THE JOURNAL OF FINANCE • VOL. L, NO. 4 • SEPTEMBER 1995

Do LBO Supermarkets Charge More? An Empirical Analysis of the Effects of LBOs on Supermarket Pricing

JUDITH A. CHEVALIER*

ABSTRACT

This article examines changes in supermarket prices in local markets following supermarket leveraged buyouts (LBOs). I find that prices rise following LBOs in local markets in which the LBO firm's rivals are also highly leveraged and that LBO firms have higher prices than their less leveraged rivals, suggesting that LBOs create incentives to raise prices. However, I also find that prices fall following LBOs in local markets in which rival firms have low leverage and are concentrated. These price drops are associated with LBO firms exiting the local market, suggesting that rivals attempt to "prey" on LBO chains.

DURING THE LATE 1980S, an unprecedented number of firms undertook leveraged buyouts (LBOs) and other highly leveraged transactions. Because of this, leveraged buyouts have been the subject of a large body of empirical research in recent years. In particular, researchers have examined the effect of leveraged buyouts on firms' operating performance (Kaplan (1989) and Smith (1990)), capital expenditures (Kaplan (1989)), research and development (Long and Ravenscraft (1993)), and employment and compensation (Lichtenberg and Siegel (1990)). Nonetheless, there is currently very little work that examines whether leveraged buyouts affect firms' pricing and output behavior. This omission is surprising given the recent surge of theoretical interest in the interaction between firm capital structure and product market competition.[1]

This article investigates how LBOs affect the pricing behavior of firms and their rivals, using data from the supermarket industry at the local and firm level. The focus on the supermarket industry allows study of the effect of LBOs

* Graduate School of Business, University of Chicago. This is a revised version of Chapter 3 of my MIT dissertation. I am grateful to Chris James, Wally Mullin, Dick Schmalensee, Fiona Scott Morton, René Stulz, an anonymous referee, and especially David Scharfstein and Paul Joskow for comments and suggestions. I also appreciate the comments of seminar participants at the NBER 1993 Summer Institutes in Corporate Finance and Industrial Organization, the American Finance Association meetings, Cornell University, Harvard University, and the University of Maryland. Some of the data used in this paper were obtained from Information Resources Inc. with the help of John D.C. Little. Sabrina Bernold and Andrea Densham provided able research assistance. This work was supported by the Centel Foundation/Robert P. Reuss Faculty Research Fund at the Graduate School of Business at the University of Chicago.

[1] A partial list of theoretical papers examining this issue includes Brander and Lewis (1986), Fudenberg and Tirole (1986), Gertner, Gibbons, and Scharfstein (1988), Maksimovic (1988), Bolton and Scharfstein (1990), and Rotemberg and Scharfstein (1990).

on pricing behavior in a cross-section of local markets in a single industry. This allows an examination of whether LBOs affect pricing differently in markets with different competitive characteristics, holding industry fixed. I find evidence of price *increases* in a local market following the LBO of a supermarket chain operating in that market if, at the time of the LBO, rival firms are also highly leveraged. Price *decreases* following an LBO are associated with the presence of rival firms which are not highly leveraged, and the existence of a single large competitor with low leverage that controls a large share of the local market. These results are consistent with the hypothesis that a linkage exists between firm capital structure and product market competition and helps to complete our understanding of the behavior of LBO firms.

This article contributes to the small empirical literature on product market competition and increases in leverage. Chevalier (1995) examines the entry and exit behavior of supermarket chains following leveraged buyouts, but does not contain evidence on changes in supermarket prices following LBOs. In the only prior study of price changes following LBOs, Phillips (1995) examines changes in market prices following LBOs in four industries. It is impossible to ascertain from the results in Phillips (1995) what factors lead to a price increase in three of the markets, but a price decrease in the fourth. In contrast, this article focuses on a single industry, but examines a broad cross-section of local markets. Thus, I am able to study how prices change following LBOs in markets with different characteristics, holding industry constant. This article also differs from prior work because data on *firm-level* prices are used to study price *differences* between LBO and non-LBO firms.

This work also extends the previous research on LBOs. For example, Kaplan (1989) and Smith (1990) show that operating income rises following LBOs. Kaplan (1989) also shows that capital expenditures fall following LBOs. Lichtenberg and Siegel (1990) study the effect of LBOs on total factor productivity, employment, and compensation. They find that total factor productivity rises and that white-collar employment and compensation fall following LBOs. Long and Ravenscraft (1993) document a decrease in research and development activity following LBOs.

The entire body of research on the effects of LBOs suffers from the difficulty that one can never be certain that the LBO *caused* the change in operating income, capital expenditures, productivity, employment, or R&D expenditures. It may be that a common factor leads the firm to both undertake the LBO and to change its behavior. Unfortunately, this difficulty is also present in this paper, although steps have been taken to try to show that the measured pricing effects are caused by the LBO. I show that none of the pricing changes documented are a continuation of a pre-LBO trend in pricing and that the pricing effects begin to appear within 6 months following the LBO. The use of local market data in this study also ameliorates the reverse causality problem. I show that prices rise in some markets and fall in others following an LBO, depending on the characteristics of local rivalry. It is difficult to imagine a cost or demand shock that would tend to cause LBOs and would cause prices to rise in some markets and fall in others.

The remainder of the article is organized as follows: Section I describes theoretical reasons why leveraged buyouts may affect supermarket pricing and describes LBO activity in the supermarket industry. Section II examines price changes in a city coincident with the leveraged buyout of a supermarket chain operating in that city and uses scanner data to show firm-level differences in the prices of LBO and non-LBO supermarket chains. Evidence on exit by the LBO firm is presented that supports the hypothesis that non-LBO supermarket chains prey on their local LBO rivals following the LBO. Section III concludes.

