MARKETING SCIENCE INSTITUTE

MSI Reports

2008

WORKING PAPER SERIES

ISSUE FOUR

NO. 08-004

MARKETING SCIENCE INSTITUTE

MSI Reports

2008

WORKING PAPER SERIES

ISSUE FOUR

NO. 08-004

The Marketing Science Institute supports academic research for the development —and practical translation— of leading-edge marketing knowledge on issues of importance to business performance. Topics are identified by the Board of Trustees, which represents MSI member corporations and the academic community. MSI supports academic studies on these issues and disseminates findings through conferences and workshops, as well as through its publications series.

Marketing Science Institute
1000 Massachusetts Avenue
Cambridge, MA
02138–5396

Phone: 617.491.2060
Fax: 617.491.2065
www.msi.org

MSI Reports (ISSN 1545–5041) is published quarterly by the Marketing Science Institute. It is not to be reproduced or published, in any form or by any means, electronic or mechanical, without written permission.

The views expressed here are those of the authors.

Working Paper Series
The articles that appear in *MSI Reports* have not undergone a formal academic review. They are released as part of the MSI Working Paper Series, and are distributed for the benefit of MSI corporate and academic members and the general public.

Subscriptions
Annual subscriptions to *MSI Reports* can be placed online at www.msi.org. Questions regarding subscriptions may be directed to pubs@msi.org.

Single reports
Articles in *MSI Reports* are available in downloadable (PDF) format at www.msi.org.

Past reports
MSI working papers published before 2003 are available as individual hard-copy reports; many are also available in downloadable (PDF) format. To order, go to www.msi.org.

Corporate members
MSI member company personnel receive all MSI reports (PDF and print versions) free of charge.

Academic members
Academics may qualify for free access to PDF (downloadable) versions of MSI reports and for special rates on other MSI print publications. For more information and to apply, go to "Apply for academic membership" on www.msi.org.

Classroom use
Upon written request, MSI working papers may be copied for one-time classroom use free of charge. Please contact MSI to obtain permission.

Search for publications
See the searchable publications database at www.msi.org.

Submissions
MSI will consider a paper for inclusion in *MSI Reports*, even if the research was not originally supported by MSI, if the paper deals with a priority subject, represents a significant advance over existing literature, and has not been widely disseminated elsewhere. Only submissions from faculty members or doctoral students working with faculty advisors will be considered. "Working Paper Guidelines" and "MSI 2008–2010 Research Priorities" are available in the Research section of www.msi.org.

Publication announcements
To sign up to receive MSI's electronic newsletter, go to www.msi.org.

Change of address
Send old and new addresses to pubs@msi.org.

When Wal-Mart Enters: Retailer Reactions and Sales Outcomes

Kusum L. Ailawadi, Jie Zhang, Aradhna Krishna, and Michael W. Kruger

When a formidable competitor enters the market, many retailers react with "no reaction." But retailers can mitigate sales loss by fine-tuning marketing mix activities. With data on seven Wal-Mart market entries, this study investigates supermarket, drug store, and mass merchant responses and outcomes.

Report Summary

Prior research into the impact that Wal-Mart's entry has on incumbent retailers has focused mainly on the incumbent retailers' sales and other outcome measures. Little is known, however, about how incumbent retailers adapt their marketing mix activities in reaction to the Wal-Mart entry. Here, authors Ailawadi, Zhang, Krishna, and Kruger conduct a systematic examination of retailers' reactions to a Wal-Mart entry into their local market and the consequences of these reactions for the retailers' sales outcomes.

Their analyses benefit from a unique large-scale data set. They ascertain the locations of seven first-time Wal-Mart entries, carefully identify incumbent supermarkets, drugstores, and mass merchant chains in the vicinity of these entries, and also identify control stores of the same chains not exposed to these entries. For these 91 experimental and control stores, they have weekly store movement data for 46 product categories for time periods both before and after Wal-Mart's entry, which allows them to measure reactions and sales outcomes using a before-and-after-with-control-group analysis.

They find that a Wal-Mart entry has strong negative effects on incumbent retailers' sales in general, with substantial variation across categories and retail formats both in retailer reactions and in their sales outcomes. Importantly, their analysis shows that a retailer's sales outcomes are indeed affected by how it reacts to the entry, and the relationship between reactions and outcomes varies across retail formats. For example, cutting assortment is not an effective strategy for incumbent retailers in any format. However, supermarkets can mitigate sales losses by reducing their regular prices and by selling higher percentages of top-tier national brands and private labels—but that approach is not useful for drugstores or mass merchandisers. Broad promotions are a useful tactic for drugstores, while deep promotions help mass merchandisers. In general, incumbents benefit more by differentiating themselves from Wal-Mart rather than attempting to emulate Wal-Mart. These results have important implications for how retailers in different formats adjust their marketing mix activities to mitigate the negative impact of a powerful competitor's entry. ■

Kusum L. Ailawadi is the Charles Jordan 1911 TU'12 Professor of Marketing at the Tuck School of Business, Dartmouth College.
Jie Zhang is Assistant Professor at the Robert H. Smith School of Business, University of Maryland.
Aradhna Krishna is the Isadore and Leone Winkelman Professor of Marketing at the Ross School of Business, University of Michigan.
Michael W. Kruger is Executive Vice President, Strategic Initiatives, at Information Resources, Inc.

Introduction

Consumer packaged-goods (CPG) retailing has become increasingly competitive in the last two decades. Traditional supermarkets and drugstores face intense competition not only from one another, but also from the fast-growing large discount formats that generally have three main features: everyday low prices, one-stop shopping for a large variety of product categories, and limited assortment of brands within most categories. It is important to understand the impact that the entry of large discount stores such as these have on incumbent retailers. The behemoth of discount formats is Wal-Mart, the world's largest retailer, with more than 4,000 stores in the United States employing approximately 1.4 million workers. More than 200 million people in the United States shop at Wal-Mart each year (Wal-Mart 2008), and the company's 2005 U.S. revenues exceeded those of the next five U.S. retailers combined (Schulz 2006). Therefore, it is not surprising that consumers, incumbent retailers, and the local economy are significantly affected when Wal-Mart opens stores in a given market.

Researchers have studied the impact of a Wal-Mart entry on consumer purchase behavior (Singh, Hansen, and Blattberg 2006), the labor market (Basker 2005a; Beaver 2005), average retail prices (Basker 2005b; Hausman and Liebtag 2005; Noel and Basker 2007), retail sales in the market (Stone 1995; Vance and Scott 1994), entries and exits by other retailers (Basker 2005a; Jia 2005), and shareholder value of other retailers (Gielens et. al. 2008). There has been little academic research, however, on how individual retailers react to Wal-Mart entry into their local markets. Analyzing incumbent retailers' reactions to Wal-Mart entries is important not only in its own right, but also because it can provide valuable insights into why some retailers, categories, and brands are impacted strongly by a Wal-Mart entry, while others are relatively less affected by it. Such analyses can also prove insightful for understanding reactions to and predicting the impact of other large discount stores.

Most CPG retailers carry a large number of product categories that are vulnerable to varying degrees to Wal-Mart's entry, but little is known about how retailers' reactions to the entry might vary across these categories. Further, retailers have multiple marketing mix variables at their disposal, yet prior research has focused primarily on price, with little attention given to other marketing mix variables. Moreover, we are not aware of any research that examines how the sales impact of Wal-Mart's entry on incumbent retailers is affected by the way the incumbents react to that entry.

In this research, we conduct a systematic examination of incumbent retailers' reactions to Wal-Mart entry into their local markets and the consequences of these reactions for the retailers' sales outcomes. The specific objectives of this research are: (1) to estimate how incumbent retailers change their pricing, promotion, and product assortment in reaction to a Wal-Mart entry; (2) to examine how these reactions vary across retail formats, stores, and product categories; and (3) to study whether and how these reactions influence a retailer's sales outcomes associated with the Wal-Mart entry.

Our analyses use a unique large-scale data set comprising the incumbent stores in the area of seven first-time Wal-Mart entries in 2000–2002 and control stores not exposed to the entry. For these 91 experimental and control stores, we have weekly store movement data for 46 product categories for time periods both before and after the Wal-Mart entry. The experimental stores belong to six retail chains that cover all three major CPG retail formats: supermarkets, drugstores, and mass merchandisers (called "mass stores" hereafter), and we choose corresponding control stores from the same chains, which allows us to perform before-and-after-with-control-group analyses.

The paper makes several contributions to the literature on response to large-store entry. We study the reactions of multiple incumbent retailers on a full array of marketing mix variables. As such, our research provides broader and more detailed substantive insights than prior studies that have focused on Wal-Mart's impact on retailers' sales and market-level prices. The data in prior research are either at the market level, averaged across retailers, or limited to a single store, and don't lend themselves to studying retailer-level reactions. The broad scope of our empirical analyses across multiple markets, retail formats, stores, and product categories also means that our results are more generalizable than those in prior research. Moreover, this study is the first to systematically link the impact of Wal-Mart entry on a retailer's sales outcomes to the way the retailer reacted to the entry, thus providing retailers with guidance on how they can adjust their marketing mix activities to minimize the negative impact of entry.

Our methodology also substantially improves on earlier work. While past research examining price and sales effects has generally employed a before-and-after entry analysis, our before-and-after-with-control-group analysis is novel. Such analysis allows us to rigorously quantify reactions and sales outcome effects, separating them from other chain-specific, regional, or temporal factors, and alleviating potential bias due to endogeneity of Wal-Mart entry. Our estimation of the effects of incumbent retailer reactions on their sales outcomes is also novel: it relies on a combination of simulated maximum-likelihood estimation and instrumental variables to account for uncertainty in the parameter estimates as well as potential endogeneity of retailers' marketing mix reactions.

