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An Empirical Analysis of Determinants of Retailer Pricing Strategy

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This paper empirically investigates the determinants of retailers' pricing decisions. It finds that competitor factors explain the most variance in retailer pricing strategy. Only in the cases of price-promotion coordination and relative brand price do category and chain factors explain much variance in retailer pricing. These findings are derived from a simultaneous equation model of how underlying dimensions of retailers' pricing strategies are influenced by variables representing the market, chain, store, category, brand, customer, and competition. The optical scanner data base describes 1,364 brand-store combinations from six categories of consumer packaged goods in five U.S. markets over a two-year time period. Our study classifies retailers' pricing strategies based on four underlying dimensions: price consistency, price-promotion intensity, price-promotion coordination, and relative brand price. These four pricing dimensions are statistically related to: (1) competitor price and deal frequency (competitor factors), (2) storability and necessity (category factors), (3) chain positioning and size (chain factors), (4) store size and assortment (store factors), (5) brand preference and advertising (brand factors), and (6) own-price and deal elasticities (customer factors). These findings are useful to retailers profiling alternative pricing strategies, and to manufacturers customizing the levels of marketing support spending for different retailers.

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1. Introduction

Retailers face a complex task in formulating pricing strategies and tactics for multiple products in today's competitive environment (Kahn and McAlister 1997, Levy and Weitz 1998). Many marketing scientists have observed that retailers' pricing strategies and tactics are diverse (Fader and Lodish 1990, Hoch et al. 1994). Surprisingly, there has been little research that describes retailers' actual pricing strategies—that is, what types of strategies are adopted; how pricing strategies are customized for particular brands, categories, stores, chains, and markets; and what factors influence the customization process. Descriptive research on the customization of retailer pricing strategies could be very useful to retailers to profile their pricing decisions—and predict their competitors' decisions. Manufacturers also need to make informed decisions about retailers and marketing-support spending for their brands, based on insights from analyses of retailers' pricing decisions.

Prior research suggests that pricing strategy depends on company, customer, competitor, and other factors (Tellis 1986). Although there is considerable evidence on how these factors influence manufacturer pricing strategies, very little is known about how they influence retailer pricing. Moreover, most prior research that includes retailer prices (e.g., the choice modeling and price promotion literatures) has used models that do not take into account the marketing efforts of competing retailers. As retail markets become increasingly competitive, it is important to characterize retailer pricing decisions and investigate how they are related to different factors—particularly to the price and promotion decisions of competing stores.

The purpose of this study is to investigate the following focal research question: *How are retailers' pricing strategies customized for different brands, categories, stores, chains, markets, customers, and competitive situations*? Specifically, how are competitors' marketing efforts—particularly price and deal decisions—related to retailer pricing? What factors are most important in retailer pricing decisions: category, brand, and market characteristics—or competitor marketing efforts? Furthermore, what is the role of brand characteristics, such as brand advertising and brand equity, in pricing strategy? How do category factors, such as storability and necessity, affect pricing strategies? How do characteristics of the store, such as outlet size and category assortment, influence retailers' pricing decisions? How do pricing strategies vary across chains and markets? What is the effect of consumer sensitivity to price changes or deals on retailer pricing for each brand at a store? We consider these questions within a broader investigation of how product and market characteristics are related to retailer pricing decisions.

Our study empirically examines retailers' strategic pricing decisions, identifies the underlying dimensions of retailers' pricing strategies, and investigates how the dimensions are related to multiple factors. Thus, it is a *descriptive study* of retailers' pricing decisions, not a normative study of how pricing decisions *should* be made. The majority of relevant prior empirical research can be grouped into three streams: (1) studies of the determinants of price and promotional response or elasticities (e.g., Bell et al. 1999, Bolton 1989a and b, Hoch et al. 1995, Narasimhan et al. 1996); (2) studies of how retailer pricing tactics are related to purchase behavior, customer variables, and category structure (e.g., Fader and Lodish 1990, Neslin et al. 1994, Tellis and Zufryden 1995); and (3) studies of product/market structure (e.g., Leeflang and Wittink 1996). Most prior empirical research on retailer pricing has focused on the role of customers—despite evidence that managers attend closely to the actions of competitors in a general setting (Leeflang and Wittink 1996). An important empirical study by Chintagunta (2002) investigates brand-retail chain prices for one product category as a function of manufacturer and store factors. Our study extends this work by examining a more comprehensive set of factors on multiple pricing strategy dimensions across multiple product categories and retail chains with a focus on the role of competition factors. The unique contributions of this study relative to prior research are:

- A conceptualization of retailers' pricing decisions as *interdependent*, and of retailer pricing strategy as characterized by *stable underlying dimensions*.
- An emphasis on *strategic* aspects of retailers' decisions for brands at different outlets, rather than a focus on storewide policies or brand tactics.
- A methodological approach that models retailers' pricing strategies as *dependent (endogenous) variables* that are related to a comprehensive set of factors while accounting for potential simultaneity in the determination of pricing decisions and price and promotion responsiveness.

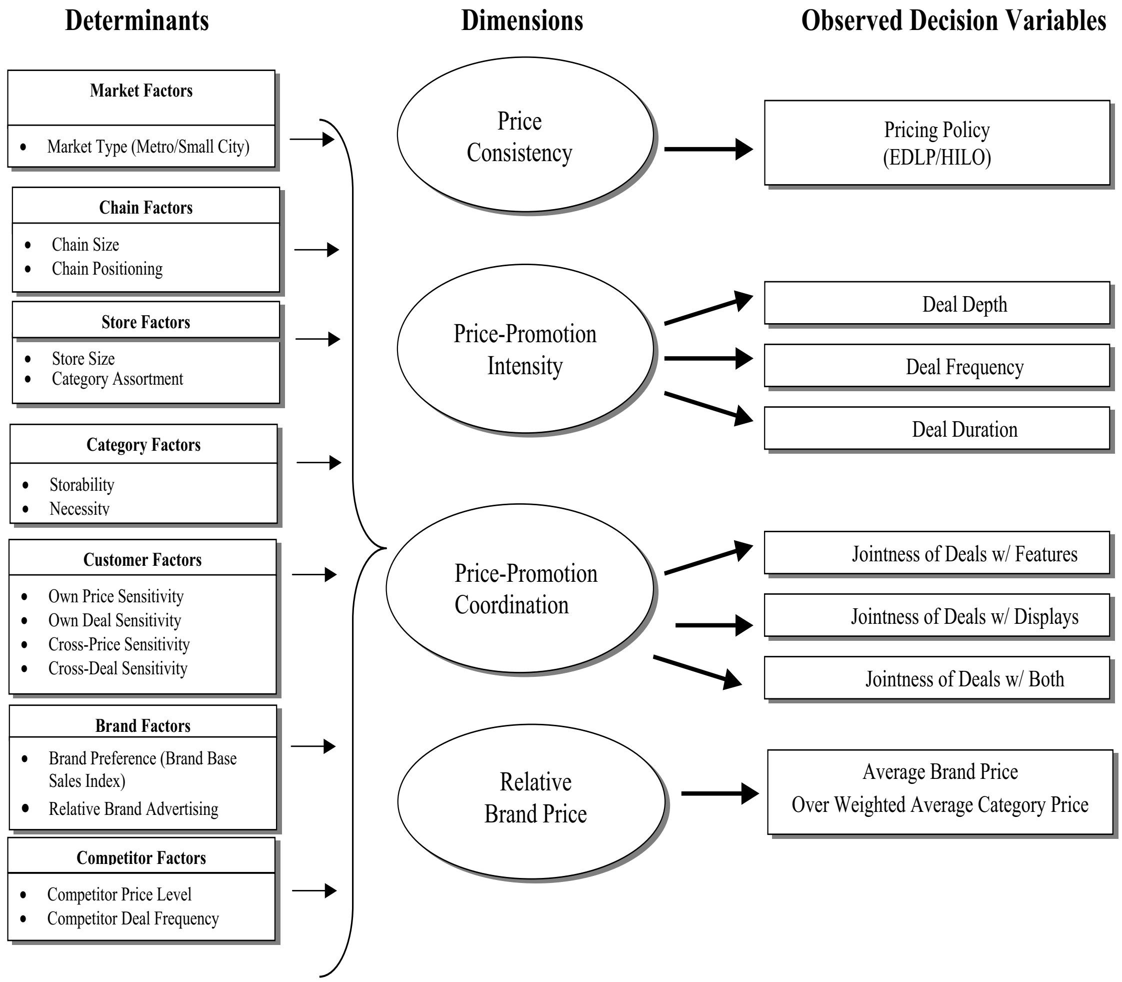
In this study, we characterize retailers' observed pricing decisions (for different brand-store combinations)—such as regular price, deal frequency, depth of deal discount, feature, and display—along four stable, underlying dimensions: price consistency, price-promotion intensity, price-promotion coordination, and relative brand price. We develop a simultaneous equation model that relates the four pricing dimensions to market, chain, store, category, brand, customer, and competitor characteristics (see Figure 1) and estimate it using store-level scanner data on 1,364 brand-store combinations from six categories of consumer packaged goods in five U.S. markets over a two-year period. To address our focal research question, we assess the relative importance of customer, competitor, and other factors in determining retailer pricing strategies, and characterize how retailers make pricing decisions under different conditions.

2. Retailer Pricing Decisions and Dimensions

2.1. The Database

The database consists of weekly multibrand, multistore store-level scanner data drawn from six categories of consumer-packaged goods in five U.S. markets—obtained from two sources, ACNielsen and Co. and Information Resources, Inc. (IRI). The categories are spaghetti sauce, bathroom tissue, liquid bleach, ketchup, mouthwash, and frozen waffles. The cities are New York, Los Angeles, Chicago, Marion (Indiana), and Pittsfield (Massachusetts). The first three cities are fairly representative of large U.S. markets, and the last two small cities are considered to have demographic profiles that closely match the U.S. average. There are 17 chains and 212 stores in the database. The 12 stores and 4 categories described by the IRI data set are different from the 200 stores and 2 categories in the Nielsen data set, yielding combined data for 1,364 brand-store combinations over a maximum of 121 weeks in any particular store. The period of data is not the same for all the stores. The use of two different data sources makes it possible to uncover systematic patterns that exist across the different data collection and measurement conditions—increasing the generalizability of the study's findings. In addition, we collected data on retailer characteristics for the 17 chains in our data from *Trade Dimensions*. These data include chain sales, square footage, and number of stores. We assume that data over a two-year period represent a stable competitive equilibrium among retailers. This assumption seems reasonable for three reasons. First, we do not have more than 121 weeks of data for any one store, and it is not a long enough period of time to be concerned about changes in competitive equilibria in the retail marketplace. Second, the retail chains and the markets we study are established chains that have been in business over decades. Third, no major

Figure 1 Determinants of Retailer Pricing Strategy



consolidations or dramatic market events occurred during the studied time period for any chain.

