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# Price-matching Policies: An Empirical Case

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**Promises by retailers to match the prices of their competitors give an impression of fierce price competition. These policies, however, may deter rivals from cutting prices because the threat of price matching makes it more likely that market share will not be gained. This paper empirically tests these two conflicting theories using data collected from grocery stores in a market where several stores had announced that they would match the prices of the low-price supermarket. The evidence supports the theory that price-matching policies help supermarkets avoid price competition and therefore lead to generally higher prices.**

Retailers commonly promise to match or beat the prices of their competitors as the following advertisement from *The News and Observer* (Raleigh, North Carolina), 24 March 1986, demonstrates:

> Big Star SUPERMARKET
> Matches Food Lion Supermarket's
> Everyday
> low shelf prices
> FOREVER
>
> If the low price supermarket lowers its regular prices,
> Big Star Supermarket will respond by matching them.
> If the other supermarket lowers prices again, so will Big Star. And Big Star will keep its prices low.

Appliance stores, hardware stores and supermarkets advertise such price-matching policies heavily and sometimes even offer to refund double or triple the price difference to convince customers that they do so.

What is the purpose of a price-matching guarantee? Does it help increase price uniformity among the supermarkets, and what is the effect of greater price co-ordination on market price levels? Does it encourage or discourage price competition? This study of price-matching marketing campaigns by leading North Carolina supermarket chains was designed to provide answers to these questions. Studying the price patterns of the supermarkets in response to a price-matching policy will improve our understanding of such marketing strategies and their effects on market prices.

We will first outline the alternative theories of price-matching behavior and then describe the data set we have collected to test these theories. Our data provide evidence that the announced price-matching policy is consistent with a higher degree of price co-ordination among the supermarkets. Finally, we investigate whether the increased price co-ordination resulted in lower prices both for the market as a whole and for the specific store that was the target of the price-matching policy.

## THEORETICAL CONSIDERATIONS

The simplest explanation of a price-matching policy is that the store *really* is initiating price competition, perhaps because it thinks it has a cost advantage or because it wants to build market share at the expense of current profit margins. The retailer may use this marketing policy to convince customers that they will find low prices if they visit the store. Therefore, the price-matching policy leads to price reductions. Furthermore, price-matching policies might encourage consumers to intensify search for bargains, which can help lower prices for the entire market (Golding and Slutsky, 1986).

Price-matching behavior recently has attracted the interest of theorists, who have focused mainly on two alternative explanations: oligopoly co-ordination and price discrimination.

Price-matching policies can help retailers avoid a prisoner's dilemma (see Luce and Raiffa, 1957; Rapoport and Chammah, 1965). When all other retailers maintain high prices, an individual retailer is tempted to reduce price to gain significant market

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share. The consequence of all retailers simultaneously following this reasoning is that market shares remain constant and profits of all sellers decrease.

Price-matching policies deter rivals from cutting prices because they increase the probability that competitors will follow suit. Grocery stores in particular are likely to face a prisoner's dilemma because total demand for food seems to be price inelastic (Blanciforti and Green, 1983; Wohlgenant, 1984). That is, price reductions by one supermarket may attract customers away from other stores, but they do not substantially increase the amount of food purchased by households.

Macgregor (1983), Belton (1987), Kalai and Satterthwaite (1986) and Salop (1986) go a step further. They argue that sellers view these policies as signals to raise prices to a level that would maximize joint profits. That is, a price-matching guarantee is thought to be a collusive practice that helps oligopolists maintain monopoly prices.

Although the models cited above involve stores selling a single item, supermarkets could apply the same logic to their pricing strategies for a multitude of products. A supermarket claim of matching the prices of a rival store for every item can easily be verified by customers and the rival stores simply by checking any arbitrary subset of products. An alternative claim of matching overall pricing is more difficult to verify because the entire list of products must be averaged and may be perceived as less credible.

In contrast, the case studied in this paper cannot test another method of price guarantees where stores promise to refund price differences to customers who bring proof that a competitor has a lower price. Such refunds help price discriminate between well-informed and ill-informed consumers (see Png and Hirshleifer, 1987; Doyle, 1987). Since refunds are made only to customers who can show that a lower price is available at another store, ill-informed customers actually are charged high prices. Such refunds are typical for stores selling shopping goods such as appliances. Price-sensitive customers typically would visit more than one store to find the best deal for shopping goods. For stores that sell convenience goods, however, money-back guarantees are not common, perhaps because customers usually limit their shopping trips to one visit. In our case, the stores promised to adjust their future prices to match the lowest-priced supermarket but did not offer refunds on previous sales.

Empirical research aimed at testing these theories is scarce, and yet testing is important to both the government policy maker and the retailer. If price-matching policies have the effect predicted by the implicit-price collusion theory rather than that predicted by the price-war theory, then implementing a price-matching strategy may have the surprising implication of raising price levels. This paper is based on a unique supermarket data set that is used to test these conflicting theories.

