Retailer Pricing and Competitive Effects

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Abstract

Until recently, retailers have taken an either/or approach to competition: either reacting fiercely to competitive price changes or ignoring them altogether. Today, however, firms make a concerted effort to determine and quantify competitive effects. In this paper, we focus on how pricing and competitive effects interact as a general phenomenon, particularly as it applies to retailing. We attempt to construct a general framework that enhances our understanding of the emerging research issues in the area of pricing and competitive effects, and we examine their implications for practice. The areas that show high promise/opportunity are in the online setting for all types of goods—fashion, perishable and packaged staples, and durables—particularly with respect to pricing for profitability and understanding the impact of competition. Other opportunities include understanding the pricing and competitive effects in the perishable goods category sold in specialty, discount, and convenience stores.
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Introduction

Pricing is a key aspect of the marketing mix. It is the only marketing element where managers expect customers to part with their dollars. And since consumer dollars spent at one retail store may imply fewer dollars spent at a competing retail store, it is not surprising that competitive forces may play a key role in determining prices at various outlets, such as online stores, department stores, specialty stores, discount stores, grocery, drug, and convenience stores. The pricing strategies at any one of these stores are likely to impact demand at another store. Moreover, many competitive price effects may be "less easily observable" in the sense that one may not observe demand shifts in the near term due to competition. While retailers traditionally took a black-or-white approach to competition (either reacting fiercely to competitive price changes or ignoring them altogether), more and more firms currently are engaged in determining and quantifying competitive effects. Further, while some competitive effects may be within a category—say, the impact of Minute Maid refrigerated orange juice on the sales of Tropicana and vice versa—other price effects on sales are across categories, stores, and formats—for example, the impact of cola prices on orange juice sales or discount stores on regular department stores or online versus off-line. Despite their ubiquity and importance, however, there has been little effort to categorize pricing and competitive effects or link customer, store level, and situational factors to the direction, magnitude, and nature of competitive effects. The purpose of this paper is to focus on the interaction between pricing and competitive effects as a general

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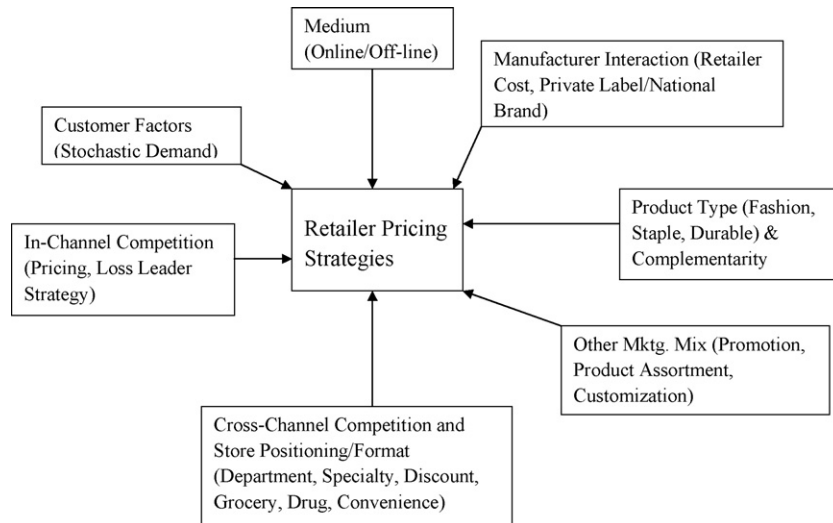 [5] Tel.: +1 972 883 2745.
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Fig. 1. Overall framework for retailer pricing and competitive effects.

phenomenon, with a particular application to the world of retailing.

Retailing has unique features that affect pricing in a competitive environment. A key component of the output of retailing is a set of services, such as location, information, assortment, delivery, and ambience (Betancourt and Gautschi 1990; Betancourt 2004). Because these services lower transportation and search costs and possibly provide other benefits, consumers are willing to pay for them. From the retailer's standpoint, services such as location and ambience are like public goods, and their cost is largely independent of the number of store patrons and the specific items sold. Retailers normally do not charge separately for these services but still must cover the cost of providing them. Similarly, since transportation and other costs of shopping that consumers incur are specific to the trip and independent of the items bought, consumers seek to minimize the cost of obtaining those items (Bell, Ho, & Tang 1998; Messinger and Narasimhan 1997).

Because of these forces, retail pricing is a matter of setting a menu of prices on individual items to recover the cost of providing various services, a similar problem to a government setting an optimal set of sales taxes (Bliss 1988). Competition should result in segmentation of the market into store formats that provide different services in return for different margins (Ehrlich and Fisher 1982; Ratchford and Stoops 1988). Within formats, differences among consumers in location, information, and propensities to search provide a scope for price discrimination in the form of periodic promotions (Narasimhan 1988; Varian 1980) or different margins on specific items that exploit these differences among consumers; loss-leader promotions might be an example of the latter. In sum, the fixed costs of service provision on the retailer side of the market and the fixed costs of shopping on the consumer side make setting retail prices in a competitive market both a difficult problem to study and a difficult problem to solve in practice.

A considerable amount of prior work has addressed key competitive effects in pricing. Economic work on cross-price effects (Moorthy 2005); studies of cross-store competition and promo-

tional strategies (Bell and Lattin 1998; Kumar and Leone 1988); the literature on price image (Cox and Cox 1990), store format choice (González-Benito, Muñoz-Gallego, & Kopalle 2005), and online pricing (Venkatesan, Mehta, & Bapna 2007); studies of loss leaders (Walters and Rinne 1986) and price wars (van Heerde, Gijsbrechts, & Pauwels 2008); and much of the work in private label and national brand interactions focus on various types of competitive effects in pricing. Here, we attempt to look across these areas to construct a general framework for understanding the emerging research issues in the area of pricing and competitive effects.

From a managerial perspective, it is important to present the interactive effects of pricing and competitive effects for three reasons. First, current pricing practices appear too reactive, perhaps driven by a need to match competition, by short-term business needs, or both. Second, pricing strategies are not tied to customer insights. Third, typical firms do not have the data, energy, or analytics to understand complex linkages with respect to pricing, customer reactions, cost, and competition.

Evaluating research opportunities in retailer pricing and competitive effects

Following Bolton, Shankar, and Montoya (2007) and Levy et al. (2004), Fig. 1 provides an overall framework with respect to seven different factors that impact retailer pricing strategies. These include (1) in-channel competition, which can be broken down to (i) within- and cross-store price competition and (ii) the impact of loss leaders on traffic; (2) cross-channel competition which includes store positioning/format choice; (3) integration with other marketing mix variables (e.g., price and product customization); (4) customer factors that lead to demand uncertainty and the corresponding joint optimization of price, promotion, and product assortment; (5) product type and complementarity; (6) manufacturer interaction; and (7) medium—that is, online or off-line—which can be subdivided into (i) understanding online pricing practices and (ii) multichannel retail pricing. Below, we discuss each of the above factors in detail, first examining

extant research in the corresponding areas and then currently unaddressed research questions.

