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Do Changes in Customer Satisfaction Lead to Changes in Sales Performance in Food Retailing?

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ABSTRACT

We measure the links between store attribute perceptions and customer satisfaction, and between customer satisfaction and sales performance, in the food retail sector. Our data set consists of six waves of customer satisfaction and sales information for about 250 stores over the period 1998-2001 for a publicly held supermarket company. We construct a statistical model to address nonlinearities and asymmetries in the satisfaction-sales performance links, and we illustrate how food retailers can affect store revenues by managing customer satisfaction. Contributions of our study include the analysis of behavioral consequences of customer satisfaction in the food retail sector, the measurement of complexities of the satisfaction-sales performance links based on an empirical model of first differences, and a discussion of how managers can use such results for customer satisfaction policies.

INTRODUCTION

Food retailers recognize that customer satisfaction (CS) plays a key role in a successful business strategy. What is unclear is the exact nature of that role, how precisely satisfaction should be managed, and whether managerial efforts aimed at increasing satisfaction lead to higher store sales. Today, managers in the food retail sector undertake substantial efforts to conduct CS surveys. Yet it appears that in most cases the data are used to simply monitor specific store attributes, and especially overall satisfaction, over time. Unless the impact of customer satisfaction on store revenues is assessed, managers have little basis for allocation of resources. In general, the linkages between drivers of customer satisfaction and sales performance have not been firmly established in the food industry. For the estimation of these linkages, recent research indicates that several issues must be addressed. These include possible multicollinearity among attribute ratings, asymmetries and nonlinearities in the links, and time lags. Models and managerial tools that ignore these issues might lead to inappropriate managerial decisions.

We measure the links between attribute perceptions and customer satisfaction, and between customer satisfaction and sales performance, in the food retail sector. The study relies upon an extensive data set comprised of six waves of customer satisfaction and sales information for approximately 250 stores over the period 1998-2001 for a publicly held supermarket company operating in the Eastern US. We construct a statistical model in first differences that addresses the inherent nonlinearities and asymmetries in these links. We also provide an example of how firms can use the estimated linkages to develop satisfaction policies that are predicted to increase store revenues.

Our study makes three contributions to the literature, one methodological and two substantive. First, we examine nonlinearities and asymmetries in the satisfaction-sales performance links based on an empirical model expressed in first differences. Second, the study advances the measurement of behavioral links between customer satisfaction and performance in the food retail sector with firm-specific data. Third, our study shows how firms can employ such results to develop appropriate customer satisfaction policies. This paper is organized as follows: in the next section, we discuss customer satisfaction in food retailing. We then provide a review of the relevant literature, we describe the data, and we elaborate the statistical model. We conclude with the presentation of results and a discussion of possible extensions for future research.

IMPORTANCE OF CUSTOMER SATISFACTION TO FOOD RETAILERS

The food and beverage market is often the largest industrial sector in developed economies. In the US, expenditures on food in both retail stores and food service establishments account for nearly 30 percent of all retail spending (US Department of Commerce 2002). Food retailing alone is among the largest of all retailing sectors in most countries. In 1997, the most recent industrial census year in the US, grocery stores accounted for about seventeen percent of total retail trade revenues, and the industry employed about eighteen percent of all workers in retail establishments (US Department of Commerce 2002). This represents the second largest share among all retail census categories in the US, surpassed only by automotive.

Current sector trends of increased competition, enhanced retailer ability to analyze markets and greater shopper expectations make satisfying customers especially critical to food retailers. Furthermore, food retailing has unique characteristics that make it different from other

retail sectors with regard to customer satisfaction. Food retailers offer a variety of *goods* and *services* simultaneously, as opposed to other sectors that frequently specialize in offering either goods or services. Indeed, for the customer there is more to visiting a supermarket than the mere acquisition of consumption goods. Differences in the “shopping experience” between food retail outlets (e.g. store ambience, disposition of associates, store services) are often as important to the customer as differences in the physical characteristics of the goods they buy (price, quality, etc).

Another factor that differentiates the food retail sector from other retail industries is high and frequent customer traffic. According to the Food Marketing Institute, customer traffic in supermarkets is roughly two times per person per week, the second highest among all establishments in the retail channel after only convenience stores (Progressive Grocer 2001). However, customer counts in the convenient store industry are only a fraction of those in the supermarket industry. Thus it is not surprising that Anderson and Sullivan (1993) report that the elasticity of repurchase intentions with respect to customer satisfaction in the supermarket industry is one of the highest among all retail sectors. Because of high customer frequency and presumed low switching costs due to the proliferation of supermarkets and competing retailers with similar product offerings, unsatisfied customers are unlikely to remain loyal. After an unsatisfactory experience in a given supermarket, the customer decision to shift stores might follow almost immediately, thus affecting store sales performance in a short period. Conversely, food retailers who understand the linkages between customer satisfaction drivers and sales performance may be able to avoid creating the unsatisfactory experience in the first place. Thus, by making the right decisions to satisfy their customers, informed retailers may enjoy greater sales payoffs relative to their competitors.

The food retailing industry is aware of the increasing importance of having satisfied customers. For example, a national study conducted by *Progressive Grocer* and the NPD Group found small but significant decreases in the general level of customer satisfaction in the supermarket industry from 1995 to 1996 (Mathews 1997). Such customer dissatisfaction, the study suggests, could drive customers out of the supermarket channel--to competing channels--if managers are unable to redress these levels of dissatisfaction. Decision makers in food retailing firms now appear to agree on the vital importance of customer satisfaction (cf., Bannister 2001). For example, two of the most consulted trade sources in the food industry, *Progressive Grocer* and *Supermarket Business*, together have produced more than a hundred articles addressing customer satisfaction in the last decade.

While food retailers recognize that customer satisfaction is vital to the creation of a successful business strategy, what is unclear is the exact nature of that role, how to manage satisfaction, and whether investing in customer satisfaction leads to higher sales. The linkages between drivers of customer satisfaction and sales performance in the food industry have not been firmly established. Earlier research helped retailers understand that investments in customer satisfaction must be financially justified. A key component of this thinking is that management requires information that accurately describes the linkages between satisfaction and sales performance to guide customer satisfaction policies.

LITERATURE REVIEW

Our study focuses on the relations between attribute perceptions, overall customer satisfaction and store sales performance. Such links are part of a broader conceptual framework proposed by Heskett et al. (1994), namely the Service-Profit Chain. Anderson and Mittal (2000)

strengthened this framework by accommodating nonlinearities and asymmetries in the links, and they renamed it the Satisfaction-Profit Chain. Hereafter we use the acronym CSSP, Customer Satisfaction-Sales Performance, to refer to the links of interest. We show the elements of the CSSP chain in Figure 1. First, we identify specific and measurable attributes that are expected to influence overall satisfaction. The attributes are summarized into factors to accommodate commonality and to minimize multicollinearity. These satisfaction factors, in turn, capture product and service variables that lead to overall satisfaction. It follows that improvements in these satisfaction factors, in turn, should increase overall customer satisfaction. And increased customer satisfaction should lead to greater store sales, via increased likelihood of repurchase and favorable word of mouth. We discuss extant findings on these linkages next.

[Figure 1 About Here]

Attribute Perceptions and Customer Satisfaction

To capture the relationship between attribute perceptions and overall customer satisfaction, we must identify how customers interpret and respond to the products and services they buy and experience. Here it is essential to distinguish between specific attributes of a product or a service and the satisfaction factor they represent. In food retailing, for instance, consumers may put high value on a factor that might be called “customer service” provided by the supermarket. This is an example of an abstract or subjective benefit. This abstract benefit depends on a set of related measurable attributes such as the disposition of the cashiers and sales associates, speed and accuracy of checkout, and availability of everyday grocery items and store cleanliness, among others. In addition to customer service, other relevant factors affecting overall customer satisfaction in grocery stores include the store ambiance, the perceived product quality of (growing) perishables departments--now 50 percent or more of store sales in some

stores--such as fresh produce, deli/bakery, seafood, fresh meat and floral, as well as the perceived value of products relative to their price.