## THE DATA

We began to study an actual statewide price-matching marketing campaign initiated in 1983 by a North Carolina supermarket chain named Big Star. This case is of special interest because a *Price Finder* of over 9000 items was published weekly that specified Big Star's regular prices that were to match those of its low-price rival, Food Lion. The *Price Finder* was available to all customers at all of Big Star's location and was heavily advertised in newspapers and on television. Appendix 1 duplicates the price-matching promise found in the *Price Finder*. While the *Price Finder* did not give prices at both Big Star and Food Lion, it possibly led to lower prices because customers were better able to compare prices. Alternatively, it might facilitate price co-ordination among competitors, thereby leading to higher prices.

Although Big Star was the first store to use a price-matching program, the focus of our study is Winn-Dixie, a grocery store chain. Almost two years after introduction of price matching as a marketing policy, Winn-Dixie began advertising that it too would match Food Lion's prices, and it also provided a similar price list for a few weeks. Our study focuses on Winn-Dixie rather than Big Star because detailed price data were not available for the period preceding Big Star's introduction, but were gathered prior to Winn-Dixie's policy change. Therefore, our data set contains both 'before' and 'after' data for Winn-Dixie. In addition, we studied two other grocery store chains that did not have price-matching policies. The market shares as of November 1983 for the stores in our sample were: Big Star—34.1%, Food Lion—26.3%, Winn-Dixie—25.2%, Harris-Teater—5.8%, and Krogers —0.6%.

Two groups of products were selected for study. The first consisted of the 79 most frequently pur-

chased products (*Progressive Grocer*, 1980) that were included in the *Price Finder*. (During the sampling period Tylenol Extra Strength Capsules was discontinued and therefore was dropped from the study.) The second group consisted of 35 products excluded from the *Price Finder* (perhaps because of wholesale price fluctuations or legal issues). Products not included in the *Price Finder* were not guaranteed to match those in the Food Lion. Two samples were collected to learn whether price co-ordination is enhanced for products specifically included in the *Price Finder vis-a-vis* those products excluded. A list of products in both groups is given in Appendix 2. Throughout this paper those 79 products subject to the price-matching policy will be referred to as included products, since they were included in the *Price Finder*. The other 35 products will be called excluded products.

Because of limited resources, data were obtained only in selected weeks when research assistance was available. All stores were visited within a period of 24 hours in each week sampled. Thirty-three visits to five stores (twelve weeks were sampled in 1984, twelve in 1985 and nine in 1986) have produced data that provide useful information about price-matching policies, as shown below.

## PRICE-MATCHING POLICY AND PRICE CO-ORDINATION

Did the price-matching policies of the Big Star and Winn-Dixie stores actually lead to a higher degree of price co-ordination between these supermarkets and their major rival Food Lion? How did they influence stores not involved in the price-matching contest?

Tables 1 and 2 were constructed to highlight the high level of price co-ordination reached for products included in the *Price Finder*. Price comparisons are made for the first and last week in which data were obtained on ten products selected randomly from the two product groups.

The price dispersion apparent in the first week significantly diminished by the last week for products subject to price-matching policy. In the first week only 13 of 40 possible price matches occurred, while in the final week 28 of 40 possible prices matched. By the last week 40% of the included products were priced identically to within a penny in all five supermarkets, up from 0% in week one. Only 10% of the products excluded from the *Price*

**Table 1. Prices of Selected Items at Five Supermarkets for Products Included in the *Price Finder***

| *First week* | Food Lion | Big Star | Winn Dixie | Harris Teater | Krogers |
|---|---|---|---|---|---|
| Hellman's Mayonnaise | 1.49 | 1.49[a] | 1.99 | 1.89 | 1.65 |
| Chef Boyardee Pizza | 1.39 | 1.39[a] | 1.59 | 1.39[a] | 1.49 |
| Hunt's Whole Tomatoes | 0.60 | 0.60[a] | 0.69 | 0.60[a] | 0.50 |
| Jiffy Corn Muffin Mix | 0.22 | 0.24 | 0.25 | 0.24 | 0.25 |
| Mazola Oil | 1.99 | 1.99[a] | 2.15 | 1.89 | 2.19 |
| Pillsbury Flour | 0.79 | 0.79[a] | 0.99 | 0.99 | 0.79[a] |
| Maxwell House Coffee | 2.19 | 2.33 | 2.29 | 2.19[a] | 2.19[a] |
| Comet Cleanser | 0.69 | 0.69[a] | 0.85 | 0.67 | 0.75 |
| Nabisco Oreo Cookies | 1.89 | 1.85 | 1.99 | 1.99 | 1.89[a] |
| Mrs Smith's Apple Pie | 2.94 | 2.94[a] | 3.69 | 3.49 | 1.89 |
| *Last week* | | | | | |
| Hellman's Mayonnaise | 1.69 | 1.69[a] | 1.69[a] | 1.63 | 1.69[a] |
| Chef Boyardee Pizza | 1.44 | 1.44[a] | 1.45[a] | 1.45[a] | 1.49 |
| Hunt's Whole Tomatoes | 0.50 | 0.50[a] | 0.50[a] | 0.50[a] | 0.50[a] |
| Jiffy Corn Muffin Mix | 0.22 | 0.22[a] | 0.22[a] | 0.22[a] | 0.22[a] |
| Mazola Oil | 1.73 | 1.73[a] | 1.80 | 1.67 | 1.70 |
| Pillsbury Flour | 0.79 | 0.79[a] | 0.79[a] | 0.79[a] | 0.79[a] |
| Maxwell House Coffee | 2.89 | 2.89[a] | 2.89[a] | 3.29 | 2.89[a] |
| Comet Cleanser | 0.74 | 0.74[a] | 0.74[a] | 0.74[a] | 0.73[a] |
| Nabisco Oreo Cookies | 2.46 | 2.46[a] | 2.35 | 2.39 | 2.46[a] |
| Mrs Smith's Apple Pie | 3.35 | 3.35[a] | 3.18 | 3.39 | 3.18 |

[a] Price match with Food Lion Store to within 1¢.