I. LBOs and the Supermarket Industry

A supermarket is defined by the publication *Progressive Grocer* as a retail food establishment that has annual sales of more than $2 million and typically has greater than 9,000 square feet of selling space. Supermarkets account for 70 percent of retail food store sales but only 10 percent of retail food establishments. According to *Progressive Grocer*, there were approximately 30,754 supermarkets in the United States in 1988, 55 percent of which belonged to a chain of 11 or more stores.[2]

At the national level, the supermarket industry appears to be relatively unconcentrated. The four largest supermarket chains accounted for only 16 percent of U.S. grocery store sales in 1982.[3] However, no supermarket chain in the U.S. is truly national. For example, the largest chain in the U.S., American Stores, operated in only 18 states in 1990. Thus, while the industry is relatively unconcentrated on a national level, local markets can be highly concentrated. The average metropolitan statistical area in the U.S. had a four-firm supermarket concentration ratio of 58 percent in 1982.

The late 1980s were a period of transition in the supermarket industry, as many large supermarket chains merged or went private in LBO transactions. LBOs occurred primarily between 1985 and 1988. The largest transactions were the $5.3 billion Safeway LBO, the $4.1 billion Kroger leveraged recapitalization,[4] the $1.8 billion Supermarkets General LBO, and the $1.23 billion Stop & Shop LBO. These four companies alone owned nearly 4000 U.S. supermarkets at the time of their LBOs. During this period, it was also quite common for smaller regional chains and divisions of larger chains to undertake LBOs. Altogether, 19 of the 50 biggest supermarket chains in the U.S. have undertaken LBOs. They accounted for approximately $72 billion of the $297 billion in supermarket sales in 1991.

LBO activity has not been concentrated in any single geographic region. In the sample used in this study, LBO firms accounted for 16 percent of the stores in midwestern markets, 17 percent of the stores in southern markets, 21

[2] These data are from Progressive Grocer's "Annual Report of the Supermarket Industry", 1988.

[3] Kaufman and Handy, 1989.

[4] Because the Kroger leveraged recapitalization resulted in debt levels similar to an LBO, it is treated as an LBO in the work that follows.

percent of the stores in northeastern markets, and 42 percent of the stores in western markets. Part of the large LBO concentration in the West is due to the enormous importance of Safeway on the west coast. Safeway's 1985 market share in cities in the sample in the West totaled nearly 25 percent.

The vast majority of the leveraged buyouts were not the result of unconstrained decisions by management and shareholders. Instead, most of them were undertaken in response to unwanted takeover attempts. In fact, four of the six biggest deals (and many of the smaller ones) were undertaken to thwart the unwanted takeover attempts of the Haft family, which controls the Dart drugstore chain.

There are several reasons to expect that leveraged buyouts may affect firm pricing behavior. Empirical evidence in the agricultural economics literature suggests that there are "switching costs" for supermarket shoppers.[5] That is, once a consumer has shopped at a given supermarket, the consumer would rather return to that supermarket than shop at another. In markets in which there are "switching costs," firms may view charging low prices today as an investment in market share for the future. Firms have an incentive to attract new customers today through low prices in order to have market power over them in the future.[6]

If pricing is viewed as an investment, then two different strands of the literature predict that a firm's leverage will affect its pricing behavior. First, Jensen (1989) argues that managers of firms like to build empires and overinvest the firm's resources. It is possible that overinvesting in market share is an empire-building activity from which managers get utility. Thus, the agency hypothesis would suggest that undisciplined managers will set prices too low, maximizing market share rather than profits. When an LBO is undertaken, the incentives of managers and shareholders are aligned, and the firm raises prices. This view of supermarket LBOs is supported by the statements of Peter Magowan (1989), the CEO of Safeway, who argues that the leveraging of the entire supermarket industry would serve to eliminate price wars.

On the other hand, the literature on liquidity constraints[7] suggests that high leverage may lead firms to be cash-constrained, and that a cash-constrained firm may be forced to cut investment, even if the firm has positive net present value investment opportunities. Chevalier and Scharfstein (1994) present a model of intertemporal pricing with switching costs when firms are liquidity constrained. The main result is that, ceteris paribus, liquidity-constrained firms charge higher prices than nonliquidity-constrained firms. This model would predict that, if LBOs constrain firms financially, firms would tend to raise prices following their LBOs.

[5] See Devine and Marion (1979), pp. 228–237.

[6] Pricing as investment in market share is modeled in Klemperer (1987, 1993), Farrell and Shapiro (1988), and Chen and Rosenthal (1992).

[7] See, for example, Fazzari, Hubbard, and Peterson (1988) and Hoshi, Kashyap, and Scharfstein (1991) for empirical evidence on the effects of liquidity constraints on investment.

If pricing is viewed as an investment, both the agency model and the liquidity constraints model predict that firms will have an incentive *to raise* prices when they increase their leverage. As is the case in the previous literature that documents cuts in capital expenditures, R&D, and employment following LBOs, it is impossible to determine whether the liquidity constraint mechanism or the agency mechanism generates observed changes in firm behavior.

Of course, price changes do not occur in a vacuum. If the LBO firm increases its price, we would expect that rival firms would also increase their prices. However, rival chains may not increase their prices following the LBO if the LBO presents an opportunity for predation. Following an LBO, the LBO sponsor typically examines the supermarket chain to identify and divest underperforming divisions. Indeed, it has been suggested by Peter Magowan that the main effect of the Safeway LBO was to force Safeway to sell or spin off divisions that were not profitable (see Magowan, 1989). Magowan suggests that, following the LBO, Safeway and its advisors (Kohlberg, Kravis, and Roberts) determined in which divisions Safeway was not as strong a competitor as its rivals and sold off those divisions. The existence of this activity may give rival supermarket chains in a local market an incentive to cut prices and thus reduce the profits of their local competitor. If predation occurs, we would expect to see prices *fall* in local markets following LBOs.

