco manufacturing industries (Kelton 1982). That evidence,

plus the logical extension of the concentration level-price level relationship, suggests that a change

in concentration variable should be tested in this model. Four-firm concentration ratios were

calculated from shares reported by Metro Market Studies, with some adjustments.[4]

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[3]Depot shares were estimated using a variety of trade sources, including Metro Market Studies, Supermarket News, Market Scope, and others. The imprecise nature of the estimates obtained from such sources prevented us from constructing a reliable continuous measure of depot store shares.

[4]Since publication of Metro data lags collection of that data by one to two years, CR_4t was first calculated as the average of Metro $CR4_{t+1}$ + Metro $CR4_{t+2}$. The resulting figure was then adjusted by the ratio for that market: (1977 Census CR4)/ (1977 Metro CR4), or 1982 Census CR4/1982 Metro CR4, or a combination of these ratios.

The following table shows the weights assigned to each coefficient of adjustment for all the years:

Change in Per Capita Income: Per capita income may influence store prices in at least two ways. First, demand is more inelastic in high income markets. This means that the monopoly price is higher in high income compared to low income markets. Second, as income per capita in an MSA increases, consumers are expected to shift their purchases towards higher priced products and towards stores with higher levels of service. The long-run effects of these shifts would be an increase in food store sales that stem in-part from higher prices and in-part from changes in products sold.[5]

The percentage change in personal disposable income was calculated using Sales and Marketing Management's (S&MM) estimate of "Effective Buying Income," as reported in the Annual Survey of Buying Power.

Change in Population: Change in population is a measure of growth in the MSAs examined. A faster rate of growth in population would be expected to expand demand and increase prices, all else the same. Rapid growth is likely to result in high capacity utilization. Conversely, slow or negative growth is more likely to encounter over capacity, greater rivalry and lower prices. Thus a

Year:	77	78	79	80	81	82	1983 to 1987
Coef1: (C77/M77)	(1)	(.8)	(.6)	(.4)	(.2)	(.0)	(.0)
Coef2: (C82/M82)	(.0)	(.2)	(.4)	(.6)	(.8)	(1)	(1)

[5]Given the relatively short period of this empirical study and BLS methodology, it may not be possible to detect the expected positive relationship between price change and income change. For the five year periods between CPOPS surveys, the products and outlets on which BLS collects prices and the weights used are held constant. If consumers shift towards higher service stores as incomes increase, that will only be detected by BLS when a new CPOPS survey is conducted. Then--because of the bridging procedure followed, the shift in consumer patronage to high service-high priced stores (or low price stores) is not allowed to influence the change in CPI. Thus the nature of the BLS data set conceals certain effects of changes in income.

positive sign is expected. We measure this variable by calculating the percentage change in population as estimated in S&MM's survey of buying power.

Change in Operating Costs: The combination of utility and rental costs account for 10-12% of grocery store operating costs and roughly 2% of grocery stores sales. As a proxy for the cost of these inputs to store owners, CPI data for fuels and for residential rent were combined to form an "energy plus rent" price index. The annual percentage change in this index was then calculated. The "energy plus rent" index was calculated as a simple average of the two price indices since grocery industry data show that utilities (excluding telephone service) accounted for roughly the same percentage of operating costs as did rent payments during 1978-1982 (Progressive Grocer, April 1983 p. 96). We expect that price changes for these inputs are similar for consumers and commercial purchasers.

Labor Costs: By far the largest single operating expense for food stores is payroll, accounting for nearly 60% of operating expenses (Progressive Grocer 1985). Lamm and Wescott (1981) found changes in wages of food and grocery store employees to be a large and significant factor contributing to national changes in grocery prices over time. Such wage changes differ considerably across markets due to, inter alia, differing levels of unionization and union success in affecting wages (Lamm 1982; Harp 1979), and differing levels of unemployment.