These links have been the subject of intense scrutiny by marketing researchers. Since the seminal behavior-oriented research by Oliver (1981), several articles have focused on the antecedents of customer satisfaction in a wide variety of contexts, ranging from firm-specific studies to nation-wide assessments. Although satisfaction factors vary according to the type of products, services and business sectors considered, empirical studies provide vast evidence of their impact on overall satisfaction (e.g. Szymansky and Henard 2001). Most studies on antecedents of customer satisfaction utilize models reviewed by Johnson (1998) and show significant correlation between various satisfaction factors and overall satisfaction (Szymansky and Henard 2001; Bernhardt, Donthu and Kennett 2000; Mittal, Ross and Baldasare 1998; Wittink and Bayer 1994). In general, these studies tend to collect information on consumer ratings of specific attributes. Often, multivariate statistical models are constructed to identify latent variables representing satisfaction factors (e.g. Johnson and Gustafsson 2000; Johnson 1998; Fornell et al. 1996; Bolton and Drew 1991). In the majority of past research, overall customer satisfaction is then modeled as a linear function of these latent variables. Much recent research, however, is critical of the incomplete treatment of the CSSP links, and researchers call for more elaborate analysis (e.g., Anderson and Mittal 2000).

Addressing the Consequences of Customer Satisfaction

Unlike the antecedents of satisfied customers, the consequences of satisfied (or dissatisfied) customers have received little attention from researchers (Szymanski and Henard 2001). Perhaps the first study was the pioneering research conducted by Zahorik and Rust (1992) on the consequences of customer satisfaction. Their work included a mathematical framework to

evaluate the financial value of satisfaction (Rust and Zahorik 1993) based on the effect of satisfaction on customer retention, and the subsequent impact on market share. Anderson and Sullivan (1993) addressed the simultaneous estimation of the antecedents to and consequences of customer satisfaction, with data from more than twenty thousand Swedish consumers patronizing a hundred or so Swedish companies. Their model identifies factors that determine customer satisfaction, which in turn have a positive association with financial performance. Perhaps the most important contribution of this work is the identification of asymmetries in the linkages between disconfirmation of expectations and customer satisfaction. After Anderson and Sullivan (1993), several studies have examined the relationships in the Satisfaction-Profit (or Service-Profit) Chain with data from a variety of channels (c.f., Kamakura et al., 2002; Scharitzer and Kollarits 2000; Soteriou and Zenios, 1999; Johnson 1998; Loveman 1998; Anderson, Fornell and Lehmann 1994).

Mittal, Ross and Baldasare (1998) and Anderson and Mittal (2000) point out that, for the most part, earlier research ignored nonlinearities and asymmetries in the links of the CSSP chain. They maintain that the relationships in the CSSP chain are far more complex than originally postulated and, specifically, that linear models are insufficient. To illustrate the asymmetry concept, consider the quality of the produce department and the friendliness of cashiers in a supermarket. Stronger consumer evaluations of the quality of the produce department might not imply strongly positive effects on customer satisfaction, while weaker quality might be quite damaging. Or, improvements in customer-oriented dispositions of cashiers and associates could have a large positive impact on customer satisfaction while reductions in cashier performance may be only mildly negative.

Now consider the potential role of nonlinearity in the link between customer satisfaction and sales performance. A retail store with low current levels of customer satisfaction may require only small investments in satisfaction drivers to improve sales performance. In contrast, a store with high current levels of satisfaction is likely to need a much larger investment in drivers to produce impacts on performance of a similar magnitude. Ignoring relevant nonlinearities and asymmetries inevitably leads to incorrect estimates of the linkages in the CSSP chain. Furthermore, if the results of CSSP chain research are to be adopted by retail managers, incorrect measures are certain to lead to incorrect strategy formulation thus dooming further strategic use of satisfaction data.

Bernhardt, Donthu and Kennett (2000) suggest that another pitfall of many satisfaction studies is the tendency to rely on cross sectional analysis for statistical inference (Anderson, Fornell and Lehmann 1994, provides an exception). Bernhardt, Donthu and Kennett argue that a proper analysis of the links between satisfaction and performance requires a dynamic approach. This argument echoes Rust and Zahorik's (1993) contention that efforts to improve customer satisfaction must be financially accountable over time. Bernhardt, Donthu and Kennett (2000) study customer satisfaction in a fast-food chain based on monthly data. Although based on simple correlations, the study shows that a dynamic model outperforms a cross-sectional model in the examination of the CSSP links.

Extant research has focused primarily on the CSSP links at the aggregate level and for selected sectors such as telecommunications, banking, healthcare, automobile and pharmaceuticals, among others (cf., Anderson and Fornell 2000; Scharitser and Kollarits 2000; Mittal, Ross and Baldasare 1998; Bryant and Cha 1996; Anderson, Fornell and Lehmann 1994). Conversely, only a few firm-specific CSSP assessments have been conducted. Examples include

fast-food restaurants (Bernhardt, Donthu and Kennett 2000) and department stores (Rucci, Kim and Quinn 1998). Anderson and Mittal (2000) discuss several examples where the incorporation of non-linearities and asymmetries added significant value to a firm's understanding of the CSSP links. It is especially desirable to use firm-specific data so the linkages between satisfaction and performance are examined in the context of a firm's strategy.

We note that academic research on the CSSP linkages in the food retail sector is scarce. Practically all empirical investigations on food retailing, in the U.S. as well as internationally, address the drivers of customer satisfaction but do not address their ultimate impact on store revenues. Among the drivers often identified are: perceived value of products relative to their prices, staff friendliness and willingness to help, quality and freshness of products, store appearance, and the degree of customer service (cf., Jin and Jai-Ok 2001; Hackl, Scharitzer and Zuba 2000; Gail and Scott 1995). However, while the drivers of satisfaction are known qualitatively, and managers believe that satisfaction affects performance, it is necessary to measure explicitly the impact of satisfaction on store sales in order to prioritize strategies to manage the drivers of satisfaction.

This study advances the measurement of the behavioral links in the CSSP Chain in the food retail sector. We link attribute perceptions, overall satisfaction, and store sales, and we allow for nonlinear and asymmetric effects. We specify the model in first differences and we allow for time lags between changes in satisfaction and changes in store sales performance. We also provide an example to show how managers can use the results to develop appropriate customer satisfaction policies.

MODEL AND DATA

Model

The model is a system of equations linking attribute performance, customer satisfaction, and store sales over time, where stores are the unit of analysis. Consider a store with satisfaction-related attributes perceived by consumers at time t . Consumers rate the store on each of these attributes at each time t ($CA_{1,t}$, $CA_{2,t}$, ..., $CA_{K,t}$). To reduce the overlap in interrelated variables, it is convenient to reduce the number of variables based on their observed correlations.