It seems unlikely that supermarket chains would ever undertake LBOs if a predatory response were likely in *every* local market in which the LBO firm competes. Thus, one would predict that prices would rise in many markets following LBOs but would fall in those markets where predation is likely. In the next section, I examine price changes in local markets following LBOs. I try to separate cities in which one would expect the predation response to be large from cities in which one would expect the LBO firm's incentive to raise prices to be accommodated.

II. Pricing, Competition, and LBOs

A. Price Changes at the Time of the LBO

In this section, I examine how prices change in a city when an incumbent supermarket chain in the city undertakes an LBO. This is accomplished by uniting three data sets: the American Chamber of Commerce Researchers Association's quarterly price index; Progressive Grocer's *Market Scope*, which contains information on supermarket locations; and a master list of supermarket LBOs.

For information about supermarket locations, I use Progressive Grocer's *Market Scope*. Progressive Grocer lists all of the supermarkets operating in each of the 100 largest Metropolitan Statistical Areas (MSAs) in the United States and lists the number of stores in each chain. The Progressive Grocer data lists store names, not the names of parent companies. Store names are matched to parent company names using the *Retail Tenants Directory*, *Thomas's Grocery Register*, and supermarket firms' annual 10K disclosures.

The information on LBOs is obtained in two ways. The first step is a search for listings of supermarket LBOs in quarterly editions of *Mergers and Acquisitions*, which contains information on all ownership transactions (including LBOs) of greater than $1 million. The second step is a search for all references to transactions involving the supermarket parent companies in the sample using indices to *Supermarket News*, *Supermarket Business*, and *Progressive Grocer*. From these sources, a list of LBOs is assembled. *Mergers and Acquisitions* and firm 10Ks are used to determine the date on which each LBO was legally consummated. All of the LBOs examined in this study were consummated between 1981 and 1990.

The price data are drawn from the American Chamber of Commerce Researchers Association (ACCRA) *Cost of Living Index*. The quarterly ACCRA index quantifies price differences among cities to assist individuals making locational decisions. The data are collected by local chambers of commerce in accordance with the specifications outlined by ACCRA. Cities are missing from the data if the local chamber of commerce has opted not to collect the data. The index attempts to include goods representative of those purchased by a typical "middle manager." The overall ACCRA price index includes real estate prices, grocery prices, energy prices, consumer goods prices, and prices of services. The analysis will focus on the grocery price index component, which is reported separately while the index of the nongrocery components will be used as a control. The grocery price index compares the cost of specific grocery products in a city to the average cost of the same products in other cities in the ACCRA survey.

The Progressive Grocer LBO data are at the MSA level; the ACCRA data are at the city level. In order to match these data together, one must assume that the distribution of supermarket competitors is nearly constant across the MSA. To match the data, I extracted ACCRA data for all cities within the Progressive Grocer MSAs. For any LBO event in an MSA, I calculate one price index observation per quarter by averaging the price index observations within the MSA. I use only information from the cities for which price data are available for every quarter. Thus, the price data for a given MSA are comparable from quarter to quarter because information from a constant set of cities is used to construct the quarterly data. For the majority of MSAs in the Progressive Grocer data, the only data available are from the central city of the MSA.

Price changes following an LBO in a city are calculated using the change in the grocery price index for the city between the quarter prior to the LBO and each of the six quarters following the LBO. The price index changes measure the change in the price of the products in the ACCRA basket in a city relative to the average price of the products in the basket for the entire ACCRA sample. In the tests that follow, the price index observation for each city is compared only to other observations of the price index for the same city. The tests also control for time effects, because each city's grocery price level is measured relative to the U.S. average grocery price level.

In examining changes in local supermarket prices around the time of the LBO, it is important to control for concurrent changes in the state of the local economy. Unfortunately, there are no good economic series available quarterly

Table I

Summary Statistics for Independent Variables

This table contains means and standard deviations of all independent variables included in subsequent specifications. The variables measure characteristics of a city for the quarters surrounding the leveraged buyout (LBO) of a supermarket chain operating in that city. The sample includes all cities in which a supermarket LBO occurred for which both supermarket location data are available from *Progressive Grocer's Market Scope* and grocery price index data are available from *the American Chamber of Commerce Researcher's Association Cost of Living Index.* Data on employment changes are at the state level and are obtained from Data Resources, Inc.

Variable	Mean	Std. Dev.
Store share of firm undertaking LBO	0.12	0.09
Store share of LBO firm's rivals that have previously undertaken an LBO	0.09	0.13
Total stores in MSA	185.38	155.61
Store share of non-LBO firms accounted for by largest share non-LBO firm	0.23	0.10
Employment change		
Quarter −1 to quarter +1	0.0007	0.012
Quarter −1 to quarter +2	0.0008	0.013
Quarter −1 to quarter +3	0.0036	0.017
Quarter −1 to quarter +4	0.0046	0.019
Quarter −1 to quarter +5	0.0086	0.021
Quarter −1 to quarter +6	0.0058	0.023
Overall nongrocery price index change		
Quarter −1 to quarter +1	0.0036	0.027
Quarter −1 to quarter +2	0.0077	0.030
Quarter −1 to quarter +3	0.0031	0.038
Quarter −1 to quarter +4	0.0045	0.038

at the MSA level. However, quarterly data on the change in the state's share of total national employment are available from Data Resources, Inc. Blanchard and Katz (1992) argue that changes in employment are good measures of regional fluctuations because employment measures capture both fluctuations in the fraction of workers employed and fluctuations in population.