The umbrella product categories for these six categories are: frozen breakfast (i.e., waffles), oral care (i.e., mouthwash), paper (i.e., bathroom tissue), laundry care (i.e., bleach), condiments (i.e., ketchup), and pasta (i.e., spaghetti sauce). They are reasonably large categories and their roles capture the spectrum of category roles in a typical store. This notion is amply supported by penetration and frequency of purchase data for these categories among U.S. households (IRI Category Report 1998). It is also supported by qualitative information on category roles obtained in interviews conducted with marketing directors of four leading grocery chains in the United States. Their responses on category roles could be summarized in terms of the importance (high or low) of sales and profits, yielding four combinations: (1) support category comprising low sales and low profits (frozen waffles), (2) preferred category consisting of low sales, but high profits (mouthwash), (3) destination category comprising high sales, but low profits (bathroom tissue and bleach), and (4) ideal category consisting of high sales and high profits (ketchup and spaghetti sauce).

2.2. Assessing the Brand-Store Combination as a Unit of Analysis

In this paper, we investigate retailers' pricing strategies for brands at stores—that is, the brand-store combination is the unit of analysis. Although retailers may be making price decisions at both the category and brand levels, our goal is to discover why a retailer may customize pricing strategies in different ways, such as promoting one brand within a category with higher intensity (in the long run) than the other brands within the same category. Our reasons for conducting our empirical analysis at the brand-store level are as follows. First, supermarket chains have "category managers" who plan purchases at the category level, but set prices at the brand level and sometimes at the SKU level. Because the prices of different flavors or colors of a brand (e.g., mouthwash or waffle or bath tissue SKUs) are often the same, price decisions tend to take place at the brand level rather than the

SKU level. Second, our interviews with the marketing and category managers of a few retail chains suggested that retailers are likely to make price decisions at a brand level for a particular store. Third, we conducted extensive preliminary analyses of the extent of variability in brand-store prices in our database and ascertained that there was sufficient brand-level variation to develop an econometric model. Fourth, Chintagunta (2002) shows that retailer pricing is done at a brand level rather than at a category level. In sum, prior research, managerial reports, and our preliminary analyses indicated that there is rich information about pricing decisions at brand level.

2.3. Measurement of Pricing Decisions and Conceptualization of Pricing Dimensions

Prior research has viewed retailer pricing strategy in terms of pricing policy or format, typically labeled EDLP or HiLo (Hoch et al. 1994). An EDLP policy involves offering consistently low prices on many brands and categories and is practiced by some supermarkets (e.g., Food Lion and Lucky). A HiLo policy is characterized by steep temporary price discounts on high "regular" prices for many brands and categories and is adopted by other supermarkets (e.g., Kroger, Safeway). An EDLP policy tends to draw price-sensitive shoppers, whereas a HiLo policy often attracts "cherry pickers" (see, e.g., Lal and Rao 1997). Our study departs from prior research concerning retailers' pricing strategies in three significant ways. First, most prior studies consider these pricing formats as storewide policies. In contrast, we develop measures of retailers' pricing strategies that are specific to the brand-store combination. Second, most prior studies view pricing policy as a dichotomous variable (EDLP or HiLo). However, some evidence suggests that EDLP and HiLo occupy different positions on a pricing-policy continuum (e.g., Hoch et al. 1994). Hence, we view retailer pricing strategy along a continuum. Third, retailer pricing strategy has been typically viewed as one-dimensional. We consider retailers' strategic pricing strategy on multiple dimensions that recognize the existence of price promotions.

To identify the dimensions of retailer pricing strategy, we calculated nine measures of retailers' pricing decisions at the brand-store level for the categories in the database. These measures are: price consistency; depth of deals during all weeks; deal depth during promoted weeks; frequency of deals; duration of deals; proportion of weeks with feature and deal together; proportion of weeks with display and deal together; proportion of weeks with feature, display, and deal together; and average relative brand price. They are summarized in Table 1. A brief rationale for these measures and the dimensions is provided below. Additional information is provided by Bolton and Shankar (2003).

Price Consistency. Prior research has typically studied price consistency at the store level (cf., Hoch et al. 1994). In this paper, we examine price consistency for a *brand-store combination*. Although price consistency refers to stable prices, many retailers that have stable prices tend to have *low* stable prices to stay competitive (e.g., Walmart, Food Lion, Lucky). Hence, we measure price consistency for a brand in a store in a given week by calculating the coefficient of variation or the ratio of the standard deviation of actual price over the mean of the actual price, following Shankar and Krishnamurthi (1996). The value for a brand-store

Table 1 Measures of Retailers' Pricing Decisions

Dimensions	Decision Variables/Measures Used in This Study
Price Consistency—Extent to which a retailer follows a pricing policy/format that is EDLP on one end and HiLo on the other end of the continuum.	*Single Variable/Measure* Pricing policy: Standard deviation of the brand price divided by its mean over the weeks.
Price-Promotion Intensity—The regularity of depth, frequency, and duration of price cuts or deal discounts for a given brand at the retail level.	*Four Variables/Measures* (1) Deal depth 1: Average deal depth (in cents) across all weeks; (2) Deal depth 2: Average deal depth (in cents) across only deal weeks; (3) Deal frequency: Percentage of weeks with deals; (4) Deal duration: Average deal duration (in weeks). Each brand-store average is standardized by dividing by the category average.
Price-Promotion Coordination—The "jointness" or complementarity of price and promotion decisions for a given brand.	*Three Variables/Measures* (1) Feature and deal: Percentage of weeks with feature and deal; (2) Display and deal: Percentage of weeks with display and deal; (3) Feature, display, and deal: Percentage of weeks with feature, display, and deal.
Relative Brand Price—Average actual price of the brand relative to other brands in the category at the store level.	*Single Variable/Measure* Average brand price divided by the weighted average category price (where the weights are market shares within the store).[1]

[1]Actual brand price is the price per equivalent unit size as given to us by the data providers. In some cases, when we were given prices for multiple brand sizes or SKUs, we calculated a simple average across brand sizes or SKUs—which is similar to how it was done by the data providers in the other cases.

pair is calculated for that brand in that store over the period of data. This measure is a dimensionless ratio that enables us to compare across different brand-store combinations, and it theoretically varies between zero and infinity. When the brand-store is price consistent, the ratio is close to zero.

Price-Promotion Intensity. Retailers' pricing strategies include decisions on the frequency, depth, and duration of deals—ultimately determining the final price paid by the consumers for a brand. Higher deal depth, greater deal frequency, and longer deal duration reflect higher overall price-promotion intensity for a brand in a given category and store. These tactical decisions are interrelated for a given brand or category (Alba et al. 1994) and may be different for different brands within a category (Tellis and Zufryden 1995), across categories, and across stores. Because deal frequency and deal magnitude may be negatively correlated for some brands (Alba et al. 1994), we calculated two measures of deal magnitude or depth: the average deal magnitude over all weeks (i.e., weeks not on deal are assigned the value zero) and the average deal magnitude over only deal weeks. Average deal depth over only the deal weeks captures deal magnitude, whereas average deal depth over all weeks captures a combination of deal magnitude and frequency. These calculations yielded four measures of pricing decisions that concern price-promotion intensity: deal frequency, deal duration, and two measures of deal depth. Together, the four measures represent all the facets of price-promotion intensity.

Price-Promotion Coordination. A retailer's pricing strategy for a brand includes the management of displays and feature advertising with price discount/deal decisions over time. A retailer's deal discount may or may not occur together with feature advertising for any brand in a given week (Blattberg and Neslin 1990). Furthermore, features or displays may be accompanied by deals during some weeks, but not in other weeks (Fader and Lodish 1990, Inman and McAlister 1993). Price specials or deals, if accompanied by features or displays, may benefit both consumers (nearly half of whom are nonvigilant about prices) and the retailer (Dickson and Sawyer 1990). The extent to which these decisions occur together (or do not occur together) for a brand over time reflects the degree of price-promotion coordination by the retailer for that brand. We believe that the coordination of price-promotion decisions across multiple brands within a category and across categories in a given store is an important complementary aspect of retailers' pricing decisions. Higher *absolute* correlations among deal, feature, and display activity indicate greater price-promotion coordination. Hence, we calculate these three measures of pricing decisions that concern price-promotion coordination.

Relative Brand Price. Different stores have different relative prices for a brand, i.e., price premiums/discounts for a brand relative to the mean category price. For example, a supermarket located in an upscale neighborhood may have a different price level for a particular brand than a supermarket in a blue-collar neighborhood (Hoch et al. 1995). Hence, we measure the relative price of a brand at a given store as the ratio of the actual price of the brand over the average actual price of the category (i.e., across all brands), consistent with Bolton (1989a). This measure can be interpreted as follows. Because we consider price level for a brand *relative to other brands in the category*, we are implicitly choosing to measure relative price effects that operate across brands within a category. Interstore variation in relative price could be due to differences in category assortments at the stores or differences in the store's strategies. We investigate this issue by (1) including category assortment at the store as a potential determinant of pricing strategy and (2) by conducting a subgroup analysis of EDLP- versus HiLo-positioned stores. We discuss this issue in the results section.

Underlying Pricing Dimensions. The correlation matrix of the nine measures of pricing decisions serves as a multitrait multimethod matrix, from which we can assess our postulated underlying dimensions of pricing decisions (Campbell and Fiske 1959) (see Table 2). Grouping the measures based on their correlations, we obtain the four dimensions. Note that the measures are more highly correlated within each of the two dimensions, price-promotion intensity and price-promotion coordination, than they are across all the dimensions (shown in bold in Table 2).[1] Price consistency and relative brand price are each represented by a single item, whereas price-promotion intensity and coordination are represented by additive indices. Each additive index was computed by adding the values of the component measures, each of which is dimensionless, representing a different facet of the dimension.

[1] Deal duration's highest absolute correlation is with deal frequency, a price-promotion intensity measure. However, the observant reader will note that deal duration has low correlations with deal depth, and somewhat high correlations with the price-promotion coordination measures. To further explore this issue, we analyzed the measures using principal components analysis (varimax rotation) and found that deal duration loaded with the price-promotion intensity measures. Hence, we classified deal duration as a price-promotion intensity measure. Furthermore, we investigated the interrelatedness of the four pricing dimensions by calculating their correlations (i.e., the correlations of their indices). Throughout the remainder of the paper, the results reported are equivalent to the results obtained if we used factor scores rather than additive indices.

Table 2 Correlation Matrix of Pricing Measures

	Price Consistency	Depth (All Weeks)	Depth Deal (Weeks)	Deal Frequency	Deal Duration	Frequency (Feature + Deal)	Frequency (Display + Deal)	Frequency (Feature + Display + Deal)	Relative (Brand Price)
Price consistency	1		**0.07**				**−0.06**		**0.04**
Deal depth all (weeks)	−0.02	1							
Deal depth deal (weeks)	0.07	0.45	1				**0.32**		**−0.02**
Deal frequency	−0.07	−0.36	−0.46	1					
Deal duration	0.14	0.17	0.12	−0.49	1				
Frequency of feature + deal	−0.10	−0.17	−0.07	0.39	−0.26	1			
Frequency of display + deal	−0.20	−0.10	−0.15	0.30	−0.28	0.51	1		**0.11**
Frequency of feature + display + deal	−0.16	−0.17	−0.19	0.31	−0.28	0.64	0.83	1	
Relative brand price	0.04	−0.14	−0.05	0.01	0.06	−0.11	−0.09	−0.09	1

Note. The numbers in boldface type represent the correlation among the four dimensions, namely, price consistency, price-promotion intensity, price-promotion coordination, and relative brand price.