Consequently, a vector of M latent variables is used to represent satisfaction factors, ($SF_{1,t}$, $SF_{2,t}$, ..., $SF_{M,t}$), with $M < K$. To capture the dynamic properties of the CSSP chain over time, we define changes in latent variable m ($\Delta SF_{m,t}$) as a function of the changes in specific store attributes ($\Delta CA_{1,t}$, ..., $\Delta CA_{k_m,t}$). As a result, there are M equations for the changes in satisfaction factors:

$$\Delta SF_{m,t} = F_{m_1}(\Delta CA_{1,t}, \Delta CA_{2,t}, \dots, \Delta CA_{k_m,t}) \quad \text{for } m = 1, \dots, M. \quad (1)$$

We propose that changes in the satisfaction factors, ($\Delta SF_{1,t}$, $\Delta SF_{2,t}$, ..., $\Delta SF_{M,t}$), affect the evolution of overall satisfaction at time t , or CS_t . Next, changes in overall customer satisfaction ΔCS_t may produce changes in the store sales performance at time t , ΔSP_t . Therefore, in addition to the M equations in (1), the system also includes:

$$\Delta CS_t = G(\Delta SF_{1,t}, \Delta SF_{2,t}, \dots, \Delta SF_{M,t}), \quad (2)$$

$$\Delta SP_t = H(\Delta CS_t, STR, DEM, GEO), \quad (3)$$

where STR , DEM and GEO represent multiple store, demographic and geographic characteristics respectively.

We argue that it is more appropriate to model the CSSP links in changes than in levels. For example, the parameter estimates in levels may be confounded by various cross-sectional

differences that are difficult or impossible to consider. By focusing on changes, we remove unobserved cross-sectional differences from the data. Further, we define percentage change in sales performance ($\% \Delta SP_t$) to accommodate the dependence of sales performance on store size. Customer satisfaction scores, however, are not ratio scaled so that it is inappropriate to use percentage change for satisfaction. However, we do include the level of lagged satisfaction, CS_{t-1} , to account for hypothesized nonlinearities in the links between customer satisfaction and sales performance, as is explained below. We estimate the relationships in equations (2) and (3) to estimate how changes in satisfaction factors affect changes in sales performance via changes in overall satisfaction, and to determine the relevance of nonlinear and asymmetric effects in the relations between satisfaction factors and overall satisfaction, and between overall satisfaction and store sales performance.

Data

We use an extensive data set consisting of customer satisfaction information, store sales, market demographics and store characteristics for more than 250 stores over the period 1998-2001 for a publicly held supermarket company operating in the Eastern US. At each store, customer satisfaction data are collected semiannually by mail (February and August) from approximately one hundred of the top 40 percent customers, based on a random sample from the company's loyalty card data base (responses are anonymous). Thus, the data do not represent the entire customer base. We note, however, that the top 40 percent of customers represent approximately 82 percent of total store sales. By working with a sample of the highest revenue customers, we actually have data that pertain closely to storewide activity.

In the survey instrument, customers rate the store, from 1 (poor) to 6 (excellent), on 21 questions pertaining to attribute perceptions and customer satisfaction. The last question pertains

to overall satisfaction (CS_t), while questions 1-20 measure attribute perceptions (CA_t).

Additionally, the survey collects demographic information, such as respondent's age and household size. These variables serve as controls in the statistical model that follows. Random samples are drawn independently each semiannual period, thus the relevant unit of observation is the store, not the individual customer. By averaging the customer responses for each store, we create store-level panel data with time series on differences of length six on more than 250 units.¹

We employ sales per square foot as the measure of store sales performance (SP). This is preferred over alternative performance measures such as profits for the following reasons. First, any profit measure is necessarily subject to accounting conventions, and these conventions may change over time. Second, given the behavioral focus of our study we expect sales per square foot to increase with customer satisfaction, but such a link is less obvious for profits. Finally, and related to the previous point, profits depend on other store-specific variables that affect economic efficiency such as labor and operational costs that are related to customer satisfaction.

To capture the dynamics, we consider the time lag between change in overall customer satisfaction (ΔCS_t) and percent change in store sales performance ($\% \Delta SP_t$). We propose that changes in overall satisfaction result in changes in sales per square foot in the three months after the satisfaction survey is conducted. Since sales per square foot is available on a monthly basis, the measure of sales performance, SP_t , is the monthly average of sales per square foot corresponding to the *three months after customer satisfaction wave t is conducted*. Thus the measure of change in store sales performance expressed as a percent is:²

$$\% \Delta SP_t = \left(\frac{SP_t - SP_{t-1}}{SP_{t-1}} \right) * 100 . \quad (4)$$

To illustrate, consider the customer satisfaction surveys corresponding to February, 2000 ($t-1$) and August, 2000 (t). Here ΔCS_t is the change in overall satisfaction of the store's customers between these two survey waves. Accordingly, change in store sales performance is measured as the percent change in sales per square foot between the monthly average of March, April, May 2000 (the three months following the February survey) and the monthly average of September, October, November 2000 (the three months following the August survey). All dollar figures represent real values deflated by the US consumer price index. Finally, additional data were gathered from the cooperating company regarding store age, store size, and whether major or minor remodeling had been done during the period of analysis.

We show descriptive statistics of the percent change in store sales performance ($\% \Delta SP_t$) and change in customer satisfaction (ΔCS_t) between waves for the seven periods February 1998 – February 2001 in Table 1. The data show that sales per square foot on average declined during the study period while customer satisfaction changed very little. The dispersion of both measures, ΔCS_t and $\% \Delta SP_t$, evidenced by the standard deviation, is relatively stable over the period of analysis. Although customers rate satisfaction from 1 to 6, the range of variation at the store level is far smaller because we average individual responses per store (the minimum and maximum average values are 3.5 and 5.3, respectively). We also show the means and standard deviations of the levels. The average monthly sales per square foot across waves varies between \$13.04 and \$14.70 (in 1996 dollars). The average customer satisfaction (across the stores) shows a low of 4.69 and a high of 4.81. Finally, the number of stores increased from 236 to 262 during the period 1998-2001, indicating a substantial expansion of operations of approximately 11 percent in number.

[Table 1 About Here]

Factor Analysis

Respondents to the customer satisfaction survey rated twenty store attributes relevant to their shopping experience. We show eighteen survey elements in Table 2 (two are absent because those attributes apply to a subset of the stores). However, inclusion of all eighteen attributes separately in the model weakens statistical analysis and makes it difficult to identify managerial implications of the CSSP chain in food retailing. Consequently, we conducted a principal components factor analysis, employing a Varimax factor rotation, to reduce the store attribute measures to a smaller set of factors, each of which is a linear combination of a subset of the attributes. We considered all factors with eigenvalues exceeding one. To be consistent with the dynamic model specified in terms of changes, the factor analysis was also conducted on changes in specific attributes ($\Delta CA_{m,t}$) so as to group variables that move together over time.

[Table 2 About Here]

We show the factor loadings for the three-factor solution in Table 2. These three factors account for 76 percent of the variation in the eighteen attributes. To facilitate interpretation and use of subsequent results, we do not use the factor scores but instead use simple averages of the attributes loading highly on a factor (0.6 or more). This implies that we allow for a modest amount of correlation between the three factors. We define the three satisfaction factors as follows: “customer service (CU)”, referring largely to the overall attitude of the employees toward customers, including service levels; “quality (QU)”, relating to quality and variety of meats and produce, availability of everyday grocery items as well as cleanliness inside the store; and “value (VA)”, referring to the price-performance ratio of the items purchased and the benefits of being loyal to the store.

Empirical model

The model consists of two parts. The first presents an unrestricted specification of equations (2)-(3) that allows for all possible nonlinearities and asymmetries. The second part discusses nonlinearity and asymmetry in CSSP. Our empirical specification of equation (2) expresses changes in customer satisfaction as a function of a vector of changes in the three factors (customer service, quality, value). Separating negative from positive changes in the three factors allows us to control for asymmetry, while we capture nonlinearity by squaring the changes in satisfaction factors.