Table I shows the means and standard deviations for all variables. Table II shows the post-LBO grocery price changes for the cities under study. Clearly, the mean, median, and significance levels of the price changes suggest that prices do not unambiguously either rise or fall when a supermarket chain undertakes an LBO.[8]

Our main interest in examining post-LBO price changes is to examine whether 1) prices rise in cities where rival firms would be expected to accommodate the LBO firm's expected price increase and 2) whether or not there is any evidence that predation occurs. While Table II appears unrevealing, it may mask important heterogeneity among cities in the price response to an LBO. In Table III, I attempt to separate out cities in which one would expect that the

[8] Table II is similar if, instead of studying the change in the grocery price index, one studies the change in the grocery price index net of the change in the overall price index.

Table II

Grocery Price Index Changes Following LBOs

The change in the ACCRA grocery price index for a city between the quarter prior to a supermarket leveraged buyout (LBO) and each of the quarters following the LBO are examined. The sample is the set of cities in which a supermarket LBO occurred for which both the city-level price index data are available and supermarket location data are available. The test for the equality of the means is a two-sample *t*-test with matched pairs of observations. It tests if the price indices following the LBO for each city differ from the price index for the same city for the quarter prior to the LBO.

Quarters	Mean Price Index Difference	*t*-Statistic	Number of Cities with Positive Price Change	*N*
−1 to +1	0.19%	0.34	42	79
−1 to +2	0.02%	0.11	44	74
−1 to +3	−0.26%	0.68	45	79
−1 to +4	−0.59%	1.35	41	69
−1 to +5	−0.36%	0.88	40	71
−1 to +6	−0.38%	0.94	40	69

hypothesized price increases by the LBO firm would be accommodated from cities in which predation should be an important factor.

If leveraged firms have an incentive to cut their investment in future market share by raising prices, then one would expect that following the LBO, overall city prices would rise, if rival firms accommodate the LBO firm's price increases. Most standard oligopoly models of pricing with differentiated products imply that when one firm increases its prices, rivals will typically increase their prices as well. Thus, we might expect to see prices rise in a city in which an LBO has just occurred, controlling for changes in the overall economic climate of the city.

However, rivals will not increase prices following an LBO if the LBO creates an opportunity for predation. Predation should only be expected to be a significant factor in cities in which there exist rivals that are financially unconstrained enough to undertake predation. Thus, I regress the price changes in each city on the share of rival firms' stores in the city that are owned by chains which have previously undertaken LBOs. This may seem to be a crude approximation for the share of supermarket that which do not have enough financial slack to prey on their rivals.[9] While more direct data on the amount of financial slack available to rival supermarket chains might be preferred to this measure, many large supermarket chains are not publicly traded, and thus do not disclose financial information. Therefore, it would be impossible to measure the amount of financial slack available to rival chains.

[9] The inability to prey need not be interpreted as a weakness on the part of the firm. Indeed, it may not be optimal to prey on leveraged rivals, but managers of less leveraged firms may have the cash to indulge their taste for a large market share.

Table III

Determinants of Post-LBO Grocery Price Changes

The columns of the table below represent regression specifications in which the dependent variables are price changes from the quarter prior to a leveraged buyout (LBO) to a quarter following the LBO. The independent variables of interest are: the share of total supermarket outlets in the city accounted for by the firm undertaking the LBO, the share of total supermarket outlets in the city accounted for by firms which undertook LBOs prior to the quarters examined, and the share of total non-LBO supermarkets accounted for by the non-LBO supermarket chain in the city with the largest number of stores in the city. The change in the state's share of national employment and the change in the ACCRA non-grocery price index are included as control variables. Absolute values of t-statistics are in parentheses.

	Price Change over Quarters					
	−1 to +1	−1 to +2	−1 to +3	−1 to +4	−1 to +5	−1 to +6
Store share of LBO firm	0.038	0.013	−0.022	−0.006	0.058	−0.022
	(0.80)	(0.24)	(0.41)	(0.10)	(1.04)	(0.40)
Store share of prior LBO firms in city	0.0010	0.042	0.063	0.067	0.042	0.065
	(0.03)	(1.30)	(2.15)	(2.20)	(1.44)	(2.02)
Share of largest share non-LBO firm in city	−0.042	−0.016	−0.13	−0.14	−0.18	−0.13
	(0.94)	(0.30)	(2.67)	(2.66)	(3.71)	(2.60)
Change in state's share of national employment	0.51	0.15	−0.064	0.18	0.22	−0.0055
	(1.38)	(0.42)	(0.26)	(0.72)	(0.97)	−(0.027)
Change in ACCRA non-grocery price index	0.12	0.031	0.052	0.11	−0.011	0.14
	(0.81)	(0.20)	(0.46)	(0.88)	(0.17)	(1.27)
Constant	0.0048	−0.0026	0.021	0.016	0.023	0.022
	(0.40)	(0.17)	(1.64)	(1.16)	(1.70)	(1.61)
N	79	74	79	69	71	69
R^2	0.04	0.03	0.16	0.20	0.22	0.18

However, for supermarket chains with publicly traded debt or equity, the distribution of debt to total capitalization ratios is essentially bimodal: LBO firms have very high leverage; non-LBO firms generally have a debt to total capitalization ratio of less than 20 percent. Therefore, classifying firms into LBO firms and non-LBO firms should reasonably identify those firms possessing financial slack. We should expect prices to rise following LBOs in cities in which rivals have high debt and are thus, unlikely to prey. We should expect prices to fall following LBOs in cities in which rivals are not highly leveraged and thus, likely to prey.[10]

Gilbert and Vives (1986) argue that predation has a public good component and that only a firm that stands to reap most of the benefits of preying would

[10] The empirical results in Phillips (1995) are suggestive of these hypotheses. He studies four industries in which the lead firm in the industry undertook an LBO. He finds that in the three industries in which rivals were also leveraged, prices rose following the LBO of the leading firm. In the fourth industry, rivals were not highly leveraged and prices fell following the LBO of the leading firm.

undertake a predatory strategy. Furthermore, if rivals cannot coordinate on a predatory strategy, then a division closure or sale is likely to be induced only if there is a single rival in the market with enough stores in enough locations within the metropolitan area that this single firm's predatory actions could render the entire area unprofitable for the LBO firm.[11] Thus, the likelihood of predation may not only be a function of whether rivals in the local market have the financial resources to prey; we should only expect to see predation if there exists at least one rival with a strong incentive to prey and enough locations to do so successfully. I measure local rivals' incentives to prey by including in the regression specification the share of the rival chains' stores accounted for by the non-LBO firm with the largest single share.