3. Determinants of Pricing Strategy

We now focus on the determinants of retailer pricing strategy. Dhar and Hoch (1997) argue that a parsimonious theory to explain across retailer variation in store brand penetration is unlikely because store brands sit in the middle of the manufacturer-retailer-consumer vertical relationship. We believe that a parsimonious theory to explain variation in brand-store pricing strategies is equally unlikely for the same reason. Retailers' pricing strategies and tactics are likely to be influenced by upstream (i.e., manufacturer/brand, category) and downstream (i.e., customer) factors, as well as by market, chain, and store factors. However, it is also likely that a key driving force could be horizontal or competitor factors. Furthermore, determinants of pricing strategies in a cross-category analysis are not the same ones that explain performance across retailers within a category (i.e., manufacturer/brand, competitor, market, chain, and store factors). These considerations suggest that retailers' pricing strategies depend on seven factors: market, chain, store, category, brand, customer, and competitor factors as depicted in Figure 1. Thus, we extend Tellis' (1986) taxonomy of pricing strategies to include market, chain, and store factors in a retailing context, consistent with Dhar and Hoch (1997).

In this section, we identify specific variables corresponding to each of these factors by considering prior research on retailer strategies and tactics (e.g., Blattberg and Neslin 1990, Kumar and Leone 1988, Neslin et al. 1995). We begin by discussing how competitor factors—that have been somewhat neglected in prior research—may influence retailer pricing decisions. We then consider the other factors associated with retailer pricing decisions. We do not discuss the predicted direction of the effects of these variables because they can be simultaneously determined (i.e., interdependent) and because the predictions are tentative. However, we explicitly account for simultaneity in our model specification and estimation.

3.1. Competitor Factors

In general, firms are usually very sensitive to the activities of their competitors in the same market (Lambin et al. 1975, Hanssens 1980). Competitor activities shape a firm's pricing decisions to the extent to which they affect the market share of the firm (Ailawadi et al. 2001). Leeflang and Wittink (1996) show that managers tend to overreact to competitors' marketing activities. One reason for this finding may be that people tend to weigh highly variable attributes more heavily in decision-making contexts (Meyer and Eagle 1982)—and competitive behavior tends to be highly variable and visible. Among the various competitor activities, pricing activities are more salient and tend to elicit firm's responses more than other types of activities (Hanssens 1980).

In the retail context, theoretical research suggests that retail competition influences retail pricing (e.g., Lal and Villas Boas 1998). Competition between retailers for accumulated shoppers influences deal decisions (Pesendorfer 2002). Chintagunta's (2002) empirical study shows that competitor factors are important determinants of retail pricing, but he operationalizes retail competition through store traffic as a proxy variable for lack of data availability. Other empirical research on retailer pricing has studied two variable and visible aspects of competitive retailer activities: competitors' price level and deal frequency (Urbany and Dickson 1990, 1991). Our interviews with retailers, together with prior research (e.g., Alba et al. 1994), indicate that they are the most visible and important variables that a retailer may take into account over a two-year period.

Competitor Price Level. Retailers' pricing decisions for brands will typically be very sensitive to pricing decisions by competing stores because organizations tend to match competitive moves (Hanssens 1980, Leeflang and Wittink 1996). In response to decrease in prices by its competitors, a retailer's price consistency may change significantly—that is, the retailer may change its prices more often—e.g., lowering regular prices if it anticipates short-term gains in volume (Urbany and Dickson 1990). This response is consistent with the game-theoretic result of Lal and Rao (1997) that EDLP retailers (those with high price consistency) coexist with HiLo retailers (price reducers) in equilibrium. A second possible response to lower competitor prices is that the retailer may offer more price promotions to increase the value of its offerings. Third, a retailer might also change its levels of coordination of deals, features, and displays—depending on the anticipated impact of competitor price changes on its sales of a brand. Finally, when competitors' prices are lower, a brand's price level could be either higher or lower depending on the degree of rivalry with the competitor. If the rivalry is high, relative brand price could be low, but if the rivalry is low, relative brand price may be high, consistent with Ailawadi et al. (2001). We do not predict the directions of associations, but examine them in our empirical analysis.

Competitor Deal Frequency. We believe that retailers will respond to competitive deal activity because dealing is one of the most visible competitor activities (Rao and Syam 2001). Although both deal magnitude and frequency characterize deal activity, deal frequency dominates consumer perceptions of store pricing. Consequently, to occupy a favorable position in a consumer's mind, a retailer is likely to respond to changes in competitors' deal frequency (Alba et al. 1994). Our interviews with retailers indicated that over a long period such as a year or more, they were more likely to be able to recall competitors' deal frequencies than they were to recall deal depth. This observation is not entirely surprising because prior studies have shown that people do not follow strict temporal integration models in constructing retrospective evaluations (Fredrickson and Kahneman 1993). In other words, keeping track of deal frequency counts is cognitively less demanding than remembering deal depth magnitudes, so deal frequency is more salient than deal depth over a long period.

Changes in competitor deal frequency may be associated with changes in all four retailer pricing dimensions. Retailers with different levels of competitor deal frequencies may differ in their price consistencies. A retailer whose competitors have a high frequency of deals might be less consistent in its prices than a store whose competitors have deals less often. In their study of price-cutting momentum, Urbany and Dickson (1991) find that competitors typically follow suit when there is a price cut/deal by one of the players, regardless of whether consumers actively compare prices or not. Their study also suggests that retailers are likely to respond to high competitor deal frequency with higher price-promotion intensity, greater price-promotion coordination, and lower brand prices. Therefore, we predict that differences in competitor deal frequency will be associated with differences in relative brand price, price consistency, price-promotion intensity, and price-promotion coordination. Again, we do not predict whether these relationships will be positive or negative—simply that they will exist. For example, in the case of relative brand price, retailers might charge higher or lower prices depending on the net effect of competitor deal frequency and magnitude. If the net competitor discount is lower, a store may charge a higher relative brand price; but if the net competitor discount is steeper, the store is likely to have a lower relative brand price.

3.2. Market Factors

Different markets or cities may witness different pricing practices (Dhar and Hoch 1997). In particular, *market type*, in terms of whether the market is a metropolitan city or a small city, may be associated with a particular pricing environment and thus may be related to pricing practice.

3.3. Chain Factors

Different retail chains may have different retail strategies based on differences in *chain size* and *chain positioning*, consistent with their corporate missions and policies. Large and small chains may be different with respect to scale economies, printing and holding costs, and power with suppliers, so they may price and promote differently (Dhar and Hoch 1997). Similarly, the positioning of a retail chain (as reflected in its annual report and other publicly available documents) may be related to pricing strategy (Bell and Lattin 1998). Positioning is a strategic decision of the chain that generally does not change over time, so it can be considered exogenous.

3.4. Store Factors

We consider two store-specific characteristics examined by prior research in other contexts (cf., Hoch et al. 1995, Dhar and Hoch 1997): *store size* and *category assortment*. Prior research suggests that large and small stores may indulge in different pricing strategies to defend or increase their market shares (Messinger and Narasimhan 1997). Retailer pricing strategy depends on its decisions about which brands and sizes to stock in each category (category assortment) at a given retail outlet (Bawa et al. 1989). Promotional elasticities are lower for categories with a larger number of brands (Narasimhan et al. 1996).

3.5. Category Factors

Category factors influence the value of the perceived economic opportunity offered by retailer pricing. Bell et al. (1999) identified five potential category characteristics: share of budget, brand assortment, size assortment, storability, and extent of necessity—that may influence promotional price elasticities. Among these, we believe that the *storability* and the extent of *necessity* of product categories may influence retailer pricing strategies for the categories in our study (assortment is store specific and is already included under store factors). In our database, categories such as bleach and bathroom tissue can be stored, whereas ketchup and spaghetti sauce are perishable. Similarly, bathroom tissue is a necessary category for a household, whereas mouthwash is not. We study these two factors because our database only contains six categories.

3.6. Brand Factors

Game-theoretic models of manufacturer/retailer behavior (e.g., Rao et al. 1995) predict that retailer price levels will depend on manufacturers' marketing efforts. Three key aspects of manufacturer marketing effort that might affect retailers' pricing dimensions are *brand equity or preference*, *relative brand advertising*, and *relative brand trade deals*. First, brand equity has an important influence on marketing strategy, but its effect on pricing strategy is complex (Keller 1993), so we incorporate brand preference in our model. In our empirical analysis, we represent brand preference with a brand base sales index (which we describe subsequently).[2] Second, we incorporate a *relative* measure of brand advertising so that we do not have to include different competitor brand advertising efforts as additional factors in our model. "Market power" ("advertising as information") theory suggests that relative brand advertising may be associated with higher (lower) retail price levels (Farris and Albion 1981, Kaul and Wittink 1995, Neslin et al. 1995).

Third, we considered that manufacturers offer trade promotions that chains (or stores) may pass along to customers, so trade promotions may influence pricing strategies of a store *and, potentially, its competitors*. Trade deals may be correlated with advertising because a brand that advertises heavily is likely to offer lower trade discounts less often (cf., Neslin et al. 1995). Unfortunately, due to insufficient data this paper cannot model the role of trade deals. However, we conducted some supplementary analyses concerning trade deals on a subset of the data (for two categories and one chain). We ran regressions for all four dimensions, including trade deal magnitude and frequency and wholesale price as additional explanatory variables. These additional variables were not significant in any of the regressions. Moreover, we found that the magnitudes and signs of the other independent variables were very similar. Importantly, competitor factors still remained the most powerful explanatory variables. In sum, the supplementary trade analysis revealed that the significance and explanatory power of the variables remained the same despite the inclusion of trade deals.

3.7. Customer Factors

Classical economic theory and empirical research predict that retailers' pricing decisions will depend on consumer sensitivity to price changes and deals of brands in a given market—i.e., on *own-* and *cross-price and deal elasticities* (cf., Blattberg and Neslin 1990, Reibstein and Gatignon 1984). Furthermore, retailers' pricing decisions should depend on differences in the clientele at different stores—which will also be reflected in these price and deal elasticities (Moriarty 1985). For example, income (Hoch et al. 1995) and loyalty (Raju et al. 1990) are related to price sensitivity. Clientele effects are sometimes represented by demographic variables and degree of loyalty, but such variables can be considered surrogates for actual customer behavior that can be measured by price elasticities. Hence, our study represents customer factors solely by own- and cross-price and deal elasticities.

4. Model Development and Estimation

This section develops a simultaneous equation model of how the four underlying pricing dimensions depend on market type, chain size, chain positioning, store size, category assortment, storability, necessity, brand preference, relative brand advertising, customer own and cross elasticities for prices and deals, competitor relative price and deal frequency. The pricing dimensions, own- and cross-price elasticities, competitor relative price, and deal frequencies are treated as endogenous variables.

[2] We make the same predictions for brand equity and brand preference. In prior research, the brand sales index has been treated as a measure of brand equity. However, it should probably be interpreted as a measure of brand preference because it captures both tangible and intangible attributes. (We are indebted to a reviewer for noting this point.) Hence, we can only test the influence of brand preference on pricing strategies. The remainder of this paper uses the term *brand preference*, subsuming the notion of brand equity. We also note that although this brand sales index is derived after accounting for the impact of retailer pricing on sales, there is a possibility that in the long run, brand equity is affected by retailer pricing strategy.