Background and Conceptual Framework

In this section, we review prior research on the "Wal-Mart effect" in particular and on competitive response in general. The former provides a context against which our empirical findings can be assessed; the latter provides the conceptual framework for studying variations in incumbent retailers' reactions to Wal-Mart entry and the impact of those reactions on their sales.

The Wal-Mart effect

The "Wal-Mart effect" refers to "the range of effects resulting from Wal-Mart's way of doing business" on retailers, consumers, suppliers, the labor market, and the local economy (Fishman 2006). Table 1 summarizes extant research regarding the effect on retailers, which is directly relevant to our work.

As the table shows, most of the prior empirical work on the Wal-Mart effect on retailers specifies models of retail prices and retail sales as a function of the number of Wal-Mart or other discount stores in the market. These models are estimated with longitudinal data pooled across retailers and product categories. Some of them control for other factors affecting prices and sales through fixed effects and for the potential endogeneity of Wal-Mart entry timing and location through instrumental variables (e.g., Basker 2005a, 2005b; Hausman and Leibtag 2005; Noel and Basker 2007).

This stream of work is fairly consistent in concluding that, on average, a Wal-Mart entry leads to a significant decrease of about 3% in average retail prices paid by consumers. But, this reduction includes the lower prices at Wal-Mart. The average decrease in incumbent retailer prices is smaller, ranging between .5% and 1.5%. Prior work also suggests that Wal-Mart has a significantly negative effect on the sales of incumbent retailers, with declines ranging from 5% to 17%, and small retailers being hurt more than large ones. However, some retailers in businesses that do not overlap with Wal-Mart may benefit from increased trade-area traffic and see small sales increases. Consistent with this, expected performance impact as measured by stock returns is less

Table 1
The Wal-Mart Effect on Retailers: Highlights of Prior Research

Study	Type of Data	Key Findings
Retail Prices		
Basker (2005b)	Average retail prices for 10 products in 165 cities over 20 years. From quarterly survey of retailers conducted by American Chamber of Commerce Research Association. Longitudinal analysis, including variable for Wal-Mart entry. Instrument to account for endogeneity of Wal-Mart entry decision.	Price decline of 1.5–3% immediately after entry in four of ten product categories. Becomes 4x over the long term through autoregression.
Hausman and Leibtag (2005)	Average price paid for 20 food products for four years. From AC Nielsen Homescan consumer panel. Longitudinal analysis of data aggregated to monthly market level including a variable for percentage of expenditure in SMCs (supercenters, mass merchants, and club stores). Instrument to account for endogeneity of SMC expenditure.	Average prices paid by consumers fall by 3% over four years or .75% per year as shopping shifts to the lower-priced SMCs. Average price decrease in traditional outlets is smaller.
Noel and Basker (2007)	Retail prices for 24 grocery items in 175 markets for four years. From annual survey of retailers by American Chamber of Commerce Research Association. Model of price as a function of number of Wal-Mart supercenters in the market and other product and market variables.	Prices are lower by about 1.2% on average when a Wal-Mart supercenter is present in the market. For large supermarket chains, prices are lower by a smaller amount (.45%).
Retailer Performance		
Stone (1995)	Retail sales data for Iowa communities in Wal-Mart towns and non–Wal-Mart towns from 1983 to 1993. Overall sales and sales for various retail classes. From Iowa retail sales-and-use tax reports.	5–6% increase in retail sales in Wal-Mart towns (including Wal-Mart sales). Incumbent retailers lose a significant percentage of their sales, from 5% for supermarkets to 13% for building-material stores. Largest decrease for mass merchants. Home furnishings and eating establishments whose assortment does not overlap with Wal-Mart experience sales gains of 2–3%.
Singh, Hansen, and Blattberg (2006)	Purchases by top 10,000 loyalty program customers of a single supermarket store. 20 months spanning period before and after Wal-Mart entry. Analysis of pre- versus postentry store visits and expenditure per visit, allowing for heterogeneity in reaction across consumers.	Monthly sales volume for the store decreases by an average of 18% due to Wal-Mart entry from fewer store visits per month as well as smaller basket size per visit. Substantial heterogeneity in reaction across consumers with 20% of consumers accounting for 70% of lost revenue. More likely to be large-basket, weekend, and heavy store-brand buyers.

Table 1, continued

Study	Type of Data	Key Findings
Basker (2005a)	Nationwide county-level data on population, employment, number of retail establishments over 23 years. From census bureau. Longitudinal analysis, including a variable for number of Wal-Mart openings in a county. Store planning date as instrument to account for endogeneity of Wal-Mart entry timing.	Increase of .7 large retail establishments within a year after Wal-Mart entry. Since this includes Wal-Mart, this means a small decline in other large establishments. Decline of .7 medium establishments within two years, and decline of 3 small establishments within two years after entry.
Jia (2005)	Number, location, and size of discount chain stores over ten-year period by county. From Chain Store Guide and County Business Patterns. Empirical estimation of a three-stage game with (1) prechain competition between small establishments, (2) chain (Wal-Mart and Kmart) entry decision, and (3) postentry decisions of small establishments.	Approximately 40% of the reduction in small discount stores is explained by Wal-Mart's expansion in the country. Two to three fewer small discount stores as a result of entry.
Gielens et al. (2008)	Stock prices for 98 incumbent retailers before, during, and after Wal-Mart's takeover of Asda to enter the U.K. Retailers identified through Thompson Analytics and stock price data from Datastream. Event study to quantify effect of entry on each retailer's expected performance (as measured by cumulative abnormal return, CAR, and subsequent regression to explain variations in CAR across retailers).	Expected performance is more negative for retailers whose assortment and positioning overlap more with Wal-Mart. It is also more negative for small, less financially healthy firms. It is less negative for retailers with experience in competitive countries with a strong price focus.

negative for large, financially strong retailers that overlap less with Wal-Mart and have experience in price-competitive markets.

Consultants and academic researchers have offered suggestions for effective ways to compete with Wal-Mart (Boyd 1997; McCune 1994; Pearson 1994). But these recommendations are based on variations in the extent to which the performance of different retailers is hurt by Wal-Mart entry (Gielens et al. 2008; Stone 1995). They do not explicitly examine the relationship between retailers' reactions to Wal-Mart entries and the impact of those reactions on the retailers' performance outcomes. Therefore, it is unclear whether variation in performance impact is because of variation in reactions or merely due to differences in vulnerability. We are not aware of any research that documents how retailers actually changed their product assortment, pricing, and promotion activities in reaction to entry and then evaluates the effectiveness of these reactions.

Competitive response

Research on competitive response to entry spans the industrial organization, corporate strategy, and marketing strategy literature. A common theme in this literature is that the likelihood of response is a function of (1) the magnitude and visibility of the entrant (Bowman and Gatignon 1995; Chen and Miller 1994; Robinson 1988); (2) the incumbent's motivation to react, which in turn is dictated by how much the entrant affects the incumbent and how important the market affected is to the incumbent (Ailawadi, Lehmann, and Neslin 2001; Chen 1996; Gielens et al. 2008; Shankar 1999); and (3) the incumbent's ability to react (Chen 1996; Gatignon, Anderson, and Helsen 1989; Shankar 1999).

Normative models predict the optimal direction of response, but this varies with factors such as the incumbent's objectives (e.g., profit maximization, market share preservation), the response function used, whether the incumbent brand is dominant or nondominant (Bell and Carpenter 1992; Gruca, Kumar, and Sudharshan 1992; Hauser and Shugan 1983). A few theoretical frameworks have been proposed to predict the direction of response. For instance, Chen (1996) predicts that response is more likely to be retaliatory when there is market commonality and resource similarity between the attacking and incumbent firms. Gatignon, Anderson, and Helsen (1989) and Shankar (1997) argue that incumbents will retaliate with their most effective marketing mix variables and accommodate or cut back with less effective ones.

Empirical research, however, has had limited success in predicting the direction and magnitude of actual responses. A few exceptions include studies by Gatignon, Anderson, and Helsen (1989) and Putsis and Dhar (1998), who find that firms compete more strongly with variables for which they have strong self-elasticities. Shankar (1999) and Ramaswamy, Gatignon, and Reibstein (1994) also find support for some hypotheses regarding retaliatory versus accommodating behavior, but not all. Ailawadi, Lehmann, and Neslin (2001) find that incumbents are more likely to respond when they are more affected by the entrant's actions, but they do not find a consistent or predictable pattern in the direction of response. Brodie, Bonfrer, and Cutler (1996) and Leeflang and Wittink (1996) find that competitors often overreact or underreact. Even in the specific context of response to Wal-Mart, researchers have documented mixed results in price reaction across products and cannot ascribe any predictable pattern to them (Basker 2005b; Hausman and Leibtag 2005).

Finally, despite the high degree of variation that has been observed in competitive response, there is little research that relates incumbents' reactions to their own performance. Chen and Miller (1994) and Shankar (1999) consider the effect of competitive response on performance of the entering firm, but not the incumbents. The only paper we are aware of that examines the effectiveness of incumbent response is Gatignon, Robertson, and Fein (1997). They use survey data to relate the speed and direction of reaction to the success of that reaction. The latter is measured as self-reported change in share from before to after entry/attack.