In-channel competition: within- and cross-store price effects

Prior research in this area focuses on within-store competition effects and cross-store price competition among retailers. Kumar and Leone's (1988) pioneering paper investigates the effect of retail store prices and promotion variables of disposable diapers within a city and documents the significance and magnitude of store substitution in this category. Using weekly, chain-level scanner data for four major grocery chains, Richards and Hamilton (2006) provide some empirical evidence on supermarket retailers' price and variety strategies and find (i) supermarket retailers compete for market share using both price and variety and (ii) there is lower elasticity of substitution among products within each firm than among firms. Each firm tends to follow a "cooperative" variety strategy towards competitors based on the similarity of such factors as location, price level, private label strategies, and so forth. Managers, however, believe that competition is one of the key factors influencing retailer pricing.

Accordingly, Shankar and Bolton (2004), using weekly multi-brand, multi-store, store-level scanner data from six categories of consumer packaged goods in five U.S. markets, find that competition is a key determinant of four underlying price dimensions: consistency, price-promotion intensity, price-promotion coordination, and relative brand price. On the other hand, the Nijs, Srinivasan, and Pauwels (2007) study of 55 Denver area supermarkets in 43 categories over 123 weeks shows that competitive retailer prices account for 5.5 percent of retail price variance—well behind cost, demand, and category management considerations. Note that the above studies focus primarily on periods of "business-as-usual" competition. However, retail price competition intensifies during periods of price wars (van Heerde, Gijsbrechts, & Pauwels 2008) and when a "category killer" enters the market.

Finally, a considerable amount of research shows that consumers tend to develop loyalty to the previous brand they bought (Ailawadi et al. 2007). However, while there is a lot of research on cross-price effects on sales within a store, not much work has been done on the implications of this form of state dependence for retailer pricing. Dubé et al. (2008) develop a category pricing model that yields steady-state prices for categories that exhibit state dependence vis-à-vis the last brand purchased. The authors show that a forward-looking category manager may reduce prices of high quality items relative to the myopic case because there is a payoff to inducing loyalty through current purchases.

Future research

One impediment to studying the competitive pricing strategies of retailers is that category and store-level prices are difficult to define and measure. A store may stock many thousands of different items, and most of their prices may be irrelevant for a given consumer. Moreover, different consumers may be interested in different mixes of items so that a store's prices may be relatively high for one consumer but relatively low for another.

Another problem is that standard fixed-weight price indexes for a category or store are problematic because promotions tend to have a large impact on sales that the fixed weights would not capture (Chevalier, Kashyap, & Rossi 2003). These problems make measuring overall retailer price levels a difficult issue that needs further theoretical and empirical research.

There is extensive literature that implies retailers should play mixed strategies in which prices are randomized between high—those that will extract rents from loyal consumers—and low—those that provide a chance to capture consumers who search; the latter can be thought of as promotions. Price dispersion is an outcome of this model, and a testable implication is that the rank order of prices that competitors charge in a market should fluctuate randomly over time. Iyer and Pazgal (2003) provide some evidence in favor of this mixed-strategy pricing model in their study of online retailers. But the mixed-strategy explanation is such a pervasive part of the theoretical literature on pricing that it should be tested further.

While mixed strategies provide one explanation for promotions, models of mixed strategies do not readily deal with the multiple product nature of most retail offerings. Specifically, we know that actual promotions often involve selling items at a loss in hopes of compensating through profits on sales in other categories that are induced by the loss leader. In the next section, we discuss what is known and what needs further study about loss leaders.

In-channel competition: impact of loss leaders on store traffic

Loss leaders are products temporarily priced at or below retailer cost (Walters and MacKenzie 1988). Usually, loss leaders are also featured in local advertising. Selling such deeply discounted items can be effective because the losses are made up on the sale of complementary items to current customers (Bliss 1988) or because they bring incremental traffic to the store. This last argument is the focus of papers by Hess and Gerstner (1987) and Lal and Matutes (1994). Hess and Gerstner (1987) consider a model with a shopping good that is used to select a store and other impulse goods bought without price comparison. In a market with free entry, competing stores price the shopping good as a loss leader, while the cost of going to another store gives the retailer monopoly power over impulse goods.

Lal and Matutes (1994), incorporating imperfect information and advertising, explain loss leaders as a device for committing not to exploit consumers' sunk travel costs. Basically, consumers know that retailers gain monopoly power over them once they incur the cost of visiting stores. Loss leaders provide assurance that retailers will not exploit this monopoly to the fullest extent, thus justifying the store visit. In order to remain competitive, all retailers have to offer loss leaders as an inducement to undertake the trip to their stores. Effects on traffic may therefore cancel out. These results suggest an identification problem in efforts to determine whether loss leaders build traffic. While they are necessary for the store to have any traffic at all, equilibria with a stable set of loss leaders and traffic should result in a competitive setting.

Empirical studies of loss leaders' impact on traffic, sales, and profits have been scarce. Walters and Rinne (1986) study loss leader and double coupon promotions in three stores over 145 weeks and use store traffic, store grocery sales, and store grocery profits as dependent variables. They find that consumers have different responses to different portfolios of loss leaders. They also find that only two portfolios in one of the three stores have a significant impact on traffic, which may suggest that the consumers who respond to loss leaders are mostly the store's existing consumers. Contrary to conventional wisdom, the researchers find that loss leaders only increase the sales of promoted products, which are low-margin items. Therefore, only a few of the loss leaders may be profitable. Walters and MacKenzie (1988) find similar results. They examine data from two supermarkets associated with a large midwestern supermarket chain and identify some categories as frequent loss leaders, such as rolls and buns, baking supplies, paper products, prepared foods, eggs, coffee, carbonated soft drinks, and condiments. The researchers find that only one of the eight loss-leader categories (rolls and buns) is associated with significantly increased traffic and profits. Sales of loss leaders themselves increased in several categories, but loss leaders generally failed to influence the sales of other non-promoted items.

Chevalier, Kashyap, and Rossi (2003) test the loss-leader pricing explanation of Lal and Matutes (1994) against two competing explanations for the observed declines: lower buyer search costs and intensified competition. They find that price declines coincide with idiosyncratic demand peaks, which do not generally coincide with overall peak demand, and that advertising for the promoted items is greatest at the peaks, leading them to conclude that the evidence was most consistent with the loss-leader pricing model. For a further discussion on the effectiveness of "loss leader" promotion strategy, see Ailawadi et al. (this issue).

Future research

Despite the importance of retail promotions and the common use of loss leaders, published empirical research about their effects has been limited. Studies tend to consider only a few stores and a limited number of categories in a store and have been largely confined to supermarkets and drugstores. The data challenges involved are a substantial impediment to this research: large numbers of items tend to be promoted simultaneously, promotions may have an influence on a much larger number of non-promoted items, and costs of individual items are hard to determine given the different ways in which manufacturers may support promotions. Research that addresses these problems to provide a better understanding of loss leaders' impact is needed.

Prior literature suggests that loss leaders do increase store traffic and may improve profitability, but there are contradictory findings with respect to the source of higher profitability; is it from the sales of non-promoted brands or is it primarily driven by the promoted items? Future research might investigate the conditions under which loss leaders could improve profitability by increasing the sales of non-promoted items.

