Retail stores are segmented using socioeconomic characteristics of the trade area, and it is shown that the effects of store environment on store performance vary across segments. Store performance is measured by a market-based measure—sales and a productivity-based measure—sales per square feet. The internal store environment includes the number of checkout counters per square foot of selling area, the number of nongrocery products sold (extent of scrambled merchandising), whether the store at least doubles manufacturers coupons, whether there is a banking facility, and whether the store is open for 24 hours. The external store environment includes the type of neighborhood it is located in. A methodology for predicting store performance (for existing and new stores) based on the type of environment and store location by using aggregate secondary data is demonstrated. The proposed models are estimated and validated using Market Metrics geodemographic data for 646 grocery stores provided by A.C. Nielsen. It is shown how the findings of this retail environment study can be used to offer guidelines to retailers for attaining desired levels of sales and sales per square feet by using readily available data.  

Address correspondence to V. Kumar, Marvin Hurley Professor of Business Administration, Melcher Faculty Scholar and Director of Marketing Research Studies, University of Houston, Houston, TX 77204-6283.


The Effect of Retail Store Environment on Retailer Performance

V. Kumar
UNIVERSITY OF HOUSTON
Kiran Karande
OLD DOMINION UNIVERSITY

Retailing atmospherics have been used to create differences across stores in order to exploit consumer characteristics and the competitive environment (Kotler, 1973; Hoch, Byung-Do, Montgomery, and Rossi, 1995). In the past, marketers’ ability to test the variations in retail atmospherics was constrained because of nonavailability of data covering a wide range of variables across a cross-section of retailers. However, with the advent of technology, marketers now have access to such data on a wide range of variables (for example, the Market Metrics data in the United States). In this study, we use a broad definition of retail atmospherics, which represents the retail environment. We use a unique data set covering a wide range of variables related to retail environmental variables both within and outside the store. The internal retail environmental variables include retailers’ micro-marketing strategies and the external retail environment that pertains to the neighborhood location and trade area demographics. The effect of the influence of retail environment on retail performance is studied using data for 646 grocery stores across the United States. A.C. Nielsen provided this Market Metrics data. We add to the past literature on retail atmospherics and retail performance (see Ghosh and McLafferty [1987]; Wrigley [1990]; and Rogers [1992] for excellent reviews) by showing how such information can be used by retailers to improve store performance.

Past research has shown that store performance 1 is influenced by variables such as trade area demographics including population and socioeconomic characteristics (Craig, Ghosh, and McLafferty, 1984), level of competition (Ghosh, 1984), retail atmospherics including location on intersection, sales area, credit card service, number of checkout counters, number of aisles (Jain and Mahajan, 1979), and promotions (Walters and Rinne, 1986; Walters and MacKenzie, 1988). In recent years, the grocery store industry has become increasingly competitive, and therefore additional variables, particularly those related to the effects of actions taken by the retailer, need to be studied. For example, retailers are looking at ways to differentiate themselves from competition by increasing the level of service at checkout and adding services, such as keeping the store open for 24 hours. They are using promotions such as double or triple couponing, selling a variety nongrocery products (scrambled merchandising), and locating stores in smaller markets with an intent to improve store performance. To the best of our knowledge, no past study 2 has explained performance by using promotional variables, such as double couponing, but have not addressed the range of store environment variables.

1 Performance is measured as dollar sales, sales per square foot, market share, retail patronage, store choice, store traffic, and store profits in different studies.
2 Other studies (Walter and Rinne, 1986; Walters and MacKenzie, 1988) have explained performance by using promotional variables, such as double couponing, but have not addressed the range of store environment variables.
researched the effect of internal retail environment including level of service, double couponing, extended store hours, the extent of scrambled merchandising, and external retail environment, such as store neighborhood characteristics on grocery store performance.

An interesting question to address is whether the effect of retail environment on retail store performance is similar across all neighborhoods. Past research has studied the effects of different variables on store performance without attempting to segment stores to assess the differential impact of variables across stores. Researchers studying store choice have acknowledged (Ghosh, 1984) and shown the effect of factors, such as income, occupation, and ethnicity on the relative importance given to variables by shoppers (Craig, Ghosh, and McAfferty, 1984). However, such modeling requires the collection of primary data. Our study deals with store level secondary data that is cross-sectional in nature. As a result, segmenting stores by using this data offers useful insights into the determinants of grocery store performance.

We add to the knowledge generated by past research by integrating a wide range of variables to model grocery store performance. Specifically, we develop two models explaining the effect of a store’s internal and external environment on the variation in (1) a market-based measure of performance—sales, and (2) a productivity-based measure of performance—sales per square foot. Furthermore, we segment the stores on the basis of their socioeconomic characteristics and empirically demonstrate the differential impact of a store’s internal and external environment on store performance across segments. The proposed models are estimated and the consistency of results assessed using the Market Metrics data.

Our findings should provide useful insights into issues that retailers regularly encounter within a store, such as the impact of the number of checkout counters, the kind of merchandise sold, double couponing, keeping the store open for 24 hours, and neighborhood characteristics on sales and sales per square foot. In addition, it should help them understand whether the socioeconomic characteristics of the trade area influence the effect of a store’s internal and external environment on sales and sales per square foot. These insights should enable managers to plan for desired levels of performance by using readily available secondary data.

To summarize, this study contributes to the literature in several ways. This study focuses on empirically demonstrating the effect of a store’s internal and external environment on store performance. It is, also, one of the first studies to empirically show that using the same retail environment strategies across all stores might not be an appropriate strategy. Strategies should, in fact, depend upon the socioeconomic characteristics of the trade area. Most studies in the past have focused on forecasting market-based performance measures, such as sales (Ingene and Lusch, 1980; Kumar and Leone, 1988) or market share (Durvasula, Sharma, and Andrews, 1992). Here, in a single study, we address two dimensions of performance—market-based and productivity-based performance. In other words, our study integrates a broad spectrum of variables in modeling the effect of store atmospherics on store performance.

In this study, we show that socioeconomic characteristics of the trade area moderate the effect of retail atmospherics on store performance. We demonstrate a methodology for predicting store performance (for existing and new stores) based on the internal and external environment of grocery stores by using aggregate secondary data. Specifically, the findings are used to offer guidelines to retailers for attaining desired levels of sales and sales per square foot by using readily available data.

This research is organized as follows: first, past research is reviewed in light of the current study. Hypotheses are presented next. Then, data, methodology, and results are discussed. Implications of the results to grocery store managers are drawn. Finally, limitations of this study and suggestions for future research are discussed.

**Literature Review and Hypotheses**

We position this research in two ways. First, we discuss the literature on why retail atmospherics is critical for a store’s performance. Next, we discuss our study in the light of past research on measuring store performance and then other relevant studies. In doing so, we provide a brief review of the literature on methods used for assessing/forecasting sales performance in retail outlets. This is important since our framework also enables retailers to generate an estimate of performance measures.

**Retail Atmospherics**

Atmospherics are often designed to create a buying environment that produces specific emotional effects that will enhance a consumer’s likelihood of purchase. Both the functional attributes in the store (e.g., merchandise type) and the emotional

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3 Store performance can be assessed using three different measures (Dunn, Lusch, and Gable, 1995): market-based performance measures, such as sales or market share, productivity-based performance measures, such as sales per square foot or sales per employee, and profitability-based performance measures, such as gross margin or return on assets. It is useful to study all types of store performance measures because these measures of store performance are mutually exclusive. For example, stores with high dollar sales might not ensure a high productivity-based performance (e.g., sales per square foot) or a high profitability-based performance (e.g., gross margin). In this research, since profit margins are not available across retailers, we restrict our analysis to only market and productivity-based measures of performance.