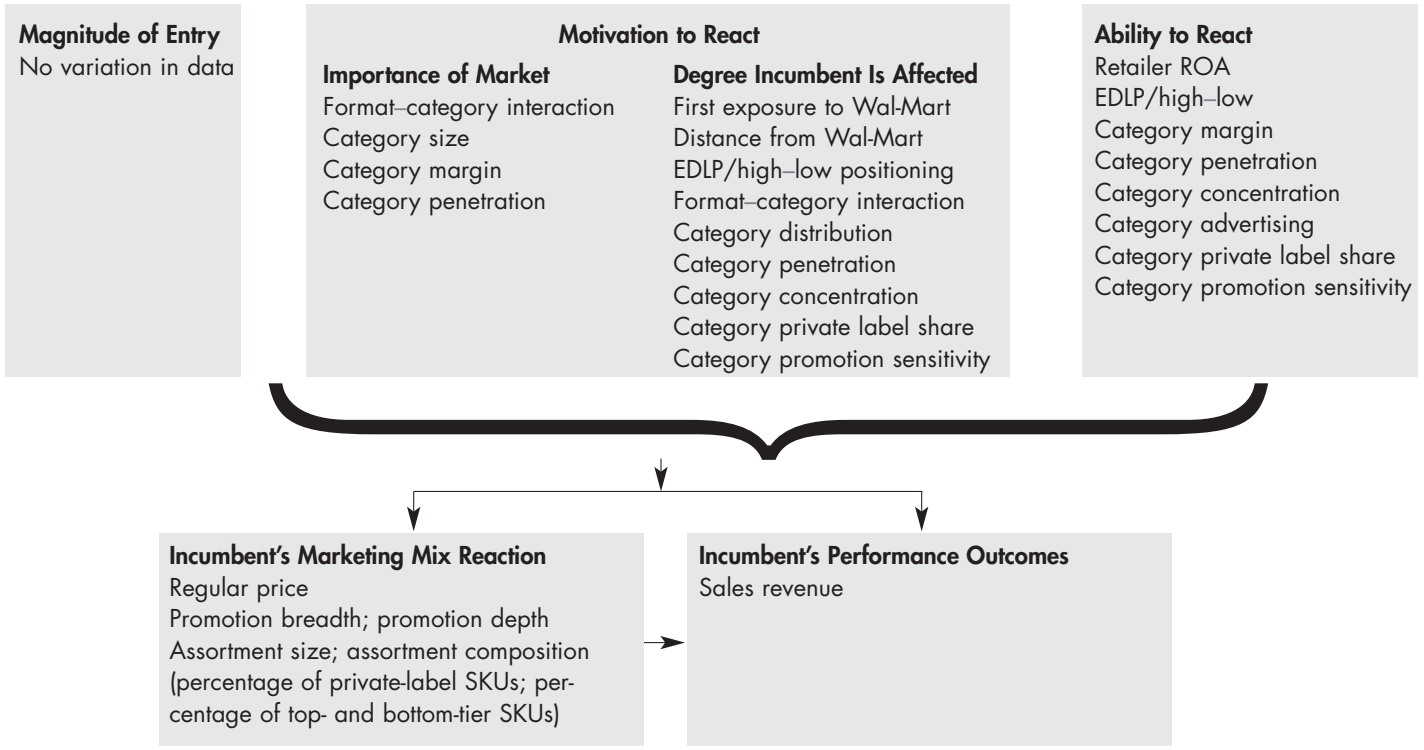
Conceptual model

Our integrative conceptual model of incumbent retailers' reactions to Wal-Mart entries and the impact on sales outcomes is based on this literature and is depicted in Figure 1. The figure shows that the reaction of incumbent retailers is a function of the magnitude of the entry, the motivation of incumbent retailers to react, and their ability to react. Together with these three elements, incumbents' reactions determine the extent to which their sales outcomes are affected by the entry. Below, we use this framework to identify relevant variables that may influence incumbent retailers' reactions and sales outcomes.

Magnitude of Entry. A Wal-Mart store opening is highly visible, and all the Wal-Mart entries in our study are supercenters. Thus, there is little variation in the magnitude of entry in our data. Given the fairly uniform positioning of Wal-Mart supercenters around the United States, there is also little variation in the nature of entry.[1]

Motivation to React. Retailers may consider product categories that are more closely associated with their format (Inman, Shankar, and Ferraro 2004) to be more important, for example, health and beauty products (HBC) for drugstores, food products for supermarkets, and general household products (Gen. HH) for mass stores. This can be assessed by interactions of these three product department

Figure 1
Conceptual Framework



dummy variables with dummy variables for retail format. Also, high-sales, high-margin, and high-penetration categories may be more valuable for incumbents.

Several store characteristics may play a role in determining how much a retailer will be affected by the entry. If the store has had prior exposure to Wal-Mart, it may have adjusted to such competition, so both reaction and the impact on sales may be smaller (Gielens et al. 2008).[2] The smaller the distance between an incumbent store and the entry, and the more similar its format and positioning are to the entrant, the more likely it is to be affected (Chen 1996; Gielens et al. 2008). The format-department interactions described above capture the possibility that the three formats may be differentially vulnerable. Also, we distinguish between everyday low price (EDLP) and high-low positioning of incumbent retailers using an EDLP dummy variable.

Various categories within a store may also be differentially affected by the entry. Competitive intensity is stronger in high-penetration and widely distributed categories, so they are more likely to be affected. Given the EDLP positioning of the entrant, the more price sensitive a category is, the more its sales may be affected. We do not have a measure of regular price sensitivity for the different categories. Nonetheless, since price consciousness has been shown to be strongly related to private-label usage, we use private-label share as a surrogate for price sensitivity. The more promotion sensitive a category is, the less vulnerable it may be to the entrant's EDLP positioning. As Hoch, Drèze, and Purk (1994) suggest, in some product categories consumers have a preference for shopping on promotions offered by high–low stores as opposed to shopping in EDLP stores. Finally, concentrated categories may be affected more because Wal-Mart tends to carry a few top-selling brands in each category, and these brands

account for a larger percentage of sales in concentrated categories.

Ability to React. The greater the financial strength of a retailer, as measured by its return on assets (ROA), the greater its ability to respond to and withstand the entry should be (Gielens et al. 2008). EDLP retailers may be less able than high–low retailers to react effectively given their head-on price comparisons with Wal-Mart. Among category characteristics, an incumbent retailer is likely to have more leeway to react in high-margin categories, and less leeway to react in highly concentrated and heavily advertised categories in which manufacturers wield considerable leverage. Also, a retailer may be able to react more effectively in price- and promotion-sensitive categories.

The 20 store and category characteristics that we have identified above are included in Figure 1. In summary, we expect that mass stores (whose format overlaps with Wal-Mart), EDLP stores (whose positioning overlaps with Wal-Mart), stores with first-time exposure to Wal-Mart, and stores that are located close to the entry will be affected more. Similarly, we expect that concentrated and widely distributed categories with high penetration and a high share of private-label brands will be affected more, while promotion-sensitive categories will be affected less by a Wal-Mart entry. Given the limited success of prior research in predicting competitive reactions, and given that several of the variables described above influence more than one element in the conceptual framework (see Figure 1), we do not develop a priori hypotheses about the nature of incumbent retailers' reactions to the entry or the specific effects of the store and category characteristics in explaining the reactions. Our analyses, however, should provide valuable descriptive insights into the direction and pattern of incumbents' reactions to the entry of a powerful competitor, thus enriching empirical research on competitive response.

Data

As mentioned in the introduction, we analyze seven first-time entries by Wal-Mart that occurred during the 2000–2002 period. The first entry in our data occurred in August 2000, and the last one occurred in February 2002. We use weekly store-level data on 46 product categories from experimental and control stores belonging to six retail chains, covering the period from December 1999 to a period of one year after each Wal-Mart entry. The data are provided by Information Resources Inc. (IRI). There are three supermarket chains, two drugstore chains, and one mass merchandiser chain, and the categories span a wide range of grocery, health and beauty, and general household products (see Appendix 1 for the list of categories).

Selection of markets and experimental and control stores

We first identified IRI markets in which Wal-Mart opened a store during the 2000–2002 period and in which there had previously been no Wal-Mart within a 15-mile radius of the new store. Using market information from IRI and store opening information from Wal-Mart's website, we identified seven such first-time entries in a three-state region in the eastern United States.

Next, based on the location of all supermarket, drug, and mass merchandiser chain stores covered by IRI in the region, we selected stores that were within a 15-mile radius of the Wal-Mart entry and either did not previously have a Wal-Mart within a 15-miles radius, or, if they did have a pre-existing Wal-Mart, it had opened more than five years ago.[3] This selection process gave us 41 experimental stores from six chains, of which 26 did not have prior exposure to Wal-Mart within 15 miles and 15 had prior exposure but had undergone a "cooling off" period of at least five years since the last entry, thus allowing any prior effects to stabilize. Seventeen of the experimental stores are supermarkets, 19 are drugstores, and five are mass stores.

Finally, we identified stores to serve as control stores for each of the six chains. These are stores in the same market and from the same chain that either did not have (and had never had) a Wal-Mart store within a 15-mile radius, or, if they did, the Wal-Mart entry was at least five years ago and the store had not experienced any new Wal-Mart entries since then. The former set includes 35 control stores for those experimental stores without prior exposure to Wal-Mart, and the latter set includes 15 control stores for those experimental stores with prior Wal-Mart exposure. With this careful selection of experimental and control stores, we are able to rigorously quantify the effect of a Wal-Mart entry on the incumbent retailer's reactions and their sales outcomes.

Variables in the analyses

As stated earlier, our analyses involve three key components: measuring incumbent retailers' marketing mix reactions and sales outcomes, examining how these reactions vary across retailers and product categories, and examining how retailers' sales outcomes are affected by their reactions.

The variables in the first analysis span the key marketing mix decisions that a retailer controls: product assortment (size and composition), price, and promotion (breadth and depth). We measure assortment size by the number of SKUs carried in a category. Assortment composition is measured by the percentage of national-brand SKUs in the top-third and bottom-third price tiers, respectively,[4] and by the percentage of total SKUs that are private labels. Price is measured as the average regular price per unit volume to avoid confounding it with promotion. Promotion breadth is measured by the percentage of SKUs on price promotion in a given week, and promotion depth by the average percentage of price discounts, where the percentage is relative to the regular price. In addition to these seven marketing mix reactions, we also quantify the impact of a Wal-Mart entry on the sales revenue of each incumbent retailer.