The effects of changing wage rates on prices depends upon the extent to which productivity also changes. Thus, payroll per dollar of sales is preferred to wage rates as a measure of labor costs since it incorporates changes in wages, productivity and the mix of employees (part-time v. full-time). Change in labor costs were measured as the annual percentage change in payroll as a

percent of sales:[6]

$$\Delta\ PAYRAT = \left[\frac{(Payroll_t\ /Sales_t)}{(Payroll_{t-1}\ /Sales_{t-1})}\right] - 1.0$$

Entry: In some markets, depot stores have been developed by supermarket firms already in the market. In other cases, depot stores were introduced by new entrants. In the latter cases, a new competitor is added to the market whereas in the former cases, only a new strategic group is added. We hypothesize that the response of the market will be different in the two situations. An entry dummy variable is included in most models to distinguish between the two methods of introducing depot stores and to also capture the effects of denovo entry by major supermarket firms. The dummy variable has a value of one for the year of entry and the following year. A negative sign is expected.

2.   Variables in Cross-Sectional Analysis of Average Price Changes for 1977-1987 Period.

Whereas the previous data set is used in pooled time series-cross sectional analysis in which the dependent variable is year to year percentage changes in prices, the cross sectional analysis examines average price changes over the period 1977-1987. The dependent variable is the simple average of year to year changes in the Food at Home CPI over the ten-year period based upon BLS data.

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[6]Payroll data were calculated from Bureau of Census County Business Pattern data which reports gross wages and other compensation for civilian employees of food stores. The geographic areas for these data were generally identical to BLS areas. Sales data for each MSA and year were from S&MM Survey of Buying Power, which estimates sales of stores selling food primarily for home consumption.

13

The market share of depot stores changed considerably in some MSAs over the ten years studied. Thus, the presence of depot stores was measured by the average annual change in depot store shares over the ten year period. Three binary variables were used to designate three rates of growth:

$$0 < D_1 \leq 1\%$$
$$1\% < D_2 \leq 2\%$$
$$2\% < D_3$$

Average annual change in concentration used the data discussed above and were calculated as the simple average of the ten annual changes. The percentage changes in per capita income and labor costs were calculated for the entire ten year period in a similar manner as the dependent variable.

Variables analogous to the population change and energy plus rent cost change for the ten year period were constructed and included in preliminary analysis. However, collinearity problems and the limited degrees of freedom in this data set resulted in our omitting these variables from subsequent analyses.

Empirical Results

A. Pooled Data Set

The pooled data set consisted of 249 observations: ten annual observations for 24 geographic markets for the years 1977-1987, plus nine annual observations for the Miami MSA (data for 1977 were unavailable). The average annual percentage changes in the Food-at-Home CPI for observations grouped by depot market share are shown in Table 1. On average, the percentage change in CPI drops as depot store shares increase up to 20 to 30 percent of the market.

Table 1. Descriptive Statistics, Pooled Data Set

Depot Shares	D0 0	D1 $0 < D_1 \leq 5\%$	D2 $5 < D_2 \leq 10\%$	D3 $10 < D_3 \leq 20\%$	D4 $20 < D_4 \leq 30\%$	D5 >30%
Average Annual % ΔMSA CPI	6.57%	5.48%	4.33%	4.00%	1.87%	3.30%
Average Annual % ΔMSA CPI - ΔU.S. CPI	.182	-.016	-.003	-.412	-.776	+.330
Average Annual % ΔCR4	1.16%	-.41%	1.27%	1.40%	-.47%	-1.08%
# Observation	113	37	49	30	10	10
# Areas	18	15	16	10	4	3

The regression model estimated using the pooled data set was:

$$FOODP_{it} = \alpha + \text{\ss}_1 D1_{it} + \text{\ss}_2 D2_{it} + \text{\ss}_3 D3_{it} + \text{\ss}_4 D4_{it} + \text{\ss}_5 D5_{it} + \text{\ss}_6 \Delta CR4_{it} + \text{\ss}_7 E_{it} + \text{\ss}_8 \Delta INC_{it} + \text{\ss}_9 \Delta POP_{it} +$$

$$\text{\ss}_{10} \Delta FRP_{it} + \text{\ss}_{11} \Delta PAYRAT_{it} + \text{\ss}_j Tj_t + e_{it}$$

where:

i,t = area, year subscripts;