Despite a general understanding that effective loss leaders might be items that large numbers of consumers buy, are diffi-

cult to stockpile, and that might trigger the most spending on non-promoted items (Lal and Matutes 1994), little empirical evidence exists about what categories are the most effective loss leaders. Thus, more empirical research is needed to establish why some product categories make for effective loss leaders, help identify such categories, and determine whether these categories differ across different channels (department, specialty, discount, grocery, drug, and convenience stores). Lastly, future research could examine the source of increased traffic due to loss leaders; to what extent is the increased traffic a primary demand shifter versus traffic from other channels, and is there an asymmetric store-traffic effect across different channels?

Cross-channel competition: store format choice

In general, one can distinguish between pricing strategies and competitive behavior within a format, say, a supermarket, or between competitive strategies across formats, say, a supermarket and a discount store such as Wal-Mart. In this regard, the store format and the corresponding category associations play a key role in consumers' store format choices (Inman, Shankar, & Ferraro 2004).

Two key retail pricing strategies researched are everyday low pricing (EDLP) and promotional pricing (PROMO), and most of the work on these strategies considers supermarkets. In particular, Lal and Rao (1997) develop a theoretical model of the strategies adopted by firms in a competitive game, and Bell and Lattin (1998) study consumer preferences for one strategy over the other. The latter study specifically examines the relationship between grocery shopping behavior, retail price format, and store choice. Bell and Lattin (1998) find that consumers' price expectations for the basket they buy influence store choice. A large-basket shopper with less ability to respond to prices in individual product categories will be more sensitive to the expected cost of the overall portfolio (the market basket) when choosing a store. EDLP stores get a greater than expected share of business from large-basket shoppers, while PROMO stores get a greater than expected share from small-basket shoppers. Large-basket shoppers are relatively price inelastic in their category purchase incidence decisions and price elastic in their store choice decisions. While much of the research focuses on EDLP and PROMO, retailers tend to use other strategies, such exclusive pricing, moderately promotional pricing, and aggressive pricing (Bolton and Shankar 2003).

Using data from five stores, Bell, Ho, and Tang (1998) analyze the underlying factors that affect store choice. A key insight is that a consumer's store choice should consist of choosing a store (or stores) to minimize the sum of fixed and variable costs of shopping. Fixed costs are primarily travel costs, while variable costs are largely the costs of acquiring the desired market basket. The latter loom larger as the size of the market basket increases, making it more feasible to incur a relatively high fixed cost in order to get lower prices. To be competitive in a market segment, a store should avoid having high fixed and high variable costs of shopping simultaneously. It turns out that a focused strategy—that is, serving small (or large) basket sizes—or a diversified strategy—that is, serving a mix of

basket sizes—can lead to gains in store traffic at the expense of competitors.

In a similar vein, Messinger and Narasimhan (1997) develop a model to help explain the growth of one-stop shopping and the consequent growth of supermarket assortments. Basically, as consumer time becomes more valuable and as improvements in consumer transport and inventory-holding (refrigeration) technology take place, the efficiency of shopping for a large basket at one location increases. Stores respond by providing larger assortments.

Other key results related to supermarket pricing strategies are as follows: With respect to a comparison between EDLP and HILO (high-low) stores, Hoch, Dreze, and Purk's (1994) analysis reveals that a ten percent EDLP category price decrease leads to a three percent sales volume increase, while a ten percent HILO price increase leads to a three percent sales decrease. An EDLP policy reduces profits by eighteen percent, and HILO pricing increases profits by fifteen percent. Kumar and Rao (2006) analytically examine how supermarkets can price their goods intelligently when serving heterogeneous consumers by use of data-analytics programs. Shankar and Bolton (2004) empirically investigate the determinants of retailers' pricing decisions. HILO-positioned chains, larger chains, and larger stores have high price-promotion intensity and high price-promotion coordination. Retailers targeting price sensitive shoppers typically carry a greater assortment of brands in a given category. Retailers charge price premiums and are less price consistent, promote more intensely, and coordinate prices and promotions more closely for brands with higher brand-preference levels. Finally, Briesch, Chintagunta, and Fox (2009) provide a comprehensive study of the impact that location, price, assortment, and feature advertising have on store choice.

Ellickson and Misra (2008) study the choice of EDLP, PROMO, and a hybrid of the two strategies as a competitive game of incomplete information. Using data on over 17,000 supermarkets, their key finding is that supermarket operators tend to coordinate their choice of strategies in a given market: if the competitor is likely to choose EDLP, the focal firm is more likely to choose it. This finding runs counter to the expectation that competing firms would choose different strategies to segment the market. The authors also find that choice of EDLP is associated with lower income, racially diverse markets with larger household size.

Compared to studies of alternative supermarket-pricing strategies and of grocery store choice, less attention has been paid to pricing and competition across formats. Bhatnagar and Ratcgford (2004) develop a general model of retail format choice for nondurable goods and isolate conditions under which shopping at supermarkets, convenience stores, and food warehouses would be optimal. González-Benito, Muñoz-Gallego, and Kopalle (2005) model both within and across format choices and find that (i) the rivalry within store formats differs significantly from rivalry across store formats and (ii) there is more rivalry within store formats relative to the rivalry across store formats.

Some initial work in quantifying the impact of prices in one format/channel on prices in other formats/channels has been carried out by Chu, Chintagunta, and Vilcassim (2007). In the context of durable goods, specifically, personal computer sales, they find an asymmetric pattern of cross-price elasticities across various channels through which personal computer manufacturers market their products. In particular, they find that direct channels (sales force, Internet, and catalog) primarily compete among themselves, as do indirect channels (dealer/VAR, etc.). The telemarketing and catalog channel and the Internet channel are essentially the same marketing tool, and they have the highest cross-elasticity. The substitution between direct and indirect channels is also substantial. When the dealer/VAR channel changes prices, it affects all other channels because this channel primarily serves institutional customers, who have access to other channels.

Binkley and Connor (1998) find that competitive conditions differentially affect prices across product types. For instance, entry by warehouse (and similar grocery formats) lowers prices for perishables more than for staple goods. Frequent price changes in a market serve to reduce food prices. While Singh, Hansen, and Blattberg (2006) study how the entry of a Wal-Mart superstore into a specific market impacts consumers, they do not investigate strategy changes by the incumbent retailer.

Fox, Montgomery, and Lodish (2005) analyze monthly data that capture the shopping behavior of 96 households over six chains in three formats over a 24-month period. They find that consumers' price elasticities for their market baskets are not significantly different from 1. This suggests that consumer spending is not highly sensitive to observed variation in market-basket prices for the different packaged-goods retailers. Mass merchandisers are least sensitive to shoppers' travel time. While retailers across formats respond to consumers' sensitivity to assortment, groceries in particular would benefit from offering even deeper assortments. Lower penetration of mass merchandisers for grocery products is consistent with shoppers' insensitivity to travel for this format. Households that have higher intrinsic preferences for spending at grocery stores also prefer to spend more at other formats, particularly mass merchandisers. Within grocery stores, spending preferences are negatively related. It also appears that spending preferences exist within promotional "tiers." Spending preferences at the most promotional stores (e.g., drug chains and some grocery stores) are positively related, while preferences at moderately promotional stores (certain mass merchandisers) are also positively related. No strong relationship exists for patronage preferences across formats, though relationships within formats are apparent. Taken together, the findings suggest that (i) competition between formats is fundamentally different from competition within formats and (ii) across formats, stores are not close substitutes.