4.1. Specification of Equations for Pricing Dimensions

Our predictions of how retailer price consistency, price-promotion intensity, price-promotion coordination, and relative brand price are related to variables describing customer, competitor, and product mix factors can be expressed mathematically as follows:

$$\begin{aligned}\mathrm{DIM}_{ij}^{d} = {} & \alpha_1^d + \alpha_2^d \mathrm{METRO}_j + \alpha_3^d \mathrm{CHSZ}_j + \alpha_4^d \mathrm{CHPOS}_j \\ & + \alpha_5^d \mathrm{STORAB}_i + \alpha_6^d \mathrm{NECES}_i + \gamma_1^d \mathrm{SS}_{ij} + \gamma_2^d \mathrm{CA}_{ij} \\ & + \gamma_3^d \mathrm{PE}_{ij} + \gamma_4^d \mathrm{DE}_{ij} + \gamma_5^d \mathrm{CPE}_{ij} + \gamma_6^d \mathrm{CDE}_{ij} \\ & + \gamma_7^d \mathrm{BE}_{ij} + \gamma_8^d \mathrm{AD}_{ij} + \gamma_9^d \mathrm{CPL}_{ij} + \gamma_{10}^d \mathrm{CDF}_{ij} + \eta_{ij},\end{aligned} \tag{1}$$

where DIM^d denotes Dimension

$$d \in \{\mathrm{PRCON}, \mathrm{PROMINT}, \mathrm{PRCORD}, \mathrm{BPRICE}\},$$

PRCON is price consistency score, PROMINT is price-promotion intensity score, PRCORD is price-promotion coordination score, BRPRICE is relative brand price, METRO denotes if the store is in a metropolitan city or a small city, CHSZ denotes chain size, CHPOS denotes the positioning of the chain's pricing format (EDLP or HLP), STORAB is the storability of the category, NECES denotes if the product is a necessity, SS denotes store size, CA denotes category assortment, PE denotes estimated price elasticity, DE denotes estimated deal elasticity, CPE denotes estimated cross-price elasticity, CDE denotes estimated cross-deal elasticity, BE denotes estimated brand equity/preference (brand base sales index), AD denotes relative brand advertising, CPL denotes competitor relative price, CDF denotes competitor deal frequency, i is brand, j is store, and η is an error term.[3]

[3] We also estimated models that included store, chain, and market dummies instead of the proposed store, chain, and market factors. These models provided results for the other variables that were directionally similar to those obtained from the proposed set of factors. Some of these dummies were significant, but many were not. For example, the dummy variables for those chains that could be classified as large (based on a mean split) were significant compared to those for small chains in the price-promotion intensity and price-promotion coordination equations. This result is consistent with the coefficient of chain size in the proposed model in those equations. Because there were many dummies (mainly chain and store) in such a model, the results could not be interpreted in a succinct manner. Because the differences in pricing dimensions are more parsimoniously captured by the proposed set of factors, we retained these factors in our model. We also tested for interaction effects of the category with chain or market, but found them insignificant ($p > 0.05$).

4.2. Specification of Equations for Price Elasticities, Competitor Price Level, and Deal Frequency

The pricing dimensions and some of their determinants may be interdependent or simultaneously determined. In particular, there is considerable research evidence that shows that consumer price elasticities (both own and cross elasticities) depend on market characteristics—including price and deal decisions. Following Bolton (1989a), Shankar and Krishnamurthi (1996), and Mulhern et al. (1998), we express the elasticities as a function of market share, price consistency, price-promotion intensity, price-promotion coordination, and relative brand price as follows:

$$\begin{aligned}\mathrm{E}_{ij} = {} & \delta_1^{\mathrm{E}} + \delta_2^{\mathrm{E}} \mathrm{METRO}_j + \delta_3^{\mathrm{E}} \mathrm{CHSZ}_j + \delta_4^{\mathrm{E}} \mathrm{CHPOS}_j \\ & + \delta_5^{\mathrm{E}} \mathrm{STORAB}_i + \delta_6^{\mathrm{E}} \mathrm{NECES}_i + \phi_1^{\mathrm{E}} \mathrm{MS}_{ij} + \phi_2^{\mathrm{E}} \mathrm{MS}_{ij}^2 \\ & + \phi_3^{\mathrm{E}} \mathrm{PRCON}_{ij} + \phi_4^{\mathrm{E}} \mathrm{PROMINT}_{ij} + \phi_5^{E} \mathrm{PRCORD}_{ij} \\ & + \phi_6^{\mathrm{E}} \mathrm{BPRICE}_{ij} + \zeta_{ij}^{\mathrm{E}},\end{aligned} \tag{2}$$

where $\mathrm{E} \in \{\mathrm{PE}, \mathrm{DE}, \mathrm{CPE}, \mathrm{CDE}\}$, MS is market share, ζ is the error term, and the other terms are as defined earlier. Note that Equation (2) is the specification for both price and deal elasticities, including own and cross elasticities, for all each brand store.

Because competitor price level (CPL) and competitor deal frequency (CDF) are endogenous, we create instrumental variables for them with the following equations. These equations are given by

$$\begin{aligned}\mathrm{CPL}_{ij} = {} & \delta_1^{\mathrm{P}} + \delta_2^{\mathrm{P}} \mathrm{METRO}_j + \delta_3^{\mathrm{P}} \mathrm{CHSZ}_j + \delta_4^{\mathrm{P}} \mathrm{CHPOS}_j \\ & + \delta_5^{\mathrm{P}} \mathrm{STORAB}_i + \delta_6^{\mathrm{P}} \mathrm{NECES}_i + \phi_1^{\mathrm{P}} \mathrm{SS}_{ij} \\ & + \phi_2^{\mathrm{P}} \mathrm{CA}_{ij} + \phi_3^{\mathrm{P}} \mathrm{BE}_{ij} + \phi_4^{\mathrm{P}} \mathrm{AD}_{ij} + \phi_5^{\mathrm{P}} \mathrm{INC}_j \\ & + \phi_6^{\mathrm{P}} \mathrm{FS}_j + \phi_7^{\mathrm{P}} \mathrm{SSFT}_j + \phi_8^{\mathrm{P}} \mathrm{POP}_j + \zeta_{ij}^{\mathrm{P}},\end{aligned} \tag{3}$$

$$\begin{aligned}\mathrm{CDF}_{ij} = {} & \delta_1^{\mathrm{D}} + \delta_2^{\mathrm{D}} \mathrm{METRO}_j + \delta_3^{\mathrm{D}} \mathrm{CHSZ}_j + \delta_4^{\mathrm{D}} \mathrm{CHPOS}_j \\ & + \delta_5^{\mathrm{D}} \mathrm{STORAB}_i + \delta_6^{\mathrm{D}} \mathrm{NECES}_i + \phi_1^{\mathrm{D}} \mathrm{SS}_{ij} \\ & + \phi_2^{\mathrm{D}} \mathrm{CA}_{ij} + \phi_3^{\mathrm{D}} \mathrm{BE}_{ij} + \phi_4^{\mathrm{D}} \mathrm{AD}_{ij} + \phi_5^{\mathrm{D}} \mathrm{INC}_j \\ & + \phi_6^{\mathrm{D}} \mathrm{FS}_j + \phi_7^{\mathrm{D}} \mathrm{SSFT}_j + \phi_8^{\mathrm{D}} \mathrm{POP}_j + \zeta_{ij}^{\mathrm{D}},\end{aligned} \tag{4}$$

where INC is the average household income, FS is the average family size, SSFT is the square footage of the store, and POP is the population of the store neighborhood, all obtained from *Spectra* database. These instruments are created from predetermined variables appearing elsewhere in the system (Green 1993, Johnston 1984). The exogeneity was confirmed through the Hausman (1978) test of m-statistic (chi-square distributed) that did not reject the exogeneity of each of these variables with respect to other predetermined variables in the system ($p < 0.05$). We specified linear equations based on past research

(Bolton 1989b) and preliminary analyses to determine whether a linear or nonlinear form was suitable for certain variables (Box and Cox 1964, Raju 1992). We postulate that the remaining predictor variables—including market type, chain size, chain positioning, storability, necessity, store size, category assortment, brand preference, and brand advertising are exogenously determined for two reasons. While the first five variables are predetermined, retailer characteristics (store size and category assortment) change very slowly over time; and manufacturers make investments in brand equity/preference and national advertising with small regard for the decisions of retailers at specific outlets (although they may attempt to anticipate the reactions of store chains). Furthermore, these characteristics are typically outside the retailer's control, and they are averages over a long time period (rather than being contemporaneous decision variables).

4.3. Model Operationalization

We first calculated measures of competitor, market, chain, store, category, brand, and customer variables. The descriptive statistics of the variables appear in Table 3. As discussed below, the measures are comparable across categories, thereby allowing us to pool all the brand-store combinations in our analyses.

Table 3 Summary Statistics of Key Variables from the Data*

Variables	Mean (Standard Deviation)
Pricing policy	0.05 (0.04)
Deal depth (all weeks)	0.12 (0.06)
Deal depth (deal weeks)	0.38 (0.17)
Deal frequency	0.35 (0.19)
Deal duration	0.11 (0.15)
Feature and deal	0.08 (0.04)
Display and deal	0.06 (0.06)
Feature, display, and deal	0.03 (0.03)
Price-promotion intensity	0.28 (0.09)
Price-promotion coordination	0.06 (0.04)
Relative brand price	1.00 (0.17)
Market type (metro city vs. small city)	0.92 (0.27)
Chain size (chain sales revenue in $100 millions)	0.46 (0.32)
Chain positioning (EDLP vs. HiLo)	0.11 (0.31)
Store size ($ million ACV)	3.87 (1.31)
Category assortment	9.92 (1.34)
Storability	0.14 (0.20)
Necessity	0.13 (0.20)
Brand base sales index	3.00 (0.91)
Brand advertising ($ million)	35.00 (24.15)
Own-price elasticity	−2.40 (4.19)
Own-deal elasticity	3.07 (3.51)
Cross-price elasticity	0.37 (0.51)
Cross-deal elasticity	−1.07 (3.94)
Competitor relative price	1.00 (0.10)
Competitor deal frequency	0.28 (0.21)

*Based on store-level data for a maximum of 121 weeks.

4.3.1. Direct Measures of Determinant Variables. The unit of analysis is the brand-store combination. Many of the measures can be calculated in a direct and relatively straightforward fashion from the scanner database. Competitor average price level and average deal frequency are calculated for the store's closest competing stores.[4] Because national advertising expenditures are not available in the scanner database, we obtained expenditures for the relevant time period from Leading National Advertisers. Category assortment is measured by counting the number of brands and sizes sold in a given category in a retail outlet; store size is measured by calculating the all-commodity volume (ACV).[5] Chain variables were obtained from *Trade Dimensions*. Chain size is measured in sales revenues, number of stores, and total square footage.[6] Chain positioning is measured as a dummy variable reflecting a HiLo (base) or an EDLP position. Market type, storability, and necessity are also operationalized using dummy variables.