In the second analysis, we use the 20 store and category characteristics identified previously to explain variations in incumbent retailers' marketing mix reactions. Finally, in the third analysis, we examine the extent to which variations in the sales outcomes for incumbent retailers are driven by the marketing mix reactions while controlling for the same set of store and category characteristics. Definitions of all variables are provided in Appendix 2, and mean values of the marketing mix variables and sales revenue for the three retail formats during the first six months of data (before any Wal-Mart entry) are provided in Table 2.

Methodology

First-stage analysis: Estimating reactions and outcomes

We use a "before-and-after-with-control-group" approach to quantifying each Wal-Mart effect.[5] Recall that we have weekly data before and after Wal-Mart entry for each of the variables described above for each category in each store of each chain. Further, we have identified experimental and control stores within each chain. We estimate the following regression model for each marketing mix variable and also for sales revenue in each category in each experimental store belonging to each chain. Since we have 46 categories, 41 experimental stores across the six chains, seven marketing mix variables, and sales revenue, we estimate approximately 15,000 equations.

$$Variable^{v}_{its} = \beta^{v}_{0ie} + \beta^{v}_{1ie} Expt_{s} + \beta^{v}_{2ie} After_{te} + \beta^{v}_{3ie} Expt_{s} \times After_{te} + \varepsilon_{its}, \quad (1)$$

where:

$Variable^{v}_{its}$ = value of variable v (e.g., regular price) in category i in week t in store s;

$Expt_{s}$ = 1 if store s is an experimental store, 0 otherwise;

Table 2
Mean Values of Variables in the Three Retail Formats

	Supermarkets		Drugstores		Mass Stores	
Variable	**Mean**	**Std. dev.**	**Mean**	**Std. dev.**	**Mean**	**Std. dev.**
Regular price	.94*	.16	1.13	.19	.96	.19
Assortment size	1.20	.45	.53	.47	1.17	.73
Percentage of top-tier SKUs	1.02	.50	.94	.55	1.04	.58
Percentage of bottom-tier SKUs	1.11	.61	.78	.52	1.11	.92
Percentage of private-label SKUs	1.16	.92	.89	1.18	.66	.60
Promotion breadth	.94	.47	1.09	.53	1.02	.40
Promotion depth	.99	.29	1.06	.32	.93	.22
Sales revenue	1.27	.58	.19	.26	1.56	1.38

Note: All variables are first indexed to the within-category average across all stores. The means reported here are averages of this index across all stores in a given format during the first six months of the data.
*Read as: Regular prices in supermarkets are 94% of the average across all stores in our sample.

$After_{te}$ = 1 if week t is after Wal-Mart entry in the market of experimental store e, 0 otherwise;

Expt × *After* = interaction between the *Expt* and *After* variables.

We would like to explain a few features of this model. First, we estimate the model separately for each category in each experimental store belonging to each chain. That is why the regression coefficients are subscripted by category i and experimental store e. The superscript v denotes that the model is for variable v. There are sufficient degrees of freedom to estimate each model separately, although a random-effects model estimated using data pooled across categories and experimental stores within a chain provided similar results.

Second, the coefficient of the interaction term $\hat{\beta}^{v}_{3ie}$ represents the Wal-Mart effect on a given variable.[6] Note that we do not need to explicitly account for chain-specific, market, or temporal factors since these are all controlled for in the "difference in differences" analysis, assuring internal validity (Campbell and Stanley 1963, p. 13–14). The impact of potential endogeneity of the Wal-Mart entry decision is also alleviated since our controls are for the same period and from the same markets as the experimental stores.

Third, all control stores of a given chain with prior exposure to Wal-Mart serve as controls for each experimental store of that chain with prior exposure to Wal-Mart. Similarly, all control stores without prior exposure to Wal-Mart serve as controls for each experimental store without prior exposure. In other words, each experimental store is compared to the average value across its corresponding control stores in a chain. This evens out idiosyncratic differences in individual control stores and thus provides a more reliable control group.

Finally, we can estimate this model using different time periods after the Wal-Mart entry to obtain the Wal-Mart effect in each of those time periods. For instance, we can use the period before entry and up to 12 months after entry to estimate the Wal-Mart effect in the first year after entry. Similarly, we can use the period before entry and the first and second six months after entry to estimate the Wal-Mart effect in the first and second six months after entry, respectively.

Second-stage analysis: Examining variations in marketing mix reactions

We estimate an ordered probit model for each marketing mix variable reaction to examine the extent to which our store and category characteristics explain variations in reactions. The dependent variable is ordinal. It is equal to 1 if the estimated reaction to a Wal-Mart entry is significantly negative, 2 if the reaction is not significantly different from zero, and 3 if it is significantly positive. The independent variables are the 20 store and category characteristics. We use an ordinal dependent variable instead of actual magnitudes of the reactions because, as we discussed in our literature review, even the direction of reaction has been very hard to predict. Explaining variations in the magnitude of reaction would be even more challenging.

Third-stage analysis: Linking retailers' reactions to their sales outcomes

In the final stage, we study the effects of these marketing mix reactions on the sales impact for a given category in a given experimental store. The dependent variable for this analysis is the Wal-Mart entry effect on sales of category *i* in experimental store *e,* and the key independent variables are the marketing mix reactions for the corresponding category and store, all of which are estimated in the first-stage analysis. In addition, we include the store and category characteristics as control variables in the model, since they may influence how sales of a given category in a given experimental store were affected by the Wal-Mart entry.

There are two econometric issues that we need to address in this analysis. First, the dependent variable and the seven key independent variables (the marketing mix reactions) are themselves estimated and thus the uncertainty in these parameter estimates needs to be accounted for. We rely on the distributions of these parameter estimates to generate random draws for each variable, and we then use a simulated maximum-likelihood procedure to estimate the models in the third-stage analysis. Second, incumbent retailers may adjust their marketing mix reactions based on how much their sales have been affected by the entry. We use an instrumental variable approach to deal with this potential endogeneity of marketing mix reactions. Specifically, we divide the one-year postentry period into two halves and use reactions in the first six months as instruments for reactions in the second six months. Clearly, reactions in the first six months cannot be affected by sales effects in the subsequent six months. Details of the estimation procedure are available upon request. We present below only the final model of interest.

Let i = category i, e = experiment store e, k = retail format k (supermarket, drug, or mass merchandiser), and $\tau = 1, 2$ denoting the first and second six months after entry, respectively. The final model is specified as:

$$S_{ie}^{\tau=2} = \alpha + \hat{X}_{ie}^{\tau=2}\gamma_k + Z_{ie}\theta + \varepsilon_{ie}, \qquad (2)$$

where $S_{ie}^{\tau=2}$ is the impact on sales in category i and store e during the second six months after entry; $\hat{X}_{ie}^{\tau=2}$ is a vector of the predicted values of the seven marketing mix reactions in category i and store e during the same time period, obtained through the instrumental variable approach; and Z_{ie} is a vector of the 20 category and store characteristics.[7] We allow coefficients of the reaction variables to be format specific. The dependent variable and the assortment size and regular price reactions are divided by their average values for each category i and store e so as to make these sales and reaction values comparable across categories and stores.[8] The other five reaction variables are measured as percentages and thus do not need to be scaled.

Empirical Analyses

First-stage analysis: Incumbent reactions and sales outcomes

For each marketing mix variable and for sales revenue, Table 3 summarizes the percentage of

Table 3
Stage 1 Analysis: Direction of Incumbent Retailer Reactions and Outcomes

	Percentage of Effects in Supermarket Format			Percentage of Effects in Drug Format			Percentage of Effects in Mass Format		
Variable	**sig. +**	**insig.**	**sig. −**	**sig. +**	**insig.**	**sig. −**	**sig. +**	**insig.**	**sig. −**
Incumbent Retailer Reactions									
Regular price	14.3*	57.5**	28.2***	13.2	70.8	16.0	17.1	44.9	38.0
Assortment size	18.5	47.9	33.6	22.2	44.5	33.3	14.9	30.0	55.1
Percentage of top-tier SKUs	18.8	45.8	35.4	25.1	44.8	30.1	30.1	33.0	36.9
Percentage of bottom-tier SKUs	27.4	50.8	21.9	31.1	40.3	28.6	28.7	39.7	31.6
Percentage of private-label SKUs	26.9	52.3	20.8	27.2	38.1	34.7	37.4	38.1	24.5
Promotion breadth	4.9	78.7	16.4	12.5	80.4	7.1	22.4	60.7	16.9
Promotion depth	9.7	83.5	6.8	11.1	80.0	8.9	13.1	76.0	10.9
Incumbent Retailer Outcomes									
Sales revenue	6.2	41.7	52.1	10.7	75.1	14.2	3.2	31.0	65.8

*Read as: Regular price increased significantly in reaction to Wal-Mart entry in 14.3% of all categories in supermarkets.
**Read as: There was no significant change in regular price in reaction to Wal-Mart entry in 57.5% of all categories in supermarkets.
***Read as: Regular price decreased significantly in reaction to Wal-Mart entry in 28.2% of all categories in supermarkets.

cases in which there is no significant change, a significant increase, or a significant decrease as a result of the entry. This summary is provided for each of the three retail formats.