4 It is important to state why we use different models for explaining weekly dollar sales and sales per square foot because it can be argued that the weekly sales can be predicted knowing the sales per square foot and the square footage of the store. There are two reasons for specifying separate models. First, sales and sales per square foot are conceptually different dependent variables. One is a market-based measure of performance and the other is a productivity-based measure of performance. Second, even if we could predict sales by estimating only the sales per square foot model, the effect of individual variables on weekly dollar sales cannot be predicted.
Table 1. A Brief Review of Literature on Retail Performance

<table>
<thead>
<tr>
<th>Method</th>
<th>Performance Measure</th>
<th>Explanatory Variables</th>
<th>Level of Data Collection</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space Sales Ratio (Ghosh and McLafferty, 1987)</td>
<td>Sales</td>
<td>Share of selling space of store</td>
<td>Aggregate</td>
<td>No past data needed</td>
</tr>
<tr>
<td>Proximity Area Method (Ghosh and McLafferty, 1987)</td>
<td>Sales</td>
<td>Population of geographical area closer to the outlet than any other outlet</td>
<td>Aggregate</td>
<td>No past data needed</td>
</tr>
<tr>
<td>Reilly’s Law of Retail Gravitation (Reilly, 1931)</td>
<td>Proportion of retail trade from intermediate towns</td>
<td>Population and square of distance</td>
<td>Aggregate</td>
<td>To determine the extent to which two towns draw business from an intermediate town</td>
</tr>
<tr>
<td>Analog Method (Applebaum, 1966)</td>
<td>Sales</td>
<td>Distance, per capita purchases by consumers</td>
<td>Individual</td>
<td>Wide variety of variables can be considered</td>
</tr>
<tr>
<td>Multiple Regression (Ingene and Lusch, 1980; Lord and Lynds, 1981)</td>
<td>Sales, market share</td>
<td>Trade area demographics site characteristics, store variables, and competition</td>
<td>Aggregate</td>
<td>Effects of individual variables can be studied</td>
</tr>
<tr>
<td>Spatial Interaction Models (Huff, 1964; Ghosh, 1984)</td>
<td>Market share</td>
<td>Distance, size, autos owned, driving time, out-of-pocket cost</td>
<td>Individual</td>
<td>Market share depends upon utility derived by a store compared with total utility from all stores</td>
</tr>
</tbody>
</table>

attributes (e.g., pleasantness) that a consumer elicits in his/her mind determine a store’s personality. Darden and Babin (1994) indicated that the emotional and functional aspects are strongly correlated with each other. Therefore, this study focuses on the retailing personality as measured by the functional aspects of a store’s environment. In fact, Titus and Everett (1995) argued that the design of the shopping environment is an important element in the consumer retail search process.

According to Ward, Bitner, and Barnes (1992), the physical environment that a retail store presents to potential customers can be divided into two parts: the external environment, that part of the store visible prior to entry into the retail sales or service area (parking lot, façade, entrance, etc.), and the internal environment, that part visible from the retail selling space. Although no research that we know of addresses the issue, it is reasonable to suppose that the relative importance of the external versus the internal environment in determining a store’s categorization may differ across retailers.

Darley and Gilbert (1985) and Holahan (1986) suggested that the built environment has many significant influences on human psychology and behavior.

Donovan and Rossiter (1982) and Gardner and Siomkos (1986) have suggested the importance of physical environment in retailing. Based on the literature on typicality and attitude (Loken and Ward, 1990), it is proposed that a consumer’s attitude be positively related to the internal and external environment of the retail setting. Recently K-Mart has created three different types of stores—K-Mart, Big K, and Super K. Similarly, Kroger has developed a new concept called the Signature store (in addition to the regular store). The differences across these types of stores being the assortment of merchandise sold as well as various services including in-store bakery, banking facilities, open for 24 hours, etc. More quality services are offered in larger stores, which are located in many neighborhoods. In other words, the store’s environment should be attractive enough (in case of grocery stores, it could be the advertising of the availability of banking services, travel agency, restaurant, open for 24 hours, offering of double or triple couponing, etc.) for a consumer to enter. In order to complete a sale, the other environmental variables, such as assortment of merchandise and in-store bakery, should be acceptable to the consumer. Thus, retail atmospherics play a critical role in consumer shopping behavior.

Store Performance

An aggregate measure of the effect of consumer shopping behavior is store performance. Ghosh and McLafferty (1987), Wrigley (1990), and Rogers (1992) provide excellent reviews on forecasting retail performance. Table 1 summarizes the literature on forecasting retail performance along four dimensions—the method used, the type of performance measure used (sales, market share), the type of explanatory variables used (for example, managerial judgements, distance, etc.), and type of data collection required (individual level vs. aggregate). Our study uses linear models and requires aggregate level secondary data. It adds to the knowledge generated by past
research by proposing a method for forecasting weekly dollar sales (a measure of market-based performance) and sales per square foot (a measure of productivity-based performance). While earlier research has predominantly explained market-based performance (sales, market share) by using variables including distance, size of the store, and trade area demographics, this study focuses on the effect of a store's internal and external environment on sales and sales per square foot. In addition, the moderating effects of the socioeconomic characteristics of the trade area also are demonstrated.

Other related research on retail store choice has dealt with helping managers select neighborhoods under different circumstances. These studies include selecting store locations by using managerial judgement (Durvasula, Sharma, and Andrews, 1992), under a changing environment (Ghosh and McAfferty, 1982), selecting multiple store locations (Achabal, Gorr, and Mahajan, 1982), and a portfolio of stores (Mahajan, Sharma, and Srinivas, 1985). Like forecasting performance studies, these studies primarily focus on achieving desirable levels of sales or market share by using external environment characteristics.

It is also important to compare this study with other relevant studies. Walters and Mackenzie (1988) and Walters and Rinne (1986) developed hypotheses on the effects of loss leaders, in-store price specials, and double coupon promotions on overall store sales, profits, and traffic. Thus, in addition to market-based factors (sales and traffic), they also explained profitability based performance (profits). Their study primarily focused on studying the impact of promotional policies on store performance. Like Walters and Mackenzie's (Walters and Mackenzie, 1988) and Walters and Rinne's (Walters and Rinne, 1986) study, the dependent measure of interest is store performance. However, our study differs from theirs in scope. While they considered only promotional policies, we include a number of a store's internal and external environment variables, including promotional policy variables, such as double couponing. Also, we explain market-based performance (dollar sales) and productivity-based performance (sales per square foot).

Hoch et al.'s (Hoch, Byung-Do, Montgomery, and Rossi, 1995) study used geodemographic data to predict store level price elasticities. Their study, too, was conducted with promotional policy as the focus (the sales impact of a reduction in price due to retail price promotion). They use Becker's (Becker, 1965) theory of allocation of time to develop the hypotheses, which also forms the theoretical basis for our hypotheses. Our study differs from Hoch et al.'s (Hoch, Byung-Do, Montgomery, and Rossi, 1995) study in focus. They focused on promotional policy, and their analysis was done at the product category level. We include a wide range of environmental variables, and our analysis is done at the store level. Furthermore, in addition to explaining dollar sales, we also explain sales per square foot.