Future research

Some key research issues in this area are how prices in department (or grocery, drug, or convenience) stores impact sales in discount stores and vice versa. Similarly, another avenue for fruitful research is to quantify the cross-price elasticities within a format (i.e., discount, grocery, department, etc.). The structural modeling approach of Chu et al. (2007) should be useful for these studies of between and within format cross-elasticities.

There is also a need for more study of changes in retail price competition during periods of economic recession versus boom, and periods of upheaval (e.g., Wal-Mart entry) versus business as usual. Most of the extant research on store choice, format choice, or both has not formally modeled how individual customers choose between store formats, an issue ripe for future research. In fact, there has been surprisingly little study of competition between formats, especially between traditional retailers and hard discounters, even though this is an important topic for practitioners today (van Heerde, Gijsbrechts, & Pauwels 2008). Not much is known about how consumers divide their purchases among formats or what drives this. Models of shopping costs and consumer inventory behavior, like those of Messinger and Narasimhan (1997), Bell, Ho, and Tang (1998), and Bhatnagar and Ratcgford (2004), might provide a useful framework for studying choice among formats. Also, not much is known about the supply side aspects of store-format competition, either from a theoretical or an empirical standpoint. For example, it might be useful to have a model of optimal response to the actual or potential entry of a superstore into a market and to determine how competitors react to such entry or threats of entry. Within a given format, future research can examine which stores to shop at by considering differential effects of location, convenience, price, and assortment.

Price and product customization

Given to the difficulty of disentangling price from a product, that is, price may simply be viewed as an attribute of a product bundle, we believe examining pricing alone in a competitive context reveals only half the story. A more complete picture will emerge when both price and product are customized simultaneously to fit customer tastes. In this regard, in an analytical sense, it appears that a higher quality firm can actually be worse off with personalized pricing (PP [Choudhary et al. 2005]). While it is optimal for the firm adopting PP to increase product differentiation, the non-PP firm seeks to reduce differentiation by moving in closer in the quality space. While PP results in wider market coverage, it also leads to aggravated price competition between firms. Despite the threat of first-degree price discrimination, the results suggest that PP with competing firms can lead to an overall increase in consumer welfare. Also, while there may be increased complexity in product customization, consumers in an experimental setting are more willing to accept the complexity of a mass customization configuration if the configuration allows them to achieve a higher product utility (Dellaert and Stremersch 2005). Although targetability (personalized pricing) may actually hurt a retailer (Liu and Zhang 2006), the retailer may still want to embrace it because personalized pricing can be used to deter the manufacturer from direct entry or from offering personalized pricing. Furthermore, when firms offer customized products, they are able to expand demand as well as to increase the prices of their standard products relative to when they do not.

When a firm offers customized products, a dominant strategy is for it to also offer its standard product. This highlights the role of standard products and the importance of retain-

ing them when firms offer customized products (Syam and Kumar 2006). In a competitive environment, complete customization of all attributes will not persist in equilibrium due to severe downward pressure on prices; a partial customization turns out to be a corresponding solution (Syam, Ruan, & Hess 2005). Also, incremental profit of individual-level promotions over segment-level promotions, and of segment-level over mass-market-level customized promotions, is small in general, especially in off-line stores (Zhang & Wedel in press). For promotion sensitive categories, firms can gain meaningful profit increases from individual-level over segment-level customized promotions, and from segment-level over mass-market-level customized promotions, in online stores. If individual-level promotions are to be implemented, the online setting will be more suitable. Customized promotions at all levels are more profitable than undifferentiated promotions in online stores, but not so in off-line stores.

Future research

Clearly, we have a lot of interesting research on pricing and product customization in a competitive context. In the future, it would be a fertile and meaningful exercise to test empirically the extent to which some of the above discussed would hold in the field. For example, in an empirical setting, would we observe that a high quality firm be always worse off with a personalized pricing approach or the degree to which targetability would deter manufacturer entry? Under what conditions might we empirically observe product customization on all attributes versus a few attributes in a competitive environment? Similarly, one can also evaluate the implementation of customized pricing for different categories in an online environment.

Advances in technology are further allowing customization on a much broader scale than was possible in the past. BMW, for example, lets customers customize their cars up until the automobile leaves the assembly line. The price is adjusted as more features are added to the product. This raises an interesting reference price issue from a customer's perspective since the customer would have paid already for the base car that was ordered and the only relevant cost as time passes would be the incremental cost of the customized features added; this is because this cost has been disentangled from the price of the car due to the sunk cost of the original price paid as well as the passage of time. This issue also ties in with research in the domain of endowment effects and reference-dependence models, which would suggest that consumers make additional product-option choices by using their endowed configuration as a starting reference point (Park, Jun, & MacInnis 2000). It would be interesting to optimize prices and product features from a firm's perspective by incorporating customer behavior in product customization over time and the corresponding competitive environment.

In this regard, there is also a lot of scope for academic research to learn from the cutting-edge practices in industry, particularly from the grocery and drugstore chains. For example, when grocery stores implement price optimization algorithms that are developed by SAP, Oracle, DemandTec, or Revionics, to what extent do they impact the sales volume, unit margins, and gross contributions? And to what extent are

they in line with the predictions of the optimization models built in academic research? Future research might examine how personalized coupons, such as those CVS distributes to customers at checkout, alter consumer behavior and the optimal design of these coupons with respect to the product category, face value, expiration date, and so forth.

Another productive future research issue is the impact of radio frequency identification (RFID) technology. RFID technology radically increases an organization's ability to attain a vast array of data about the location and properties of any stock-keeping unit (SKU) that can be physically tagged and wirelessly scanned. Given this data, one can examine the potential for dynamic pricing, keeping track of inventory on shelf and the corresponding impact on customer behavior, and the role of competitive prices on sales.

Joint optimization of price, promotion, and assortment

The growth of efficient consumer response (ECR) and subsequent emphasis on category management encouraged retailers to focus on the profitability of an entire product category rather than individual brands (Levy et al. 2004). Basuroy, Mantrala, and Walters (2001), Chintagunta (2002), Shugan and Desiraju (2001), and Tellis and Zufryden (1995) empirically study the implications of a category management approach and show the correspondingly higher profitability from such an approach. Dhar, Hoch, and Kumar (2001) examine data from a large packaged goods firm, including nineteen major product categories sold in their key retail accounts, to identify the drivers of effective category management and how these drivers depend on the category's position in the overall retail portfolio. The researchers group categories into four sections based on frequency and penetration and find breadth and depth of assortment have positive influence on category development index (CDI). A lower category price increases unit category sales and dollar revenues in variety enhancer and niche categories.

The pricing aspect has been considered in Shankar and Krishnamurthi (1996), who present an empirical analysis of the relationship between price elasticities and retail pricing policies. A comprehensive analysis of retail promotions is discussed in this special issue (see Ailawadi et al. this issue), where it is argued that retailers should coordinate and jointly optimize pricing and promotion activity in order to avoid sub-optimal decisions on both fronts.