**Table 2. Prices of Selected Items at Five Supermarkets for Products Excluded from the *Price Finder***

| *First week* | Food Lion | Big Star | Winn Dixie | Harris Teater | Krogers |
|---|---|---|---|---|---|
| Cut Green Beans | $0.35 | 0.35[a] | 0.33 | 0.49 | 0.33 |
| Thin Sliced Bread | 0.59 | 0.55 | 0.48 | 0.33 | 0.50 |
| Head Lettuce | 0.89 | 0.69 | 0.69 | 0.99 | 0.79 |
| Pork Loin Chops | 3.69 | 2.49 | 2.79 | 2.79 | 2.79 |
| Ground Beef | 1.69 | 1.69[a] | 0.99 | 1.79 | 1.55 |
| Swift Hostess Ham | 8.99 | 8.99[a] | 9.98 | 9.99 | 9.99 |
| Coke | 0.99 | 1.29 | 1.49 | 0.89 | 1.39 |
| Pepsi | 1.47 | 1.19 | 1.29 | 1.69 | 0.99 |
| Large Grade A Eggs | 1.33 | 1.37 | 1.37 | 1.29 | 1.47 |
| Miller Beer | 2.71 | 2.71[a] | 2.71[a] | 2.63 | 2.65 |
| *Last week* | | | | | |
| Cut Green Beans | 0.33 | 0.33[a] | 0.33[a] | 0.40 | 0.33[a] |
| Thin Sliced Bread | 0.55 | 0.69 | 0.50 | 0.50 | 0.55[a] |
| Head Lettuce | 0.89 | 0.99 | 0.99 | 0.99 | 0.49 |
| Pork Loin Chops | 3.49 | 2.99 | 2.99 | 3.29 | 3.39 |
| Ground Beef | 1.49 | 1.69 | 1.49[a] | 1.49[a] | 1.49[a] |
| Swift Hostess Ham | 9.99 | 9.99[a] | 7.99 | 10.99 | 10.99 |
| Coke | 1.09 | 0.89 | 1.39 | 0.99 | 1.49 |
| Pepsi | 1.29 | 1.39 | 0.99 | 1.39 | 1.09 |
| Large Grade A Eggs | 0.78 | 0.49 | 0.68 | 0.79[a] | 0.89 |
| Miller Beer | 2.84 | 2.84[a] | 2.84[a] | 2.85[a] | 2.85[a] |

[a] Price match with Food Lion Store to within 1¢.

*Finder* had identical prices in all stores by the last week. While Tables 1 and 2 are meant only to casually illustrate the degree of price matching, more appropriate statistics are found in Table 3.

Table 3 gives the percentage of products in each store that had prices exactly identical to those in Food Lion. These percentages were calculated separately for each product group; products included in the *Price Finder* are given in Part A and products excluded (and therefore not covered by the price-matching guarantee) are given in Part B. The prices are actual not regular ones. Since temporary sales prices were not included in the price-matching guarantee, only regular prices, this is a conservative measure of the degree of price matching. Had we used only regular prices the price matching would be much closer to 100%.

Before-after price comparisons are possible for Winn-Dixie's price-matching policy that began in January 1985. As can be clearly seen in column 1 of Table 3, there was a significant increase in the percentage of products in the *Price Finder* with identical prices in Winn-Dixie and Food Lions, from roughly 4% in 1984 to 70% in 1985. This is statistically significant at the 1% level. The corresponding change for products not covered by the price-matching policy was not nearly as large and is not significant at the 5% level.

The second column of data gives price matches between the Big Star and Food Lion store. The percentage of identical prices in these two stores is very high for 'included' products (Part A). Because data gathering began after the institution of Big Star's price-matching policy, it is hard to say how much this extraordinary matching is due specifically to the price-matching policy. Nonetheless, these Big Star-Food Lion price matches are consistently and significantly higher than those between other stores throughout all of 1984.

Furthermore, comparison with excluded products (Part B) shows that price matches are consistently higher for products covered by the price-matching policy than for those excluded. Table 3, Part B, also shows that for products excluded from the *Price Finder*, price-match percentages between the Big Star and Food Lion store were initially high relative to those of other stores. This evidence leads to the following conclusion:

> *The price-matching policies are effective. That is, they result in a high degree of price co-ordination between the announcing supermarkets and their targeted rival.*

Did the price-matching policy eventually result in a higher degree of price co-ordination among *all* stores in the market, including those not using a price-matching policy? Significant increases over time in price matches would indicate higher price co-ordination for both product groups. More frequent matches for products subject to price-matching policies would indicate that the *Price Finder* helps all supermarkets better co-ordinate their prices.