Ghosh (1984) focused on the nonstationarity of parameter estimates. He proposed that parameter nonstationarity arises due to two factors—the socioeconomic characteristics of the shopper and the spatial characteristics of the alternative considered (competition) by the individuals. His study tested nonstationarity of parameters in a "gravity" model due to spatial characteristics of competition. Like Ghosh (1984), we propose that the effects of environmental variables vary depending on socioeconomic characteristics of the trade area. While Ghosh's (Ghosh, 1984) study focused on testing of nonstationarity, our study focuses on explaining store performance. Also, while his study was done at the individual level (involving primary data collection), our study uses aggregate secondary data (which is readily available).

Cottrell's (Cottrell, 1973) and Davies's (Davies, 1973) studies also addressed store performance. However, they were carried out at a time when geodemographic data were difficult to obtain. Therefore, they are not discussed in detail. Thus, the present study builds up on these past studies and attempts to provide an integrated view for the retailer to improve their performance based on the store's internal and external environment.

**Hypotheses**

The focus of this study is on offering guidelines to retailers for determining the appropriate retail environment to attain desired levels of store performance. The internal environment we study to explain store performance includes convenience (number of checkout counters per square foot of area), scambled merchandising (number of nongrocery items sold), whether a store at least doubles manufacturers' coupons, whether a store has banking facilities, and whether a store is open 24 hours. The total number of households in the area and the geographical region where a store is located operationalizes a store's external environment. The socioeconomic characteristics of the trade area (part of the external environment) studied include the percentage of households with annual income greater than $30,000, the percentage of households with a family size of four or more, and the percentage of households owning their homes. Hypotheses on the effect of the internal and external environmental variables are derived based on the theory of the allocation of time between different activities (Becker, 1965). Hoch, Byung-Do, Montgomery, and Rossi (1995) and Blattberg, Buesing, Peacock, and Sen (1978) in the context of sales promotion have used this theory. While Hoch, Byung-Do, Montgomery, and Rossi (1995) applied the theory for predicting store level price elasticity by using trade area demographics, Blattberg, Buesing, Peacock, and Sen (1978) applied the theory to determine the demographic characteristics of deal prone consumers.

Becker's (Becker, 1965) theory postulated that shopping activity is a part of the overall household production process.

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1 Some of the operationalizations of the variables are constrained by the availability of data.
Households determine their returns from shopping (how much and what they buy) by analyzing total costs of shopping. In addition to the cost of goods, the total costs of shopping for a household include inventory, transportation, opportunity, and search costs. For example, the costs of shopping for the same basket of goods at the same store for households living near the grocery store are lower than those for households living farther from the store. Similarly, the costs of shopping for households whose incomes are high are more than that for households with relatively low incomes due to higher opportunity costs of time. Furthermore, the theory postulates that households tend to substitute the cost of time with goods and vice versa. For example, high-income households might be more interested in buying expensive convenience goods thereby trading off the costs of the product against the costs of time. Using Becker’s (Becker, 1965) theory, we propose two sets of hypotheses: (1) the effect of retail environment on sales, and (2) the effect of retail environment on sales per square foot.

In the development of hypotheses, the discussion surrounding the hypotheses related to the effects of individual variables on sales and sales per square foot is similar. However, we are interested in empirically exploring the differential effects (in terms of magnitude as well as direction) of the internal and external environment variables. Therefore, hypotheses related to both sales and sales per square foot are developed and stated simultaneously.

THE EFFECT OF A STORE’S INTERNAL ENVIRONMENT ON SALES AND SALES PER SQUARE FOOT. The total time spent in grocery shopping can increase considerably because of long waits due to insufficient checkout counters (relative to the size of the store). If the number of checkout counters relative to the size of the store (convenience) is high then the waiting time is likely to be lower. Consequently, the opportunity cost to shoppers due to waiting will be lower. Shoppers can partially substitute this cost saving by shopping for other goods, thereby increasing store sales. Also, the more convenience-oriented consumers who shop at other stores could switch stores (Kumar and Leone, 1988) due to greater convenience.

In a study of supermarket stores, Cottrell (1973) found that sales per square foot were higher for stores with higher number of checkout counters per square foot of store area. Also, Ingene (1984) used waiting time at checkout to measure service quantity and showed that it influenced market potential for a store. Based on Becker’s (Becker, 1965) theory and past literature, we hypothesize that,

H1a: Sales of a grocery store are positively related to the number of checkout counters per square foot of selling area.

H2a: Sales per square foot of a grocery store are positively related to the number of checkout counters per square foot of selling area.

Literature on multipurpose shopping indicates that agglomeration of diverse retailers in shopping centers increases the attractiveness of those places for consumer shopping (Craig, Ghosh, and McLafferty, 1984). Agglomeration is advantageous because it facilitates multipurpose travel by consumers and allows them to benefit from economies of scale. When shopping at grocery stores, the availability of diverse merchandise increases the attractiveness of stores because shoppers can do one-stop shopping instead of shopping at two or more different stores. In the context of the theory of allocation of time, the total cost of shopping reduces due to the availability of diverse merchandise. In addition to buying more of the goods they would have bought at the same store, consumers buy other merchandise that they would have bought at other stores, resulting in higher store sales.

Stores selling nongrocery products are said to use scrambled merchandising. Such products include automotive supplies, film developing, sporting goods, and video renting. The number of nongrocery products and services sold by the retailer operationalizes the extent of scrambled merchandising. We hypothesize that,

H1b: Sales of a grocery store are positively related to the extent of scrambled merchandising by the grocery store.

Boston College conducted a research and found that in the Chicago area, the number one reason why consumers shop a store is for assortment and selection (Liebeck, 1994). However, Hutchinson (1993) opined that consumers limit their shopping on a given trip for two basic reasons. First, there are costs to shopping that offset the potential benefits of finding a higher quality item or a lower price. Each consumer may have no more than two or three options (i.e., stores) in his/her consideration set (Hauser and Wernerfelt, 1990). Since consumers want to buy high quality products at a lower price, it is not necessary that they would shop in one store, even though it offers a larger assortment of merchandise. Given that stores are located close to one another, shopping costs can be lower resulting in increase in the number of stores shopped by consumers.

Therefore, it is possible that as retailers expand their store size by offering more assortments, the increase in sales per square foot need not be increasing in the same proportion. In other words,

H2b: Sales per square foot of a grocery store are negatively related to the extent of scrambled merchandising by the grocery store.

Couponing, in general, and double or triple couponing, in particular, appeal to a sizeable market segment and may attract not only coupon users among the store’s regular clientele but also coupon users loyal to competing retailers, thereby increasing store traffic (Walters and Mackenzie, 1988). Double or triple coupons influence store sales in two ways—by stimu-
lating store traffic and increasing sales for products for which valid coupons are in circulation. Doubling the value of manufacturers' coupons redeemed in a store increases the value of the coupon by substantially decreasing the price the consumer must pay for the product.

In the context of our theory, cost of shopping reduces because of double couponing, and households can substitute this cost saving by buying additional items, thereby increasing store sales. Therefore, we hypothesize that,

\( H1c: \) Sales of a grocery store are positively related to whether the store doubles the value of manufacturer coupons.

\( H2c: \) Sales per square foot of a grocery store are positively related to whether the store doubles the value of manufacturer coupons.