FOODP = percentage change in BLS Food-at-Home price index   **Expected Sign**
         expressed in decimals

D0 = 1 if depot store share is < 0

D1 = 1 if depot store share is $0 < D_1 \leq 5\%$, 0 otherwise   <0

D2 = 1 if depot store share is $5 < D_2 \leq 10\%$, 0 otherwise   <0

D3 = 1 if depot store share is $10 < D_3 \leq 20\%$, 0 otherwise   <0

D4 = 1 if depot store share is $20 < D_4 \leq 30\%$, 0 otherwise   <0

D5 = 1 if depot store share is >30%, 0 otherwise   <0

ΔCR4 = change in CR4 expressed in decimals   >0

Entry dummy = 1 if denovo entry by depot store or major supermarket firm occurred
    during year or during previous year < 0

ΔINC = percentage change in per capita disposable income expressed in decimals > 0

ΔPOP = percentage change in population expressed in decimals > 0

ΔFRP = percentage change in price index of energy plus rent in decimals > 0

$\Delta PAYRAT$ = percentage change in payroll/sales expressed in decimals > 0

Tj_t = 1 when year = t, 0 otherwise. An alternative variable,
    the change in the U.S. Food-At-Home CPI, was used in
    some models instead of the time dummies $\neq 0$

      The set of time-related dummy variables was introduced to control for the impact of other trend-related factors on food price such as inflationary expectations, recession, and worldwide price fluctuations. Without a time trend, these factors would be partially captured by the warehouse dummies since warehouse market share generally increases with time. The percentage change in the U.S. food-at-home CPI was used instead of time dummies in some models. The annual change in this index ranged from slightly over 10% to 1% during 1977-87.

      Tests on OLS residuals showed a strong positive correlation between the logarithm of the squared residuals and the logarithm on the concentration ratio so that we may assume that Var $(e^{2)}$ = $\beta_o CR4_\beta$. Table 2 shows the OLS and GLS regression results for the pooled data set.

<u>Analysis</u>: Regression results strongly support our hypothesis that the introduction of depot stores and the increase in their market share affected food prices negatively. Whenever depot stores made significant inroads into a market, capturing 10 to 20% (D3) or 20 to 30% (D4), a marked slowdown

Table 2. Regression Analysis Explaining Annual Change in BLS Food-At-Home Prices in 25 Metropolitan Areas, 1977- 1987[1] (Pooled Time-Series/Cross Section Data Set, n=249)

	OLS Coeff.	(t-stat)	GLS Coeff.	(t-stat)
Intercept	.0376	(10.07)**	.0362	(9.97)**
D1	-.0002	(-0.06)	-.0008	(-0.30)
D2	-.0011	(-0.44)	-.0012	(-0.50)
D3	-.0054	(-1.87)*	-.0060	(-2.09)*
D4	-.0083	(-1.76)*	-.0060	(-1.39)+
D5	.0029	(0.61)	.0042	(1.02)
ΔCR4	.0470	(2.49)**	.0664	(3.80)**
ΔINC	.0286	(0.92)	.0505	(1.64)+
ΔPOP	.0481	(1.04)	.0604	(1.30)
ΔFRP	.0071	(0.36)	-.0051	(-0.25)
ΔPAYRAT	.0029	(0.26)	.0091	(0.88)
Entry	-.0121	(-3.01)**	-.0074	(-1.57)+
T78	.0638	(14.82)**	.0635	(14.54)**
T79	.0693	(15.01)**	.0693	(14.76)**
T80	.0340	(6.90)**	.0366	(7.34)**
T81	.0323	(7.07)**	.0325	(7.11)**
T82	-.0027	(-0.64)	-.0021	(-0.48)
T83	-.0211	(-5.19)**	-.0215	(-5.31)**
T84	-.0055	(-1.34)	-.0116	(-2.84)**
T85	-.0218	(-5.65)**	-.0228	(-5.87)**
T86	-.0084	(-2.15)*	-.0103	(-2.60)**
R^2	.8721			
$\bar{R}^2$	.8609			
F				

[1]1978-87 for Miami

in food price increases was apparent. We note, however, that the coefficients on D1 and D2 are not statistically significant, indicating that these levels of entry were insufficient to significantly affect prices market-wide.