Table 3 shows that the products with identical prices in the Food Lion and Harris-Teater and Krogers increased from roughly 18% to over 40% for the entire sample period. Furthermore, the increases for products included in the policy are, in general, more significant than for those excluded. The evidence just presented leads to the following conclusion:

> *The price-matching policy resulted in greater price co-ordination among all supermarkets including those without a price-matching policy.*

**Table 3. Percentage of Products with Price Identical to Food Lion's**

(A) Products included in the *Price Finder*

| Year | Winn-Dixie | Big Star | Harris-Teater | Krogers |
|---|---|---|---|---|
| 1984 | 3.5 | 87.8 | 19.1 | 13.0 |
| 1985 | 69.5 | 85.6 | 24.1 | 29.5 |
| 1986 | 71.5 | 80.1 | 57.9 | 40.1 |

(B) Products excluded from the *Price Finder*

| Year | Winn-Dixie | Big Star | Harris-Teater | Krogers |
|---|---|---|---|---|
| 1984 | 24.8 | 52.6 | 23.3 | 18.6 |
| 1985 | 41.0 | 51.9 | 36.9 | 33.6 |
| 1986 | 34.3 | 47.3 | 35.6 | 26.7 |

These are the average weekly percentage matches. Twelve weeks were sampled in 1984, twelve in 1985 and nine in 1986.

## PRICE-MATCHING POLICY AND PRICE LEVEL

How did the price-matching policy affect market price level? Did the increased price co-ordination lead to price reductions as conventional wisdom predicts? Did it help the supermarkets avoid the price-cutting spiral typical for prisoner's dilemma situations or even increase the market price level, as the implicit collusion theory predicts? How did the store targeted by the price-matching policy re-

spond? In this section the impact of the price-matching policy on overall market prices is studied. In the next section we will look in more detail at the behavior of the target of the price matching, Food Lion, to understand better the overall market response.

To analyze the effect of the price-matching guarantee on the overall market price it is necessary first to construct a price index for the many products included in our sample. Consider first Fig. 1, where the dollar expenditure needed to purchase a typical basket of goods from the 'included' product group is displayed for the observation period. The typical basket of goods was established by using the weights for equivalent products from the Consumer Price Index (see Appendix 2 for details). In Fig. 1 this price index is given for the weighted average of the five stores using their market shares given above. Figure 2 gives equivalent information for products excluded from the *Price Finder*.

If the price-matching guarantee policy signals price competition, one would expect more significant price reductions or more moderate price increases for products under price guarantees than for products not under guarantee. That is, the following ratio will fall:

$$\text{Relative price} = \frac{\text{Average price (included)}}{\text{Average price (excluded)}}. \quad (1)$$

Comparing Figs 1 and 2, one can see a clear tendency for the average market prices to increase during the observation period for products covered by the price-matching policy. This is not the case, however, for products not included in the guarantee. Figure 3 shows that the relative prices in Eqn (1) has indeed increased during the observation period.

To explain variation in the five-store average price level we will use regression analysis. Our first model uses a dummy explanatory variable:

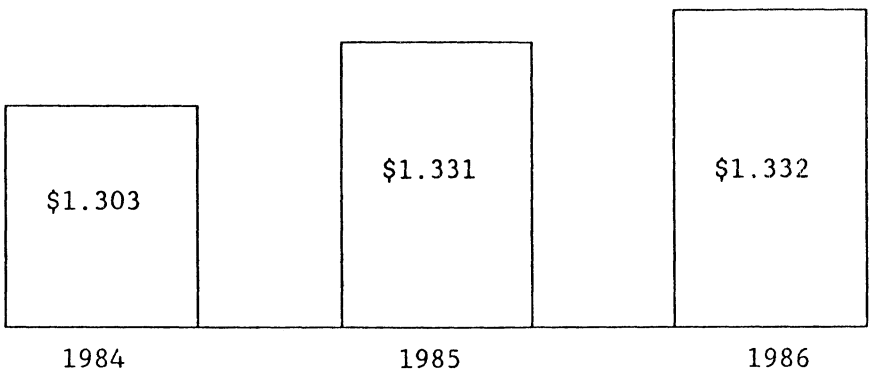


**Figure 1.** Average market prices for a basket of included products. The prices are the average weekly price index for 79 products included in the *Price Finder* for the five stores weighted by market share. Twelve weeks were sampled in 1984, twelve in 1985 and nine in 1986.

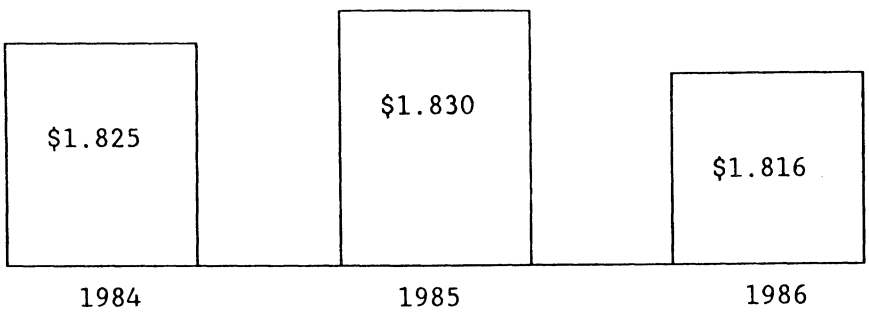


**Figure 2.** Average market prices for a basket of excluded products. The prices are the average weekly price index for 35 products excluded in the *Price Finder* for the five stores weighted by market share. Twelve weeks were sampled in 1984, twelve in 1985 and nine in 1986.