Finally, whether or not predation occurs may depend on whether the LBO firm is a small or large presence in the local market. However, the effect of this variable is unclear. If the LBO firm has a large number of stores in the local market, rivals might gain a lot from forcing the firm to exit the local market. On the other hand, a firm may be more likely to successfully force an LBO rival to retreat from a local market if the LBO firm has very few stores. This is because local economies of scale are quite large in this industry and the LBO firm may be much closer to its exit threshold in cities in which it has a small market share.

Table III shows the relationship between the percent change in the ACCRA price index and five variables. The first two variables in the regression are control variables—we examine the change in grocery prices controlling for the overall change in prices in the city (using the change in the nongrocery components of the ACCRA index), and controlling for the change in the health of the economy in the city (using the change in the state's share of national employment). The variables of interest are those that measure the extent that price increases would be accommodated. These variables are the store share of the firm undertaking the LBO, the store share of the LBO firm's rivals in the city that had previously undertaken an LBO, and the share of non-LBO stores in the city accounted for by the non-LBO firm with the largest market share. All of the share variables are calculated by using counts of stores in the city from the *Progressive Grocer* data. Table III reports the results from the regressions of the percent change in the ACCRA index between the quarter before the LBO and each of the six quarters following the LBO on the share variables and the control variables. Notice that the six regressions represent overlapping time windows, and thus, the six regression specifications should not be considered to be independent of one another.

For all six of the time windows examined, the relationship between the change in the grocery price index and the market share of the firm undertaking the LBO in the window is insignificantly different from zero.

[11] Of course, a firm with a small number of locations in a city could render individual stores within a division unprofitable and try to induce their exit. However, I show in Chevalier (1995) that the closing of individual stores within a division does not usually increase after an LBO. LBO firms are very active in abandoning unprofitable cities. Only a firm with a large number of locations in a city could render an entire city area unprofitable for an LBO rival.

The coefficient for the share of supermarket chains in the city that had undertaken LBOs prior to the time window is positive for all six time windows. It is significantly different from zero at the five percent level for the 3rd, 4th, and 6th time windows. This result suggests that grocery prices in a city rise more (or fall less) following an LBO if the firm undertaking the LBO faces highly leveraged rivals.

I interpret these results to mean that the LBO firm has incentives to raise prices following the LBO and that these price increases are accommodated if rivals are highly leveraged. Repeating the regression specifications of Table III using the price change between each of the 6 quarters *before* the LBO and the quarter *before* the LBO reveals absolutely no relationship between the LBO share of rival firms in the city and price changes in the period *prior* to the LBO. Thus, the relationship between rival firms' leverage and price changes is not merely due to the continuation of a pre-LBO trend. This finding makes a reverse causality explanation for the findings in Table III unlikely. It is difficult to imagine that the LBO is undertaken in anticipation of future price changes. The decision to undertake the LBO generally precedes the legal consummation of the LBO by two or three quarters. Thus, a considerable amount of foresight would be required if LBOs were undertaken in anticipation of the future price changes documented here. The results, therefore, strongly suggest that the LBO triggers price changes that are increasing in the share of LBO rivals in the city.

Predation is more likely in cities in which a single non-LBO rival has a large market share. This is because, in order to induce an LBO chain to undertake an asset sale of an entire division, a predator would have to have enough stores in enough locations in a city to render the entire city unprofitable for the LBO rival. Table III shows that the coefficient for the store share of the largest non-LBO chain in the city has the predicted effects for the predation hypothesis; it is negative for all six time windows. It is significantly different from zero at approximately the 1 percent level for the 3rd through 6th windows. Again, this result is not due to the continuation of a pre-LBO trend. The relationship between the largest non-LBO firm's share and price changes prior to the LBO is statistically insignificant.

It is impossible to eliminate concern that a common shock both caused the LBO and the subsequent price effects. The local market character of the data helps to alleviate some concerns about this alternative hypothesis. It is hard to imagine a shock that causes prices to rise in some of a firm's markets (where rivals are highly leveraged), causes them to fall in others (where rivals are not highly leveraged), and causes the LBO.[12]

[12] This pattern of results could be generated if each of the local markets for a single firm tended to be alike and, for example, prices were rising in all Safeway cities due to a factor that caused its LBO, and prices were falling in all Stop & Shop cities due to a factor that caused its LBO. The test for the correlation of intra-firm error independence suggests that this is not a big factor. Also, the results were reexamined to see if the pattern detected in the full sample could be detected for the Safeway LBO in the sample of cities where Safeway operates. The results, though based on a small sample, were very similar to those presented in Table III in size and significance.

The results in Table III suggest that LBO firms have an incentive to raise prices following LBOs. This result is consistent with the hypothesis that firms were maximizing market share rather than profits prior to the LBO (the agency view) and also with the hypothesis that LBO firms were charging intertemporal profit-maximizing prices prior to the LBO, but must charge short-run profit maximizing prices after the LBO (the liquidity view).[13] The results are also consistent with the hypothesis that large low-leverage rivals attempt to prey on LBO firms by lowering prices following the LBO.