Some retailers provide 24-hour service and others provide service for limited hours. With the changing pace of society, many consumers might find it more convenient to shop at night or after the regular working hours of the grocery store because their opportunity cost of time is lower at that time. Also, many consumers who prefer to shop at such times (due to lower costs) might shift from stores that are not open 24 hours. Shoppers partially substitute this reduced opportunity cost with more goods, thereby increasing store sales. Therefore, we hypothesize that,

\( H1d: \) Sales of a grocery store are positively related to whether the grocery store is open 24 hours.

\( H2d: \) Sales per square foot of a grocery store are positively related to whether the grocery store is open 24 hours.

Recently, banks have started opening branches in many locations to increase their market share. One of the popular places where banks are being located is within grocery stores. The banking service is being offered as a convenience for customers. While the banks believe that there is some benefit to them through multiple outlets, it is not clear how the grocery industry is going to be benefited. The speculation is that if a store can draw more customers into their store because of banking facilities then the store has something to gain. On the contrary, it is not known whether the additional space allocated for banking is useful for stores with respect to sales per square foot. The assumption is that the presence of banking facilities should enhance both the store sales and sales per square foot. Therefore, we hypothesize that,

\( H1e: \) Sales of a grocery store are positively related to the presence of a bank in the grocery store.

\( H2e: \) Sales per square foot of a grocery store are positively related to the presence of a bank in the grocery store.

\( H1f: \) Sales of a grocery store are positively related to the total number of households in the trade area.

\( H2f: \) Sales per square foot of a grocery store are positively related to the total number of households in the trade area.

Different markets have different characteristics. For example, in the United States, the population density is higher in the Northeast than in the South. Therefore, stores in the Northeast should have higher sales per store. Also, the environment in different regions is different. For example, stores in the South sell alcoholic beverages, but those in the Northeast do not. These differences should influence the sales in grocery stores. Because of the multiplicity of unknown differences across geographical regions, it is difficult to hypothesize the direction. Therefore, we hypothesize that,

\( H1g: \) Sales of a grocery store vary across geographical regions in which they are located.

\( H2g: \) Sales per square foot of a grocery store vary across geographical region in which they are located.

Methodology

Data

A.C. Nielsen provided the Market Metrics data at the store level. It covers five different regions of the United States (Northwest, Midwest, Southeast, Northeast, and Southwest), and varying types of stores (supermarkets, superstores, etc.).

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\(^6\) Assuming the degree of competition is fairly constant in both areas.
Data for the 646 stores⁷ in this study can be classified into three categories:

1. Store description: includes data such as average weekly sales (in dollars), total selling area, and number of checkout counters for each store.
2. Store's internal environment: includes the types of products sold in each store. For example, pharmacy prepared food, etc. (there are 28 different kinds of products included). Also, whether the store is open 24 hours, provides banking facilities, offers double couponing, etc.
3. Store's external environment: includes the total number of households in the trading area and the region where the store is located, as well as the number of people in different age groups, income groups, family sizes, occupation, and number of people renting or owning their residence.

Market Metrics define trading area for all stores by using proprietary models that take into account population density (urban vs. suburban), competition, road conditions, and various regional differences. Furthermore, they define a trading area by expanding a polygon around each store location to enclose an area large enough to support the all commodity volume (ACV) of the store (Hoch, Byung-Do, Montgomery, and Rossi, 1995).

After removing the data on stores with extreme values (outliers), the data were divided into an estimation sample of 460 stores and a holdout sample of 160 stores. The holdout sample would be used for checking the consistency of the parameter estimates. This division was done using stratified random sampling with the stratification based on the region. In other words, we segregated the data into five groups for the five regions. Then, from each group we randomly selected approximately three-fourths of the sample for estimation and one-fourth for holdout. Finally, we stacked the data for all the stores in the estimation sample for the five regions to perform the analysis. Similar stacking was done for the holdout sample. The random selection for stores of the estimation sample was done using the RANUNI procedure in SAS.

Model

We specify the two models—the SALES model for explaining the effect of retail environment on sales and the PRODUCTIVITY model for explaining the effect of retail environment on sales per square foot. We tested different model forms (linear, exponential, and multiplicative) and found that the linear form offered the best fit⁸. The SALES and the PRODUCTIVITY models can be specified by equations 1 and 2:

\[
\text{SALES}_j = \alpha_0 + \alpha_1 \text{ CONVE}_j + \alpha_2 \text{ SCRAMB}_j + \alpha_3 \text{ DC}_j + \alpha_4 \text{ O24}_j + \alpha_5 \text{ Bank}_j + \alpha_6 \text{ THH}_j + \alpha_7 \text{ NEAST}_j + \alpha_8 \text{ MWEST}_j + \alpha_9 \text{ SWEST}_j + \varepsilon_j
\]

\[
\text{PRODUCTIVITY}_j = \beta_0 + \beta_1 \text{ SCRAMB}_j + \beta_2 \text{ DC}_j + \beta_3 \text{ O24}_j + \beta_4 \text{ Bank}_j + \beta_5 \text{ THH}_j + \beta_6 \text{ NEAST}_j + \beta_7 \text{ MWEST}_j + \beta_8 \text{ NWEST}_j + \beta_9 \text{ SWEST}_j + \delta_j
\]

Where, \( j = \) grocery store (\( j = 1 \) to 460). \( \text{SALES}_j = \) weekly dollar sales for grocery store. \( \text{PRODUCTIVITY}_j = \) sales per square foot for the grocery store. \( \text{CONVE}_j = \) number of checkout counters per 10,000 square foot of selling area. \( \text{SCRAMB}_j = \) number of nongrocery products sold (ranging from 0 to 28). \( \text{DC}_j = 1 \) if store doubles or triples manufacturers' coupons (0 otherwise). \( \text{O24}_j = 1 \) if store is open 24 hours (0 otherwise). \( \text{Bank}_j = 1 \), if banking facility is available. \( \text{THH}_j = \) total number of households in the trade area (in thousands). \( \text{NEAST}_j = 1 \) if store is located in the Northeast (0 otherwise). \( \text{MWEST}_j = 1 \) if store is located in the Midwest (0 otherwise). \( \text{NWEST}_j = 1 \) if store is located in the Northwest (0 otherwise). \( \text{SWEST}_j = 1 \) if store is located in the Southwest (0 otherwise). \( \alpha_0, \alpha_1, \ldots \alpha_9 \) = parameter estimates for the SALES model. \( \beta_0, \beta_1, \ldots \beta_9 \) = parameter estimates for the PRODUCTIVITY model. \( \varepsilon_j \) = error term for the SALES model. \( \delta_j \) = error term for the PRODUCTIVITY model.

We checked for heteroscedasticity and multicollinearity. There were no serious problems of heteroscedasticity as evidenced by a plot of the error terms with the predicted values. Also, there was very little multicollinearity as evidenced by the correlations between the independent variables as well as the condition index (which is below the condition index of 30 for moderate levels of multicollinearity as suggested by Kleinbaum, Kupper, and Muller, 1988).

Results

The Effect of Retail Environment on Sales (the SALES Model)

The SALES model results are summarized in Table 2. Results indicate that the retail environment variables significantly explain the variation in store sales across grocery stores (Model \( F = 429, p = 0.0001 \)). Also, 87.2% of the variation in store sales is explained by store policies and store location (Adjusted \( R^2 = 0.872 \)). Past studies attempting to predict store performance also have found similar \( R^2 \) (Ingene and Lusch, 1980; Ghosh, 1984).