Keeping in mind that our dependent variable is the annual percentage change in BLS prices, one plausible explanation for the positive sign on D5 is that a new equilibrium was achieved in the three MSAs in which depot store shares exceeded 30 percent. Although food price levels may have been relatively low in these areas, the market reaction (so-called indirect effect) to depot stores may have played itself out. If the market penetration of depot stores plateaued, incumbent supermarkets (and their depot store competitors) may have decided it was time to raise prices. A positive sign for D5 could be the result.

From a theoretical perspective, one of the more interesting results is the strong positive impact of an increase in the four-firm concentration ratio on food price increases. Of all the variables except the time dummies, this variable has the largest "t" value in the GLS results. A 10 percentage point increase in CR4 was associated, on average, with an increase in food prices of .66%.

The entry variable also had the expected sign and was marginally significant. Thus, when depot stores were introduced into an MSA by denovo entry, the prices of incumbent supermarkets were negatively affected even more than when the depot stores were introduced by an incumbent retailer. Based upon the GLS coefficients, the entry effect on prices was roughly equal to depot stores capturing 10 to 30% of the market.

Of the remaining control variables, only the change in per capita disposable income was significant in the GLS results (and positive as hypothesized). The two variables used as proxies for

cost increases were never significant. Change in population was positively linked to change in food prices but was not quite significant at the 10% level.

B. Cross Section Data Set

The cross section data set consisted of 25 observations. The percentage changes in the Food-at-Home CPI for areas grouped by average annual depot share growth were:

	Δshare=0	D_1 0<Δshare$\leq$1	D_2 1<Δshare$\leq$2	D_3 Δshare >2%
Annual ΔCPI, 1977-1987	5.58%	5.28%	5.17%	5.21%
Annual ΔCR4, 1977-1987	1.20	1.26	0.96	-1.49
# Observations	8	7	7	3

The regression model estimated using the cross-section data was:

$$AFOODP_i = \alpha + \beta_1 D1_i + \beta_2 D2_i + \beta_3 D3i + \beta_4 ACR4_i + \beta_5 AINC_i + \beta_6 APOP_i + \beta_7 APAYRAT_i + e_i$$

Expected sign

$AFOODP_i$ = annual average percentage change in BLS Food-At-Home price index for MSA i over the period 1977 to 1987.

D1 = low growth binary variable, value = 1 if average annual change in depot share is greater than 0 and less than or equal to 1, other wise 0.;   <0

D2 = medium growth binary variable, value = 1 if average annual change in depot share is greater than 1 and less than or equal to 2, otherwise = 0;   <0

D3 = high growth binary variable, value = 1 if average annual change in depot share is greater than 2, otherwise = 0;   <0

ACR4 = annual average percentage point change in concentration ratio during the period 1977 to 1987.   >0

AINC = annual average percentage point change in per capita disposable income for period 1977 to 1987.   >0

19

APOP = annual average percentage point change in population   >0
       during 1977 to 1987.

APAYRAT = annual average percentage point change in payroll/sales
       ratio during 1977 to 1987.   >0

Whereas the pooled data analysis allowed us to examine whether a certain degree of market penetration by depot store was necessary to affect prices, the cross-section analysis examines the effect of varying rates of growth of depot stores on market prices.

The regression results on the cross-section data indicate that a medium growth rate in market share by depot stores seems to have the strongest negative effect on market price (Table 3). Although all three depot store dummies have a negative sign only D2 (annual share growth of 1 to 2 percent) is significant in the GLS results.