4.3.2. Derived Measures of Determinant Variables. We obtained some customer and brand characteristics by estimating a sales equation for each brand-store combination. We operationalize customer price and deal sensitivities with estimates of elasticities because a retailer will base his assessments of price and deal sensitivities on such estimated values, similar to many other economic situations (Johnston 1984, p. 430). To derive these measures, we estimate a sales response equation for each brand-store combination, following Wittink et al. (1988). This procedure

[4] Competitive proximity could not be measured by exact geographic proximity because this information was not available. The IRI data describe stores in small cities with few potential competing stores, and the Nielsen data describe stores in the largest cities with many potential competing stores. In the IRI data, competing retailers are defined to be all stores in the same city that belong to a different chain. For the stores in the Nielsen data set, we obtained *Spectra* data that provides the zip codes served by a store. Using these data, we identified stores that served the same zip code and came up with the competitive set for each zip code. We also tried a different definition of a competing retailer for the Nielsen data set. In this definition, competing retailers are defined to be stores with highly negatively correlated sales (over time) in the same city. The cut off for "highly negatively correlated" is that the magnitude of the correlation is among the top one-third of all negative correlations for that store. This classification produced remarkably similar competitor store categorization (95% match). In addition, we did the analysis only for the IRI data. The results were similar. We acknowledge that this is the best approximation we could do in the absence of information on precise location of stores.

[5] One could also use average size of the store within each chain, which is a possible indicator of promotional budget for a store. Such an operationalization is appropriate if all chains have the same promotions across the stores within each chain. This was not the case in our data, so we did not use this operationalization.

[6] We use the sales revenue as the measure in our results. The use of square footage or number of stores produced similar results.

is described in Appendix 2. These 1,364 equations yield estimates of brand preference, own-price and deal elasticities, and cross-price and deal elasticities that will be used as potential determinants of pricing strategy. Because we do not observe manufacturers' investments in brand equity or brand preference, we operationalize brand preference (i.e., base brand sales index) using the intercept of the brand sales equation, scaled by the average brand sales volume (calculated over time). This operationalization is consistent with Guadagni and Little (1983). The intuition behind this calculation is that a brand with higher equity or preference will have a higher level of "base" sales that are not influenced by short-term marketing efforts.

4.4. Model Estimation

We estimated Equations (1)–(4) jointly to account for simultaneity in the determination of the pricing dimensions, elasticities, and competitor actions. We checked for potential multicollinearity among the independent variables, but this was not a problem. In particular, the correlation between store size and category assortment, two variables that could be potentially correlated, was low (0.24). We initially assumed that the error terms in Equations (1)–(4) were independently and identically distributed normal. However, Glesjer's (1969) test revealed the existence of heteroscedasticity in the error terms, primarily due to category differences. Hence, we corrected for this problem by estimating Equations (1)–(4) using the Generalized Method of Moments (GMM) and a two-stage weighted least-squares procedure (2SWLS, Greene 1993). Note that estimated elasticities contain errors, and so we could consider a mixed heteroscedastic regression (Hanushek 1974, Wittink 1977). However, the efficiency gains in such a regression are not high in the presence of GMM estimation (Greene 1993), so we report the GMM results. We tested for possible model misspecification using the Hausman (1978) test, which did not reject the hypothesis of exogeneity of the assumed exogenous variables ($p < 0.05$), as stated earlier.

4.5. Category-Level Model

Because there is a growing interest in analyses at the category level (Dhar et al. 2001, Raju 1992), and to better assess the insights from the model with brand-store combination as the unit of analysis (hereafter, brand-level model), we also estimated another model with category-store combination as the unit of analysis (hereafter, category-level model). The category-level model is similar to the brand-level model, with the following differences. First, category-level measures for some factors and variables such as pricing dimensions and price and deal elasticities were created with market share weights for brands within the category (e.g., price-promotion intensity, category price, category price elasticity, category-level advertising). Second, the category-level model does not have variables corresponding to brand preference, cross-price elasticity, and cross-deal elasticity. Third, relative brand advertising is replaced by category-level advertising and included as a category factor. Although such a model will have a limited number of observations (448) relative to the brand-level model (1,364), it is useful because we can examine the consistency in the directionality of the relationship between factors and the different pricing dimensions. The brand-level model will have additional insights from brand factors.

5. Results

The GMM estimation results for Equation (1)—describing the determinants of price consistency, price-promotion intensity, price-promotion coordination, and relative brand price—are displayed in Table 4. Equations (2)–(4) were estimated, but the results are not shown here due to space limitations. To assess the role of market, chain, store, category, brand, customer, and competitor variables, we calculated the relative importance of the variables in each regression equation from the squared standardized regression coefficients scaled to sum to 100, and expressed as percentages. Note that these relative importance values depend on the impact and variation of the variables in the data set. The 2SWLS results are similar to GMM results and are not reported. All significant results discussed below are significant at at least the 0.10 level.

5.1. Price Consistency

A retailer has a higher level of price consistency for a brand when competitors' prices are lower and when competitors' deals are less frequent. Price consistency for a brand at a given store is also associated with market type, chain size and positioning, category assortment, storability, necessity, brand preference, relative brand advertising, own-price elasticity, own-deal elasticity, cross-price elasticity, and cross-deal elasticity. Specifically, retailers in metropolitan cities tend to be more price consistent than those in smaller cities. Retailers are also more price consistent for smaller chains and those positioned as EDLP chains. Furthermore, they are more price consistent for brands in storable categories (e.g., bathroom tissue and bleach), categories that are necessities (e.g., bathroom tissue), and categories with small assortments. Our results suggest that retailers may choose to be less price consistent for brands in "discretionary" (nonstorable, nonessential) categories where it is possible for price changes to stimulate increases in primary demand (rather than simply encourage

Table 4 Simultaneous Equation Model Results for Pricing Dimensions

	Price Consistency		Price-Promotion Intensity		Price-Promotion Coordination		Relative Brand Price	
Factors	Estimate (Standard Error)	RSSCP	Estimate (Standard Error)	RSSCP	Estimate (Standard Error)	RSSCP	Estimate (Standard Error)	RSSCP
Market factors		**2.51**		**0.36**		**3.68**		**5.03**
Market type	−0.102 (0.009)***	2.51	−0.022 (0.031)	0.36	0.103 (0.010)***	3.68	0.012 (0.094)	5.03
Chain factors		**1.63**		**3.47**		**7.76**		**37.51**
Chain size	0.004 (0.001)***	0.00	0.004 (0.001)***	0.00	0.006 (0.001)***	0.00	0.002 (0.004)	0.00
Chain positioning	−0.037 (0.020)*	1.63	−0.078 (0.027)***	3.47	−0.065 (0.020)***	7.76	−0.241 (0.013)**	37.51
Store factors		**0.00**		**0.00**		**0.00**		**0.08**
Store size	0.002 (0.002)	0.00	0.011 (0.001)***	0.00	0.002 (0.001)**	0.00	−0.025 (0.000)***	0.00
Category assortment	0.006 (0.001)***	0.00	−0.011 (0.002)***	0.00	0.008 (0.001)***	0.00	−0.025 (0.006)***	0.08
Category factors		**3.92**		**8.45**		**26.12**		**0.90**
Storability	−0.028 (0.009)***	0.18	0.023 (0.011)**	0.05	−0.017 (0.007)***	0.05	−0.006 (0.039)	0.21
Necessity	−0.056 (0.020)***	3.74	0.131 (0.025)***	8.40	0.183 (0.015)***	26.17	0.005 (0.085)	0.69
Brand factors		**0.00**		**0.00**		**0.00**		**0.78**
Brand preference	0.001 (0.000)***	0.00	0.002 (0.000)***	0.00	0.001 (0.000)***	0.00	0.004 (0.001)***	0.00
Relative brand advertising	0.014 (0.002)***	0.00	0.002 (0.004)	0.00	0.013 (0.002)***	0.00	0.041 (0.011)***	0.78
Customer factors		**0.00**		**0.00**		**0.00**		**0.05**
Own-price elasticity	−0.003 (0.001)***	0.00	−0.005 (0.001)***	0.00	−0.002 (0.001)***	0.00	−0.018 (0.004)***	0.01
Own-deal elasticity	0.005 (0.001)***	0.00	0.012 (0.001)***	0.00	−0.014 (0.001)***	0.00	0.032 (0.003)***	0.04
Cross-price elasticity	0.001 (0.000)***	0.00	0.003 (0.000)***	0.00	0.002 (0.000)***	0.00	−0.006 (0.001)***	0.00
Cross-deal elasticity	0.001 (0.000)***	0.00	−0.000 (0.001)	0.00	0.002 (0.000)***	0.00	−0.000 (0.001)	0.00
Competitor factors		**91.93**		**87.71**		**62.34**		**55.66**
Competitor relative price level	0.174 (0.017)***	26.08	0.188 (0.050)***	69.20	−0.027 (0.014)*	0.50	0.210 (0.010)***	16.84
Competitor deal frequency	0.235 (0.020)***	65.85	0.143 (0.034)***	18.51	0.211 (0.020)***	61.84	−0.319 (0.010)***	38.82
Intercept	−0.112 (0.044)***		0.133 (0.063)**		0.044 (0.039)		1.160 (0.158)***	
Correlation between predicted and actual values of dependent variable	0.71		0.58		0.58		0.55	

*Significant at 0.10 level; **significant at 0.05 level; ***significant at 0.01 level; NR, not relevant; RSSCP, relative squared standardized coefficient percentage. Price consistency is measured such that the greater the number, the lower the price consistency; elasticities are operationalized as positive for ease of interpretation; and $n = 1{,}364$.

stockpiling). These findings can explain apparently "inconsistent" behavior observed in the market place, such as when a chain that claims to practice an EDLP strategy offers less stable prices (for some categories) than a chain that is considered to practice a HiLo strategy for brands in the same category. Retailers are more price consistent when consumers are own-price elastic and cross-price inelastic. They also exhibit lower levels of price consistency for brands in stores where consumers are more deal elastic (own and cross), and when brand preference and relative brand advertising are high. Hence, chains that are positioned as EDLP chains may appear (superficially) inconsistent for some brands and categories—but they have simply tailored their overall strategy to recognize differences in consumer demand within and across categories.