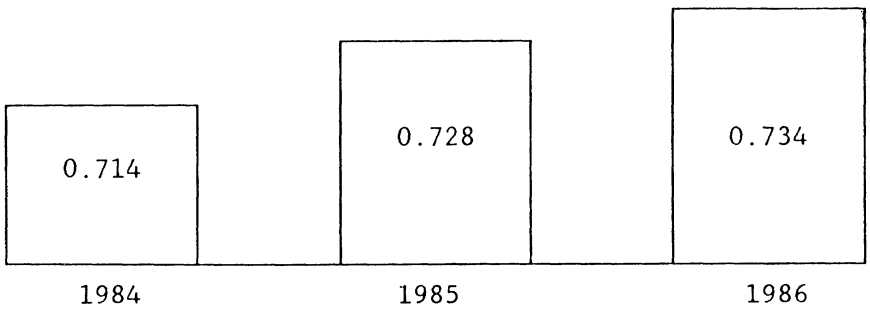


**Figure 3.** Relative prices (included/excluded products). The relative prices are the average weekly ratio of the price index for products included in the *Price Finder* to the price index for excluded products.

*POLICY* variable = 0 in Winn-Dixie's 'before-policy' period, 1984, and *POLICY* variable = 1 in its 'after-policy' period, 1985–6. The results are given in Table 4. The coefficient of the *POLICY* variable is positive and significant at the 1% level, indicating that *introduction of a price-matching policy increases the market's average price.*

In itself, however, the announcement of the policy may not be taken seriously by rivals. To convince competitors that the policy is credible, the retailer must actually match or even beat prices. (Effective price matching today is only a signal of intent to match prices tomorrow, and might not be perceived as a commitment.) To capture degree of commitment, price-matching percentages are used as explanatory variables (the results below are not changed if the explanatory variables reflect equal *or* lower prices). This is accomplished by comparing the price matching for products included in the *Price Finder* with what it would otherwise be for excluded products. The ratio of percentage of identical prices of included products (the weekly equivalent of Table 3, Part A) to that of excluded products (the weekly equivalent of Table 3, Part B) is calculated for each week:

$$\text{Relative match} = \frac{\text{Matching percentage (included)}}{\text{Matching percentage (excluded)}}. \quad (2)$$

The larger this ratio, the more co-ordinated are the two stores' prices over those products identified by the price-matching policy. These ratio variables were calculated for Winn-Dixie and for Big Star (both matched with Food Lion). An increased magnitude of price matching should reduce the price level if the price-matching policy triggers price competition.

**Table 4. Regression Equation for Relative Price of Included Products to Excluded Products for the Five-store Average**

| Independent variable | Coefficient | (*t*-ratio) |
|---|---|---|
| *POLICY* variable | 0.01634 | (+3.335)[a] |
| Intercept | 0.71390 | (182.7)[a] |

$N = 33$, $R^2 = 0.2640$.
[a] Significance at 1%.
*POLICY* variable equals 0 before Winn-Dixie introduces its price-matching policy and 1 afterwards.

To statistically test the price competition theory against the implicit collusion theory the following empirical model was specified:

$$\text{Relative price} = a + b\ \text{Relative match}_{\text{Winn-Dixie}} + c\ \text{Relative match}_{\text{Big Star}} \quad (3)$$

The variables are always ratios of products included in the *Price Finder* to those of products excluded from the *Price Finder* and the dependent variable is the overall market price of the five stores. Results of the ordinary-least-squares regression are presented in Table 5.

Consider first the estimated coefficient for the relative match of Winn-Dixie with Food Lion. The Winn-Dixie had high prices initially and reduced them to match prices with the low-price Food Lion during the period that data were gathered. There is a natural tendency for the market price to fall because Winn-Dixie has over 25% of the market sales and has reduced its prices. Despite this, the estimated coefficient significantly shows that with more commitment to price matching, the products targeted by the policy are made relatively more expensive compared to excluded goods.

**Table 5. Regression Equation for Relative Price of Included Products to Excluded Products for the Five-store Average**

| Independent variable | Coefficient | (*t*-ratio) |
|---|---|---|
| Relative match: Winn-Dixie with Food Lion | 0.00836 | (+3.164)[a] |
| Relative match: Big Star with Food Lion | −0.01596 | (−1.992)[b] |
| Intercept | 0.74103 | (+52.62)[a] |

$N=33$, $R^2=0.3070$.
[a] Significance at 1%.
[b] Significance at 5%.
Relative match is defined in Eqn (2).

The coefficient of the Big Star store is negative and marginally significant. This provides some evidence supporting the price competition theory. As we will see in the next section, however, when Big Star (the oldest rival in the price-matching competition) reduces prices to match those of Food Lion, there is little response by Food Lion. So the *average* price of the five-store retail market falls because Big Star alone has reduced its prices.