Likelihood and Direction of Reaction. Table 3 shows that reaction varies considerably across the marketing mix variables. In all three formats, reaction is least frequent on promotion breadth and depth, as can be seen from the high percentage of insignificant estimated effects. And, reaction is most common on assortment, where the number of insignificant effects is smallest. Reaction is also quite common on regular price, except in the drugstore format. The low frequency of promotion reaction may seem surprising since most of the incumbents in our analysis are high–low retailers who, one might argue, should find it relatively easy to adjust their promotions. However, our conversations with retailers confirm that individual stores have more flexibility to adjust price and assortment than promotions because the same weekly promotion flyers are typically used for entire market areas and are more difficult to adjust on a store-by-store basis.

The table also shows that reaction, when it does occur, can be either positive or negative. Lower prices, higher promotion breadth and depth, and higher assortment reflect retaliatory behavior. The reverse reflects accommodation. We see that in all three formats, and for all marketing mix variables, there is retaliation in some cases and accommodation in others. In general, however, retaliation is somewhat more likely in price, whereas accommodation is somewhat more likely in assortment and promotion. Incumbent retailers tend to cut their prices to be more competitive with Wal-Mart's everyday low prices, and many of them reduce their assortment perhaps to try and lower costs. In other words, they are more likely to try to emulate Wal-Mart than to differentiate themselves. The patterns, however, are different across retail formats. Mass stores are more retaliatory on price and promotion, while drugstores are more retaliatory on assortment and refrain from changing prices and promotion.[9]

Table 4

Stage 1 Analysis: Magnitude of Incumbent Retailer Reactions and Outcomes

	Median Percentage Effect in Supermarket Format			Median Percentage Effect in Drug Format			Median Percentage Effect in Mass Format		
Variable	**overall**	**sig. +**	**sig. –**	**overall**	**sig. +**	**sig. –**	**overall**	**sig. +**	**sig. –**
Incumbent Retailer Reactions									
Regular price per unit volume	–.4*	3.9**	–5.1***	–.1	8.1	–10.5	–2.0	16.5	–6.4
Assortment size	–1.2	5.8	–13.8	–2.6	20.7	–15.3	–6.0	9.8	–13.7
Percentage of top-tier SKUs	–1.3	8.3	–10.0	–.8	17.0	–18.7	–1.5	15.7	–10.4
Percentage of bottom-tier SKUs	.4	8.9	–8.5	–.5	22.2	–22.6	–.3	15.0	–12.6
Percentage of private-label SKUs	.1	13.5	–8.2	–1.6	19.7	–17.6	1.6	17.2	–17.2
Promotion breadth	–6.7	46.3	–25.9	–.5	45.5	–28.1	–1.0	142.0	–32.0
Promotion depth	1.2	28.1	–20.2	2.1	39.2	–32.3	–1.0	52.2	–31.2
Incumbent Retailer Outcomes									
Sales revenue	–17.3	20.4	–27.2	–5.8	60.2	–29.3	–40.4	65.4	–46.2

*Read as: Overall, the median change in regular price was –.4% in reaction to Wal-Mart entry in supermarkets.
**Read as: When regular price increased significantly in reaction to Wal-Mart entry, the median increase was 3.9% in supermarkets.
***Read as: When regular price decreased significantly in reaction to Wal-Mart entry, the median decrease was –5.1% in supermarkets.

Magnitude of Reaction. For each marketing mix variable and for sales revenue, Table 4 shows the median percentage change, overall, as well as the percentage change in cases in which there was a significant increase or a significant decrease. The base for each percentage is the value of the variable for the same category and store in the first six months of the data (see Appendix 2).

The magnitude of reactions in Table 4 is interesting. The median magnitude of price reaction ranges from a decrease of .1% for drugstores to a decrease of 2% for mass stores and is consistent with that reported in prior research (see Table 1). Corresponding numbers for promotion breadth range from a decrease of .5% for drugstores to a decrease of 6.7% for supermarkets. Numbers for assortment size range from a decrease of a little over 1% for supermarkets to a decrease of 6% for mass stores. Promotion depth decreases by 1% for mass stores but it increases by 1.2% for supermarkets and 2.1% for drugstores overall.

The median reactions in cases where there is a significant decrease or a significant increase show that supermarkets are generally more measured in their reaction. For instance, the median price reaction in cases of an increase is 3.9% and the median in cases of a decrease is –5.1%. Corresponding numbers for drugstores and mass stores are substantially bigger. Patterns are similar for the other marketing mix variables. Drugstores, in particular, are least likely to react, but when they do, the magnitude of reaction is substantial.

Sales Effects. Wal-Mart entry had substantial impact on the sales revenues of incumbent retailers, and there are fairly large differences across retail formats. The percentage of cases of significant sales decreases is highest for mass stores (more than 65%) and lowest for drugstores (less than 15%). The magnitude of sales effects tells a similar story. The percentage change in sales due to entry is highest for mass stores, who suffer a median decrease of 40%, and lowest for drugstores, who suffer a median decrease of less than 6%.

Table 5
Stage 2 Analysis: Explaining Variations in Incumbent Retailer Reactions

Explanatory Variable	Coefficient Estimate in Ordered Probit Model for Incumbent Reaction on[a]		
	Regular Price	Assortment Size	Promotion Breadth
Chain ROA	.467***	.710***	–.530**
	(2.58)	(4.00)	(–2.48)
EDLP (vs. high-low) positioning	.141	.684***	.223**
	(1.45)	(6.96)	(2.01)
First exposure	–.275***	–.211***	–.012
	(–4.14)	(–3.22)	(–.18)
Distance to Wal-Mart	.018***	.051***	.005
	(3.15)	(8.98)	(.68)
Category size	.156	.164	.246
	(.47)	(.50)	(.64)
Category penetration	.019	.141	–.504***
	(.13)	(.99)	(–3.02)
Category retail margin	–.030	–.522	.922*
	(–.07)	(–1.16)	(1.79)
Category promotion elasticity	.075**	.040	.054
	(2.07)	(1.11)	(1.34)
Category private-label share	.713***	–.400	.191
	(2.78)	(–1.58)	(.59)
Category distribution	–.956*	–.400	–.162
	(–1.89)	(–.81)	(–.23)
Category concentration	.170	.233	.753*
	(.61)	(.86)	(1.70)
Category advertising	–.078	–.200	–.054
	(–.39)	(–1.01)	(–.23)
Drug chain x HBC	.286*	.198	.622***
	(1.84)	(1.27)	(3.51)
Drug chain x gen.HH	.193	.291**	.613***
	(1.54)	(2.34)	(4.18)
Drug chain x food	.407***	.495***	.536***
	(3.51)	(4.29)	(3.82)
Mass chain x HBC	.060	–.245	.578**
	(.26)	(–1.03)	(2.36)
Mass chain x gen.HH	–.26	–.261	.691***
	(–1.42)	(–1.38)	(3.37)
Mass chain x food	.101	.101	.685***
	(.63)	(.62)	(3.74)

Continued on next page

Supermarkets suffer a median decrease of 17%. These magnitudes are consistent, in general, with those reported elsewhere (e.g., Singh, Hansen, and Blattberg 2006; Stone 1995).

Second-stage analysis: Variations in marketing mix reactions

We now attempt to explain the variation in incumbents' reactions as a function of category and store characteristics, using the ordered probit model. A significantly positive coefficient for a particular covariate means that, as the variable increases, the retailer is more likely to increase the marketing mix variable, or, equivalently, less likely to decrease it.

Since the store and category characteristics explain a statistically significant portion of the variation only in price, assortment size, and promotion breadth reactions, we report model estimates for these three reactions in Table 5. One can see that the goodness-of-fit measures reported at the bottom of Table 5 are not high, but, as we discussed in the literature review, this is not surprising. Nonetheless, some of the store characteristics have intuitively appealing coefficient estimates. Stores belonging to profitable companies resist price and promotion wars and are less likely to cut assortment. This can be seen in the positive effect of chain return on investment on price and assortment size, and the negative effect on promotion breadth. EDLP chains, whose positioning overlaps more with Wal-Mart and therefore may be affected more (Gielens et al. 2008) are more retaliatory — they are less likely to cut assortment size and promotion breadth.

Stores that have not been previously exposed to Wal-Mart retaliate more strongly on price. This makes sense as first-time incumbents have to make greater adjustments to calibrate their prices to Wal-Mart levels. They are also more likely to cut assortment size, perhaps in an attempt to cut costs and survive. Similarly,

Table 5, continued

Explanatory Variable	Coefficient Estimate in Ordered Probit Model for Incumbent Reaction on[a]		
	Regular Price	Assortment Size	Promotion Breadth
Supermarket chain x HBC	.067 (.46)	–.277* (–1.89)	–.265 (–1.59)
Supermarket chain x gen.HH	.046 (.42)	.067 (.61)	–.107 (–.82)
Goodness of Model Fit:			
No. of observations	1563	1562	1401
Likelihood ratio	96.49	236.34	95.39
Aldrich-Nelson	.058	.131	.064
Veall-Zimmerman	.089	.194	.110

[a]The dependent variable is 1 for a significant decrease in the marketing mix variable, 0 for no significant change, and 3 for a significant increase.
Note: t-statistics are in parentheses
***$p < .01$; **$p < .05$; *$p < .10$

stores located close to the entry are more likely to cut their price and their assortment size. In general, first-time incumbents and stores close to the entry are focused on closing the gap with Wal-Mart on price points at the expense of assortment.

The impact of category characteristics on reaction is not particularly consistent or significant. It does not appear as if retailers systematically fine-tune their reaction in different categories. This is consistent with our conversations with several retailers who noted that they distinguish between "Wal-Mart zones" and "non Wal-Mart zones" but react in a more broad-brush fashion across large groups of categories.