Next, we allow changes in store sales to be explained by changes in customer satisfaction, store characteristics and customer characteristics. Following Mittal, Kumar and Tsiros (1999), the level of customer satisfaction at $t-1$ may affect the relation between changes in store sales and changes in customer satisfaction. Consequently, the model includes the store satisfaction score at time $t-1$ (CS_{t-1}), and its product with ΔCS_t . We also allow for separate positive and negative ΔCS_t effects to account for asymmetries, and we use the interaction between CS_{t-1} and subsequent changes on overall satisfaction to measure nonlinearities. Demographic and store-specific variables such as average customer age, average household size, store location (urban or rural) and real estate information are included as control variables. Since changes in store sales vary over time, we also use time dummies to accommodate wave-specific effects.

With all possible asymmetries and nonlinearities, the empirical specification yields:

$$\Delta CS_{t,i} = \alpha_0 + \alpha_1 \Delta CU_{t,i} + \alpha_2 \Delta CU_{t,i}^- + \alpha_3 \Delta CU_{t,i}^2 + \alpha_4 \Delta QU_{t,i} + \alpha_5 \Delta QU_{t,i}^- + \alpha_6 \Delta QU_{t,i}^2 + \alpha_7 \Delta VA_{t,i} + \alpha_8 \Delta VA_{t,i}^- + \alpha_9 \Delta VA_{t,i}^2 + e_{1t,i} \quad (5)$$

$$\% \Delta SP_{t,i} = \beta_0 + \beta_1 \Delta CS_{t,i} + \beta_2 \Delta CS_{t,i}^- + \beta_3 CS_{t-1,i} + \beta_4 \Delta CS_{t,i} CS_{t-1,i} + \beta_5 \Delta CS_{t,i}^- CS_{t-1,i} + \beta_6 \Delta AGE_{t,i} + \beta_7 \Delta HHSZ_{t,i} + \beta_8 ME_i + \beta_9 NW_i + \beta_{10} MR_i + \beta_{11} EXP_i + \delta \mathbf{WD} + \gamma \mathbf{REG} + e_{2t,i} \quad (6)$$

where,

$\Delta CU_{t,i}$	is change in customer service factor score in store i at wave t ,
$\Delta CU_{t,i}^-$	equals $\Delta CU_{t,i}$ if its value is negative; zero otherwise,
$\Delta CU_{t,i}^2$	is change squared in customer service factor score in store i at wave t ,
$\Delta QU_{t,i}$	is change in quality factor score in store i at wave t ,
$\Delta QU_{t,i}^-$	is $\Delta QU_{t,i}$ if its value is negative; zero otherwise,
$\Delta QU_{t,i}^2$	is change squared in quality factor score in store i at wave t ,
$\Delta VA_{t,i}$	is change in value factor score in store i at wave t ,
$\Delta VA_{t,i}^-$	is $\Delta VA_{t,i}$ if its value is negative; zero otherwise,
$\Delta VA_{t,i}^2$	is change squared in value factor score in store i at wave t ,
$\Delta CS_{t,i}$	is change in overall customer satisfaction score in store i at wave t ,
$\Delta CS_{t,i}^-$	equals $\Delta CS_{t,i}$ if $\Delta CS_{t,i}$ is negative; zero otherwise,
$\% \Delta SP_{t,i}$	is monthly percentage change in sales per square foot in the three months after the satisfaction survey is conducted,
$CS_{t-1,i}$	is average customer satisfaction score in store i at wave $t-1$,
$\Delta AGE_{t,i}$	is change in average age of survey respondents in store i at wave t ,
$\Delta HSZ_{t,i}$	is change in average household size of survey respondents in store i at wave t ,
ME_i	is one if store i is located in a metropolitan area; zero otherwise,
EXP_i	is one if store was expanded, for all periods since expansion; zero otherwise,
NW_i	is one if store is new for all periods since opening; zero otherwise,
MR_i	is one if store was remodeled, for all periods since remodeling; zero otherwise,
REG	is a vector of dimension four of (0,1) dummy variables representing regional locations of the stores, and
WD	is a vector of (0,1) dummy variables corresponding to customer satisfaction waves.

We summarize the test results of nonlinearity and asymmetry between ΔCS_t and the vector of satisfaction factors (ΔCU_t , ΔQU_t , ΔVA_t) in Table 3. We compare three models to the unrestricted version (asymmetric-nonlinear), namely (1) linear-symmetric, (2) linear-asymmetric and (3) nonlinear-symmetric, constraining the same effects to apply to all three factors. We therefore use F tests to determine which specification fits the data best. The linear-symmetric model is rejected, indicating the presence of asymmetries and/or nonlinearities ($p < 0.01$). Test

statistics also suggest that a linear-asymmetric model is preferred over its nonlinear-symmetric counterpart (p-values are 0.12 and 0.80 respectively). Given that there is very little evidence for nonlinearity, we next impose linearity on the otherwise unrestricted version, and test for asymmetry once more. This test is highly significant, suggesting that asymmetries matter especially for a linear model ($p < 0.01$). These test results favor a linear-asymmetric specification in the three factors. Thus, it appears that positive changes in the factors have different effect magnitudes than negative changes do on overall satisfaction.

We employ a different approach to address nonlinearity and asymmetry in the link between overall satisfaction and sales. Contrary to equation (5), in which we explore the simultaneous influences of the *three* satisfaction factors on overall satisfaction, in equation (6) we examine nonlinear-asymmetric effects of only a *single* variable, *CS*, on store sales. We use the results for the parameters β_1 - β_5 to discuss the nature and magnitudes of these asymmetries and nonlinearities. In equation (6), these links are nonlinear if the parameter corresponding to the interaction between the level of satisfaction at $t-1$ and the subsequent change in overall satisfaction, β_4 , differs from zero. Asymmetry exists if β_2 , the parameter capturing the difference between positive and negative changes in *CS*, differs from zero. The parameter β_5 captures the combined effect of nonlinearity and asymmetry.

[Table 3 About Here]

The test results show that all five parameter estimates pertaining to the effects of overall satisfaction on sales are statistically significant (Table 4). This is a strong result, given that some of the predictor variables are correlated to a considerable degree (the five predictor variables capture main- and interaction effects). Indeed, three of the five effects are only significant at the 10 percent level, two-tailed.

We note that Ordinary Least Squares estimates (OLS) are biased and inconsistent if current-period endogenous variables appear as regressors in other equations in the system. However, OLS is appropriate in the case of simultaneous equations when the models are recursive with lagged endogenous variables as in equations (5)-(6), as long as the disturbances e_{1t} and e_{2t} are uncorrelated. If these disturbances are correlated, seemingly unrelated regression (SUR) yields consistent and unbiased estimates. In our application, statistical tests fail to reject the null hypothesis of zero contemporaneous correlation between these disturbances. We therefore use OLS to obtain unbiased and efficient estimates.

FINDINGS

We show OLS estimates of the linear, asymmetric specification of equation (5) and the nonlinear, asymmetric specification of equation (6) in Table 4. Changes in the three customer satisfaction factors explain nearly three quarters of the variation in the changes in customer satisfaction. This is a high degree of explanatory power given that the factors and overall satisfaction represent changes over time as opposed to levels. Mittal and Kamakura (2000) suggest that a high R-square may be the consequence of a common method bias, resulting from measuring satisfaction attributes and overall satisfaction in the same survey instrument. A common method bias also applies to changes but the focus on changes nevertheless reduces R-square. We note that this common method bias is also a compelling reason for managers to go beyond the links between attribute perceptions and overall satisfaction, and address the ultimate impact of satisfaction on store revenues.