The effect of number of checkout counters per square foot of store area (convenience) is positive and significant. Therefore, hypothesis H2a is supported. Sales are positively related to the extent of scrambled merchandising (\( \alpha_7 = 5289, p = 0.0001 \)). The more nongrocery products a store sells, the higher the store's dollar sales. Therefore, hypothesis H2b is
supported. Sales are positively related to whether the store doubles the manufacturer coupons (α = 11584, p = 0.0689), which is also in the hypothesized direction. This is an interesting finding because of a tendency among retailers to use double couponing strategy to combat competitive pressures (i.e., not to lose sales to competition). Store sales are significantly related to a store being open 24 hours, and therefore hypothesis H2d is supported. The presence of banking services in the grocery store increases the sales significantly (α = 2901, p = 0.0592), and therefore H1e is supported.

Dollar sales are positively related to the total number of households served by the store (α = 61585, p = 0.0001). Therefore, hypothesis H1f is supported. The coefficients for the geographic regions in which the store is located (Northeast, Midwest, Northwest, and Southwest) were found to be significant (α = 49212, p = 0.0001), (α = −10042, p = 0.0462), (α = 19464, p = 0.0230), and (α = 28212, p = 0.0104), respectively). The southeastern region was treated as the base level. Stores in the Northeast, Northwest, and Southwest have higher weekly dollar sales than stores in the southeastern part of the United States. This could be for a variety of reasons including population density, size of the stores, types of merchandise sold, and level of competition. Also, stores in the Midwest have lower sales than stores in the Southeast. Therefore, hypothesis H1g is supported.

The Effect of Retail Environment on Sales per Square Foot (The PRODUCTIVITY Model)

The PRODUCTIVITY model results are summarized in Table 2. Results indicate that both the internal and external environment variables significantly explain the variation in sales per square foot across supermarkets (Model F = 112.2, p = 0.0001). Also, the retail environment explains 67.12% of the variation in weekly sales per square foot.

Sales per square foot are positively related (β = 71.21, p = 0.0001) to the number of checkout counters per square foot of store area (convenience). In other words, the more convenience a grocery store offers, higher is their sales per square foot. Therefore, hypothesis H2a is supported. Sales per square foot are negatively related to the extent of scrambled merchandising by a store (β = −5.82, p = 0.0001). This result is as hypothesized and offers an interesting finding. Stores that sell more non-grocery products get more dollar sales, but it leads to lower sales per square foot. This finding is acceptable given that many retailers are facing a downward trend in sales per square foot. This is partly because the additional merchandise carried may be of a lower price or just more space is added to the existing merchandise display. Sales per square foot are significantly related to a store offering double couponing (β = 8.77, p = 0.0715) and a store being open 24 hours (β = 20.82, p = 0.01). Therefore, hypotheses H2c, H2d, and H2e are supported. However, the addition of banking facilities yields a lower sales per square foot (β = −7.01, p = 0.082). This implies that the space provided to the bank does not result in a proportionate increase in store sales per square foot.

Sales per square foot are positively related to the total number of households in the trade area (β = 47.81, p = 0.0001). Therefore, hypothesis H2f is supported. The coefficients for the four regions in which the store was located were found to be significant. Stores in the Northeast (β = 152.12, p = 0.0001), Northwest (β = 82.14, p = 0.0001), and Southwest (β = 98.92, p = 0.0007) have higher sales per square foot than stores in the southeastern part of the United States. However, there is no statistically significant difference between sales per square foot of stores in the Midwest and stores in the Southeast. Overall, there is support for hypothesis H2g.

In summary, the results are as hypothesized with the exception of the effect of banking services on sales per square foot.

Identification of Homogeneous Trade Areas by Using Socioeconomic Characteristics

The 460 stores were segmented using cluster analysis based on the socioeconomic characteristics of the trade area: percentage of households with annual income greater than $30,000, percentage of households with four or members, and percentage of households owning their residences. First, hierarchical clustering was conducted using Ward’s method. Punj and Stewart (1983) recommend that hierarchical and nonhierarchical clustering be used sequentially. The results from Ward’s method were used as seed for a nonhierarchical clustering. The hierarchical and nonhierarchical clustering were done using the CLUSTER procedure and the FASTCLUS procedure in SAS, respectively. A four-cluster solution was obtained.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Sales</th>
<th>Productivity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model</td>
<td>Model</td>
</tr>
<tr>
<td>Intercept</td>
<td>10.281*</td>
<td>12.21*</td>
</tr>
<tr>
<td>CONVE</td>
<td>4.892*</td>
<td>7.21*</td>
</tr>
<tr>
<td>SCRAMB</td>
<td>5.289*</td>
<td>−5.82*</td>
</tr>
<tr>
<td>DC</td>
<td>11.584*</td>
<td>8.77*</td>
</tr>
<tr>
<td>O24</td>
<td>10.398*</td>
<td>20.82*</td>
</tr>
<tr>
<td>Bank</td>
<td>2.901*</td>
<td>−7.01*</td>
</tr>
<tr>
<td>THH</td>
<td>61.585*</td>
<td>47.81*</td>
</tr>
<tr>
<td>NEAST</td>
<td>49.212*</td>
<td>152.12*</td>
</tr>
<tr>
<td>MWEST</td>
<td>−10.042*</td>
<td>NS</td>
</tr>
<tr>
<td>NWEST</td>
<td>19.464*</td>
<td>82.14*</td>
</tr>
<tr>
<td>SWEST</td>
<td>28.212*</td>
<td>98.92*</td>
</tr>
<tr>
<td>R² (adjusted)</td>
<td>0.872</td>
<td>0.6712</td>
</tr>
</tbody>
</table>

Significant at the 5% level.
Significant at the 10% level.
Table 3. Interpretation of Segment Solution

<table>
<thead>
<tr>
<th>Segment Proportions</th>
<th>Number of stores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Segment</td>
<td>HHSIZE</td>
</tr>
<tr>
<td>1</td>
<td>30.2 (high)</td>
</tr>
<tr>
<td>2</td>
<td>21.4 (low)</td>
</tr>
<tr>
<td>3</td>
<td>20.7 (low)</td>
</tr>
<tr>
<td>4</td>
<td>17.1 (low)</td>
</tr>
</tbody>
</table>

HHSIZE, percentage of households with four or more family members; HHINC, percentage of households with household income greater than $30,000; HHOWN, percentage of households owning their homes.

INTERPRETATION OF THE CLUSTER SOLUTION. The cluster solution was interpreted using cluster means (Aaker, Kumar, and Day, 1998). The cluster means are given in Table 3. Based on the variable proportions for each cluster, they were classified as low or high (on a relative basis). For example, in Table 3, the household income proportions of 74.8% for cluster 1 and 67.2% for cluster 2 are interpreted as high household income whereas household income proportions of 44.2 and 48.7% are interpreted as low. Similar interpretations for household size and home ownership are given in Table 3. To summarize, cluster 1 corresponds to trade areas with higher income, bigger families who own homes, cluster 2 corresponds to trade areas with higher income, smaller families who own homes, cluster 3 corresponds to trade areas with lower income, smaller families who own homes, and cluster 4 corresponds to trade areas with lower income, smaller families who tend to rent. The four clusters consisted of 107, 160, 109, and 84 stores, respectively.

CROSS-VALIDATION OF CLUSTER SOLUTION. The cluster centroids were obtained from the cluster solution of the estimation sample of 460 stores. The cluster solution was validated using a holdout sample of 160 stores. Stores in the holdout sample were assigned to the cluster that had the smallest Euclidean distance from the four cluster centroids. The degree of agreement between the assignment of the observations and a separate cluster analysis of the holdout sample was used as a measure of consistency of the cluster solution. It was found that 140 (87.5%) stores of the 160 stores in the holdout sample were correctly classified, indicating good consistency of the cluster solution.