This statistical analysis of the data leads to the following conclusion:

> *An effective price-matching policy limits price competition and the overall market price level rises relative to products not covered by the policy.*

One might infer that the target of the price-matching policy, Food Lion, must have raised its prices and by such a large amount that the average price in the marketplace rises. This is exactly what the oligopoly collusion theory would predict, but is it an empirically valid inference? We investigate this question in the following section.

## PRICE-MATCHING POLICY AND TARGETED STORE'S RESPONSE

The evidence from overall market price response given above suggests that the low-price store targeted by the price-matching guarantees, Food Lion, may have increased its prices. As shown in Table 6, the nominal prices of Food Lion rose in 1985 over those of 1984 in both the included and excluded categories but subsequently dropped slightly in 1986. But the crucial ratio of included to excluded prices rose each year, indicating that Food Lion allowed the included products' prices to drift higher relative to those excluded from the policy.

**Table 6. Price Indices of Food Lion**

| Year | Included | Excluded | Relative |
|---|---|---|---|
| 1984 | $1.266 | $1.799 | 0.704 |
| 1985 | $1.330 | $1.837 | 0.725 |
| 1986 | $1.324 | $1.787 | 0.741 |

**Table 7. Regression Equation for Relative Price of Included Products to Excluded Products at Food Lion**

| Independent variable | Coefficient | (*t*-ratio) |
|---|---|---|
| *POLICY* variable | 0.02728 | (+4.192)[a] |
| Intercept | 0.70432 | (159.0)[a] |

$N=33$, $R^2=0.4377$.
[a] Significance at 1%.
*POLICY* variable equals 0 before Winn-Dixie introduces its price-matching policy and 1 afterward.

**Table 8. Regression Equation for Relative Price of Included Products to Excluded Products at Food Lion**

| Independent variable | Coefficient | (*t*-ratio) |
|---|---|---|
| Relative match: Winn-Dixie with Food Lion | 0.01478 | (+4.791)[a] |
| Relative match: Big Star with Food Lion | −0.00933 | (−0.997) |
| Intercept | 0.71901 | (+43.747)[a] |

$N=33$, $R^2=0.4389$.
[a] Significance at 1%.
Relative match variable is defined in Eqn (2).

To test this we first regressed the relative price of Food Lion on the *POLICY* variable associated with the introduction of Winn-Dixie's price-matching policy. In Table 7 one can see that the introduction of a price-matching policy leads to significant increases in the relative price of included products at Food Lion.

As before, to incorporate commitment to the policy in the test, the model of Eqn (3) was estimated with Food Lion's relative price as the dependent variable. The results are found in Table 8. The coefficient of the price-match ratio for Winn-Dixie is positive and statistically significant at the 1% level. This indicates that the more committed to

price matching is Winn-Dixie, the higher is Food Lion's prices for products included as compared to products excluded. This is contrary to conventional wisdom.

It is not surprising to see that the coefficient for Big Star is negative but statistically insignificant, since the data set does not have 'pre'-price-matching samples for the Big Star. The percentage matches were high in the first week of observation and stayed uniformly high throughout the sample. Possible collinearity with the intercept term makes it hard to measure this coefficient accurately. We conclude that

*A price-matching policy induces the targeted store to raise its prices for products included relative to those excluded from the policy.*

## CONCLUSIONS

In this paper we empirically tested the impact of price-matching policies by supermarkets. Price data collected from grocery stores support the theory that a credible price-matching policy helps competitors relieve the downward price pressure typical of oligopolies. We find no evidence of cut-throat price competition.

As a time-series quasi-design, our study is subject to sources of biases related to the specific history. For example, the North Carolina market for grocery products could have been subjected to demand or cost shocks that generated the observed price increases. An ideal experiment would hold such forces constant or include them in a multivariate model of prices.

There are other ways to correct the price variable for confounding demand sources of variation. If a price deflator for North Carolina was available on a weekly basis, one could correct the prices in Fig. 1 for inflation by taking the stores' prices relative to this deflator. We have chosen to use a different price deflator: the price level of goods that were not part of the price-matching strategy. We have computed the ratio of the price level of included products relative to the price level of excluded products, and such a ratio will wash out any inflationary bias.

Our implicit assumption is that the two product groups are equivalent except for the price-matching policy. The two lists of items found in Appendix 2 are not identical product types. The excluded products are typically perishable store brands or potentially visibile leader products like Coke or eggs, so perhaps there was some systematic shift over time in the demand for these type of products that confounds the interpretation of our statistical results. Moreover, the quality of store brands might vary across stores and time.

Higher grocery prices might be driven by higher costs. The simplest way to account for cost increases as a source of retail price rises is to correct for variation in wholesale prices. Unfortunately, we do not have a comparable time series of wholesale prices for included and excluded products. Since we are explaining relative prices at the retail level, this is a problem only when wholesale prices of included products change relative to those of excluded products. A pure inflation in wholesale prices will not bias our results. We considered using the lowest retail price in the market as a proxy for wholesale price, but retail prices are not always constant mark-ups of wholesale prices (featured brands may in fact be sold at a loss (Kemp, 1955; Hess and Gerstner, 1987)).