Competitor characteristics (primarily competitor deal frequency) account for a sizable portion (92%) of the relative importance of the independent variables, followed by category factors (4%). Customer, brand, and store characteristics constitute only a negligible portion of the relative importance, despite the significance of all these variables. Interestingly, only store size is insignificant. These results suggest that price consistency is primarily associated with competitor activities, but it is tailored to category characteristics as well as to chain, store, brand, and customer factors.[7]

[7] Interestingly, some parameter estimates that have similar t-statistics do not have the same RSSCPs (e.g., market type and competitor relative price level in the price consistency equation). This feature arises because (algebraically), the t-ratio is not directly proportional to the standardized coefficient or beta weight, which determines the RSSCP. The beta weight associated with an independent variable is a function of the coefficient multiplied by the standard deviation of the independent variable and divided

5.2. Price-Promotion Intensity

Price-promotion intensity for a brand store is significantly associated with competitor price level and competitor deal frequency. The higher the competitor price level and the higher competitor dealing frequency, the more intense price promotions are. Price-promotion intensity is also associated with chain size, chain positioning, store size, category assortment, storability, necessity, brand preference, own-price elasticity, own-deal elasticity, and cross-price elasticity. Specifically, retailer price-promotion intensity is higher for larger chains and for chains positioned as HiLo price formats. Retailers price promote more intensively in larger stores and in categories with small numbers of brands. Promotion intensity is high for a storable product that performs a destination category role like tissue. It is high for product categories that are necessities, consistent with Bell et al. (1999). It is also positively associated with brand preference, and cross-price and cross-deal elasticities. Brands with high preference and equity tend to be promoted often (Neslin et al. 1995). Two possible reasons are that (1) high brand preference amid high competitor prices creates a promotional opportunity, and (2) high cross-price and cross-deal elasticities (i.e., consumer deal proneness) represent potential threats requiring intensive promotion to counter them. Retailers are more price-promotion intensive when brands are less price elastic but more deal elastic. The type of market (metropolitan or small city), relative brand advertising, and cross-deal elasticity do not seem to have significant associations with promotion intensity.

Competitor characteristics (primarily competitor relative prices) account for the most explained variance (88%), while category factors (8%) and chain characteristics (3%) account for the bulk of the remaining amounts of explained variance in price-promotion intensity. This pattern of results suggests that retail chains fix their deal depth, frequency, and duration decisions for the category and then vary these across brand and store by basing them primarily on prices at competing stores. These findings imply that price-promotion intensity is "customized" to the category-chain-store combination.

by the standard deviation of the dependent variable. The t-ratio, on the other hand, is the coefficient divided by its standard error, which is a function of the error variance in the equation. Thus, only the coefficient or parameter estimate is common to both the t-ratio and the beta weight. The other items that determine these two measures are vastly different. The t-statistics and the RSSCPs are thus dependent on the data matrix and the model used. In our data and model, the relative variance (i.e., variance computed relative to the variance of the dependent variable) of variables such as competitor price level and deal frequency tend to be generally higher than the relative variances of some other variables, so they have higher RSSCPs.

5.3. Price-Promotion Coordination

Price-promotion coordination is higher when competitors' prices are lower and competitors' deal frequencies are higher. It is also associated with market type, chain size, chain positioning, store size, category assortment, storability, necessity, brand preference, relative brand advertising, own-deal elasticity, cross-price elasticity, and cross-deal elasticity. A retailer tends to coordinate price and promotion when the store is located in metropolitan cities (as opposed to smaller cities), and when it is part of a large chain or a chain that is positioned as having a HiLo strategy. Price-promotion coordination is greater for brands in large stores and with large category assortments. Price-promotion coordination is likely to yield greater benefits in such situations because of the large scale of retail operations. Storable categories are less coordinated, but necessity categories are more coordinated. Retailers coordinate deals, features, and displays more closely for brands with higher brand-preference levels and relative advertising expenditures. This pattern is consistent with the trend toward integrated marketing communication and promotion whereby brands tend to advertise and simultaneously coordinate their promotions to benefit from synergistic effects. Presumably, retailers are attempting to maximize the impact of their promotions. It is also higher when consumers are less own-price and own-deal inelastic. Consistent with this result, price-promotion coordination is higher when consumers are cross-price and cross-deal elastic. In other words, coordination is higher when brands within a category are differentiated, yet there is still potential for some consumers to view brands within a category as substitutes. Presumably, price and deal elasticities are less important (i.e., weak) predictors because coordination has more to do with the occurrence (or nonoccurrence) of promotional variables rather than with changes in prices or deals.

Competitor factors, in particular competitor deal frequency, are the most important determinants of price-promotion coordination (62%) and category factors are the next most influential set of factors (26%). Chain factors account for 8% of explained variance. In sum, the results show that price-promotion coordination is significantly associated with competitor activities and is category and chain dependent.

5.4. Relative Brand Price

Relative brand price is lower when competitor prices are lower and competitor deals are more frequent. It is also associated with chain positioning, store size, category assortment, brand preference, relative brand advertising, own-price elasticity, own-deal elasticity, and cross-price elasticity. Relative brand price levels are lower for brands in large stores, and with large category assortments—presumably due to the competitive pressure posed by the presence of multiple brands. This result suggests that manufacturers with multiple brands in the same category, such as Procter & Gamble and Frito Lay, who do not wish to compete on price at the retail level, might consider pruning their product line. This observation may explain the recent trend of manufacturers to rationalize their product lines and remove redundant brands (e.g., Procter & Gamble deleting White Cloud brand in favor of Charmin from the bathroom tissue category). Retailers charge lower prices when consumers are more own-price elastic and less own-deal elastic. This observation may explain why pricing decisions differ across stores in the same chain—individual outlets may have different clienteles (cf., Moriarty 1985). They are also lower when brand preference and relative brand advertising are lower, and when chains position themselves as EDLP rather than HiLo stores. The type of market, chain size, and category characteristics do not have any significant relationships to relative brand price.

Table 5 shows that EDLP-positioned stores have lower relative brand prices than do HiLo-positioned stores (after controlling for other factors). Importantly, from Table 4, the retailer-positioning variable accounts for about 37.5% of the explained variance in relative brand price. This could be due to either (1) an "assortment effect," whereby the category assortments at the two types of stores are significantly different, or (2) a "market share effect," whereby the market shares of the same brands are significantly different at EDLP- and HiLo-positioned stores, or (3) a "price-compression effect," whereby EDLP-positioned stores price their items within a significantly narrower range than do HiLo-positioned stores. To investigate this issue, we performed a number of additional analyses, including splitting the sample into EDLP- and HiLo-positioned stores and examining the differences in relative brand price and category assortment between these two sub samples. As shown in Table 5, the average relative brand price at EDLP-positioned stores is slightly lower than the average relative brand price at HiLo-positioned stores (0.96 vs. 1.00). Notably, the *range* of relative brand prices at EDLP-positioned stores is significantly narrower than that at HiLo-positioned stores (0.74 vs. 0.93).

Table 5 **Summary of Relative Brand Price, Category Assortment, and Market Share Differences by Chain Positioning**

Factors/Variables	HiLo Stores	EDLP Stores
Number of brand stores	1,214	150
Average relative brand price*	1.00	0.96
Range of relative brand price**	0.93	0.74
Average category assortment	9.95	9.72
Percentage of brands whose market shares at EDLP-positioned stores are significantly different from those at HiLo-positioned stores***	13.21	

*Note that the average relative brand price across all stores is also 1.00 because of rounding to two decimal places.

**Significantly different between HiLo and EDLP stores at the 0.01 level.

***We compared the average (across time and stores) market shares of the brands that were sold at both HiLo- and EDLP-positioned stores in the same market. Out of 53 brands for which the comparison was possible given the distribution of stores in our data, the average market shares of seven brands were significantly different between HiLo- and EDLP-positioned stores at the 0.05 level. These seven brands comprised one brand each from three of the six categories and two brands each from two of the six categories. The differences in average market shares across EDLP- and HiLo-positioned stores in these seven cases ranged from 1.1% to 2.4%. The average market shares at EDLP-positioned stores were higher (lower) than those at HiLo-positioned stores for three (four) of the seven cases, suggesting that there is no strong evidence to show that market shares are not systematically different across EDLP- and HiLo-positioned stores in the data. Moreover, the range of average prices of brands within each category was lower at EDLP-positioned stores than that at HiLo-positioned stores.

Based on the analyses, the lower relative brand price at EDLP-positioned stores relative to HiLo-positioned stores is not likely to be due to (1) differences in category assortment or (2) differences in market shares of the same brands in these types of stores. First, the average category assortment at EDLP-positioned stores is also slightly (but not significantly) smaller than that at HiLo-positioned stores (9.72 vs. 9.95), while the range is equal (16). Moreover, the model accounts for a negative and significant effect of category assortment on relative brand price. Second, because average market shares are not different across EDLP- and HiLo-positioned stores for an overwhelming number of brands (86.79%), and even in those cases where they are significantly different the differences are low (up to 2.4%), market share differences are unlikely to be the source of differences in relative brand price in our data. In fact, in our data the range of average prices of brands within each category was lower at EDLP-positioned stores than that at HiLo-positioned stores. Taken together and in the absence of other information, these findings suggest that differences in relative brand prices across EDLP- and HiLo-positioned stores may be attributed to price compression effect in our data. The regression results for the separate subsamples (without the chain-positioning variable) are consistent across HiLo- and EDLP-positioned store samples (not shown herein) and the overall sample with respect to the direction and significance of the parameters of all the variables.

We can explain the price compression effect as follows. A HiLo-positioned store may price the higher-share brand(s) lower than at an EDLP-positioned store to attract store traffic. At the same time, to make up its contribution margin and profit, the HiLo-positioned store may price the low-share brand(s) higher than the EDLP-positioned store. Indeed, a HiLo strategy may be more profitable than an EDLP strategy (Hoch et al. 1994). Thus, the price range may be narrower at the EDLP-positioned store than it is at the HiLo-positioned store and the prices of brands at EDLP-positioned stores may be closer to the low prices than they are at HiLo-positioned stores. The result is lower relative brand prices at EDLP-positioned stores than those at HiLo-positioned stores.

Together, competitor price level and competitor deal frequency account for about 55% of the explained variance in relative brand price. Chain factors, in particular chain positioning, account for 38% of the explained variance. Market factors explain about 5% of the explained variance. These findings indicate that retailers have considerable pricing latitude for a brand.

5.5. Category-Level Analysis

The statistically significant coefficients in the category-level model, and their signs, are summarized in Table 6. The statistically significant effects in the category-store model are remarkably consistent with those in the brand-level model. However, some significant effects in the brand-level model are no longer significant in the category-level model. The main reason for the differences is that the brand-level model has additional variables (brand preference, cross-price, and cross-deal elasticities) that contribute significantly to the retailer's pricing strategy, and that cannot be incorporated in a category-level model. Moreover, the degrees of freedom are much lower in the category-level model than they are in the brand-level model. Interestingly, category advertising—which is not represented in the brand-level model—has a statistically significant effect on price consistency, price-promotion intensity, and relative brand price level in the category-level model. Specifically, higher category advertising is associated with less-consistent prices, more-intensive promotions across retailers, and higher relative brand price levels. These results are at the category level, so it is not surprising that earlier we discovered differences among the brands within a category due to the relationship between relative brand advertising and the brand's price consistency and price-promotion intensity. In general, our findings reinforce the appropriateness and usefulness of a brand-level model in obtaining insights into retailers' pricing strategies.