The Differential Effect of Internal and External Environment on Sales and Sales per Square Foot due to Socioeconomic Characteristics of the Trade Area

High-income households have high opportunity costs of time. They tend to substitute time by buying goods that will save time and are willing to pay for the added convenience. Therefore, high-income households tend to spend more money for the same bundle of products than low-income households do. It follows, then, that higher the percentage of high-income households in a trade area, higher will be the effect of both internal and external environment on sales of a store in that trade area. From another perspective, the greater the percentage of households with high incomes, the greater the extent of dispensable income in the trade area and therefore the greater the impact of retail environment on store sales.

Inventory or storage costs influence a household’s ability to buy larger quantities and take advantage of deals. Households with storage facilities have the ability to buy larger quantities by benefiting from deals and sales promotions. Homeowners have greater storage space compared with those that rent and live in apartments and therefore can buy larger quantities. Therefore, the greater the percentage of home owners in a trade area, the greater the impact of retail environment on store sales.

Time is important to larger households because of the variety of activities including those involved in childcare and other forms of time commitment (time that can be used for other activities and work). Therefore, such households would tend to buy brands and products that save time and cost more. Also, because of greater number of people in the household, their grocery bill would be higher than that for smaller families. Therefore, the greater the percentage of large families in a trade area, the greater the impact of retail environment on store sales.

To summarize, households have different costs of shopping depending on their family size, income, and home ownership. Households with higher costs of shopping are likely to be influenced (what they buy and how much they buy) more by a store’s environment, such as convenience of shopping, scrambled merchandising, 24-hour service, and whether the store is located in a bigger or smaller trade area than households that have relatively low costs of shopping. Also, the effects of retail environment on dollar sales are likely to be higher in trade areas that have higher percentage of households with high costs of shopping.

The clustering of all the stores in our data set yields four segments, which vary on the household income, family size, and home ownership. We agree that the effects of retail environment variables on store performance should vary with segments given the differences in socioeconomic characteristics. Those in group 1 (high levels for all three socioeconomic characteristics) would have the highest total costs of shopping, followed by group 2 (high levels for two of the three socioeconomic characteristics) and group 3 (high levels for one of the three socioeconomic characteristics). Group 4 (low levels for all three socioeconomic characteristics) would have the least costs of shopping and therefore would be influenced the least by the retail environment. Therefore, we hypothesize that,

H3: The effects of retail environment variables on sales
of a grocery store vary by the segments based on socioeconomic characteristics.

H4: The effects of retail environment variables on sales per square foot of a grocery store vary by the segments based on socioeconomic characteristics.

Results
We specify the SEGMENTED SALES (equation 3) and PRODUCTIVITY (equation 4) model for explaining the differential effect of retail environment on performance due to socioeconomic characteristics, and the variables are as defined in equations 1 and 2.

\[ \text{SALES}_{ij} = \alpha_0 + \alpha_1 \times \text{CONVE}_{ij} + \alpha_2 \times \text{SCRAMB}_{ij} + \alpha_3 \times DC_{ij} + \alpha_4 \times O24_{ij} + \alpha_5 \times \text{Bank}_{ij} + \alpha_6 \times \text{THH}_{ij} + \alpha_7 \times \text{NEAST}_{ij} + \alpha_8 \times \text{MWEST}_{ij} + \alpha_9 \times \text{NWEST}_{ij} + \epsilon_{ij} \]  

(3)

\[ \text{PRODUCTIVITY}_{ij} = \beta_0 + \beta_1 \times \text{CONVE}_{ij} + \beta_2 \times \text{SCRAMB}_{ij} + \beta_3 \times DC_{ij} + \beta_4 \times O24_{ij} + \beta_5 \times \text{Bank}_{ij} + \beta_6 \times \text{THH}_{ij} + \beta_7 \times \text{NEAST}_{ij} + \beta_8 \times \text{MWEST}_{ij} + \beta_9 \times \text{NWEST}_{ij} + \delta_{ij} \]  

(4)

Where, \( j \) = grocery store (\( j = 1 \) to 460), \( i \) = segment number (\( i = 1 \) to 4). \( \alpha_0, \alpha_1, \ldots, \alpha_9 \) = parameter estimates for the SEGMENTED SALES model. \( \beta_0, \beta_1, \ldots, \beta_9 \) = parameter estimates for the SEGMENTED PRODUCTIVITY model. \( \epsilon_{ij} \) = error term for the SEGMENTED SALES model. \( \delta_{ij} \) = error term for the SEGMENTED PRODUCTIVITY model.

The SEGMENTED SALES model (equation 3) was estimated for the four segments (107 stores in segment 1, 160 stores in segment 2, 109 stores in segment 3, and 84 stores in segment 4). In all the four segments, the retail environment variables significantly explain the variation in dollar sales (\( F = 141.8, p = 0.001 \) for segment 1, \( F = 161.2, p = 0.001 \) for segment 2, \( F = 287.3, p = 0.001 \) for segment 3, and \( F = 110.8, p = 0.001 \) for segment 4). Also, 93.47, 91.44, 96.32, and 94.12% (given by adjusted R²) of the variation in dollar sales of stores in segments 1, 2, 3, and 4, respectively, is explained by the retail environment variables. The interpretation of model coefficients for the four segments is similar to that of coefficients in the overall SALES models.

An interesting observation from the results is that variables have different levels of effect in the SALES model across segments in the SEGMENTED SALES model. For example, convenience is significant and has a coefficient of 4892 in the overall model while it has coefficients of 9282, 4752, 1028, and 0 for segments 1 through 4, respectively. Also, double couponing by the store is significant in the SALES model but is not significant in segment 1 of the SALES model. It is possible that affluent customers do not react to double couponing offers relative to customers in poor neighborhoods.

Regarding scrambled merchandising, the effects are different across segments. For example, the coefficients for SCRAMB are 9497, 5891, 3071, and 1028 for segments 1 through 4, respectively. It is plausible that affluent customers do not cherry pick (visiting multiple stores) and therefore shop at one store for more items relative to customers residing in poor neighborhoods. Similarly, consumers in segment 1 (affluent) contribute to sales more due to remaining open for 24 hours (\( \alpha_{15} = 15212 \)) relative to consumers in segment 4 (\( \alpha_{14} = 1429 \)). Given that the customers living in affluent areas have busy schedules, it is probable that they shop during late evenings and at nights. The effects due to presence of banking services on sales are higher for segment 1 than for other segments. In fact, the effect of the presence of banking services is not significant for segment 4. Also, as more affluent households (THH) are present, higher is the contribution to sales in segment 1 (\( \alpha_{15} = 77451 \)) relative to segment 4 (\( \alpha_{14} = 42848 \)). Likewise, the effects due to regions vary across segments. Thus, it is apparent that neighborhood characteristics are also important in designing the internal and external environment.

Regarding the segment-wise productivity model, many differences are observed across segments. In general, the relative magnitudes of effects vary across segments in the productivity model.