While we are unable to include this type of alternative explanatory force in our statistical model, results like those in Table 4 would not be particularly sensitive to differing cost inflation rates of the two product types. The coefficient of *POLICY*, a discrete before–after dummy variable, statistically is so much greater than zero that we would be surprised if the collinearity with cost inflation would reverse the empirical results. We leave this to others to investigate.

Differences in product quality makes comparison of prices across stores difficult. The fact that almost half the excluded products were store brands that are more likely to differ in quality than national brands may explain lower price-matching percentages in Table 3 for excluded *vis-à-vis* included products. If there were also significant variation in quality across time (we have no information indicating this is the case), then the relative match variable given in Eqn (2) would be a less accurate proxy for commitment to price matching, which would lead to the usual errors-in-variables bias for estimates of the coefficients in Tables 5 and 8. Since it has no influence on the before–after price matching variable, however, regressions in Tables 4 and 7 are unaffected. The same logic holds for products traditionally used in sales deals.

Price-matching policies are common in other markets such as appliance and hardware stores, and future research should focus on the impact of these policies on these markets. Other scholars already

may have collected relevant data that can be used to study issues not addressed here. For example, we could not model the dynamics related to the week-by-week responses of the competitors because our data were not gathered continuously. Therefore it was difficult to determine the process by which price co-ordination was achieved. Did the stores follow a 'tit for tat' or 'trigger' approach (Axelrod, 1982) or did they use a more complicated strategy? In addition, we also did not study other forms of non-price responses such as advertising and sales promotion.

How did stores get the information to match the unpublished prices of the low-price supermarket? In a classroom presentation a manager of one of the five supermarkets revealed that their employees, disguised as customers, used pocket tape recorders to obtain data from Food Lion. In addition, he said that common wholesale sources of products gave good indications of the competitor's prices, assuming that mark-up factors did not change significantly. Supermarkets might also use publications like the *Price Finder* to co-ordinate prices.

The *Price Finder* listed many but not all items that the supermarket sold. What was the basis for including or excluding products from the bundle of goods that were price matched?

Finally, there are other strategies that can help retailers limit competition. A grocery chain recently announced that it would honor all store coupons issued by other supermarkets in the area, thereby effectively matching the 'coupon prices' of its rivals. If other stores follow this strategy then no store would find it advantageous to compete using store coupons.

## APPENDIX 1

*Price Finder*

THIS PRICE FINDER
PROVES THAT BIG STAR
NOW HAS LOW PRICES.

If the low price supermarket lowers its regular prices, Big Star will respond by matching them. If the other supermarket lowers prices again, so will Big Star. And Big Star will keep its prices low.

YOU'LL HELP BY TELLING
YOUR BIG STAR MANAGER.

If you see any Big Star regular prices higher than the low price leading supermarket, go to your Big Star store manager and tell him. He will call our price control center for verification that it's a regular price (not a special).

When it's verified we will lower our shelf price and post it in the store—but give us a little time for the Price Finder to catch up.

Remember Big Star will still have Red Dot specials well *below* the prices in this book. Perishables and items that may change erratically are not in this book.

HOW
TO USE THIS
PRICE FINDER

1. Compare your Big Star regular prices in this book with the regular price of the same item at the low price supermarket leader. If Big Star's prices are not the same or lower, tell your Big Star manager. He'll see that it's adjusted.
2. Find out if what looks like a special price in a supermarket ad is a special price. Just compare it with Big Star's low regular price in the Price Finder.
3. Compare prices of leading brands in this book to find if one is cheaper than the other. Or check savings on Big Star brands.
4. Pick up your Price Finder next week for updated prices. Limit: one per customer please.

NO SUPERMARKET HAS EVER DONE
THIS BEFORE.

## APPENDIX 2

As mentioned in the text, the typical basket of goods was constructed by obtaining weights for equivalent products from the 1977 Consumer Price Index table of 'Relative Importance of Components'. We corrected these weights to reflect size units in our samples. For example, since the CPI measures ham prices by the pound whereas our product price is for a four-pound ham, we use our product price and one-fourth of the CPI weight. The weights are adjusted here to sum to one, so price indices are weighted averages of the products' prices.

**Products and market basket weights based on consumer price index**

79 items included in the *Price Finder*

| *Brand name and product* | *Weight × 100* |
|---|---|
| Campbell Chicken Noodle Soup | 1.14 |
| Campbell Vegetable Beef Soup | 1.14 |