Note that we cannot estimate models that fully account for unobserved heterogeneity across stores and categories because we do not have repeated observations for the same store × category combination in the current analysis. Our objective in the second-stage analysis is to explain variations in reaction across stores and categories using observed store and category characteristics. In addition, the format-department interactions serve as fixed effects to control for differences across the nine broad groups defined by the three retail formats and three department types. Coefficients of these interaction terms indicate that, after controlling for the effects of the other store and category characteristics, some differences in reaction remain across the formats and certain departments. For example, drugstores are less likely to cut price and assortment than the other two formats, while supermarkets and mass stores are more likely to cut prices and assortment across the board. Also, supermarkets are more likely to cut promotion breadth than the other two formats. There is less variation across departments within a given format. The only significant difference we observe is that supermarkets cut the assortment size for health and beauty care products more than for food and general household products, after controlling for the other store and category characteristics.[10]

Third-stage analysis: Linking reactions to sales outcomes

In the third-stage analysis, we study the effects of retailers' marketing mix reactions on their sales outcomes, while accounting for the effects of the store and category characteristics. Estimates of Equation 2 are reported in Table 6.[11]

As shown in Table 6, many of the marketing mix reactions have significant coefficients, indicating that a retailer's reactions to a Wal-Mart entry indeed influence how its sales are affected. This is an important finding of our study. It implies that retailers can proactively adjust their marketing mix activities to mitigate the negative impact of a Wal-Mart entry on their sales. The patterns of these coefficients, however, vary substantially across retail formats, indicating that sensible reaction strategies need to consider the retail format. We highlight below the key insights for each retail format.

Supermarkets. Supermarkets appear to be able to counter a Wal-Mart entry with multiple

Table 6
Stage 3 Analysis: Drivers of Incumbent Retailer Sales Outcomes

Variable/Parameter	Estimate	*t*-Statistic
Intercept	.386*	1.80
Marketing Mix Reactions		
Δ assortment size: supermarkets	.273**	2.27
Δ regular price: supermarkets	–1.904*	–1.73
Δ promotion breadth: supermarkets	.045	.03
Δ promotion depth: supermarkets	3.979**	2.14
Δ percentage of top-tier SKUs: supermarkets	.661**	1.98
Δ percentage of bottom-tier SKUs: supermarkets	.367	.73
Δ percentage of private-label SKUs: supermarkets	1.632***	3.42
Δ assortment size: drugstores	.403***	3.90
Δ regular price: drugstores	.444**	2.51
Δ promotion breadth: drugstores	.932*	1.91
Δ promotion depth: drugstores	1.720	.89
Δ percentage of SKUs, top tier: drugstores	–.052	–.12
Δ percentage of SKUs, bottom tier: drugstores	–.043	–.18
Δ percentage of SKUs, private labels: drugstores	–1.881**	–2.09
Δ assortment size: mass stores	2.149**	2.23
Δ regular price: mass stores	.917	.38
Δ promotion breadth: mass stores	.308	.75
Δ promotion depth: mass stores	10.691**	2.35
Δ percentage of SKUs, top tier: mass stores	–.160	–.73
Δ percentage of SKUs, bottom tier: mass stores	–.133	–.46
Δ percentage of SKUs, private labels: mass stores	–2.781***	–2.09
Store and Category Characteristics		
Chain ROA	.087	.99
EDLP (vs. high–low) positioning	–.066*	–1.71
First exposure	–.125***	–3.95
Distance to Wal-Mart	.010***	4.38
Category distribution (ACV)	–.662***	–3.04
Category Herfindahl Index	–.283***	–2.54
Category advertising	–.047	–.58
Category size	.173	1.37
Category private-label share	.172*	1.71
Category retail margin	.397**	2.25
Category promotion elasticity	.031**	2.04
Category penetration	–.141**	–2.47
Supermarket store × HBC	.013	.22

Continued on next page

marketing mix actions. We find that price reaction has a strongly negative coefficient, and promotion depth has a positive coefficient for supermarkets. In other words, supermarkets that drop regular price and increase promotion depth in response to entry suffer a smaller loss of sales. We also find that assortment size reaction has a positive effect, showing that the less a retailer cuts the number of SKUs in a category, the less severe its sales loss is. In terms of the assortment composition, increasing the percentage of top-tier national brands and the percentage of private labels shows positive effects in combating sales losses.

To summarize, these results indicate that supermarkets can mitigate the negative impact of Wal-Mart on their sales revenue by lowering regular prices, offering deeper promotions, and refraining from cutting their assortment. It is also helpful to step up the presence of top-tier national brands at one end and private labels at the other end of their assortment. It is interesting to note that these reactions are effective despite the fact that supermarkets already have competitive prices, the largest assortment, and the highest private-label presence (see Table 2). This is consistent with the message in prior research that retaliation should be in areas where the incumbent is strong.

Drugstores. Our analysis points to a different set of recommendations for drugstores. Like supermarkets, the coefficient for assortment size here is positive. But, regular price and promotion breadth reactions have positive coefficients, and the percentage of private labels has a negative coefficient. Thus, drugstores too should refrain from cutting the size of their assortment, but reductions in regular price actually hurt their sales revenue, and so does increasing the presence of private labels. Drugstores should respond with frequent promotions on a wide assortment of products. The finding that regular price reductions do not help for this format while more promotions do may be explained by the fact that drugstores are not a primary choice for the

Table 6, continued

Variable/Parameter	Estimate	t-Statistic
Supermarket store × gen. HH	.021	.51
Drugstore × food	.120**	2.31
Drugstore × HBC	.172***	2.66
Drugstore × gen. HH	.109**	1.97
Mass store × food	.152*	1.83
Mass store × HBC	–.011	–.12
Mass store × gen. HH	.138	1.54
Log-likelihood	–1015.7	

***$p < .01$; **$p < .05$; *$p < .10$

weekly grocery shopping of many consumers. Lowering regular prices in these secondary outlets may not induce consumers to change their store choice behavior, so there may not be enough of an increase in store visits and unit volume to make up for the price reduction. In contrast, store switching, especially of the indirect type documented by Bucklin and Lattin (1992), is more likely in response to promotions. Consumers may simply buy more products while they are in the drugstore for their secondary shopping if there are a large number of products on promotion.

Mass Stores. Dealing with Wal-Mart is most challenging for mass stores. As we saw earlier, of the three formats, these stores suffered the greatest sales losses. Table 6 shows that this format also has fewer strategic options to combat the sales loss than the other two formats. Changes in regular price and promotion breadth do not have significant effects, nor do changes in the percentage of top- or bottom-tier national brands. It appears that mass stores should maintain or increase their assortment size because, like the other two formats, its coefficient for assortment size is positive. They should also offer deeper promotions, given the strongly positive coefficient of promotion depth.

Effects of Store and Category Characteristics. Among store characteristics, first exposure, distance from Wal-Mart, and EDLP positioning all show significant effects. Stores that face a Wal-Mart store in their vicinity for the first time suffer a greater loss in sales revenue than those with prior exposure. The further the store is from a Wal-Mart entry, the smaller the sales losses. And, stores with EDLP (as opposed to high–low) positioning suffer a bigger sales loss because of their direct price comparison with Wal-Mart. These results are consistent with Gielens et al. (2008), who conclude that retailers whose positioning overlaps with Wal-Mart are likely to be hurt more, while retailers with prior experience of price competition are likely to be hurt less.

Most of the category characteristics examined exhibit significant effects on the sales outcomes. As we expected, widely distributed, high-penetration, highly promotion-sensitive, and concentrated categories suffered greater sales losses. In contrast, categories with a higher retail margin suffered smaller sales losses, possibly because retailers have higher margins in categories that are less price sensitive, and less price-sensitive categories are less vulnerable to Wal-Mart. Interestingly, categories with larger private-label shares suffered smaller sales losses. This may appear counterintuitive to the extent that private-label share in a category correlates with its price sensitivity, but it may be that Wal-Mart's average price advantage is smaller in categories with substantial sales of lower-priced private-label products.

Similar to the second-stage analysis, the format-department interactions control for differences across the nine broad groups defined by retail format and department type. As indicated by the coefficients of these interaction terms, significant differences in sales outcomes remain across the three retail formats, and to a less extent, also across certain departments, even after controlling for effects of the other covariates in the model. In particular, we find that (1) all three drugstore interactions are significantly positive, showing that their sales

losses are significantly lower than those of supermarkets; (2) the food product interaction with mass stores is significantly positive, showing that mass stores' food sales losses are less than those of supermarkets; (3) the two supermarket interactions are not significant, i.e., there is no difference in sales losses between food (the base case) and other departments for supermarkets. These interaction coefficients confirm that Wal-Mart entry is least threatening to drugstores and that food products are the most vulnerable in supermarkets, after accounting for retailer reactions and the other variables in our model.

Conclusion

In this study, we have conducted a systematic examination of incumbent retailers' reactions to the entry of Wal-Mart in their local markets. Our analyses include seven Wal-Mart supercenter entries in different locations and are carried out using data from a large number of supermarket, drug, and mass merchandise stores for movement of products in more than 40 product categories. We examine how these retailers have reacted not just on price, but also on a variety of other marketing mix variables. More importantly, we link these reactions from retailers to Wal-Mart's impact on their sales outcomes. In addition, we explore the factors that may explain differences in retailers' reactions and in their sales outcomes across retail formats, stores, and categories.

We now summarize the most important substantive findings from our analyses and their managerial implications:

The Wal-Mart effect on the sales revenue of incumbent retailers is strong. In the year following each entry, mass stores suffer a median sales decline of 40% and supermarkets suffer a median sales decline of 17%, while drugstores experience a much smaller decline of 6%. There is, however, significant variation across stores and categories even within each retail format. Among the mass stores in our study, 35% show no significant sales decline. The corresponding percentages for supermarkets and drugstores are 42% and 75%, respectively.