Evaluating the Consistency of Results
Analyzing how well the parameter estimates predict sales and sales per square foot assessed the consistency of the SEGMENTED SALES and the SEGMENTED PRODUCTIVITY models. For this purpose, data from the 160 stores in the holdout sample was used. The 160 stores were segmented into four groups based on their socioeconomic characteristics. The stores in the holdout sample that had similar neighborhood characteristics (to the stores in the estimation sample) were only included in the analysis. Also, stores with variables outside the range of the estimation sample were not included. Overall about 82% (\( n = 131 \)) of the observations were retained. Sales and sales per square foot were “computed” by substituting coefficients estimated previously (shown in Tables 4 and 5) into equations 3 and 4. The “actual” values for the stores were compared with the computed values. The error in predicting the average weekly dollar sales was calculated as the difference between actual and computed average weekly dollar sales. The criterion of average absolute error (AAE) was used. It must be noted that this reanalysis is an extremely conservative test of the consistency of results and parameter estimates (Karande and Kumar, 1995). Results indicate that the AAE for the SEGMENTED SALES model is $22,984. In other words, on an average there is an absolute difference of $22,984 between the predicted and actual (the mean of the actual SALES was $301,480) values of average weekly dollar sales, which amounts to a 7.6% error. A part of this error
Table 4. Results of the Segmented Sales Model

<table>
<thead>
<tr>
<th>Variable</th>
<th>Segment 1</th>
<th>Segment 2</th>
<th>Segment 3</th>
<th>Segment 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>14,821</td>
<td>9,084</td>
<td>13,065</td>
<td>27,042</td>
</tr>
<tr>
<td>CONVE</td>
<td>9,282</td>
<td>4,752</td>
<td>1,028</td>
<td>NS</td>
</tr>
<tr>
<td>SCRAMB</td>
<td>9,497</td>
<td>5,891</td>
<td>3,071</td>
<td>1,028</td>
</tr>
<tr>
<td>DC</td>
<td>NS</td>
<td>9,257</td>
<td>14,283</td>
<td>21,251</td>
</tr>
<tr>
<td>O24</td>
<td>15,212</td>
<td>7,286</td>
<td>4,117</td>
<td>1,429</td>
</tr>
<tr>
<td>Bank</td>
<td>4,284</td>
<td>2,502</td>
<td>691</td>
<td>NS</td>
</tr>
<tr>
<td>THH</td>
<td>77,451</td>
<td>67,298</td>
<td>50,297</td>
<td>42,848</td>
</tr>
<tr>
<td>NEAST</td>
<td>52,147</td>
<td>41,067</td>
<td>NS</td>
<td>−12,517</td>
</tr>
<tr>
<td>MWEST</td>
<td>−16,089</td>
<td>NS</td>
<td>−9,902</td>
<td>−11,054</td>
</tr>
<tr>
<td>NWEST</td>
<td>NS</td>
<td>30,141</td>
<td>18,456</td>
<td>10,281</td>
</tr>
<tr>
<td>SWEST</td>
<td>36,421</td>
<td>25,938</td>
<td>15,913</td>
<td>NS</td>
</tr>
<tr>
<td>R² (adjusted)</td>
<td>0.9347</td>
<td>0.9144</td>
<td>0.9632</td>
<td>0.9412</td>
</tr>
<tr>
<td>Number of stores</td>
<td>107</td>
<td>160</td>
<td>109</td>
<td>84</td>
</tr>
</tbody>
</table>

NS, not significant.
^Significant at the 10% level.
^Significant at the 5% level.

could be attributed to locational differences in competition
and intensity of competitive activities. The utility of the SEG-
MENTED SALES model (equation 3) was compared with that
of the overall SALES model (equation 1) for the same set of
stores (n = 131). It is found that AAE for each segment with
the overall SALES model was at least 15 to 20% higher than
with the SEGMENTED SALES model. In other words, a retailer
who has a choice between using the aggregate or the seg-
mented model will find that the segmented model results in
a lower prediction error.

Similar analysis was done to assess the utility of the SEG-
MENTED PRODUCTIVITY model. The AAE for the SEG-
MENTED PRODUCTIVITY model (n = 131) is $50.40 (the
average of the actual sales per square foot being $576.20)
amounting to an 8.7% error. Again, a part of this error could
be attributed to locational differences in competition. Furthemore, it is found that AAE for each segment with the overall

Table 5. Results of the Segmented Productivity Model

<table>
<thead>
<tr>
<th>Variable</th>
<th>Segment 1</th>
<th>Segment 2</th>
<th>Segment 3</th>
<th>Segment 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>15.38</td>
<td>11.12</td>
<td>7.09</td>
<td>3.04</td>
</tr>
<tr>
<td>CONVE</td>
<td>88.45</td>
<td>52.36</td>
<td>31.11</td>
<td>NS</td>
</tr>
<tr>
<td>SCRAMB</td>
<td>8.96</td>
<td>5.04</td>
<td>−3.9</td>
<td>−10.54</td>
</tr>
<tr>
<td>DC</td>
<td>NS</td>
<td>6.09</td>
<td>8.71</td>
<td>11.12</td>
</tr>
<tr>
<td>O24</td>
<td>25.46</td>
<td>15.84</td>
<td>7.63</td>
<td>NS</td>
</tr>
<tr>
<td>Bank</td>
<td>6.42</td>
<td>NS</td>
<td>−3.09</td>
<td>−10.42</td>
</tr>
<tr>
<td>THH</td>
<td>60.82</td>
<td>50.96</td>
<td>42.74</td>
<td>33.17</td>
</tr>
<tr>
<td>NEAST</td>
<td>171.84</td>
<td>146.91</td>
<td>NS</td>
<td>131.96</td>
</tr>
<tr>
<td>MWEST</td>
<td>−11.22</td>
<td>NS</td>
<td>−6.04</td>
<td>NS</td>
</tr>
<tr>
<td>NWEST</td>
<td>NS</td>
<td>91.41</td>
<td>NS</td>
<td>62.48</td>
</tr>
<tr>
<td>SWEST</td>
<td>74.79</td>
<td>101.23</td>
<td>59.82</td>
<td>NS</td>
</tr>
<tr>
<td>R² (adjusted)</td>
<td>0.6763</td>
<td>0.6471</td>
<td>0.6388</td>
<td>0.6642</td>
</tr>
<tr>
<td>Number of stores</td>
<td>107</td>
<td>160</td>
<td>109</td>
<td>84</td>
</tr>
</tbody>
</table>

NS, not significant.
^Significant at the 5% level.
^Significant at the 10% level.

PRODUCTIVITY model (equation 2) for the same set of stores
is at least 14 to 20% higher than that with the SEGMENTED
PRODUCTIVITY model (equation 4). The fact that the SEG-
MENTED SALES and SEGMENTED PRODUCTIVITY models
outperform the overall SALES and overall PRODUCTIVITY
models, respectively, in prediction lends further support to
our contention that retailers should consider socioeconomic
characteristics in designing individual store environment.