The factor analysis of the perceptual attributes allows us to identify the distinct components in the instrument, and it is of interest to determine differences in the effects of

changes in the three factors on overall satisfaction. These effects vary dramatically across factors. We use the results in Table 4a to classify the factors into what have elsewhere been described as “satisfaction-enhancing and satisfaction-maintaining” drivers (Anderson and Mittal 2000). Our results suggest that a one point negative change in quality decreases overall satisfaction by 0.35 ($\alpha_4 + \alpha_5$), which is seven times larger than the impact of a one point positive change in quality ($\alpha_4 = 0.05$).³ This asymmetry suggests that quality is a satisfaction-maintaining factor in food retailing. That is, improvements in quality ratings produce far smaller beneficial impacts on customer satisfaction than the damaging effects created by negative changes in quality perception of the same magnitude. However, a one point increase in the value factor has a somewhat larger impact on overall satisfaction ($\alpha_7 = 0.36$) than does a negative change of the same magnitude ($\alpha_7 + \alpha_8 = 0.25$). Thus, value appears to be primarily a satisfaction-enhancing factor. The estimates indicate that customer service is the most important determinant of overall satisfaction, and that it is also primarily a satisfaction-enhancing factor. That is, both effects are quite large, and the positive effect ($\alpha_1 = 0.69$) is larger than its negative counterpart ($\alpha_1 + \alpha_2 = 0.55$).

In Table 4b we show that the second equation explains thirteen percent of the variability in $\% \Delta SP_t$. The parameter estimates and the associated standard errors indicate that changes in customer satisfaction and in some demographic and store characteristics are relevant predictors of changes in store sales. In particular, the coefficients of the five customer satisfaction variables are all significant at least at the 10 percent level, confirming that nonlinearities and asymmetries matter. The parameter estimates of ΔCS_t and ΔCS_t^- indicate that sales performance is more sensitive to negative (-136.96) than to positive changes (+52.30) in overall satisfaction. The nonlinear effects, represented by the coefficients of CS_{t-1} and its interaction with ΔCS_t , are

stronger for lower values of CS_{t-1} . To illustrate, the effect of a one-point increase in CS in a store with $CS_{t-1}=4$ is larger than the effect of the same increase in a store with $CS_{t-1}=5$ (27.8 and 22.8, respectively).⁴ These differences suggest that the effect of positive ΔCS on sales is decreasing with the level of customer satisfaction.

[Table 4 About Here]

To illustrate the nonlinearities and asymmetries in the links between customer satisfaction and store sales, we show $\% \Delta SP_t$ as a function of ΔCS_t in Figure 2 under alternative levels of customer satisfaction at time $t-1$ (CS_{t-1}): the bottom 10% of stores ($CS \leq 4.26$); the top 10% of stores ($CS \geq 5.05$), and an average store ($CS = 4.74$), keeping everything else constant. Since the empirical model is specified in changes over time, the functions in Figure 2 represent the estimated partial derivative $\Delta SP / \Delta CS$ conditioned on CS_{t-1} . Note that the magnitudes of the estimated derivatives depend on CS_{t-1} and on whether the change is positive or negative. For the top 10% of the stores, for instance, positive ΔCS_t has much smaller impacts on sales performance relative to negative changes of the same magnitude. This asymmetric result suggests that once a high level of customer satisfaction is achieved maintaining it is critical.

[Figure 2 About Here]

Figure 2 also shows the nonlinearities between customer satisfaction and store sales performance. Given a positive ΔCS_t of a specific magnitude, the slope corresponding to stores in the top 10% is smaller than the slope associated with average stores, which is in turn smaller than the slope of stores in the bottom 10%. Thus the slope $\Delta E / \Delta CS$ tends to decrease as the level of customer satisfaction increases, i.e. the function linking overall satisfaction to sales performance is positive at a decreasing rate. Similarly, the link between satisfaction and sales performance is nonlinear with respect to negative ΔCS_t . As the level of overall satisfaction at

time $t-1$ decreases, the impact of negative ΔCS_t on sales performance tends to decrease. Hence the satisfaction-performance function decreases at a decreasing rate for negative changes in CS. The other variables in the model serve as controls to the CSSP chain. The demographic variables ΔAGE_{it} and ΔHSZ_{it} help control for differences in the samples of customers responding the CS survey, both between stores and over time. For example, on average stores that started operations (NW_i) or were remodeled (MR_i) during the period 1998-2001 show higher changes in sales performance. Also, stores in metropolitan areas (ME_i) have higher sales performance changes than their rural counterparts, as do stores located in Region 4 ($REG4$), holding other variables constant.

We conduct tests of the parameter estimates on a holdout sample, employing customer satisfaction data corresponding to an additional wave (August 2001). Considering the links between satisfaction factors and overall satisfaction, the correlation between predicted and actual ΔCS is 0.85, which is in the line with expected decreases from the estimation sample for a valid model. To examine the links between satisfaction and store revenues, we employ the following three alternative specifications: (1) without CS variables, (2) the nonlinear-asymmetric specification of CS, and (3) the parsimonious specification of CS (i.e., with a linear effect of CS). The Mean Squared Errors between predicted and actual values indicate that both the nonlinear-asymmetric specification and the parsimonious specification of CS marginally outperform the model without CS.⁵ However, the parsimonious (linear-symmetric) specification performs better than the nonlinear-asymmetric one. This suggests that the significant nonlinear and asymmetric complexities may reduce the forecasting accuracy of CS. These complexities are nevertheless relevant as indicated by the statistical significance of each of the five terms.

We also investigate the presence of seasonality in our sales data, conduct heteroskedasticity tests, and verify that multicollinearity does not affect the model estimates. The only sign of seasonality observable in the data is that sales exhibit a peak in December; however, our analysis does not include sales in this month. Nevertheless, to ensure that our model does not suffer from omitting seasonality, we employed an alternative specification in which changes were calculated with respect to the previous year (instead of with respect to the previous wave). Parameter estimates of this alternative specification are similar to the estimates presented in Table 4. We also calculate White's test statistics for both equations in Table 4, and conclude that the null hypothesis of homoscedasticity cannot be rejected. Additionally, Variance Inflation Factors and correlation coefficients indicate that satisfaction factors in equation (5) are only modestly correlated, as is the case for the customer satisfaction constructs relative to the control variables in equation (6).⁶

The estimates in Table 4 also allow us to estimate the ultimate impact of changes in satisfaction factors on changes in store sales performance. For instance, a one point decrease in quality (QU) in a store in the "top 10% group", *ceteris paribus*, is likely to produce a negative change in CS of about 0.34 points. This decrease in CS, in turn, results in a reduction of monthly sales per square foot of about 2.2 percent. In contrast, a positive change in quality QU of the same magnitude has a very small effect on ΔCS_t (only 0.05 points), producing a much smaller increase in store sales performance (0.4 percent). Such asymmetries have to be considered in managerial actions. Our results suggest that improvements in satisfaction-maintaining factors such as quality are not expected to increase sales performance dramatically; however, disregarding quality as a satisfaction factor might reduce store sales performance considerably. Changes in customer service (CU), both positive and negative, have the greatest impacts on store

sales performance among the satisfaction factors. Specifically, a one point increase (decrease) in customer service (CU) in a store in the “Average group”, produces a 0.63 increase (0.55 decrease) in CS, which in turn results in a 1.95 percent increase (2.5 percent decrease) in monthly sales per square foot. Finally, positive changes in value (VA) also can substantially improve sales per square foot. However, the impact of changes in this factor on profits is less clear, in particular if the tactics involve, say, aggressive price reductions and promotions.

In summary, a first-differences approach provides valuable insights into the behavior of the CSSP chain. The results indicate the relevance of nonlinearities and asymmetries in the linkages between satisfaction factors and store revenues. Since customer satisfaction is indeed critical to store sales performance, retail firms must understand these complex relationships in order to make appropriate satisfaction-related decisions.

IMPLICATIONS FOR MANAGERS: THE IMPACT OF CUSTOMER SATISFACTION ON STORE SALES

We simulate how alternative customer satisfaction policies lead to changes in store sales performance.⁷ Information on alternative satisfaction policies and store characteristics can be combined with the parameter estimates in Table 4 to determine the relative impact of changes in CS on changes in store revenues. We illustrate this by means of simulations to show how managers can make practical use of the findings of this study.