Change in CR4 is once again positive and significantly related to change in market prices. The coefficient on ΔCR4 is very similar for the cross section and pooled data. In the cross section analysis, change in population is also significant and positively related to change in food prices.

The lack of significance of D3 -- rapid growth of depot store share -- is somewhat puzzling. Three MSAs account for all the observations here. And these MSAs are also the only ones in which depot store share exceed 30% (D5=1 in pooled analysis). Tables 2 and 4 indicate a positive coefficient for D5 -- though not significant. However, it appears from these results that the negative influence of depot stores on price changes in these three MSAs has run its course.

Figure 2 supports this conclusion. For the three MSAs in which depot stores have had the greatest penetration, the negative effect on market prices was largest when the market share of depot stores was 10 to 20 percent. Figure 2 shows the change in food prices at the MSA level relative to the U.S. change in food prices. Thus, after adjusting for the change in U.S. CPI for
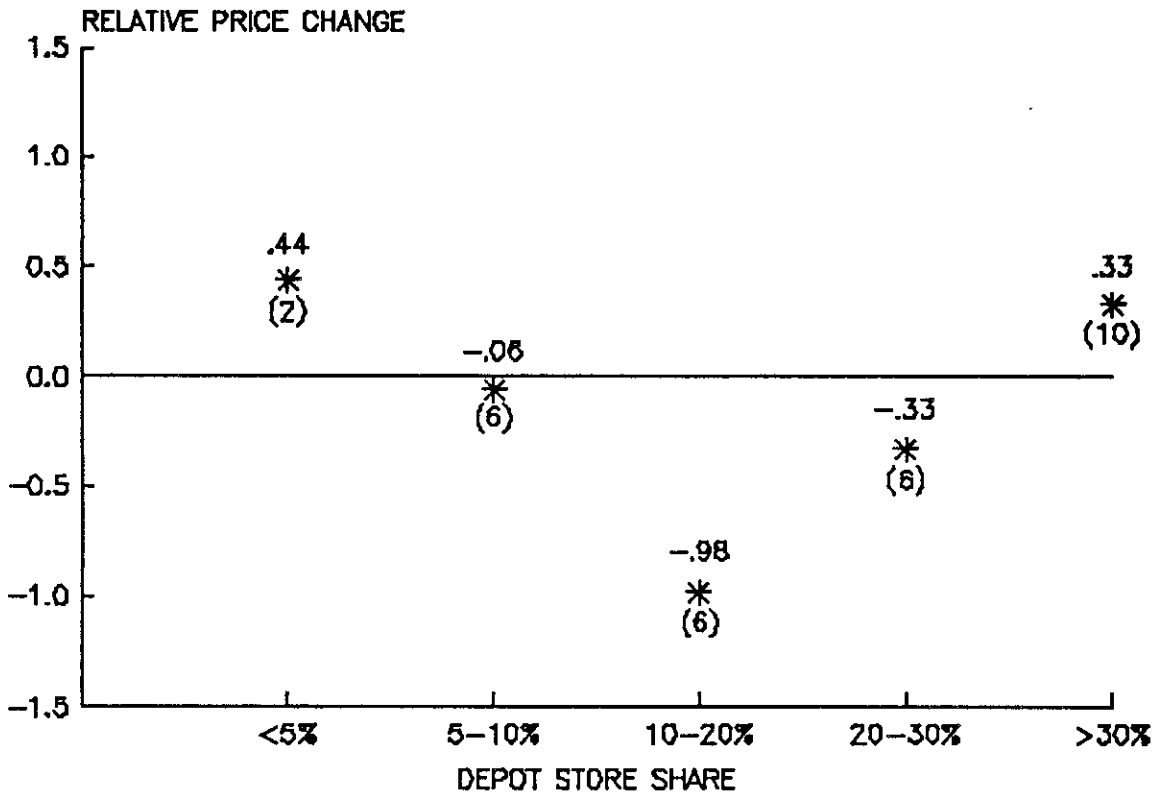
Table 3. Impact of Depot Market Share on Area Food Prices, 1977-1987[1]