Assortment is becoming one of the key factors to bring store traffic and sales. Koelemeijer and Oppewal (1999) assess the effects of assortment and ambience on choice using an experimental setting. They find that increasing the assortment size by adding items increases the likelihood of purchasing at a current store proportional to the attractiveness of the items added. McIntyre and Miller (1999) point out that consumers' perception of *assortment attractiveness* is based on such cues as (a) a belief that the preferred item is stocked, (b) the number of SKUs (items) carried, and (c) the amount of space allocated to the category.

Besides attitudinal analysis on the effects of assortment, some empirical studies also show the effect of assortment on demand. Briesch, Chintagunta, and Fox (2009) develop and estimate a model of the impact of different dimensions of assortment, as well as other variables, on grocery store choice. This model, which builds on the framework of Bell, Ho, and Tang (1998), considers five dimensions of assortment covering various aspects of breadth and depth. The authors find that demand is most sensitive to location and generally more sensitive to assortment than to price. On average, store choice is positively related to the number of brands carried but negatively related to SKUs and sizes per brand. However, heterogeneity is greatest for assortments, and many consumers actually prefer fewer brands and more SKUs and sizes per brand. Also, those who highly value the location dimension tend to value assortments less and vice versa.

Future research

Prior research has identified the drivers and the impacts of assortment, promotion, prices, and competition on consumer choice. However, much of this research has focused on grocery stores, and less is known about the impact of these variables on other retail formats.

In addition, while there is evidence about consumer response to price, promotion, and assortment, less is known about how to translate this evidence into profitable strategies. An avenue for future research is the joint optimization of product assortment, pricing, and promotions by taking into consideration competitive price effects—both within and across categories and stores—as well as stochastic demand, which may be a result of customer-related factors unobserved by the researcher. Essentially, this approach involves attempting to coordinate assortment, pricing, and promotion in the face of stochastic demand and competition. While considering such joint optimization, it is important to incorporate some key behavioral perspectives in pricing, such as reference prices, price expectations, and so forth (Chandrashekaran and Grewal 2003; Kopalle, Rao, & Assunção 1996; Kumar, Karande, & Reinartz 1998).

Pricing of complementary goods

Walters (1991), using store-level scanner data, finds that price promotions in one store have significant positive effects on the sales of at least one complementary brand in the same store, with the intra-store complementary effects being non-symmetric. For example, the promotion of spaghetti will increase the sales of its complementary, spaghetti sauce; however, the promotion of spaghetti sauce will not increase the sales of spaghetti. Additionally, price promotions on low-share brands increase the sales of high-share complements as frequently as price promotions on high-share brands stimulate sales of the low-share complements. The authors also find that the inter-store complementary effects are not significant. Similarly, Mulhern and Leone (1991) examine retailer pricing as a multiproduct pricing strategy. They point out two types of pricing strategies for complementary products: *price bundling* and *complementary pricing*. Retailers normally do implicit price bundling in order to induce non-promoted purchases and improve store profitability by price promotion. They find negative cross-price coefficients, which indicate

complementary effects. Additionally, the cross-category relationships are very symmetric, indicating that retailers can improve profitability by carefully selecting categories for price promotion.

Several authors have used supermarket scanner data to measure cross-category price elasticities across complementary categories. Song and Chintagunta (2006) find evidence for a complementary relationship between liquid softeners and liquid and powdered forms of laundry detergents. They also find that the magnitude of cross-category elasticities is brand specific—that is, different brands in a category have a different price impact on the demand for a brand in another category. Their results have implications for retailers in terms of the potential need for cross-category management as well as for manufacturers, such as Procter and Gamble, that participate in all four categories. Using household-level data, Song and Chintagunta (2007) find that most of the cross-category effect can be attributed to coincidence. Similarly, Duvvuri, Ansari, and Gupta (2007) examine the correlation of price sensitivities between complementary categories. They find that the correlation between own price sensitivities of complementary goods is negative and suggest, therefore, that retailers set the discount within a single category to maximize their profit across complementary categories when there is partial complementarity. Retailers should also set simultaneous discounts for both categories when they are fully complementary.

Future research

As seen in prior literature, many theoretical studies in the bundling area discuss optimal price bundling strategies taking into consideration a competitive setting (Anderson and Leruth 1993; Jeuland 1984; Kopalle, Krishna, & Assunção 1999). While there have been a few empirical studies that document the impact of prices one complementary good has on the sales of another and vice versa, future research should empirically examine the optimality of bundling strategies and test the extent to which the propositions derived from prior bundling theories would apply in practice. For example, it is derived analytically that mixed bundling would be a dominant equilibrium result when there is scope for market expansion, and pure components would be an equilibrium strategy when there is less scope for market expansion. It is not clear to what extent this result would hold empirically. Second, although most bundling literature focuses on combining two products from each firm, there is scope for bundling more than two components, and it would be an interesting exercise to evaluate both theoretically and empirically the optimality of bundling more than two components. One other issue in this area is the pricing of complementary durable goods. While researchers are only now exploring consumer demand across multiple durable goods categories (Sriram, Chintagunta, & Agarwal 2008), very little research exists on using knowledge of the demand function for pricing purposes.

Private label and national brand interaction

Given the increasing quality equivalence between national brands and store brands, they have become direct competitors and their pricing decisions should take this into account (Pauwels and Srinivasan 2008). Previous studies typically assumed store brands are lower quality brands, and their implications may need revisiting in the presence of premium quality store brands.

Blattberg and Wisniewski (1989) evaluate the competition between national brands and private labels in four product categories (all-purpose flour, stick margarine, bathroom tissue, and tuna). They find that promotional price competition could induce asymmetric sales effects within a retail grocery category. Specifically, higher-price/higher-quality brands steal sales from the lower-price/lower-quality brands when the higher tier reduces the price. However, the lower-price/lower-quality brands (tier) can barely draw sales from the higher tier when they reduce their prices. Similar results are seen in Bronnenberg and Wathieu (1996): national brands have an advantage in promotion effectiveness, but this advantage exists only if the quality gap between the brands is sufficiently large compared to the price gap.

On the other hand, Sethuraman and Srinivasan (2002) theoretically and empirically demonstrate that asymmetry reverses when absolute cross-price effect is considered. That is, the absolute cross-price effect of reducing the price of a low share brand on the market share or sales of a high share brand is greater than the reverse.

Accounting for own and cross-elasticities together, Allenby and Rossi (1991) find that a higher quality brand will have higher price elasticity than a lower quality brand with the same market share due to the interaction between income and substitution effects. However, for lower quality brands, the income and substitution effects cancel each other out, which leads to lower elasticities.

Controlling for category effects, Wedel and Zhang (2004) examine cross-category price effects that are specific to SKU. They study the competition between national brands and private labels across subcategories and find that the asymmetric price competition between price tiers exists both within subcategories and across subcategories. They also find that the subcategories vary strongly in terms of the store brand's relative influence within and across the subcategories.