Incumbent retailer reactions are small in magnitude in general, with a majority of cases showing no significant reactions across marketing mix variables and formats.[12] This finding is consistent with prior research which shows that the most common competitive reaction tends to be "no reaction" (Nijs et al. 2001; Pauwels 2004). In general, drugstores are least likely to react and mass stores are most likely to react to a Wal-Mart entry.

When reactions are significant, there is substantial variation in the direction of reaction, and the category characteristics that are expected to influence reaction turn out to have limited ability to explain the variation. The fact that these characteristics do not explain a significant portion of the variation in reactions suggests that retailers are not localizing and fine-tuning their reactions as much as they could or should (see Hoch, Montgomery, and Rossi 1995 for a similar finding in the context of pricing).

Sales outcomes for incumbent retailers are more predictable: many of the explanatory variables in our third-stage analysis are significant and of the expected sign. More importantly, retailers' reactions significantly influence Wal-Mart's impact on their sales outcomes, implying that retailers can proactively adjust their marketing mix activities to mitigate the negative impact of the entry. We find that cutting assortment is not an effective strategy for incumbent retailers. Across all three formats, the deeper the assortment reduction, the more severe the sales losses due to the Wal-Mart entry.

For other marketing mix variables, our analysis suggests very different strategies for the three formats. For instance, reduction in regular prices and higher percentages of top-tier

national brands and private labels can mitigate sales losses for supermarkets, but not for drug and mass stores. On the other hand, promotion breadth is particularly important for drugstores, as is promotion depth for mass stores.

Overall, we find that differentiation works well, while trying to emulate Wal-Mart does not. Supermarkets have a delicate balance to achieve between lowering regular prices while also retaining top-tier national brands in their assortment. Drugstores appear to be least vulnerable to Wal-Mart and should refrain from price cuts and assortment cuts, but should offer a broad selection of national brands on promotion. Mass stores are most limited in what they can do because most of the marketing mix reaction variables do not significantly affect the sales impact of Wal-Mart. Our results indicate that they too should refrain from cutting assortment size and that they should put more emphasis on national brands, as opposed to private labels, in combating the threat of Wal-Mart.

There are several important directions in which future research can build on our work. We have focused on studying the intermediate effect of Wal-Mart entry—within one year of entry. Both retailer reactions and sales outcomes may be different in the longer term. Future research could also examine time-varying patterns in reactions and outcomes and assess how retailers may adapt their reactions in the longer term. Our data set contains only store movement data of chain retailers, and thus we are unable to study the impact on or reactions of small independent retailers. Popular press coverage and prior research suggest that results for small independent retailers are likely to be quite different, and future research should focus on these small retailers as appropriate data become available. While sales revenue is an important outcome measure for retailers, our data do not allow us to examine the impact on retailers' net profits, which also should be investigated. In the broader context of the impact of powerful retailers, we also hope that additional research will study responses to entries by other large retailers, especially powerful discount retailers such as Target and Best Buy.

In conclusion, we have conducted a systematic examination of incumbent retailers' reactions to Wal-Mart entry into their local markets. Our study reveals substantial variations in reactions and sales outcomes across retail formats, stores, and categories. Most importantly, we find that the sales impact for a retailer is significantly affected by the way in which it reacts to the entry, and retailers can proactively adjust their marketing mix activities to mitigate the negative impact of the entry. Through three stages of analyses, we provide valuable insights for retailers across the supermarket, drug, and mass merchandiser formats in their continuing combat with a very formidable competitor.

Acknowledgments

The authors thank Information Resources, Inc., for generously providing the data used in this study and Rong Guo of the Tuck School for her invaluable help with data preparation and analyses. They also thank Michel Wedel of the University of Maryland, Debbie Samuels of Information Resources, Inc., and participants at the 2007 Marketing Science Conference, 2008 Tuck School Seminar Series, and University of Houston for their helpful suggestions.

Appendix 1

List of Product Categories

Analgesics—internal
Baby food
Baby juice
Batteries
Beer
Body lotion
Bottled juices
Butter
Cat treats
Cider—alcoholic
Cigarettes
Cold cereal—ready to eat
Cold/Allergy/Sinus tablets
Cookies
Crackers
Deodorant
Diapers
Disposable cameras
Dog treats
Dry cat food
Dry dog food
Frozen dinners
Frozen vegetables
Frozen yogurt
Ground coffee
Household cleaners
Ice cream
Instant coffee
Instant film
Laundry detergent—liquid
Laundry detergent—powder
Lightbulbs
Motor oil
Paper towels
Razors
Refrigerated juices
Refrigerated yogurt
Regular film
Shampoo
Toilet tissue
Toothpaste
Tooth whiteners
Wet cat food
Wet dog food
Whole-bean coffee
Yogurt drinks

Appendix 2

Variable Definitions

Incumbent Retailers' Marketing Mix Variables

regular price

average regular price per equivalent volume of the category in the store

assortment size

number of SKUs in the category in the store

percentage of top-tier SKUs

percentage of national-brand SKUs in the category in the store that are in the top price tier

percentage of bottom-tier SKUs

percentage of national-brand SKUs in the category in the store that are in the bottom price tier

percentage of private-label SKUs

percentage of SKUs in the category in the store that are private label

promotion breadth

percentage of SKUs in the category that are on price promotion in the store

promotion depth

average percentage discount when the category is on promotion in the store

Incumbent Retailers' Outcome Variable

dollar sales

dollar sales of the category in the store

Price Tier of National Brands

price tier

top tier consists of national brands whose prices are in the top third of the category across all stores in the first six months of data, mid tier consists of national brands whose prices are in the middle third, and bottom tier consists of brands whose prices are in the bottom third.*

Store and Category Characteristics

chain ROA

1999 company earnings as a percentage of assets for the experimental store (Compustat, Thompson)

EDLP

dummy variable = 1 if chain has EDLP positioning, 0 otherwise

first exposure

dummy variable = 1 if this is the first Wal-Mart entry within 15 miles of the experimental store; 0 if there was an existing Wal-Mart within 15 miles, though that entry was more than five years ago

distance to Wal-Mart

distance (miles) from experimental store to Wal-Mart

category size

total sales in the category across all stores in the first six months (in tens of millions of dollars)

category penetration

percentage of U.S. households who purchase the category at least once in the year (*IRI Marketing Fact Book*)

category retail margin

Average percentage retail margin for the category (point-of-purchase data from *Supermarket News*)

category promotion elasticity

average percentage increase in category sales with 15% promotional discount (Narasimhan, Neslin, and Sen 1996)

category private-label share

percentage unit share of private label in the category, computed across all stores for the first six months of the data

category distribution

national all-commodity volume distribution of the category, i.e., the percentage of total volume of all product categories that is sold by stores that carry the category (IRI)

category concentration

category Herfindahl Index: sum of squared market shares of all brands in the category, computed using sales of brands across all stores in the first six months

category advertising

total media advertising expenditure (in millions of dollars) by all manufacturers in the category (LNA)

drug chain × HBC

dummy variable = 1 if observation is for a health or beauty category in a drugstore, 0 otherwise

drug chain × gen.HH

dummy variable = 1 if observation is for a general household product in a drugstore, 0 otherwise

drug chain × food

dummy variable = 1 if observation is for a food category in a drugstore, 0 otherwise

mass chain × HBC

dummy variable = 1 if observation is for a health or beauty category in a mass merchandiser store, 0 otherwise

mass chain × gen.HH

dummy variable = 1 if observation is for a general household product in a mass merchandiser store, 0 otherwise

mass chain × food

dummy variable = 1 if observation is for a food category in a mass merchandiser store, 0 otherwise

supermarket chain × HBC

dummy variable = 1 if observation is for a health or beauty category in a supermarket store, 0 otherwise

supermarket chain × gen. HH

dummy variable = 1 if observation is for a general household product in a supermarket store, 0 otherwise

supermarket chain × food

dummy variable = 1 if observation is for a food category in a supermarket store, 0 otherwise (base case)

---

*For brands that are not available in the first six months, tier status is computed using their average price in the entire period.
Note: All variables are computed using IRI store-level data for the markets in our analysis except when an alternative source is listed.
Note: All percentages are in fractions, e.g., .15, not 15%.

Notes

1. After the period of our study, Wal-Mart began making attempts to modify positioning at the store level, particularly with respect to higher-end product assortment.

2. As we will discuss in the data section of the paper, all the entries we studied were ones that had previously had no Wal-Mart within a 15-mile radius or, if there was a Wal-Mart, it had opened more than five years before the focal entry.

3. Note that it is possible for an incumbent store within a 15-mile radius of an entry to have another Wal-Mart within a 15-mile radius, although none of the Wal-Mart entries themselves have another Wal-Mart within a 15-mile radius.

4. The percentage of mid-tier SKUs is not needed since the percentage in two of the three tiers provides full information.

5. Note that it is not possible to estimate reaction functions since Wal-Mart's marketing mix data are not available.

6. To see why, note that the average value of a given variable v for control stores before Wal-Mart entry is $\hat{\beta}^{v}_{0ie}$, and the corresponding average after entry is $\hat{\beta}^{v}_{0ie} + \hat{\beta}^{v}_{2ie}$. Similarly, the average value of the variable for an experimental store before Wal-Mart entry is $\hat{\beta}^{v}_{0ie} + \hat{\beta}^{v}_{1ie}$, and the corresponding average after entry is $\hat{\beta}^{v}_{0ie} + \hat{\beta}^{v}_{1ie} + \hat{\beta}^{v}_{2ie} + \hat{\beta}^{v}_{3ie}$. Thus, the Wal-Mart effect is the difference between "before" and "after" for the experimental store, i.e., $\hat{\beta}^{v}_{0ie} + \hat{\beta}^{v}_{1ie} + \hat{\beta}^{v}_{2ie} + \hat{\beta}^{v}_{3ie} - (\hat{\beta}^{v}_{0ie} + \hat{\beta}^{v}_{1ie}) = \hat{\beta}^{v}_{2ie} + \hat{\beta}^{v}_{3ie}$, minus the corresponding difference between "before" and "after" for the control stores, i.e., $\hat{\beta}^{v}_{0ie} + \hat{\beta}^{v}_{2ie} - \hat{\beta}^{v}_{0ie} = \hat{\beta}^{v}_{2ie}$. This "difference in differences" is $\hat{\beta}^{v}_{3ie}$.