6. Discussion

6.1. Competitor Factors Are Key

Retailers' pricing strategies are more strongly related to competitor factors than they are related to other factors for all four pricing dimensions. When competitors charge lower prices, a retailer communicates the relative attractiveness of its offerings through higher price consistency, lower price-promotion intensity, and higher price-promotion coordination—while maintaining lower relative brand prices. Price-promotion coordination is strongly associated with lower competitor price levels—suggesting that

Table 6 Significant Effects in Category Level Model ($n = 448$)

Factors	Price Consistency	Price-Promotion Intensity	Price-Promotion Coordination	Category Price
Market factors				
Market type	−		+	
Chain factors				
Chain size		+	+	
Chain positioning				
Store factors				
Store size		+		
Category assortment		−		
Category factors				
Storability	−	+	−	−
Necessity	−	+	+	−
Category advertising	+	+		+
Customer factors				
Own-price elasticity	−			−
Own-deal elasticity		+		+
Competitor factors				
Competitor category price level		+	+	+
Competitor deal frequency	+		+	−
Correlation between predicted and actual value of dependent variable	0.61	0.47	0.44	0.42

Notes. +/− indicates sign of the effect of the variable. Price consistency is measured such that the greater the number, the lower the price consistency. Elasticities are operationalized as positive for ease of interpretation.

retailers are exploiting the relative cost efficiency of coordination (compared with setting prices and promotions independently).

When competitors offer deals more frequently, retailers are less price consistent, offer aggressive promotions, more actively coordinate price promotion, and charge lower prices. The result is somewhat inconsistent with Rao et al. (1995), who found that promotions are independent across stores in an analysis of the ketchup category, but it supports the prisoner's dilemma theory of retailer promotions (Blattberg and Neslin 1990). The relationship between deal frequency and retailer pricing is also consistent with Alba et al. (1994), who found that frequency of dealing dominated consumer perceptions of comparative prices. Furthermore, it is consistent with deal momentum arguments of Urbany and Dickson (1991).

These results are generally consistent with the reported behavior of most pricing managers in the retailing industry (Urbany and Dickson 1990). Competitor pricing and promotion decisions typically form the basis for the retailer's competitive marketing strategy, as well as provide easy-to-implement inputs for specific pricing decisions. Previous research suggests that managers tend to react to competitor activities in the general context (Hanssens 1980, Lambin et al. 1975, Leeflang and Wittink 1996). Our results reinforce this phenomenon in the context of retailer pricing decisions by identifying relative competitor price level and deal frequency as significant competitor factors associated with retailer pricing decisions. What is most striking, however, is that these competitor factors are the *most dominant* determinants of retailer pricing in a broad framework that includes several other factors. The majority of research that considers retailer pricing has been based on models that ignore the pricing activities of competing retailers (e.g., choice models, pricing models). Because our results show that retailer pricing is strongly associated with competitor prices and deal frequencies, researchers and practitioners should consider incorporating competitor factors into their models.

6.2. Price-Promotion Intensity and Price-Promotion Coordination Are Complementary Dimensions

HiLo-positioned chains have high price-promotion intensity and high price-promotion coordination. Larger chains have higher price-promotion intensity and high price-promotion coordination—probably because large chains can build scale economies and promote aggressively due to lower printing and holding costs and lower prices from suppliers (Dhar and Hoch 1997). Similarly, larger stores indulge in price-promotion intensity and high price-promotion coordination—possibly to defend their market shares (Messinger and Narasimhan 1997). Small stores may not be able to offer deep or frequent promotions due to limited promotional budgets. Price-promotion intensity and coordination are also higher for necessity categories, for brands with high preferences, and in markets that are own-price inelastic, but cross-price elastic. These findings suggest that price-promotion intensity and coordination can be used synergistically.

6.3. Category Differences Are Associated with Substantial Differences in Pricing Strategies

A large category assortment is associated with price inconsistency and less-intensive promotion—but high levels of coordination of price with promotions and low relative prices. Retailers targeting price-sensitive shoppers typically carry a greater assortment of brands in a given category (Dhar et al. 2001) and promotional elasticities are lower for categories with more brands (Narasimhan et al. 1996), so a retailer with a large assortment can more effectively utilize its resources by reducing promotions, but closely coordinating price and promotion activities. Highly storable and necessary categories such as bathroom tissue have high price-promotion intensity, consistent with Bell et al. (1999). Thus, they can serve as a "traffic builders," which tend to be promoted more intensely (Dhar and Hoch 1997). In contrast, perishable categories such as ketchup and spaghetti sauce may require a more consistent pricing strategy to steadily rotate the inventory. Household necessities have lower price consistency and higher price-promotion intensity than nonessential categories.

6.4. Manufacturer/Brand Differences Create Retailer Pricing Opportunities

When brand preference is high or when manufacturers advertise heavily, retailers vary their prices and promotions, coordinating them—presumably leveraging manufacturer's marketing efforts through integrated marketing activities. Retailers charge premium prices and are less price consistent, promote more intensely, and coordinate prices and promotions more closely, for brands with higher brand preference levels. The most likely reason for this pricing strategy is that these brands have "pulling power" among consumers so that consumers are very responsive when their prices are reduced. A second possible reason is that retailers use brands with high preference levels to drive store volume, resulting in intensive and coordinated price-promotion activities for such brands. Similarly, higher levels of relative brand advertising are positively associated with premium relative brand prices, price inconsistency, and price-promotion coordination. This result is consistent with Lal and Narasimhan (1995), who show that brand advertising is positively associated with prices and brand premiums, but negatively related to retailer margins. It also supports Neslin et al. (1995), who argue for the market power theory of the effects of advertising.

6.5. The Effect of Customer Responsiveness on Retailer Pricing Is Small but Significant

Retailers' pricing strategies rely on the pricing dimensions for which consumers are most responsive in a given marketplace. Prices are more consistent, price promotion is less intensive and less coordinated, and relative brand prices are lower for brands in markets that are own-price elastic. Hence, retailers will tend to use price (regular price) rather than promotional activity as their primary competitive marketing tool in these markets. This result is also consistent with the effect of chain positioning in our study, and with the study of Shankar and Krishnamurthi (1996), in which EDLP is found to be an appropriate strategy for price-sensitive shoppers. Prices are inconsistent, price promotion is more intensive and less coordinated, and relative brand price levels are higher, when consumers are more deal elastic. The likely explanation is that some market segments may be deal focused (Ailawadi et al. 2001). Hence, retailers tend to use promotions rather than price changes as their competitive marketing tool in these markets (Blattberg and Neslin 1990). Elasticities explain only a small portion of the variance in retailer pricing, but they are significant.

7. Managerial Implications, Limitations, and Future Research

7.1. Managerial Implications

Our most striking finding is that competitor factors are strongly associated with all dimensions of retailer pricing strategy for a brand. Retailers can easily observe others' actions, assess the impact of such actions, and adopt suitable strategies (Dhar and Hoch 1997). Consequently, a retailer may want to pay particular attention to its own frequency of deals and price levels because they are strongly related to other retailers' pricing dimensions (and vice versa). For example, a retailer that intends to lower its prices on a brand or increase its dealing frequency, might expect that its competitor will likely lower brand prices, offer aggressive promotion on that brand, and better coordinate promotions. Retailers' pricing decisions are also strongly related to category factors such as storability and necessity, the store's clientele (i.e., customer factors), store factors, and brand factors. Thus, retailers can "create" pricing latitude by differentiating themselves along nonpricing dimensions (e.g., by coordinating price and promotion, emphasizing different categories, serving different clientele). Consequently, we observe a diverse set of pricing strategies that are (apparently) successful in the marketplace.

To illustrate our results, we show how a fixed set of values for the factors predicts each of the pricing dimensions, similar to Narasimhan et al. (1996). Although we could show the predictions for many different observations in the data, we have chosen to display two contrasting scenarios in Tables 7a and 7b. Scenario 1 represents pricing for a brand of bleach in a medium- to large-sized store belonging to a moderate-sized HiLo chain in a nonmetropolitan market (Table 7a). Scenario 2 comprises a brand of mouthwash in a small store of a large EDLP chain in a metropolitan market (Table 7b). The predicted values of the four dimensions are reasonably close to the actual values, showing that the model captures the effects of retailer pricing strategy determinants well. In Table 7a, price-promotion intensity, price-promotion coordination, and relative brand price are high, whereas price consistency is low compared to the average levels in the data. The high price-promotion intensity and price-promotion coordination and the low price consistency for this brand at this store are associated with high frequency of competitor deals, whose contributions to these dependent variables are substantial in the regressions. In Table 7b, the brand-store's price consistency is higher, price-promotion intensity and coordination lower, and relative brand price lower, compared to Table 7a. Again, the contributions of the competitor factors to the predicted values of pricing dimensions are substantial. These scenarios show marked differences in pricing strategy across different brand stores. These differences are associated with several factors, but most strongly with competitor price level and deal frequency.

Although this study cannot identify optimal pricing strategies, our results provide a useful method of making predictions regarding pricing strategies for an individual store or chain. Specifically, a store can compare its pricing decisions and their determinants with the decisions of a cross-section of retailers. Thus, our findings can help retailers understand their own—and their competitors'—pricing strategies. For example, a metropolitan retailer that plans to locate a store in a rural area may expect somewhat less consistent brand prices and somewhat lower coordination of brand prices and promotions than in metropolitan stores, all else equal. A retailer can also make some (general) predictions about the behavior of its competitors. Smaller chains can expect their larger rivals to use somewhat more intense promotions that are more closely coordinated with prices. Smaller stores—regardless of the chain they may belong to—may expect bigger stores to use somewhat more intense and more closely coordinated promotions, combined with lower relative prices. Stores that have wide

Table 7a Managerial Application: Prediction of Retail Pricing Strategies—Scenario 1: Brand of Bleach in Mid-Large-Size Store in a Medium-Sized HiLo Chain in a Nonmetro Market

		Estimated Contributions to the Pricing Dimension			
Factors	Scenario 1 Values	Price Consistency	Promotion Intensity	Price-Promotion Coordination	Relative Brand Price
Market factors					
Market type	0	0.000	0.000	0.000	0.000
Chain factors					
Chain size	0.31	0.001	0.001	0.002	0.001
Chain positioning	0	0.000	0.000	0.000	0.000
Store factors					
Store size	4.07	0.008	0.041	0.008	−0.102
Category assortment	4	0.026	−0.044	0.031	0.098
Category factors					
Storability	1	−0.028	0.023	−0.017	−0.006
Necessity	0	0.000	0.000	0.000	0.000
Brand factors					
Brand preference	4.10	0.002	0.007	0.004	0.016
Relative brand advertising	1.74	0.024	0.003	0.022	0.072
Customer factors					
Own-price elasticity	3.05	−0.009	−0.015	−0.006	−0.055
Own-deal elasticity	4.25	0.020	0.051	−0.060	0.136
Cross-price elasticity	0.32	0.000	0.001	0.001	−0.002
Cross-deal elasticity	0.39	0.000	−0.000	0.001	−0.000
Competitor factors					
Competitor relative price level	0.96	0.167	0.180	−0.026	0.201
Competitor deal frequency	0.92	0.216	0.132	0.194	−0.293
Intercept		−0.112	0.133	0.044	1.160
Predicted value of pricing dimension		0.316	0.512	0.197	1.029
Actual value of pricing dimension		0.297	0.488	0.182	0.993

Notes. Price consistency is measured such that the greater the number, the lower the price consistency. Elasticities are operationalized as positive for ease of interpretation.

assortments are most likely to have reasonably infrequent and shallow promotions, but slightly low prices and high coordination of prices with promotions.