(Cross-Section Data Set, n=25)

	OLS		GLS	
	Coeff.	(t-Stat)	Coeff.	(t-Stat)
Intercept	.0489	(6.55)	.0563	(12.10)
ACR4	.0639	(1.22)	.0710	(2.40)*
APOP	.0610	(0.87)	.1200	(1.95)*
ADISPOP	.0678	(0.74)	-.0422	(-0.71)
APAYRAT	.0347	(0.59)	-.0034	(-0.06)
D1	-.0031	(-1.47)*	-.0018	(-1.08)
D2	-.0050	(-2.25)*	-.0040	(-1.94)*
D3	-.0021	(-0.65)	-.0011	(-0.58)
R^2	.369			
$\bar{R}^2$	.109			
F	1.42		1743.5	

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[1]1978-87 for Miami

21

FIGURE 2. RELATIVE PRICE CHANGE IN MSA'S WITH RAPID DEPOT SHARE GROWTH, 1977-87.

RELATIVE PRICE CHANGE

```
 1.5 ┬

 1.0 ┤

            .44                                              .33
 0.5 ┤       *                                                *
            (2)                                              (10)
            
             -.06
 0.0 ┼───────*──────────────────────────────────────────────────
            (6)                             -.33
                                             *
-0.5 ┤                                      (6)

                           -.98
-1.0 ┤                      *
                           (6)

-1.5 ┴─────┼───────┼────────┼────────┼────────┼
          <5%    5-10%    10-20%   20-30%    >30%
              DEPOT STORE SHARE
```

NOTE: NUMBER OF OBSERVATIONS IN ( ).

22

food-consumed-at-home, the prices in these three MSAs dropped by nearly 1 percent during each year in which depot stores had 10-20 percent of the market. By the time depot stores had captured over 30 percent of the market, food prices in these MSAs were increasing slightly faster than the national average.

Different Model Specifications

Table 4 provides regression results in which the time dummies are replaced with a variable measuring the change in U.S. CPI for food-consumed-at-home. With this model specification, neither serial correlation nor heteroscedasticity are a problem. Thus, the results in Table 4 are OLS.

Table 4 results using the full sample are similar to the OLS results in Table 2. Depot stores have a significant negative effect on the rate of MSA price increase when depot store share is between 10 and 30 percent. Entry also has a significant negative impact on price increases. Change in four-firm concentration has a significant positive effect as in the Table 2 models. The change in U.S. CPI for food-consumed-at-home has the expected strong positive relation to price changes in MSAs.

Table 4 also examines two subsets of the sample, one in which depot stores were present but grew slowly during 1977-87, and one in which depot stores experienced medium growth during that period. Omitted from both of these data sets are 29 observations in three MSAs with rapid depot store growth and 81 observations in MSAs with no depot store presence.

In the MSAs with slow growth of depot store share a negative influence is indicated when depot stores achieve a 5 to 10 percent market share. The entry variable is negative and significant but the coefficient on change in CR4 drops to insignificance.

Table 4 OLS Regression Analysis Explaining Annual Change in BLS Food-at-home Prices in 25 MSAs, 1977-1987, Without Time Dummies.