Pauwels and Srinivasan (2004) study the effects of different levels of national brands. They show that store brands have very different competitive pricing effects for premium versus second-tier national brands. First, premium brands get a substantially smaller sales increase from a price drop because their customers are more niche and less price sensitive. At the same time, a price cut from the store brand won't affect them much either. The researchers recommend keeping prices high while justifying the price premium by continuous improvement in the identified drivers of market power. Second-tier brands face a tough dilemma; typically, they cannot win a price war with the store brand, so such brands need to choose between upgrading the brand (a large and uncertain investment) versus head-on value competition with the store brand. Hansen, Singh, and Chintagunta (2006) use frequent-shopper data from a large retail chain and examine the degree of correlation in preference across categories. They find strong evidence of correlations in household preferences for store brands and marketing-mix sensitivity across categories.

Ailawadi, Kopalle, and Neslin (2005) analyze competitor response to P&G's "value pricing" strategy, where P&G cuts their promotions and provides lower everyday prices to retailers and consumers. The data are composed of weekly retail and wholesale prices, deals, and sales for packaged goods in local stores. The researchers use a dynamic game-theoretic model to estimate the retailer's and competitor's responses to P&G's price and promotion strategies based on a manufacturer/retailer Stackelberg model (Kopalle, Mela, & Marsh 1999). They find significant predictive ability of competitive reaction with respect to wholesale and retail prices and wholesale deals. In a broader context, this fits into the vast literature that discusses the importance of channel coordination (see, for example, Ingene and Parry 2000).

Future research

Prior research on the interaction between private and national brands has focused largely on (1) lower quality store brands and (2) packaged goods, primarily in a grocery store or drugstore setting. Far less known are the pricing and competitive interactions between premium private labels and national brands (Kumar and Steenkamp 2007). How does the pricing power of national brands change in the presence of three-tier (convenience, supermarket, and hypermarket formats) retail store branding strategies (Buckley 2005)? We know even less about the private label/national brand pricing interaction in the durable goods and fashion markets. For example, is there evidence of asymmetric price effects of store versus national brands in those categories?

Understanding online pricing practice

While much research is available with respect to off-line pricing issues, we begin by taking stock of what is available, at least descriptively, with respect to online pricing. Online pricing is of two general forms: posted prices of the type normally offered at conventional retailers, and auctions similar to those at a physical auction site. Auctions, which are most applicable to items with limited supply and thin markets, account for roughly one-third of online retail sales (Bajari and Hortacsu 2004). A review of research about issues related to online pricing is presented in Ratchford (in press-b).

Early research on the Internet somewhat naïvely predicted that it would eliminate consumer search costs and that online markets would become perfectly competitive (Bakos 1997). In reality, this has not happened. The dispersion of posted prices online is similar to dispersion off-line, and online retailing has come to be dominated by major players, such as Amazon and eBay. There are a number of reasons for this. Since learning how to navigate a supplier's site tends to require substantial costs (Johnson, Bellman, & Lohse 2003), switching suppliers involves costs. In addition, consumers, who normally pay for merchandise before it is delivered, face risks of a seller failing to deliver merchandise as promised, and they also may face security risks. Therefore, most consumers will pay a premium to buy from a trusted seller (Smith and Brynjolfsson 2001). Finally, like their off-line counterparts, online consumers do not appear

to search extensively (Johnson et al. 2004; Ratchford, in press-a).

Although intuitively it may seem that online markets might foster a greater level of perfect market conditions, empirical evidence points otherwise. In fact, though limited, because sales data are hard to locate, the existing evidence on price elasticity in online markets indicates that online markets are far from being perfectly competitive. Specifically, Chevalier and Goolsbee (2003) find that the online price elasticity of demand for books is about -3.5 for Barnes and Noble but only about $-.45$ for Amazon. This estimated elasticity for Amazon implies a negative marginal revenue, an indicator that Amazon prices below the short-run profit-maximizing level. This suggests that Amazon may be using a penetration pricing strategy (Chevalier and Goolsbee 2003). Along the same lines, there are interesting findings regarding price dispersion in online markets. Pan, Ratchford, and Shankar (2002) examine whether price dispersion in online markets can be explained by differences in e-tailer service quality and find persistent online price dispersion that is not closely related to measured quality differences (see Pan, Ratchford, & Shankar, 2004 for a review). They also find that prices at pure e-tailers appear to be equal to or lower than those at bricks-and-clicks e-tailers for all categories except books and computer software.

However, product category is not the only determinant of price levels in online markets. For instance, high service quality retailers charge significantly more than the low service quality retailers when (a) level of competition and scope for differentiation are high and (b) both level of competition and scope for service differentiation are low (Venkatesan, Mehta, & Bapna 2007).

From consumers' perspective, sensitivity to shipping charges varies according to their purchase scenarios. Using a database from an online retailer that has experimented with a wide variety of shipping-fee schedules, Lewis, Singh, and Fay (2006) find that consumers are very sensitive to shipping charges and that shipping fees influence order incidence and basket size. Promotions such as free shipping for orders that exceed some size threshold are found to be very effective in generating additional sales. However, the lost revenues from shipping and the lack of response by several segments are substantial enough to render such promotions unprofitable to the retailer.

As in off-line markets, online sellers also sometimes have the prospect of receiving revenue from advertisements posted on their website, and the impact of their prices on advertising revenue has to be taken into account in setting prices. A specific case is an online provider of information who has the option of charging for access to the information. In this case, moving from free to fee (i.e., from zero to a positive price) has consequences for a firm's advertising revenues from free subscribers as it slows down the growth of free users directly and reduces the effectiveness of marketing communications in generating new free users (Pauwels and Weiss 2008).

In further research on online information providers, Viswanathan et al. (2007) examine the role of online infomediaries in market segmentation and price discrimination in the automotive retailing context and find that when consumers

obtain price information from online buying services, they pay lower prices than consumers who obtain product information for the same product. Zettelmeyer, Scott Morton, and Silva-Risso (2006) report similar results.

Research on decision support systems for online sellers has been scarce. An exception is the work of Zhang and Krishnamurthi (2004), who provide a decision support system for customized promotions, primarily for use in online stores, and develop an optimization procedure to derive the optimal amount of price discount for each household on each shopping trip.

So far, our review of online pricing has concentrated on online sellers who post their prices. But, as we stated at the beginning of this section, online auctions account for a substantial portion of online retail sales. There is a very large literature on Internet auctions, which has been reviewed from an economic perspective by Bajari and Hortacsu (2004) and from a consumer behavior perspective by Cheema et al. (2005). Major areas of research on online auctions have focused on avoiding the winner's curse and the observed tendency toward late bidding on the buyer's side, and on setting the reserve price on the seller's side. Beyond that, there is an acute moral hazard problem for online auctions since buyers do not have the ability to inspect the merchandise. This makes reputation mechanisms, such as eBay seller ratings, particularly salient (Bajari and Hortacsu 2004). Additionally, sellers are not guaranteed to receive payment from the winner, especially since eBay removed the buyer rating.

Future research

The literature on online pricing practices has focused on customer reactions to pricing strategies and shipping fees, the role of infomediaries, advertising revenues, channel interactions, and the development of personalized pricing schedules. However, little is known about pricing strategies and tactics that are, or should be, developed and implemented by a company selling online. Future research might examine these issues in an effort to (i) gain a better understanding of the different types of online pricing policies that are feasible, (ii) figure out what type(s) of online pricing strategies are more profitable in different contexts, and (iii) provide this as an input in better understanding what types of online pricing policies may be optimal from a firm's perspective.