One potential concern with the specification in Table III is that the observations may not be truly independent. This is because the observations are for a total of 26 LBOs in different cities. Observations for different cities for the same firm may be related. Moulton (1986) addresses this issue and shows that one variant of the Breusch and Pagan (1980) Lagrange Multiplier test can be used to test whether the results are affected by the "grouping" of the observations. The LM test was undertaken for all six of the regressions in Table III. Using the method described in Breusch and Pagan (1980) to simulate the distribution of the test statistic in small samples, the test statistic was simulated 10,000 times in order to determine the significance of the test statistic in the actual data. The null hypothesis of independence was not rejected at even the 20 percent level for any of the six specifications. Thus, the treatment of the observations as independent appears to be justified.

B. Exit by the LBO Firm

The hypothesis that predation leads prices to fall following LBOs is supported by an examination of exit by the LBO firm following the LBO. Data on exit is collected from available editions of Progressive Grocer's *Market Scope* and is supplemented with news announcements of exits in the trade journal *Supermarket News*. The Progressive Grocer data are matched to the available price data. Exit occurs when the firm undertaking an LBO in a city has no stores left in the city in 1993. Table IV shows the results of a probit specification in which price changes in the quarters following the LBO are included as explanatory predictors of exit, controlling for the overall change in the price level for the city and for the change in the state's share of national employment.[14] Price changes between the quarter before the LBO and each of the quarters after the LBO are studied. The coefficient for the price change is

[13] It has been suggested that price increases following LBOs in cities where rivals are also leveraged may not be due to decreasing investment in pricing for market share, but rather might be due to LBO firms changing from a low-price, low-quality strategy to a high-price, high-quality strategy. This is unlikely. In a probit specification, I find that price increases following LBOs are associated with subsequent de novo entry into the market by other supermarket chains, although no relationship is found between price increases at other times and entry. This finding suggests that the post-LBO price increases are associated with increases in rents. If there were no change in quality-adjusted prices, there would be no increase in the rents to be captured by a potential entrant.

[14] If exit occurs between the quarter after the LBO and the sixth quarter after the LBO, I exclude the observation for all quarters after the quarter in which exit occurred.

Table IV

Determinants of Exit

For each leveraged buyout (LBO) in a local market for which price data and supermarket location data are available, the columns of the table represent probit specifications testing whether post-LBO grocery price decreases induce exit by the LBO firm. The dependent variable takes the value of one if the LBO firm exits the market between the quarters examined and 1993. The ACCRA grocery and non-grocery price changes and employment changes are measured over the quarters listed at the top of each column. Absolute values of z statistics are in parentheses.

	Quarters					
	−1 to +1	−1 to +2	−1 to +3	−1 to +4	−1 to +5	−1 to +6
Change in grocery price index	−5.61	−4.41	−10.59	−8.67	−13.55	2.59
	(1.14)	(1.03)	(2.25)	(1.78)	(2.58)	(0.42)
Change in state's share of national employment	−20.89	−2.937	0.003	3.391	9.683	11.217
	(1.21)	(1.61)	(1.00)	(0.35)	(1.01)	(1.33)
Change in nongrocery price index	−4.664	−0.870	0.64	6.16	0.24	5.54
	(0.73)	(0.16)	(0.90)	(1.16)	(0.10)	(1.08)
Constant	−0.72	−0.80	−0.955	−1.19	−1.19	−1.36
	(4.36)	(4.45)	(4.99)	(5.19)	(4.71)	−(5.29)
N	75	70	72	64	62	58

negative, as predicted, for the first through fifth time windows and is significant at the 5 percent level for the price changes between the quarter before the LBO and the 3rd and 5th quarters after the LBO. It is significant at the 10 percent level for the 4th quarter following the LBO. The coefficient for the fifth time window implies that, if prices in the city fall 2 percent, the probability that the LBO firm exits increases by approximately 6 percent. This implies that a firm is more likely to exit an area following its LBO if prices fell following the LBO.[15] This result would not be that interesting or surprising if one could document that exit would occur following any period of sustained price decreases. I examined the relationship between exit and price changes between each of the six quarters *prior to* the LBO and the quarter prior to the LBO. The coefficient for the price change is statistically insignificant (and of the wrong sign) for all of the time periods studied. Thus, it is not the case that exit would follow any sustained period of price decreases. These results suggest that price decreases following the LBO are associated with a lessening of the profitability of the local market for the LBO firm. In contrast, supermarket price index changes in the period prior to the LBO must be due for the most part to factors other than a change in the degree of competitiveness of the

[15] The disappearance of any effect of the price change on subsequent exit for the sixth quarter is puzzling. It is true that the exit of LBO firms from local markets is concentrated in the first few quarters following the LBO. That is, by the 6th quarter, most of the exit that is going to happen has happened.

market. Thus, the results are consistent with the hypothesis that falling prices following LBOs are a result of predation.

III. Firm-Level Price Differences

I have argued that LBO firms have an incentive to increase prices following LBOs due to either agency or liquidity effects. The ideal test of this hypothesis is to examine whether LBO firms raised prices more than non-LBO firms in the same city at the time of their LBOs. The results in the previous section use city-level data to suggest that LBO firms raise their prices at the time of the LBO because firm-level data on supermarket prices before and after the LBO period are unavailable.