| *Brand Name and Product* | *Weight* × 100 |
|---|---|
| Peter Pan Peanut Butter | 0.930 |
| Mt Olive Kosher Dill Pickles | 0.261 |
| Wishbone Italian Dressing | 5.26 |
| Duke's Mayonnaise | 0.305 |
| Hellman's Mayonnaise | 0.159 |
| Whitehouse Vinegar | 0.392 |
| Heinz Ketchup | 0.159 |
| A-1 Steak Sauce | 0.494 |
| Heinz 57 Sauce | 0.494 |
| Morton Iodized Salt | 0.189 |
| Adolph's Meat Tenderizer | 1.39 |
| Ragu Spaghetti Sauce | 0.581 |
| Chef Boyardee Cheese Pizza | 1.20 |
| Del Monte Whole Kernel Corn | 0.494 |
| Del Monte Cut Green Beans | 0.494 |
| Campbell Pork & Beans | 0.523 |
| Hunt's Tomato Sauce | 2.12 |
| Hunt's Whole Tomatoes | 1.17 |
| V8 Cocktail Juice | 0.785 |
| Hawaiian Punch Red Fruit Juice | 0.654 |
| Kool Aid Grape Drink Mix | 0.479 |
| Gerber Applesauce | 2.09 |
| Gerber Oatmeal Cereal | 0.596 |
| Gerber Strained Carrots | 1.06 |
| Spam Luncheonmeat | 3.48 |
| Armour Vienna Sausages | 6.09 |
| Starkist Tuna | 2.96 |
| Jiffy Corn Muffin Mix | 0.712 |
| Duncan Hines Devil's Food Cake Mix | 1.70 |
| Jello Orange Gelatin | 2.74 |
| Nestle Semi-Sweet Morsels | 0.814 |
| Baker Unsweetened Chocolate | 0.610 |
| Hershey Chocolate Syrup | 0.305 |
| Hershey Cocoa | 0.610 |
| Pillsbury All-Purpose Flour | 7.27 |
| Red Band Self-Rising Flour | 0.596 |
| Betty Crocker Bisquick | 0.145 |
| Crisco Oil | 0.872 |
| Mazola Oil | 0.436 |
| Crisco Shortening | 0.290 |
| Log Cabin Syrup | 0.203 |
| Kelloggs Corn Flakes | 0.799 |
| Kelloggs Rice Krispies | 0.727 |
| General Mills Total Cereal | 0.523 |
| Brim Electric Perk | 2.10 |
| Maxwell House Reg. Ground Perk | 2.10 |
| Lipton Tea Bags | 1.87 |
| Carnation Coffeemate | 1.87 |
| Equal Sugar Substitute | 1.68 |
| Clorox Liquid Bleach | 0.189 |
| Ajax Cleanser | 0.843 |
| Comet Cleanser | 0.567 |
| Bold 3 Detergent | 0.770 |
| Cheer Detergent | 0.770 |
| Cascade Dishwasher Detergent | 0.145 |
| Lysol Disinfectant Spray | 1.16 |
| Reynold's Aluminum Foil | 0.988 |
| Cutrite Wax Paper | 1.20 |
| White Cloud Bathroom Tissue | 1.20 |
| Bounty Jumbo Paper Towels | 1.20 |
| Keebler Fudge Stripe Cookies | 1.49 |
| Nabisco Oreo Cookies | 0.857 |
| Nabisco Ritz Crackers | 1.57 |
| Kraft American Cheese Slices | 3.32 |
| Mrs Filbert's Margarine | 0.785 |
| Fleischman's Margarine | 1.23 |
| Kraft Parmesian Cheese | 5.00 |
| Breyer's Ice Cream | 1.20 |
| Sealtest Ice Cream | 1.90 |
| Minute Maid Orange Juice Concentrate | 5.96 |
| Oreida French Fries | 0.828 |
| Stouffer's Lean Cuisine/Chicken | 2.54 |
| Mrs Smith's Apple Pie | 0.319 |
| Sara Lee Streusel | 1.03 |
| Bufferin Aspirin | 1.89 |
| Ban Roll-On Deodorant | 0.988 |
| Colgate Winterfresh Gel Toothpaste | 0.988 |
| 35 items excluded from the *Price Finder* | |
| Store American Cheese Slices | 11.4 |
| Swore Cut Green Beans | 1.34 |
| Store Hot Dog Buns | 1.37 |
| Store Sugar | 0.573 |
| Store Thin Sliced Bread | 0.623 |
| Store Whole Kernel Corn | 1.27 |
| Store Whole Milk | 4.41 |
| Dole Bananas | 1.24 |
| Store Cucumbers | 5.09 |
| Store Head Lettuce | 2.29 |
| Oscar Meyer Bologna | 5.19 |
| Store USDA Full Chuck | 4.19 |
| Store USDA Cube Steak | 2.37 |
| Store USDA Choice Sirloin | 2.52 |
| Store Market Ground Beef | 9.28 |
| Store Pork Loin Chops | 2.57 |
| Jesse Jones Country Sausage | 1.87 |
| Jesse Jones Franks | 1.82 |
| Swift Hostes Ham | 1.12 |
| Ball Park Franks | 1.37 |
| Bass Farm Sausage | 1.64 |

| *Brand Name and Product* | *Weight* × 100 |
|---|---|
| Oscar Meyer Sliced Bacon | 4.19 |
| Coke | 1.82 |
| Mellow Yellow | 0.898 |
| Mountain Dew | 0.898 |
| Pepsi | 1.82 |
| Natural Light Beer | 0.573 |
| Miller Beer | 1.14 |
| Wonder Bread | 5.39 |
| Regular Cigarettes | 1.34 |
| 100 Cigarettes | 1.34 |
| Store Large Grade A Eggs | 4.34 |
| Store Medium Grade A Eggs | 2.79 |
| Thomas English Muffins | 0.948 |
| Pine State Whole Milk | 8.80 |

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