Another issue worthy of future research is the incorporation of strategic customer behavior in developing online pricing strategies. In other words, how should online firms endogenize the fact that customers are forward looking and, therefore, strategic in nature? We believe that from a normative standpoint, online pricing policies from such a framework would yield qualitatively different results compared to quantitative models that ignore such strategic customer behavior. Given the richness and the differential online pricing environment, as well as other situational and contextual factors, such an analysis would result in pricing strategies that differ from those observed in the off-line setting as well.

In addition, many online cash-back websites are emerging on the Internet, some of which incorporate the role as infomediary to provide price comparison information (http://search.live.com/cashback). This makes online retailers'

pricing practices even more complicated: their prices may depend on both the amount of cash back and the list of other retailers on the website. Additionally, the cash-back infomediaries are playing a more and more important role in the customers' purchase decisions. For example, the deep cash-back discount (up to 35 percent) provided by Windows Live Search (WLS) to eBay purchases has significantly increased both the hit rate of WLS and number of transactions on eBay. Unlike the other cash-back websites, WLS makes the cash-back discount rate dynamically, depending on its website's hit rate and the products the customers are searching, which makes the story more interesting. The joint pricing and discount strategies between cash-back infomediaries and the online retailers have not been studied.

Furthermore, a firm's online pricing strategies need to consider competitive behavior. Specifically, based on the impact a firm's prices have on competitors' sales and vice versa, it is important to incorporate strategic competitor behavior in models that determine optimal pricing strategies from a firm's perspective. In this context, one can also examine whether the pricing games a firm plays online are closer to a Nash noncooperative equilibrium or a Nash cooperative solution. There is also a need to consider customer-level dynamics with respect to how today's prices would impact future customer behavior. This would require a dynamic model. For example, Kannan and Kopalle (2001) explain the relevance of online dynamic pricing and explore the implications of certain aspects of dynamic pricing in consumer markets (e.g., dynamic pricing of posted prices, reverse auction pricing of goods and services as used by Priceline) based on consumer price expectations, the role of information and consumer learning, and their impact on consumer responses to prices across different product categories. Several propositions and issues for research were developed, which are now ripe for testing in future research.

While the existence of dispersion in prices posted online is well known, one wonders at the current relevance of this finding given that many online markets have come to be dominated by well-known sellers, such as Amazon. While consumers' heightened perceived risks in online markets and their aversion to dealing with unknown sellers have resulted in the dominance of these well-known sellers, there are potentially other factors behind this phenomenon (Biswas and Biswas 2004). In this regard, one would like to know more about how consumers choose online sellers and why they choose to shop online rather than off-line. Data on price alone will not suffice for understanding consumer choice of online outlets, and click-stream data also will not suffice since it ordinarily does not include purchases. Survey data that reveal search behavior, choice, and attitudes toward competing sellers may be required. Alternatively, since it provides data on transactions and prices, auction data can provide insights into understanding how various seller attributes affect willingness to pay for items sold online.

Multichannel retail pricing effects

Multichannel retailing is the coordination and evaluation of channels through which customers and firms interact (Neslin et

al. 2006). In this regard, while online sellers have the advantage of eliminating the need for their customers to travel to a store, off-line sellers have the advantages of making merchandise available for tactile inspection and providing immediate delivery of items they carry in inventory. Because of these differences, online and off-line sellers are inherently differentiated. However, since consumers often appear to use both channels, it is likely that sellers in online and off-line channels face some competition with one another.

There is some evidence that indicates online and off-line sellers substitute for each other. In a study of computer purchases, Goolsbee (2001) finds that the cross-elasticity of online demand with respect to off-line prices is around 1.5. Ellison and Ellison (2006) find a similar result for memory modules and also that demand is sensitive to variation in sales tax rates. Similarly, Chu et al. (2007) look at channel substitution, including online and off-line channels. Forman, Ghose, and Goldfarb (2007) show that the probability a book appears on a local best-seller list is significantly affected by Amazon's price relative to the local price. In sum, though the evidence is sketchy, it suggests that online and off-line markets may compete with one another.

If online and off-line outlets are competitive in a pricing context, one might expect multichannel sellers to set prices to soften competition between their online and off-line outlets (Pan, Shankar, & Ratchford 2002). Consequently, one might expect multichannel sellers to price higher online than their online-only counterparts. This does appear to be the case (Ancarani and Shankar 2004; Cao and Gruca 2003; Tang and Xing 2001). This result runs counter to a prediction by Zettelmeyer (2000) that multichannel retailers will charge less online when Internet penetration is small and cannibalization is limited. At the same time, with respect to competition in multichannel (Internet, off-line) environments, Zettelmeyer's (2000) analysis suggests that proliferation of channels will decrease competition.

Consumer behavior in multichannel environments is also a potentially interesting area of research. Prior studies (e.g., Degeratu, Rangaswamy, & Wu 2000) examine consumer-choice behavior in online versus off-line supermarkets and find that price sensitivity is higher online than off-line, mainly because online promotions are stronger signals of price discounts. However, the combined effect of price and promotion on choice is weaker online than off-line. Chu, Chintagunta, and Cebollada (2008) find that grocery shoppers are less price sensitive when they buy online than when they buy in the store. A key difference between these studies is that in Degeratu, Rangaswamy, and Wu (2000), online and off-line buyers are different groups, while Chu, Chintagunta, and Cebollada (2008) observe the online and off-line purchases of the same panel members. In comparing online and off-line promotions, it appears that loyalty promotions are more profitable online than off-line, while competitive promotions are more profitable off-line than online (Zhang & Wedel in press).

Another aspect that can influence consumer behavior across channels is the potential role of geography. Online consumers' preferences and choices vary across off-line geographical markets and off-line geographical spatial correlations can be useful in predicting customer online behavior (Jank and Kannan 2005).

A clear indication of the interaction effects between online and off-line markets is the strong evidence that information obtained online for use in off-line transactions leads to lower off-line prices. Specifically, the studies by Brown and Goolsbee (2002) and Zettelmeyer, Scott Morton, and Silva-Risso (2006) show that the ready availability of information provided on the Internet leads to lower prices. Brown and Goolsbee (2002) determine that information provided on the Internet lowered term insurance prices by eight to fifteen percent between 1995 and 1997. Using data on matched transaction prices and survey information on customers' use of information sources, Zettelmeyer, Scott Morton, and Silva-Risso (2006) estimate that access to price data and referrals on the Internet leads to a decline in transaction prices of about 1.5 percent and that the benefits of the Internet accrue mainly to those who dislike bargaining.

Future research

As discussed above, extant research on customer behavior online focuses on customer channel migration, customer choices online, the impact of online promotions, and the Internet's overall impact in lowering prices. This research is based on customers within a company. Thus, while current research sheds light on how quantifying the impact of a firm's off-line prices would impact that firm's online sales, not as much is known about (i) its impact on competitors' sales—and there is even less research on how a competitor's prices off-line would impact any firm's online sales—and (ii) how a competitor's online pricing strategy would impact one's own, as well as competitors', off-line sales.