In this section, I use a dataset on firm-level prices. These data are only available beginning in 1992. However, this limited dataset can be used to expand our understanding of the pricing behavior of LBO firms. The hypothesis that pricing serves as an investment in future market share has the prediction that LBO firms will charge higher prices than their less-leveraged rivals if: 1) they were maximizing market share rather than profits prior to the LBO and are forced post-LBO to maximize profits (the agency view) or 2) they were maximizing intertemporal profits prior to the LBO but post-LBO cash constraints force them to maximize short-run profits (the liquidity view). To investigate this, Table V examines the question of whether LBO firms charge higher prices than their non-LBO rivals in the same city.

Table V uses electronic supermarket scanner data to compare the price levels of LBO and non-LBO supermarket chains. These data were obtained from Information Resources Inc. (IRI), a firm which collects scanner data from supermarkets for sale to manufacturers of supermarket products. The data source aggregates the scanner information for all of the stores in a chain within one city. However, the data are a unique resource in that they report firm-specific information.[16]

The scanner database organizes supermarket products into 551 different product "types." I eliminate from study product types which *any* supermarket in the IRI database did not sell in 1992. Thus, I will compare prices for product types carried by all supermarket chains in the sample. Three hundred fifty-six product types were carried by all supermarkets in the database.

I constructed a price index for each supermarket. The price index consists of the sum of the supermarket's average price for each product type, weighted by the dollar share of the product type in total U.S. supermarket sales of the 356 product types. Weighting the product prices in this manner is sensible because consumers would consider a weighted average of product prices when comparing supermarket prices. If consumers are going to buy all of their supermarket needs in one store, then they would compare the price level of their desired

[16] Unfortunately, the IRI data are not available for the time period during which the supermarket LBOs took place. Thus, scanner data could not be used to examine an individual firm's prices before and after an LBO took place.

Table V

Price Differences between LBO and Non-LBO Chains

This table tests for differences between the prices of non-LBO and LBO firms in the same city in 1992. The test statistic in parentheses in the first column is the significance level for the test of whether the mean price difference is different from zero in a two-sample matched pairs *t*-test. The test for equality of the medians is in parentheses in the second column. It gives the significance level for the test of whether the number of cities in which the average LBO store price was higher than the average non-LBO store price is more than would be expected if "higher prices" and "lower prices" were drawn from the binomial distribution. The total number of cities in the sample is 17. This sample consists of all of the cities in the Information Resources, Inc. scanner database in which at least one LBO supermarket chain and one non-LBO supermarket chain were competing in 1992.

Category	Mean of the Price Differences between the LBO and the Non-LBO Stores in Each City (Significance Level in Parentheses)	Number of Cities in Which LBOs Had Higher Prices (Significance Level in Parentheses)
Overall	3.096% (0.003)	13 (0.049)
Refrigerated foods	1.582% (0.237)	12 (0.143)
Frozen food	2.223% (0.140)	13 (0.049)
Shelf-stable food	3.525% (0.004)	13 (0.049)
Health & beauty aids	4.620% (0.001)	13 (0.049)
Cleaners	2.510% (0.190)	10 (0.629)

basket of purchases at different supermarkets. Weighting a product's price's contribution to the price index by the product's share of total U.S. supermarket sales weights the product by its importance in the average U.S. consumer's market basket.

Each supermarket's price index is compared to the price index of other supermarkets in the same city. This is done to avoid attempting to control for the myriad cost differences across cities that could lead to different prices across cities. Supermarkets producing efficiently in the same city should have very similar costs. In order to examine LBO and non-LBO prices in the same city, I study only the 17 cities in the IRI database which have data for both LBO and non-LBO supermarkets in 1992.

For each city, I compute a non-LBO average price level and an LBO average price level. Altogether, 24 LBO and 25 non-LBO firm price levels are used to compute these averages. Table V shows tests of the hypotheses that the mean and median difference between the non-LBO average price level for a city and the LBO average price level is different from zero. The test statistics in Table V understate the true significance level of the price differences because they ignore the fact that the LBO price level and the non-LBO price level are means for each city rather than simple observations.

The results clearly suggest that LBO firms are the high priced firms in their cities. On average, the LBO supermarket price level in a city is 2.5 percent higher than the non-LBO supermarket price level. The hypothesis that the true mean difference between LBO and non-LBO price levels is zero is rejected at the 5 percent level using a two sample t test of matched pairs of observations.

I also test whether the median difference between LBO and non-LBO price levels is zero. In 13 out of 17 cities, the mean price level of the LBO firms in the city is higher than the mean price level of the non-LBO firms in the city. The test that the median price difference is zero is simply the test of the probability that 13 out of 17 cities in the sample would show higher LBO prices if LBO prices equal non-LBO prices for the median city. If the median city had no price difference between LBO firms and non-LBO firms, then one would expect to observe higher LBO prices half of the time. The two tailed significance level of the test of equality of the medians is 0.049.

One striking fact drawn from comparison of LBO and non-LBO overall price levels is not reported in Table V. For each city, I ranked all of the supermarkets in the city by their price levels. In 10 of the 17 cities, *all* of the LBO supermarkets in the city had higher prices than *any* of the non-LBO supermarkets in that city. There was only one city in which the reverse was true.[17]

The category breakdowns in Table V suggest that the price differential between LBO and non-LBO chains does not stem from a large price differential in a single category of supermarket items. LBO firms have higher prices in each category of supermarket items.

III. Summary and Conclusion

The results of this article suggest that price decreases following an LBO are likely when the LBO firm's rivals have low leverage, and one of the low-leverage rivals has a very large market share. I find evidence that these price decreases increase the probability of exit. Price increases are likely if the LBO firm's rivals are highly leveraged, and no single rival with low debt has a large market share. I find evidence that these price increases increase the probability of entry and that, as of 1992, LBO firms are the high-priced firms in their cities.

The results in this paper are consistent with the results for supermarket LBOs in Chevalier (1995) and with the general findings in Phillips (1995). They support both models of predation and the hypothesis that leverage creates an incentive for firms to raise prices.