7. The dependent variable $S^{\tau=2}_{ie}$ and the reactions $X^{\tau=2}_{ie}$ are estimated as $\hat{\beta}^{v}_{3ie}$ in Equation 1, as discussed previously.

8. Averages are computed from the first six months of the data (i.e., before any Wal-Mart entry).

9. Since the composition of a category can change over time, the change in category price may be due to an actual change in price or due to a shift in composition towards less or more expensive brands. We repeated our analysis with only a common subset of brands that remained in the assortment throughout and found similar results. Thus, the price reaction really is a price reaction, not the consequence of a change in assortment composition. The reason we do not report results based only on the common subset is because that subset tends to be quite small.

10. We also estimated the ordered probit model separately for each format. When we did so, the explanatory power was higher for supermarkets and mass stores than for drugstores, but the main results were the same as reported above in terms of the effects of store characteristics and the lack of significance and consistency in the effects of category characteristics.

11. There are no ideal goodness-of-fit measures for our model. We have computed two "pseudo" measures instead. For one, which is similar to R^2 for OLS regressions, we use the mean Wal-Mart effect on sales for each store and category as the observed variable, which equals .147. The other is computed in the same way as ρ^2 for discrete-choice models ($\rho^2 = 1 - L(\beta) / L(0)$, where $L(\beta)$ = log-likelihood of the model, $L(0)$ = log-likelihood with only the intercept), which equals .472.

12. Note that this finding is not attributable to a lack of statistical power in our analyses. After all, we do find that a Wal-Mart entry has a large impact on incumbent retailers' sales using the same approach, and experimental and control stores.

References

Ailawadi, Kusum, Donald Lehmann, and Scott Neslin (2001), "Market Response to a Major Policy Change in the Marketing Mix: Learning from P&G's Value Pricing Strategy." *Journal of Marketing* 65 (1), 44–61.

Basker, Emek E. (2005a), "Job Creation or Destruction? Labor-Market Effects of Wal-Mart Expansion." *Review of Economics and Statistics* 87 (1), 174–83.

——— (2005b), "Selling a Cheaper Mousetrap: Wal-Mart's Effect on Retail Prices." *Journal of Urban Economics* 58 (2), 203–29.

Beaver, William (2005), "Battling Wal-Mart: How Communities Can Respond." *Business and Society Review* 110 (2), 159–69.

Bell, Stephen S., and Gregory S. Carpenter (1992), "Optimal Multiple-Objective Marketing Strategies." *Marketing Letters* 3 (4), 383–93.

Bowman, Douglas, and Hubert Gatignon (1995), "Determinants of Competitor Response Time to a New Product Introduction." *Journal of Marketing Research* 32 (1), 42–53.

Boyd, David (1997), "From 'Mom and Pop' to Wal-Mart: The Impact of the Consumer Goods Pricing Act of 1975 on the Retail Sector in the United States." *Journal of Economic Issues* 31 (1), 223–32.

Brodie, Roderick J., Andre Bonfrer, and Justine Cutler (1996), "Do Managers Overreact to Each Others' Promotional Activity? Further Empirical Evidence." *International Journal of Research in Marketing* 13 (4), 379–87.

Bucklin, Randolph E., and James M. Lattin (1992), "A Model of Product Category Competition Among Grocery Retailers." *Journal of Retailing* 68 (3), 271–93.

Campbell, Donald T., and Julian C. Stanley (1963), *Experimental and Quasi-Experimental Designs for Research.* Boston, Mass: Houghton Mifflin.

Chen, Ming-Jer (1996), "Competitor Analysis and Interfirm Rivalry: Toward a Theoretical Integration." *Academy of Management Review* 21 (1), 100–34.

———, and Danny Miller (1994), "Competitive Attack, Retaliation, and Performance: An Expectancy-Valence Framework." *Strategic Management Journal* 15 (2), 85–102.

Fishman, Charles (2006), "The Wal-Mart Effect and a Decent Society: Who Knew Shopping was So Important?" *Academy of Management Perspectives* 2 (3), 6–25.

Gatignon, Hubert, Erin Anderson, and Kristiaan Helsen (1989), "Competitive Reactions to Market Entry: Explaining Interfirm Differences." *Journal of Marketing Research* 26 (1), 44–55.

———, Thomas S. Robertson, and Adam J. Fein (1997), "Incumbent Defense Strategies Against New Product Entry." *International Journal of Research in Marketing* 14 (2), 163–76.

Gielens, Katrijn, Linda M. Van de Gucht, Jan-Benedict E. M. Steenkamp, and Marnik G. Dekimpe (2008), "Dancing with a Giant: The Effect of Wal-Mart's Entry into the U.K. on the Performance of European Retailers." *Journal of Marketing Research* 45 (5) (October), 519–34.

Gruca, Thomas S., K. Ravi Kumar, and D. Sudharshan (1992), "An Equilibrium Analysis of Defensive Response to Entry Using a Coupled Response Function Model." *Marketing Science* 11 (4), 348–58.

Hauser, John, and Steven Shugan (1983), "Defensive Marketing Strategies." *Marketing Science* 2 (4), 319–60.

Hausman, Jerry, and Ephraim Leibtag (2005), "Consumer Benefits from Increased Competition in Shopping Outlets: Measuring the Effect of Wal-Mart." *Journal of Applied Econometrics* 22 (7), 1157–77.

Hoch, Stephen, Xavier Drèze, and Mary E. Purk (1994), "EDLP, Hi-Lo and Margin Arithmetic." *Journal of Marketing* 58 (4), 16–27.

———, Alan Montgomery, and Peter Rossi (1995), "Determinants of Store-Level Price Elasticity." *Journal of Marketing Research* 32 (1), 17–29.

Inman, J. Jeffrey, Venkatesh Shankar, and Rosellina Ferraro (2004), "The Roles of Channel-Category Associations and Geodemographics in Channel Patronage." *Journal of Marketing* 68 (2), 51–71.

Jia, Panle (2005), "What Happens When Wal-Mart Comes to Town: An Empirical Analysis of the Discount Industry." New Haven, Conn.: Yale University, Working Paper.

Lee, Lung-Fei (1999), "Statistical Inference with Simulated Likelihood Functions." *Econometric Theory* 15 (3), 337–60.

Leeflang, Peter S. H., and Dick R. Wittink (1996), "Competitive Reaction versus Consumer Response: Do Managers Overreact?" *International Journal of Research in Marketing* 13 (2), 103–19.

McCune, J. (1994), "In the Shadow of Wal-Mart." *Management Review* 83 (12), 10–16.

Narasimhan, Chakravarthi, Scott A. Neslin, and Subrata Sen (1996), "Promotional Elasticities and Category Characteristics." *Journal of Marketing* 60 (April), 17–30.

Nijs, Vincent R., Marnik G. Dekimpe, Jan-Benedict E. M. Steenkamp, and Dominique M. Hanssens (2001), "The Category-Demand Effects of Price Promotions." *Marketing Science* 20 (1), 1–22.

Noel, Michael, and Emek Basker (2007), "The Evolving Food Chain: Competitive Effects of Wal-Mart's Entry into the Supermarket Industry." San Diego, Calif.: University of California, San Diego, Working Paper.

Pauwels, Koen (2004), "How Dynamic Consumer Response, Competitor Response, Company Support, and Company Inertia Shape Long-term Marketing Effectiveness." *Marketing Science* 23 (4), 596–610.

Pearson, B. (1994), "Competing in the '90s." *Stores* 76 (5), 79–80.

Putsis, William, and Ravi Dhar (1998), "The Many Faces of Competition." *Marketing Letters* 9 (3), 269–84.

Ramaswamy, Venkatram, Hubert Gatignon, and David J. Reibstein (1994), "Competitive Marketing Behavior in Industrial Markets." *Journal of Marketing* 58 (2), 45–55.

Robinson, William T. (1988), "Marketing Mix Reaction to Entry." *Marketing Science* 7 (3), 368–85.

Schulz, D. P. (2006), "The Nation's Retail Power Players 2006." *Stores*, July (Special Issue).

Shankar, Venkatesh (1997), "Pioneers' Marketing Mix Reaction to Entry in Different Competitive Game Structures: Theoretical Analysis and Empirical Illustration." Marketing Science 16 (3), 271–93.

——— (1999), "New Product Introduction and Incumbent Response Strategies: Their Interrelationship and the Role of Multimarket Contact." *Journal of Marketing Research* 36 (3), 327–44.

Singh, Vishal P., Karsten T. Hansen, and Robert C. Blattberg (2006), "Market Entry and Consumer Behavior: An Investigation of a Wal-Mart Supercenter." *Marketing Science* 25 (5), 457–76.

Stone, Kenneth E. (1995), "Impact of Wal-Mart Stores on Iowa Communities: 1983-1993." *Economic Development Review* 13 (2), 60–9.

Vance, Sandra S., and Scott, Roy V. (1994), *Wal-Mart: A History of Sam Walton's Retail Phenomenon.* New York, N.Y.: Twayne Publishers.

Wal-Mart (2008), "Corporate Facts: Wal-Mart by the Numbers." (July 17). Available at http://walmartstores.com/FactsNews/FactSheets/.

Report No. 08-122