In general, retailers can expect their rivals to offer storable products at consistent prices with a heavy dose of promotions. They may also anticipate that essential products at any retailer are likely to be priced consistently, discounted heavily, and orchestrated with frequent use of displays and feature advertisements. Retailers typically offer high levels of promotions for brands with high preference or brand equity, consistent with the notion of using strong brands as a traffic builder for the store. Stores with a price-elastic clientele may wish to plan on a slightly higher price consistency, lower promotion intensity and coordination, and lower prices than other stores. Stores with a highly deal-elastic clientele may plan on slightly less consistent prices and slightly more deals than other stores. When its prices are low, a store can expect its competitors to have substantially lower prices but fewer or smaller discounts. When a store deals often, it should expect its rivals to have substantially less stable, lower prices and intense, coordinated promotions.

There is an opportunity for manufacturers to use their enhanced understanding of retailers' pricing strategies across brands and categories to become the "category captain" for their product categories, support their brands with targeted marketing efforts, and build better relationships with retailers. For example, this study's findings can help manufacturers understand the relationships among national advertising and brand preference and retailer pricing, so that they can make more informed decisions about marketing support spending. Manufacturers who want to compete on low price might predominantly focus on retailers who are more price consistent, less promotion intense, less price-promotion coordinated, and have a low relative brand price; i.e., "value-oriented pricing" retailers. Our results also show that they do not need to advertise their brands heavily. In contrast, manufacturers of brands that wish to enjoy higher relative brand prices at the retail level could distribute primarily through stores that are less price consistent, more promotion intensive, and more price-promotion coordinated. They may also wish to advertise heavily to elicit high retail prices. Finally, manufacturers of brands competing in categories with

Table 7b Managerial Application: Prediction of Retail Pricing Strategies—Scenario 2: Brand of Mouthwash in a Small Store in a Large EDLP Chain in a Metro Market

		Estimated Contributions to the Pricing Dimension			
Factors	Scenario 2 Values	Price Consistency	Promotion Intensity	Price-Promotion Coordination	Relative Brand Price
Market factors					
Market type	1	−0.102	−0.022	0.103	0.122
Chain factors					
Chain size	0.67	0.003	0.003	0.004	0.001
Chain positioning	1	−0.037	−0.078	−0.065	−0.241
Store factors					
Store size	0.35	0.000	0.000	0.000	−0.001
Category assortment	7	0.045	−0.077	0.054	−0.171
Category factors					
Storability	0	0.000	0.000	0.000	0.000
Necessity	0	0.000	0.000	0.000	0.000
Brand factors					
Brand preference	6.17	0.003	0.010	0.006	0.024
Relative brand advertising	1.26	0.017	0.003	0.016	0.052
Customer factors					
Own-price elasticity	3.14	−0.009	−0.016	−0.006	−0.057
Own-deal elasticity	1.88	0.009	0.023	−0.026	0.060
Cross-price elasticity	3.38	0.003	0.010	0.006	−0.020
Cross-deal elasticity	0.41	0.000	−0.000	0.001	−0.000
Competitor factors					
Competitor relative price level	1.02	0.177	0.192	−0.028	0.214
Competitor deal frequency	0.21	0.049	0.030	0.044	−0.067
Intercept		−0.112	0.133	0.044	1.160
Predicted value of pricing dimension		0.047	0.210	0.153	0.958
Actual value of pricing dimension		0.051	0.191	0.142	0.989

Notes. Price consistency is measured such that the greater the number, the lower the price consistency. Elasticities are operationalized as positive for ease of interpretation.

deep/wide assortments should expect less price consistency, less price-promotion intensity, greater price-promotion coordination, and a lower price level at the store level. Managers of highly storable and essential categories can expect to witness low price consistency and high price-promotion intensity.

7.2. Limitations and Future Research

Although our study provides useful insights, its limitations suggest interesting opportunities for future research. First, our empirical analysis did not include trade deal and coupon data because they were not available for all stores and categories. Omission of these variables may have heightened the commonality among retailers' and competitors' pricing strategies, thereby potentially inflating the role of competitive factors in our results. However, trade deals are correlated with brand advertising (Lal and Narasimhan 1995, Neslin et al. 1995) and retailer pass-through of manufacturer deals is typically low (Blattberg and Neslin 1990), suggesting that the degree of inflation may be small. The inclusion of these variables in subsample analyses (where data were available) did not significantly change our results. Nevertheless, the role of trade deals should be investigated more deeply in future research. Coupons are redeemed differently by different users, so it is difficult to obtain good measures of coupon activity and usage at the store level. Coupons serve the same purpose as a price cut, but they allow the retailer to price discriminate, so they also warrant further research. Second, future research might study managerial perceptions of deal magnitudes and competitor reaction elasticities—topics that can be more appropriately investigated in an experimental setting.

Third, this paper presents a descriptive model of retailer pricing. Based on the implications, a model of optimal retailer pricing that extends the promotion model of Tellis and Zufryden (1995) and new empirical industrial organization (NEIO) models that include competing retailer decisions would be desirable. Fourth, we could extend the analysis to jointly consider manufacturer pricing decisions. Such an extension would require data on manufacturer costs and could offer additional insights into channel coordination between manufacturers and retailers. Fifth, although the categories and markets we studied were reasonably diverse, it would be desirable to replicate the study on more categories and markets and use nonscanner data (e.g., external measures of brand equity) to enhance the generalizability of our findings. Sixth, we assume stable equilibrium in competition among retailers in our data. In recent years, the entry of Walmart into some markets has made retail competition less stable; these events would be interesting to study. Seventh, we did not focus on retail margins and promotion pass-through because data were unavailable. It would be useful to include these aspects in future studies. Finally, study of pricing practices such as price bundling, multiple-unit pricing, price lining, and odd pricing would be fruitful avenues for future research.

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Appendix 1: Operational Measures

Market Factors

Market type is a dummy variable indicating whether the market is in a metropolitan city (equal to one for metropolitan city, zero otherwise).

Chain Factors

Chain size is the average annual sales revenues of the chain (during the period of data) to which the store belongs. *Chain positioning* is a dummy variable indicating whether the chain is positioned as an EDLP or HiLo store (equal to one for EDLP position, zero otherwise).

Store Factors

Store size is the average all-commodity volume (ACV) of the store during the period of data. *Category assortment* is the average number of brands in that category in that store during the period of data.

Category Factors

Storability is a dummy variable indicating whether the category is storable (equal to one if the category is storable, zero otherwise). *Necessity* is a dummy variable indicating whether the category is a necessity according to IRI definitions (equal to one if the category is a necessity, zero otherwise).

Brand Factors

Brand preference is normalized base brand sales index—intercept from the brand-store sales response model normalized or standardized with respect to average sales of brand store over the period of data. *Relative brand advertising* is standardized advertising expenditures, that is, the average of ratio of brand advertising expenditures over the category advertising expenditures for that store over the period of data.

Customer Factors

Own-price elasticity is the percent change in own sales with respect to percent change in own regular price obtained from the sales response model of brand store. *Own-deal elasticity* is the percent change in own sales with respect to percent change in own transformed deal discount obtained from the sales response model of brand store. *Cross-price elasticity* is the average (across competitive brands) percent change in sales with respect to percent change in a competitive brand's regular price obtained from the sales response model of brand store. *Cross-deal elasticity* is the average (across competitive brands) percent change in sales with respect to percent change in a competitive brand's transformed deal discount obtained from the sales response model of brand store.

Competitor Factors

Competitor relative price level is the price of the brand relative to the category averaged across competitor stores and over the period of data, so that it is comparable across categories (we calculated relative brand price from raw brand prices in each category, which were typically provided to us in the form of price per equivalent unit size, or we calculated it as a simple (not share-weighted) average of brand-size prices). Competitor relative price level for a brand-store combination is computed as follows. First, relative brand price is computed for the brand in each competing store (in the same way relative brand price at the store in focus was computed) for a given week. Second, an average of the relative brand prices across all competing stores is computed for a given week. Third, an average of the average relative brand prices across all competing stores over the time period of data for the brand-store combination is computed. This final measure is the competitor relative price level. This measure is reasonable because it is comparable across categories and is consistent with the way we measure own relative brand price.

Competitor deal frequency is the percentage of weeks with deals of the brand at the competitor stores over the period of data.

Appendix 2: Store-Level Sales Response Model

In the sales equations, we separate the impact of regular price and deal, consistent with Blattberg and Neslin (1989) and Shankar and Krishnamurthi (1996). There are several reasons for doing this. First, changes in regular price typically last for a longer period of time than deals or temporary price cuts. This difference implies different consumer transactional utilities for deals vis-a-vis regular price changes. Second, consumers may stockpile on deals, but not on regular price reduction because deals last for a much shorter duration than regular price reduction. Third, a change in regular price may not be signaled but may have to be inferred by consumers, unlike a deal that could be accompanied by feature advertising and/or display. Therefore, there is less anticipatory consumer response to regular price changes, unlike the case of deals. Furthermore, several price-promotion models include regular price and deal as separate independent variables (e.g., Guadagni and Little 1983).

The sales response equation is given by a multiplicative model, consistent with Christen et al. (1997), Van Heerde et al. (2000, 2001), and Wittink et al. (1988).

$$S_{ijt} = e^{\beta_{0ij}} RP_{ijt}^{-\beta_{1ij}} (1+DR_{ijt})^{\beta_{2ij}} \prod_{k=1,\,k\neq l}^{K} RP_{kjt}^{\beta_{3kil}} (1+DR_{kjt})^{-\beta_{4kij}} \cdot \prod_{k=1}^{K} e^{\beta_{5ik}FT_{ikt}+\beta_{6ik}DP_{ikt}+\beta_{7ik}FTDP_{ikt}} e^{\varepsilon_{ijt}}, \tag{5}$$

where the subscripts represent brand i at store j in week t, k indicates a general brand in the same category, and K indicates total number of brands in the category. In Equation (5), S_{ijt} denotes sales in units, RP_{ijt} denotes regular price (or price), DR_{ijt} denotes deal depth ratio (deal depth$_{ijt}/RP_{ijt}$), FT_{ikt} denotes a dummy variable for feature advertising only, DP_{ikt} denotes a dummy variable for display only, and $FTDP_{ikt}$ denotes a dummy variable for feature and display together. β is the parameter vector associated with the explanatory variables, and ε_{ijt} is an error term assumed to be independently and identically distributed normal. We tested for functional form using the Box-Cox (1964) test and for specification error using the Hausman (1978) test.

Regular price was directly provided by Nielsen for their data. It is calculated using an algorithm that is widely used by them in their research. We computed the regular price for the IRI data using the same algorithm. The details can be obtained from the authors upon request. We use deal depth *ratio* instead of deal depth *magnitude* to capture deal depth because DR_{ijt} is relative to regular price permitting an appropriate comparison across different types of brands that may have different regular prices. Deal depth is the difference between regular price and actual (shelf) price. The dummy variables take the value one for presence of the promotional variable and zero for its absence.

The sales equations for the 1,364 brand-store combinations were estimated with ordinary least squares (OLS). OLS provided good model fits with a median R^2 value of 0.63. The Durbin Watson statistic did not indicate the existence of autocorrelation for most of the combinations. The Hausman (1978) test did not reveal any evidence of endogeneity of price and promotional variables in most of the stores. We also subsequently estimated Equation (5) with lagged price, deal, and market share terms—to check for robustness to changes in model specification—the results were similar.

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