These results do not answer the question of whether or not the large debt increases of the late 1980s were value-enhancing or value-destroying for su-

[17] If one were to assume that each firm in each city had an equal probability of taking each ranking order of prices, the probability that, in at least 10 cities, all of the LBO supermarkets had higher prices than any of the non-LBO supermarkets and that, in at most one city, all of the non-LBO supermarkets had higher prices than any of the LBO supermarkets is less than 0.01.

permarket chains. It may be that non-LBO supermarket chains charge inefficiently low-prices or are inefficiently patient in their attempts to induce the exit or deter the entry of rivals. Or, it may be true that, while leverage has other benefits, it is costly to the firm in product market competition because it leads firms to invest suboptimally in market share.

The results of this paper contribute to three literatures. First, the results extend our understanding of the effects of LBOs, by showing how product market behavior changes following LBOs. Second, the results suggest that predation occurs and may be successful, at least in one industry. Finally, the results of this paper empirically document that capital structure-product market linkages actually exist. Future research should determine whether and how capital market-product market interactions differ for other industries.

REFERENCES

American Chamber of Commerce Researchers Association, various years, *Inter-City Cost of Living Index*, and *Cost of Living Index* (American Chamber of Commerce Researchers Association, Nashville, Tenn.).

Blanchard, Olivier J., and Lawrence F. Katz, 1992, Regional evolutions, *Brookings Papers on Economic Activity*, No. 1, 1–74.

Bolton, Patrick, and David Scharfstein, 1990, A theory of predation based on agency problems in financial contracting, *American Economic Review* 80, 93–106.

Brander, James A., and Tracy R. Lewis, 1986, Oligopoly and financial structure, *American Economic Review* 76, 956–970.

Breusch, T. S., and A. R. Pagan, 1980, The LM test and its applications to model specification in econometrics, *Review of Economic Studies* 47, 239–254.

Chen, Yongmin and Robert W. Rosenthal, 1992, Dynamic duopoly with slowly changing customer loyalties, Working paper, Washington University.

Chevalier, Judith A., 1995, Capital structure and product market competition: An empirical study of supermarket LBOs, *American Economic Review* 85, 206–256.

Chevalier, Judith A., and David S. Scharfstein, 1994, Capital market imperfections and countercyclical markups: Theory and evidence, National Bureau of Economic Research, Working paper No. 4614.

Devine, D. Grant, and Bruce W. Marion, 1979, The influence of consumer price information of retail pricing and consumer behavior, *American Journal of Agricultural Economics* 61, 228–237.

Farrell, Joseph, and Carl Shapiro, 1988, Dynamic competition with switching costs, *Rand Journal of Economics* 19, 123–137.

Fazzarri, Steven M., R. Glenn Hubbard, and Bruce C. Petersen, 1988, Investment and financing reconsidered, *Brookings Papers on Economic Activity*, 141–195.

Fudenberg, Drew, and Jean Tirole, 1986, A 'signal-jamming' theory of predation, *Rand Journal of Economics* 17, 366–376.

Gertner, Robert, Robert Gibbons, and David Scharfstein, 1988, Simultaneous signaling to the capital and product markets, *Rand Journal of Economics* 19, 173–190.

Gilbert, Richard, and Xavier Vives, 1986, Entry deterrence and the free rider problem, *Review of Economic Studies* 53, 71–83.

Hoshi, Takeo, Anil Kashyap, and David Scharfstein, 1991, Corporate structure, liquidity, and investment: Evidence from Japanese industrial groups, *Quarterly Journal of Economics* 106, 33–60.

Jensen, Michael C., 1989, The eclipse of the public corporation, *Harvard Business Review*, No. 5, 61–74.

Kaplan, Steven N., 1989, The effect of management buyouts on operations and value, *Journal of Financial Economics* 24, 217–254.

Kaufman, Phillip R., and Charles R. Handy, 1989, *Supermarket Prices and Price Differences: City, Firm, and Store-Level Determinants*, (Economic Research Service, U.S. Department of Agriculture, Washington, D.C. TB-1776).

Klemperer, Paul, 1987, Markets with consumer switching costs, *Quarterly Journal of Economics* 102, 375–394.

Klemperer, P., 1993, Competition in markets with consumer switching costs: An overview, Working paper, Oxford University.

Lichtenberg, Frank R., and Donald Siegel, 1990, The effects of leveraged buyouts on productivity and related aspects of firm behavior, *Journal of Financial Economics* 27, 165–194.

Long, William F., and David J. Ravenscraft, 1993, LBOs, debt and R&D intensity, Bureau of the Census Center for Economic Studies Discussion Paper 93-3.

Magowan, Peter, 1989, The case for LBOs: The Safeway experience, *California Management Review* 32, 9–18.

Maksimovic, Vojislav, 1988, Capital structure in repeated oligopolies, *Rand Journal of Economics* 19, 389–407.

Moulton, Brent R., 1986, Random group effects and the precision of regression estimates, *Journal of Econometrics* 32, 385–398.

Phillips, Gordon M., 1995, Increased debt and product market competition: An empirical analysis, *Journal of Financial Economics* 37, 189–238.

Annual Report of the Supermarket Industry, *Progressive Grocer*, April 1989.

Progressive Grocer, 1986 and 1992 editions, *Progressive Grocer's Market Scope*, (MacLean Hunter Media, White Plains, NY).

Retail Tenants Directory, 1988 edition, (National Mall Monitor, Clearwater, Florida).

Rotemberg, Julio J., and David S. Scharfstein, 1990, Shareholder-value maximization and product market competition, *The Review of Financial Studies* 3, 367–391.

Smith, Abbie J., 1990, Management buyouts and corporate performance, *Journal of Financial Economics* 27, 143–164.