A system to monitor the links between customer satisfaction and sales performance

Suppose management of the retail company contemplates how to allocate managerial efforts among the three satisfaction factors, customer service (CU), quality (QU) and value (VA) for a particular store in year t . Assume this store is 45,000 square feet in size and its average

sales per square foot is \$25 per month. Both size and sales are our sample averages. Assume further that, based on historical data, management determines that a given level of effort produces a *net* increase across satisfaction factors of 0.3 points (for example, one combination that produces this result is $\Delta CU_t=0.5$, $\Delta QU_t=-0.1$, $\Delta VA_t=-0.1$). This amount of managerial effort might be considered the “marginal cost” of customer satisfaction (MCCS) in terms of managerial effort. One expects that MCCS is not constant; instead, it is likely to increase at an increasing rate as the scores of each factor increase. However, for illustrative purposes and to facilitate the discussion, we assume that MCCS is constant and equal across satisfaction factors.

We show simulations under alternative satisfaction policies for a store in the top 10%, average, and bottom 10% tier CS scores in Table 5. Alternative A consists of management focusing exclusively on the customer service factor (CU). The result of this particular satisfaction policy is $\Delta CU_t=0.5$ but $\Delta QU_t=-0.1$ and $\Delta VA_t=-0.1$. Alternative B consists of allocating equal amounts of effort among all the three factors. In this case, each factor score increases by a tenth of a point ($\Delta CU_t=\Delta QU_t=\Delta VA_t=0.1$). Finally, alternative C consists of zero managerial effort on customer satisfaction. Based on historical data, we identified that no effort in a satisfaction factor decreases that factor’s score by 0.1 points each year (see explanation in footnote of Table 5). Using these inputs and applying the parameter estimates of equations (5) and (6), we show in Table 5 that alternative managerial decisions can produce substantially different store revenue outcomes, depending on the level of CS. For instance, as expected, CS managerial efforts exhibit decreasing marginal returns on store sales as the level of customer satisfaction increases under various resource allocation alternatives. Additionally, the negative impacts of not making any effort are much larger for stores in the top 10% tier than for stores in the bottom 10% group, suggesting that the opportunity cost of customer satisfaction varies across

stores. We emphasize that the proper comparison of a particular level of effort that results in the simulated CS changes and revenue impact *is not* “no change in revenues” but the negative impact on revenues associated with a zero level of effort (alternative C).

[Table 5 About Here]

A comparison of the outcomes of alternatives A and B illustrates the benefits of measuring the CSSP links. Alternative A produces larger positive impacts on annual revenues than alternative B. However, both of these resource allocation alternatives produce the same decreasing marginal returns discussed above, especially when the level of satisfaction is already high (stores in the top 10% tier). Although the simulations in Table 5 consider a relatively simple situation -- all satisfaction factors having the same score and the same unknown constant “marginal costs” in terms of managerial effort – these results illustrate how a quantitative model of the CSSP chain can guide policies regarding customer satisfaction. In the application considered here, the model results indicate that a policy focusing on customer service (CU) is superior to a policy distributing managerial efforts equally across factors. In alternative C, with no managerial effort at all, we show that the negative effect of ignoring customer satisfaction increases with the level of CS.

Managerial implications

This study demonstrates that the degree of customer satisfaction influences store sales performance in the supermarket sector. Managers must regard their satisfaction surveys not simply as a mechanism to learn to what extent their stores are satisfying customer needs and expectations. Instead, customer satisfaction monitoring should be viewed as a timely managerial tool that can help increase store sales. Even if real-world managers in food retailing understand from their experience that customer satisfaction influences sales, the linkages are not intuitive

and cannot be determined from observation, simple logic and descriptive statistics alone. Thus a quantitative model that converts raw customer satisfaction data into useable information to support management decisions provides value for the supermarket business and can justify efforts to compile and analyze satisfaction data continuously. This is especially critical in today's era of major structural and competitive changes in food retailing in which companies are seeking more aggressive strategies simply to survive.

In the case of the cooperating retail company in this study, our results suggest that managers must focus on customer service, quality and value to affect overall customer satisfaction and its ultimate impact on sales. Our results also allow us to discuss more subtle managerial implications of the CSSP chain. Our parameter estimates, on the one hand, indicate that changes in overall customer satisfaction are particularly sensitive to changes in customer service. On the other hand, customers may consider quality as a pre-condition to satisfaction: positive changes in quality have modest effects on sales performance but negative changes in quality result in substantially reduced sales per square foot.

The cooperating company is taking the initial steps towards implementing a system to monitor the CSSP links. In the past, it employed CS data in the same way that characterizes many other supermarket companies. That is, analysis was limited to descriptive statistics of the CS data set and, subsequently, to a comparison of stores that differ in satisfaction scores according to various demographic and geographic variables. Additionally, the analysis included a comparison of individual stores to the companywide average for the various attributes. In certain instances, the satisfaction results were also used as a crude metric to determine store management bonuses. Although management was aware that customer satisfaction should affect performance, responses from CS data were not linked to store revenues prior to this study.

The company is now facing unprecedented competition from other channels, in particular from large mass merchandisers. In the past, the company emphasized low prices as the primary means to increase customer satisfaction -- equivalent to an emphasis on the value factor (VA) in our model. However, because it is extremely difficult to compete with mass merchandisers strictly on price, the management team recognizes the urgent need to adjust its strategies aimed at increasing customer satisfaction and at more effective monitoring of the CSSP links. Therefore, our results contribute to their planned strategy focusing on customer service rather than one of emphasizing low prices.

Directions for future research

This investigation can be extended to several areas of the CSSP chain in the food retail sector. First, future empirical studies may incorporate customer retention and loyalty since these are essential components of the links between satisfaction and performance. Similarly, they should address mediating and moderating factors that might affect the CSSP links. Second, future research should include data on market structure (e.g. number of competitors in relevant market) to accommodate the effects of competition on customer satisfaction. Adding information on competition will improve the validity of model results and would further enhance the potential utilization of the CSSP chain as a managerial tool. Third, future research could address the sensitivity of satisfaction factors to investment levels in specific underlying physical components. Fourth, longer time series of satisfaction data would facilitate the utilization of more sophisticated statistical techniques applied to panel data, thus producing superior parameter estimates and therefore making the CSSP system a more reliable managerial tool. Fifth, longer-term assessments of the impact of satisfaction on sales performance are desirable to identify how changes in industry structure and changes in customer preferences affect the parameters in the

model. For example, the data could be utilized to anticipate customer satisfaction trends. Sixth, future research on the CSSP links in food retailing could focus on the customer as the unit of observation. Having data for the same individual customers over time will facilitate the incorporation of heterogeneous customer behavior into the CSSP chain framework. Seventh, it will be useful, especially in service-oriented industries such as retailing, to examine the interdependence of customer and employee satisfaction and their joint impact on loyalty, retention and other performance measures. Finally, more industry-specific research will be useful to explore unique characteristics of different retail segments, and even individual companies, with regard to the drivers of customer satisfaction.

CONCLUDING REMARKS

Our empirical investigation demonstrates that it is possible to identify important linkages between customer satisfaction and store sales performance in the food retail sector. This study contributes to the literature by using firm-specific data and by advancing the measurement accuracy in the links between attribute perception, overall satisfaction, and store sales. Our work includes an illustration of how food retailers can use these links to develop appropriate customer satisfaction policies leading to increased store sales.