There is also scope for further research as to how information obtained by consumers in one channel influences their shopping behavior in another channel. For instance, some consumers might obtain preliminary information (such as related to price, product specifications) in an online environment, but they would make their final purchasing in an off-line market. It is possible that this type of behavior might be more likely for certain types of consumers, such as those with higher levels of risk aversion. However, the reverse pattern is also possible. That is, some consumers might obtain their preliminary information (such as related to clothing size, color effects) in an off-line environment but make their final purchase in an online market, perhaps due to the availability of greater assortment online versus off-line. Again, it might be interesting to examine the effects of factors that can moderate these types of behaviors. It is likely that such a pattern of behavior might be more likely for certain types of products, such as those with a high level of experience-attribute components.

Discussion

Table 1 presents the basic components of an overall research scope designed to summarize our understanding of key pricing and competitive issues in retailing. We divide the retailing landscape into two dimensions. The first is by product type. These include three main types: fashion, staples (perishables and packaged), and durables. The second is by medium: online versus off-line. Research in the online medium domain includes descriptive mechanisms of online pricing, the impact online

Table 1
Pricing and Competitive Issues: Summary of Research Opportunities.

Medium	Store format	Product type			
		Fashion	Staples		Durables
			Perishable	Packaged	
Online		High	High	High	High
Off-line	Dept stores	√	N/A	N/A	Need to examine the differential effects here
	Specialty Stores	Medium	√	N/A	
	Discount Stores	√	√	Medium	
	Grocery	N/A	Medium	√	N/A
	Drug	N/A	N/A	√	N/A
	Convenience	N/A	√	√	N/A

√ indicates there is lot of prior research in this area; N/A indicates "not applicable".

prices have on off-line sales and vice versa, and opportunities for pricing profitably in the online channel by taking into consideration the competitive effects. The off-line medium is divided into six major store formats. These include department, specialty, discount, grocery, drug, and convenience stores. For simplicity, we do not consider the catalog channel. Clearly, catalog marketing is important for pricing; however, we believe the information gleaned from the online and off-line channels would shed light on our understanding of the pricing and competitive effects in the catalog market. In this grid, some of the cells (e.g., sales of perishables and packaged goods in department stores; fashion goods in grocery; fashion, perishable staples, and durables in drugstores, etc.) are not applicable both from practice and research standpoints and are indicated as such (N/A) in Table 1. At the same time, there is a lot of extant research in many other cells. These are indicated by a check mark (√) in Table 1 and include such cases as our understanding of the sales of fashion merchandise in department stores, perishable and packaged goods in discount and grocery stores, and packaged goods in drug and convenience stores, and so forth.

The areas that show high promise/opportunity are in the online setting for all types of goods (fashion, perishable and packaged staples, and durables), particularly with respect to pricing for profitability and understanding the impact of competition. Other such opportunities include understanding the pricing and competitive effects in the perishable goods category sold in specialty, discount, and convenience stores. We also do not know much about the drivers of sales of fashion goods in discount stores, such as Target, Wal-Mart, Kmart, and so forth (Witness Wal-Mart's struggles with its "George" line of clothing.)

While the above topic areas reflect our research priorities, the framework in Table 1 points to several other areas of interest. For one, does optimal pricing of durable products differ for department stores, discount stores, and specialty stores? For another, how does the presence of fashion products in discount stores (e.g., T.J. Maxx) and gray markets affect pricing in traditional retail chains? Moreover, even if plenty of research has considered a particular "cell" in Table 1, the combination of research in two or more such areas is wanting. In general, we believe the field is in need of papers that consider several facets of the complex decisions retailers face, such as optimal off-line

and online pricing; optimizing assortment, location, and price; keeping loyal customers and attracting new ones, and so forth. As the retail landscape keeps changing dramatically, these are the best of times for intellectual curiosity with a keen sense of management-level insight into the current state-of-the-art in retail technology.

Impact on practice

In addition to the need for further academic research, there is a need for better systems that commercialize retail science to support better pricing decisions. Real "science" is a powerful force in retail today, particularly for addressing the complex challenge of pricing. Today, vendors provide analytical tools that help optimize pricing. These tools monitor customer demand and measure how price is perceived. Fig. 2 shows a block diagram of a price optimization solution available today. Point-of-sale data are analyzed to model price elasticity, which is used to predict how unit sales will change given a change in price. To understand the effect of price on unit sales, demand modeling must account for seasonality, promotions, holidays, out-of-stock events, cannibalization, and affinity.

Retailers understand the value of knowing price elasticity by item and store to optimize prices. This information is also used to cluster stores into pricing zones and identify key value items (KVIs) for promotion to drive store traffic. The industry has demonstrated that applying scientific principles to execute a true price-optimization strategy can lead to significant sales, margin, and profit lift for retailers. Initially, enterprise-pricing solutions were available only to large retailers through an on-premise or hosted delivery model. Today, software-as-a-service (SaaS) solutions are available even to small and medium-size retailers with extremely attractive return on investment (ROI).

Retailers have an opportunity to improve profitability further by better managing assortment, inventory, and price relative to competition, but they require more sophisticated software to effectively optimize their business in these areas. Retailers have access to data, including POS, product information, inventory, vendor incentives, competitor prices, weather, demographics, and syndicated market data; however, no solutions integrate all these data sources to manage strategies and optimize execution. Retailers have adopted simple good–better–best strategies
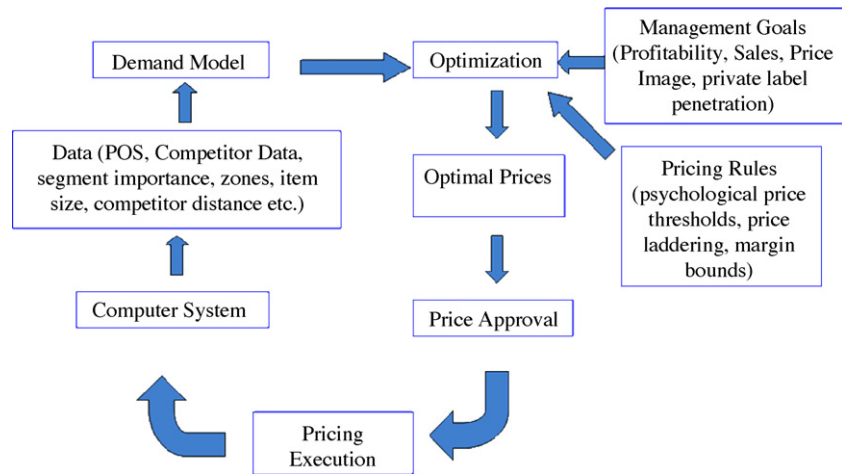
Fig. 2. Algorithm for elasticity-based, customer-centric pricing.

and largely guess at how to price private label items against national brands. Too often, retailers saturate their stores with products characterized by incremental attributes. For example, one retailer stocked 30 flavors of jellies and preserves. This was not only an inefficient use of shelf space, but the myriad options so confused some shoppers that they elected not to purchase. Retailers require intelligent solutions that combine the optimization of price, assortment, and inventory relative to competition.

We hope the above summary of the academic literature and the issues facing academics and practicing managers will provide the basis for fruitful research in the areas summarized. Further, we hope they highlight potential opportunities for academic researchers and practitioners to join together to address some of the more pressing issues.

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