Implications for Store Managers
A direct implication of the empirical findings is that retail
managers should consider the socioeconomic characteristics
of the trade area in designing individual store environment.
This information is readily available from sources such as the
census. Specifically, three types of implications can be drawn.
1. The Differential Impact of Individual Store Environment Variables on Sales and Sales per Square Foot for Stores in Different Segments and the Effects of Not Considering Socioeconomic Characteristics in Designing Individual Store Environment

Different magnitudes of effects for different segments: The effects of scrambled merchandising and total number of households on sales are different for stores in trade areas characterized by segments 1 through 4. For example, selling an additional nongrocery product results in additional weekly sales of $9,497 for stores in segment 1, $5,891 for stores in segment 2, $3,071 for stores in segment 3, and $1,028 in segment 4. In other words, selling nongrocery products results in the greatest sales increases for stores in segment 1. If clustering is not done, this differential effect gets averaged out in the overall sample where one would forecast that an additional sales of $5,289 are generated (irrespective of the segments) by selling an additional nongrocery product. Similarly, the effect of locating a store in a larger area (higher number of households) is most pronounced in segment 1. An additional 1,000 households result in incremental weekly sales of $77,451 for stores in segment 1, $67,298 for stores in segment 2, $50,297 for stores in segment 3, and $42,848 for stores in segment 4. Again, if segmenting is not used, the effect gets averaged out in the total sample where one would forecast that 1,000 additional households should generate an increase of $61,585. Similar interpretations can be offered for the differences in the magnitude of impact of convenience, the total number of households, banking services, open for 24 hours, and double couponing in different regions on sales per square foot.

Different direction of effects: Although, the overall impact of double couponing on sales is positive in the overall sample, double couponing does not impact sales significantly for stores in segment 1. While there is an impact of a store being open for 24 hours on sales per square foot in the total sample, it is found that for stores in segment 4, it has no impact. Convenience has a positive impact on sales in the total sample. However, its effect on sales is not significant in segment 4. Segment 4 includes households with low income, smaller families, and those who do not own their homes and therefore might perceive that the availability of additional convenience results in higher prices.

Similarly, the effect of scrambled merchandising on sales per square foot is not significant in segment 4. However, offering an additional nongrocery item leads to a decrease in sales per square foot of $3.90 for stores in segment 3 and $10.54 for stores in segment 4. Again, the effect gets averaged out in the total sample where it leads to a decrease in sales per square foot of $5.82 (leading to larger forecasting error). The effects of store neighborhoods in different regions can be similarly interpreted.

2. The Impact of Individual Store Policies and Store Location Variables on Sales and Sales per Square Foot

The impact of individual store policies and store location variables is illustrated with scrambled merchandising as an example. The impact of the extent of scrambled merchandising on dollar sales and sales per square foot can be determined by considering two stores in segment 4, one selling 20 nongrocery products as opposed to the other selling 15 nongrocery products. Dollar sales for the store by using greater scrambled merchandising (20 nongrocery products) would be expected to be $15,355 per week more than the other store ($\alpha_{32} = 3,071$). Similarly, the sales per square foot for the store by using greater scrambled merchandising would be expected to be $19.50 lower per square foot than the other store ($\beta_3 = -3.9$). The impact of other store environment variables on dollar sales and sales per square foot can be similarly interpreted.

3. Predicting Store Performance

Tables 6 and 7, respectively, illustrate examples of how a range of dollar sales and sales per square foot can be obtained with different store environment characteristics. For example, for a store in segment 1 with strategy 1 in Table 6, a store manager can expect to attain weekly sales of $582,539. The store is located in an area with 5,000 households in the Northeast and has a store environment that includes four checkout counters per 10,000 square feet of selling area, the sale of eight nongrocery products and services, and offers double couponing. With the same strategy, store managers could attain sales per square foot of $942. We caution the reader that the implications offered are valid only over the range of values taken by the variables for the different clusters in the estimation sample of the data set available to us.\textsuperscript{9}

Tables 6 and 7 offer some interesting implications in terms of the quantitative impact of store environment on weekly dollar sales and sales per square foot:

First, the same store policies result in different levels of sales and sales per square at different locations. For example, for a store belonging to segment 1, strategy 3 and 10 in Table 6 show the impact of locating a store serving a larger number of households. Other policies remaining the same, dollar sales go up from $530,392 per week to $762,745 per week and sales per square foot increase to $953 from $770 when the number of households increases from 5,000 to 8,000.

Similarly, the impact of regional differences can be seen in strategies 1, 2, 3, and 4. The same strategies in different geographical regions yield different results. It is seen that for stores in segment 2, the same strategy yields the highest sales in the northeast and the lowest in the Midwest and Southeast. However, for segment 4, the same strategy yields the highest sales in the Northwest and lowest sales in the Northeast.

Second, different levels of weekly dollar sales and sales per square foot can be obtained with different store policies at the same location. For example, for a store in segment 4,
Table 6. Predicted Values of Sales with Overall and Segmented Sales Models

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Table 7. Predicted Values of Sales per Square Foot with Overall and Segmented Productivity Models

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STRAT, retail environment strategy.
strategy 5 and 6 involve stores in the same location with different store environment that result in sales of $271,412 and $238,452, respectively. Similarly, the sales per square foot are $122 and $47, respectively, for the two stores with the same location but different environment.

Overall, the implications for the retailers are that (1) different performance measures yield different results, (2) different neighborhoods yield different results, and (3) retailer environment have to be tailored to achieve the desired level of performance.

Limitations and Extensions

An important outcome of this study is the illustration that retail atmospherics does matter. The use of geodemographic data to explain store performance (dollar sales and sales per square foot) by using a store's internal and external environment variables is demonstrated. Furthermore, we show that the effects of store environment on store performance vary depending on the socioeconomic characteristics of the trade area in which the store is located.

This study has a number of strengths. First, it is based on a large sample of grocery stores. The data represents different regions of the United States, different types of stores such as supermarkets and superstores, and store sizes. The use of a large sample size, along with findings on consistency of the results, should help in the generalizability of the findings. Once the model is estimated, for the purpose of forecasting, the input to this model is based on aggregate secondary data. Therefore, it is less expensive and easy to implement.

Lord and Lynds (1981), Ghosh (1984), and Rogers (1992) pointed out the problems associated with using the regression method in retail sales forecasting. These problems include statistical overfitting (large number of variables relative to the number of observations), lack of theoretical support for the variables, multicollinearity among predictor variables, and insufficient delineation of trade areas. In this study, we overcome these problems by using a large sample (460 for estimation and 131 for validation), theory to offer support for the choice of the variables, demonstrating that there is little collinearity among the predictor variables, and a clear description of neighborhoods.

This study has some limitations. Besides a store's environment, other variables such as the extent of competition, marketing variables, such as advertising and pricing, also could impact store performance. Information on music, lighting, and color inside the store also can be added to study the impact on store performance. This information was not available to us but can be addressed in future research. For example, information on pricing and advertising were not included because of nonavailability of data (due to difficulty in generalizing across products and stores), and only those demographic variables supported by our theory were included. Also, productivity-based performance could be analyzed using other measures, such as sales per employee. Additionally, future research could address profitability based performance measures, such as gross margins. Other lines of retail businesses such as departmental stores, variety stores, and drug stores also could be studied. These extensions should enable managers to get a better understanding of the effect of retail atmospherics on a retail store performance.

Another interesting application of this study is for benchmarking. Benchmarking can be used to develop a standard or measure against which to compare performance. Benchmarks could be established for store performance by using a store's internal and external environment variables. For example, stores located in neighborhoods with certain demographics could be expected to perform at a specific level with certain store policies. A portfolio analysis of multiple stores can then be made to make allocation decisions on investments and promotional expenditures. Furthermore, benchmarking studies conducted over a period of time would provide useful insights into trends in the retailing industry and would lead to greater retailer efficiency.

The authors thank A.C. Nielsen for the data. We also thank the participants at the 1997 Symposium on Retail and Service Environment Atmospherics Research, Montreal, Canada and Suresh Sundaram for their valuable comments on an earlier version of this paper.

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Effect of Retail Store Environment on Retailer Performance