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Table 1: Descriptive Statistics of Customer Satisfaction (CS) and Sales Performance (SP)

Variable	Aug/98	Feb/99	Aug/99	Feb/00	Aug/00	Feb/01
Mean^a						
<i>Levels</i>						
CS	4.81	4.70	4.72	4.74	4.69	4.78
SP (in 1996 dollars)	14.70	14.17	14.28	13.45	13.36	13.04
<i>Changes</i>						
ΔCS_t	0.01	-0.11	0.00	0.01	-0.06	0.09
$\% \Delta SP_t$	-1.34	-3.33	1.92	-4.81	-0.57	-2.56
Standard Deviation						
<i>Levels</i>						
CS	0.23	0.24	0.25	0.26	0.28	0.28
SP (in 1996 dollars)	3.58	3.36	3.30	3.11	3.29	3.29
<i>Changes</i>						
ΔCS_t	0.18	0.21	0.20	0.19	0.18	0.19
$\% \Delta SP_t$	6.65	7.29	8.42	8.51	7.94	6.13
Number of Observations	236	237	253	259	263	262

^a These are simple averages across stores

Table 2: Satisfaction Factors and Survey Elements in the Sample of Supermarkets

Satisfaction Factor	Reliability Alpha	Survey Elements - Specific Attributes	Factor Loadings	Alpha if Deleted
Customer Service (CU)	0.94	Friendliness of cashiers	0.90	0.92
		Service provided by baggers	0.88	0.93
		Overall friendliness of our associates	0.85	0.92
		Speed of checkout	0.84	0.93
		Overall store service	0.76	0.92
		Accuracy of scanning prices at checkout	0.71	0.94
		Cleanliness of parking lot	0.66	0.94
Quality (QU)	0.91	Variety in our produce department	0.88	0.88
		Quality of our produce department	0.85	0.88
		Overall store cleanliness inside	0.69	0.92
		Variety of fresh meat items	0.69	0.89
		Quality of our fresh meat items	0.66	0.89
		Availability of everyday grocery items	0.62	0.89
Value (VA)	0.89	Overall value for your money	0.92	0.85
		Overall prices as compared to competition	0.91	0.87
		Prices of loyalty card specials	0.83	0.86
		Availability of loyalty card specials	0.74	0.92
		Variety of advertised loyalty card items	0.60	0.86

Table 3: Asymmetry and Nonlinearity Tests between Attribute Perceptions and Customer Satisfaction

Restrictions	Null Hypothesis ^a	F-Statistic	P-Value
Unrestricted model is nonlinear, asymmetric			
1. Linear, Symmetric	$H_0: \alpha_2 = \alpha_3 = \alpha_5 = \alpha_6 = \alpha_8 = \alpha_9 = 0$	4.65	<0.01
2. Linear, Asymmetric	$H_0: \alpha_2 = \alpha_5 = \alpha_8 = 0$	1.94	0.12
3. Nonlinear, Symmetric	$H_0: \alpha_3 = \alpha_6 = \alpha_9 = 0$	0.33	0.80
Unrestricted model is linear, asymmetric ($\alpha_3 = \alpha_6 = \alpha_9 = 0$)			
Linear, Symmetric	$H_0: \alpha_2 = \alpha_5 = \alpha_8 = 0$	8.99	<0.01

^a In equation (5)

Table 4: Ordinary Least Squares Estimates of the Satisfaction-Sales Performance Chain

(4a) First equation: criterion variable is ΔCS_t

Label	Variable	Parameter Estimates ^a	Expected Sign
Change in Customer Service	ΔCU_t	0.69*** (0.03)	+
ΔCU_t if $\Delta CU_t < 0$; zero otherwise	ΔCU_t^-	-0.14** (0.06)	+/-
Change in Quality	ΔQU_t	0.05* (0.03)	+
ΔQU_t if $\Delta QU_t < 0$; zero otherwise	ΔQU_t^-	0.30*** (0.06)	+/-
Change in Value	ΔVA_t	0.36*** (0.04)	+
ΔVA_t if $\Delta VA_t < 0$; zero otherwise	ΔVA_t^-	-0.11** (0.06)	+/-
Constant		-0.01 (0.004)	
R ² -adjusted		0.72	
Degrees of freedom		1,504	

(4b) Second equation: criterion variable is $\% \Delta SP_t$

Label	Variable	Parameter Estimates ^a	Expected Sign
<i>Customer Satisfaction Variables</i>			
Change in Customer Satisfaction	ΔCS_t	52.30** (27.55)	+
ΔCS_t if $\Delta CS_t < 0$; zero otherwise	ΔCS_t^-	-84.66* (52.26)	+/-
Customer satisfaction at wave t-1	CS_{t-1}	4.56*** (1.32)	+
Interaction term	$\Delta CS_t * CS_{t-1}$	-10.38* (6.03)	-
Interaction term	$\Delta CS_t^- * CS_{t-1}$	18.15* (11.08)	+/-
<i>Control Variables</i>			
Change in average age	ΔAGE_t	-3.25*** (0.87)	+/-
Change in average household size	ΔHSZ_t	-0.81 (0.78)	+/-
One if Region 2; zero otherwise	$REG2$	0.67 (0.53)	+/-
One if Region 3; zero otherwise	$REG3$	0.66 (0.53)	+/-
One if Region 4; zero otherwise	$REG4$	1.05** (0.54)	+/-
One if metro area; zero otherwise	ME	0.81** (0.39)	+
One if new store; zero otherwise	NW	4.05*** (0.76)	+
One if major remodel; zero otherwise	MR	1.18 (0.75)	+
One if expanded; zero otherwise	EXP	-1.03 (0.77)	+/-
One if wave 1; zero otherwise	WD_1	2.77*** (0.73)	+/-
One if wave 2; zero otherwise	WD_2	2.62** (1.03)	+/-
One if wave 3; zero otherwise	WD_3	3.29*** (1.02)	+/-
One if wave 4; zero otherwise	WD_4	-1.42** (0.75)	+/-
One if wave 5; zero otherwise	WD_5	3.22*** (0.89)	+/-
Constant		-19.61*** (4.16)	
R ² -adjusted		0.13	
Degrees of freedom		1,490	

^a Standard errors in parentheses *** p-value<0.01; ** p-value<0.05; * p-value<0.10

Table 5: Simulation of Alternative Effort Allocations in Customer Satisfaction: Additional Annual Store Revenues (in 1996 dollars) ^{a, b}

CS Level	Effort Allocation Alternatives		
	A: All in CU Factor	B: Equally Across Factors	C: Zero CS Investment ^c
Bottom 10% ($CS_i \leq 4.26$)	211,000	79,000	-21,000
Average ($CS_i = 4.74$)	113,000	43,000	-56,000
Top 10% ($CS_i \geq 5.05$)	15,000	6,000	-105,000

^a Store size is 45,000 square feet and average sales per square foot are \$25 per month; simulation assumes that alternative A yields $\Delta CU_i = 0.5$, $\Delta QU_i = -0.1$, $\Delta VA_i = -0.1$; alternative B yields $\Delta CU_i = 0.1$, $\Delta QU_i = 0.1$, $\Delta VA_i = 0.1$; and alternative C yields $\Delta CU_i = -0.1$, $\Delta QU_i = -0.1$, $\Delta VA_i = -0.1$.

^b Two equations were employed to estimate additional annual store revenues. They correspond to equations (5) and (6) using the parameter estimates in Table 4. We estimate the impact of the changes in satisfaction factors on overall satisfaction as well as the effect of changes in overall satisfaction on percentage change in sales performance, *ceteris paribus*. The equations are:

$$\Delta CS = 0.69 * \Delta CO - 0.14 * \Delta CO^- + 0.05 * \Delta QU + 0.30 * \Delta QU^- + 0.36 * \Delta VA - 0.11 * \Delta VA^-, \text{ and}$$

$$\% \Delta PE = 52.3 * \Delta CS - 84.66 * \Delta CS^- + 4.56 * CS - 10.38 * \Delta CS * CS + 18.15 * \Delta CS^- * CS.$$

^c We assume an “annual rate of depreciation” in CS of about 0.1 points. To construct this proxy, we compute the average annual decline in each factor for a sub-sample of stores with (1) no investments in major or minor remodeling or (2) no investments in the appearance of the store (“cosmetic” investments).