	Full Sample		Slow Grth		Medium Grth	
	Coeff.	"t" Stat	Coeff.	"t"	Coeff.	"t"
Intercept	.0021	0.75	.0109	1.67	.0104	1.17
D1	-.0001	-0.05	-.0026	-0.63	.0050	0.71
D2	-.0018	-0.72	-.0071	-1.57+	.0006	0.09
D3	-.0062	-2.19*			-.0055	-0.85
D4	-.0087	-1.86*			-.0202	-1.97*
D5	.0010	0.21				
ΔCR4	.0379	2.06*	.0050	0.15	.1497	2.43**
ΔINC	.0335	1.13	-.0171	-0.34	.0140	0.19
ΔPOP	.0323	0.70	.0794	1.10	-.0531	-0.48
ΔFRP	.0042	0.28	-.0299	-0.80	.0010	0.04
ΔPayrat	-.0019	-0.18	.0286	1.51	-.0050	-0.24
ENTRY	-.0119	-3.02**	-.0106	-2.22*	-.0321	-3.33**
ΔU.S. CPI	.9320	28.29**	.9228	15.52**	.8260	9.87**
n	249		70		69	
$\bar{R}^2$	.858		.896		.790	
F	125.4		67.3		24.2	

In the MSAs with medium growth of depot stores, a significant negative impact is not indicated until depot stores achieve a 20 to 30 percent share. Change in CR4 has a significant positive effect on price increases and entry has a significant negative effect.

Although D3, a depot store share of 10 to 20 percent, has a significant negative effect in the full sample, it is not significant in the smaller samples. Apparently the significance in the full sample is due to the six observations in rapid growth MSAs that are not included in the slow growth and medium growth samples.

Summary and Conclusions

The analysis in this paper indicates that metropolitan areas with a significant presence by depot stores experienced lower retail food price increases during the ten year period studied than did areas without warehouse store activity. The point at which this negative influence is exerted seems to vary some for different MSAs. No significant effect was found where depot stores had less than a 5 percent market share. In some MSAs, a negative effect was found when depot stores had 5 to 10 percent of the market. For all MSAs, however, the negative influence of depot stores became statistically significant when the depot store share was between 10 and 30 percent. In the three MSAs in which depot shares exceeded 30 percent, food prices increased faster than average. Thus, there is some evidence that the negative influence of depot stores eventually runs out of steam. A new equilibrium may emerge at that point.

The results are consistent with the hypothesis that depot stores constitute a strategic group that is sufficiently interdependent with other supermarket formats to be an important competitive force that increases rivalry and leads to substantial consumer benefits. The results provide at least modest support for Porter's hypotheses concerning the rivalry effects of strategic groups.

25

Additional insights into the competitive behavior of retail food markets can be gained by considering the structure and conduct characteristics of strategic groups.

The results also support the hypothesis concerning the price effects of entry. Entry of a "significant competitor" had a consistent negative influence on food price increases in the two years following entry.

The results also support the hypothesis that retail food prices are positively related to MSA concentration. Although in this case, change in retail prices was related to change in concentration, the main theoretical basis for testing such a relationship is that concentration and price are expected to be positively linked.

This finding takes on added significance given the "no relationship" findings of the recent USDA study (Kaufman and Handy, 1988) and the agnostic review of food retailing structure - performance studies by Anderson (1990). The results of this study are consistent with five other studies that found a significant positive relationship between grocery store prices and the concentration of sales in local markets (Marion et al 1979; Hall, Schmitz and Cothern 1979; Lamm 1981; Meyer 1983; Cotterill 1986). The results are also consistent with Weiss's conclusions after his massive review of concentration-price studies in a wide variety of industries (Weiss 1989).

One implication of these results is the importance of ensuring that markets are free of any artificial barriers to the entry of new competitors -- especially depot stores. Depot store entrants are vulnerable to predatory pricing by incumbent chains (Mueller 1984).

Finally, the study has raised a question regarding the extent to which published CPI data accurately reflect changes in food prices facing consumers in areas with a significant depot store presence. This is a matter of which the BLS is well aware and which they face in any consumer

goods market in which discount outlets emerge. The changes in prices analyzed in this study reflect only the effects of warehouse stores on the prices of competing stores. Had the lower prices of depot stores been included in the data set (i.e., to constitute a cost of living index rather than a price index), the effects of warehouse stores would have been even greater. For example, if warehouse stores charge prices that average 7% less than conventional supermarkets and superstores, and if they achieve 30% of an MSAs sales, the actual cost of food to consumers in that market would be approximately 2% less than the CPI.

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