Figure 1: The Satisfaction-Sales Performance Chain

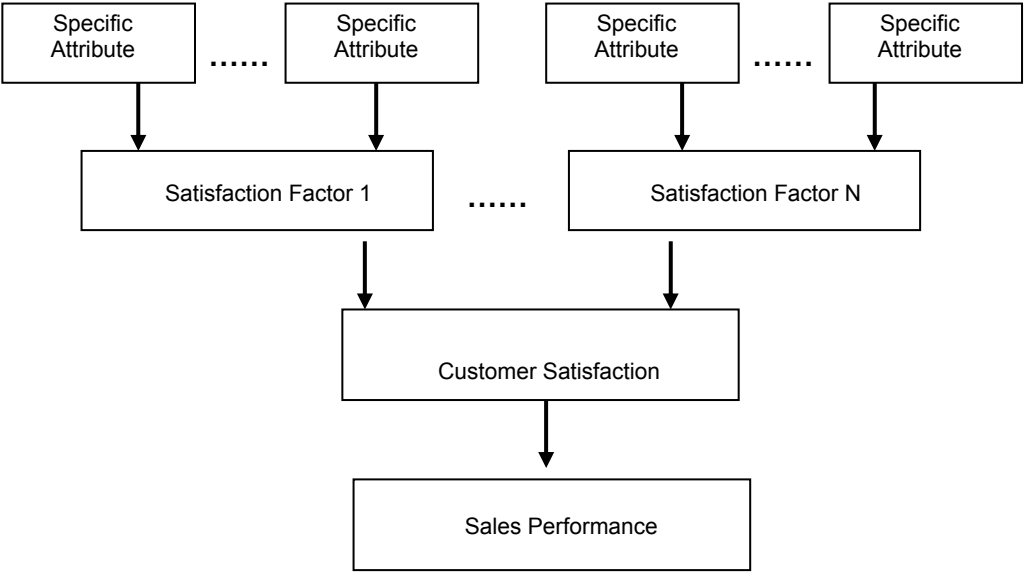
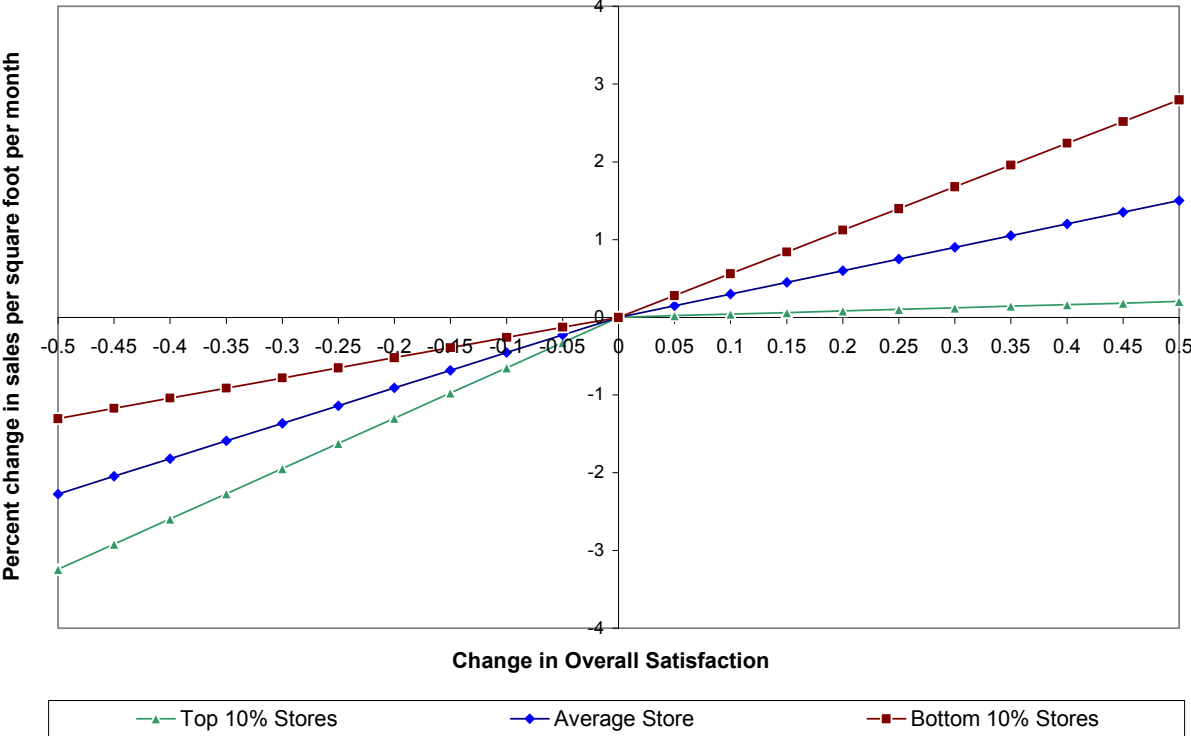


Figure 2: Effect of Changes in Customer Satisfaction on Changes in Store Sales Performance^a



^a The Figure ignores the intercept in equation (6), which reflects the average decline in sales per square foot in the period 1998-2001.

ENDNOTES

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- ¹ We emphasize the distinction between household-level panel data, and independent random samples of top-households that are converted into store averages. At the store level we have panel data because the same stores are observed over time.
- ² We employed the following additional specifications of the criterion variable to examine the robustness of the results for the second equation to the “average of the first, second and third months after” definition: (i) one month after; (ii) second month after; (iii) third month after; and (iv) average of the first and second months after”. We found the results to be robust to variation in the definition.
- ³ The definition of changes in satisfaction factors imply that one point positive change in quality (QU) means $0.05*1=0.05$. Similarly, a one point negative change in quality (QU) means $0.05*(-1) + 0.30*(-1) = -0.35$.
- ⁴ We note that $\Delta CS=1$. Therefore, For $CS_{t-1}=4$, the estimated effect is $[52.3*1 + 4.56*4 - 10.38*1*4] = 29.0$; for $CS_{t-1}=4.75$, the estimated effect is $[52.3*1 + 4.56*5 - 10.38*1*5] = 23.2$.
- ⁵ Mean Squared Errors corresponding to the specifications (1) without CS, (2) nonlinear-asymmetric, and (3) simple are 32.86, 32.80 and 32.73, respectively.
- ⁶ Heteroskedasticity: The Null hypothesis of the White test is homoscedastic errors. For the first equation, the significance of a Chi-Square with 24 degrees of freedom is 0.60. For the second equation, the significance of a Chi-Square with 176 degrees of freedom is 0.63.
- Multicollinearity: For equation (5), all Variance Inflation Factors are less than 4 in all cases; and all simple correlation coefficients are less than 0.6. For equation (6), the Variance Inflation

factors of all control variables are less than 4.5; and all simple correlation coefficients among CS variables and control variables are less than 0.1.

⁷ A detailed assessment of the cost-benefit analysis of investments in customer satisfaction is beyond the scope of this work. We do not have data to estimate the costs of changing satisfaction scores. Such an analysis must consider non-constant marginal costs of customer satisfaction expenditures, and include likely nonlinearities in the depreciation of customer satisfaction. A related issue is the need to understand the impact of changes in satisfaction drivers on changes in overall satisfaction. Do these effects depreciate over time and what is the rate of depreciation?