

Understanding Customer Level Profitability Implications of Satisfaction Programs

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This paper examines relationship between satisfaction and profitability using individual level data. The field study was conducted for the customer base of a beverage distribution company before and after a customer satisfaction initiative was implemented. The initiative resulted in increased customer satisfaction, but carefully allocating all costs to customers using ABC analysis reveals that this does not necessarily translate to increased *net* profitability of the customers.

1. INTRODUCTION

In the repertoire of a firm's strategy there are many instruments to take to the competitive battle. While traditionally firms relied on the 4 P's, increasingly a fifth element, viz., CRM or customer relationship management is becoming important. Firms have come to realize that their customers are the most important assets and it is necessary to keep those assets, grow them, and profit from them. A firm interacts with its customers repeatedly fulfilling transactions, providing after sales service, creating and expanding more opportunities etc. All these are aimed at creating value from the customer base that a firm intends to capture down the road. This means that firms have to identify the key drivers of long term customer retention and profit from them. It is common belief among managers that satisfied customers have a higher likelihood of repeat patronage and therefore satisfied customers are "good" for the firm. Like the 4P's, achieving any given level of customer satisfaction (CS) involves real resources in terms of money, managerial time, and focus. Firms spend hundreds of millions of dollars on just CS research alone (Loro 1992). Therefore understanding the link between customer satisfaction and customer profitability is managerially very important. One recent study by Kamakura et al. (2002) looks at the link between service operations, customer perceptions and profits, but does not focus on customer satisfaction, *per-se*. To know how much to invest in improving CS, firms have to know the relationship between improving the CS score and revenues on one hand and the cost of improving the CS score on the other. Only through such an exercise can we get a complete and accurate picture of the profitability of such an exercise.

Understanding the link between CS and profitability is important for another reason as well. A large and growing literature in marketing, strategy and accounting advocates the use of

both financial and non-financial variables in managerial performance evaluation.¹ Customer satisfaction is frequently cited as a key (to some, the key) non-financial measure. However, what is absent from much of this literature is evidence to support a link between customer satisfaction and economic returns. It is this gap we attempt to fill by examining the relation between customer satisfaction and customer *level* profitability (CP). We use the CS and CP data of individual customers of a wholesale beverage distributor to understand this relationship before and after the implementation of a customer satisfaction initiative.

Studying the link between CS and performance and profitability, whether at the customer level or at the firm level, has become very important for reasons cited above. Naumann and Rosenbaum (2001) cite studies that claim "... only about a third of CS initiatives accomplished anything while two thirds of them ground to a halt". Similarly a study by Andersen Consulting (1995) warns, "Many corporations erroneously believe that there is a direct connection between customer satisfaction and the bottom line". A recent article published by Booz, Allen and Hamilton (Klien and Einstein 2003), provocatively titled "The Myth of Customer Satisfaction", concludes that unless satisfaction leads to loyalty, it may not lead to profitability. Perhaps in response to such studies, Anderson and Mittal (2000) argue that CS to profitability link is solid and claim that calls for abandoning CS programs are misguided. They caution, however, that CS to profitability link is highly asymmetric implying that a small improvement in the CS score may yield a dramatically different result than a small degradation in CS. They focus on asymmetries and non-linearities in the CS-profitability link in a purely conceptual manner. In this paper, we take this further and empirically examine this relationship and the non-linearities therein.

¹ See, for example, Kaplan and Norton (1996); Hope and Hope (1997); Simons (2000).

The relationship between CS and its antecedents and consequences has been studied extensively (see for example Anderson and Sullivan (1993), Bolton and Lemon (1999)). Analyzing consequences of CS at individual customer level, Zeithaml, Berry and Parasuraman (1996) find that greater CS leads to increased purchase *intentions* while Bolton (1998), using cross sectional and time series data, finds a positive association between satisfaction and the duration of customers' relationship (that is *actual* re-purchase) with a firm. Ittner and Larcker (1998) report a positive relationship for a telecommunications company between individual customers' current satisfaction level and next year's account retention and revenues. However, these studies do not examine the costs of actions the firm took to increase satisfaction and thus do not evaluate customer level profitability net of these costs. We believe, however, that firms focusing on CRM need to evaluate customer level profitability net of these costs, which is the ultimate metric of interest. The studies cited above, while providing valuable insights, fail to measure this important metric.

There have also been many studies linking CS to firm level performance in terms of profitability or other metrics of performance. Rust and Zahorik (1993) develop a framework to evaluate the link between CS and its components and firm performance. They start with an individual model of loyalty and retention and then aggregate it to focus on firm level market share outcomes. Anderson, Fornell and Lehmann (1994) and Anderson, Fornell and Rust (1997) established the link between CS, productivity and profitability at the firm level. Nagar (1999) analyzes data on 135 retail banks to investigate information content of non-financial performance measures. He finds a one-year lead-lag association between banks' return on assets (ROA) and customer satisfaction index. Bernhardt, Donthu, and Kennett (2000) document that cross sectional studies attempting to link CS to profitability are fraught with problems while time

series analysis reveals positive relationship between changes in CS and change in firm level performance. Yeung and Ennew (2001), using aggregate measure of financial performance, show that the association between CS (measured using ACSI index) and performance across a range of companies is mixed.

One of the limitations of these studies with the firm as the unit of analysis is that it is hard to derive operational guidelines about how to go about increasing customer satisfaction besides establishing a desirability of increasing satisfaction of a firm's customer base. This is further complicated by the fact that for a typical firm, customers vary widely in terms of their characteristics like volume, patterns of interactions with the firm and consequently, profitability. We believe that conducting the analysis at individual customer level is a step towards overcoming these limitations. Our analysis of CS and CP at customer level helps us understand what type of customers are likely to reward a firm most as a result of satisfaction enhancements. Past research has established that customers who respond positively, with higher unit-volume or revenue dollars, to personalized services need not be profitable when all service costs are factored in (Niraj, Gupta and Narasimhan 2001). Thus examining the link between CS and CP tells us where to, and where not to, direct resources in the area.

Figure 1 summarizes research in this area in a 2X2 matrix along the two dimensions of "level of analysis" and the "performance metric investigated".

[Figure 1 about here]

While profitability has recently been a major performance metric of interest (see Box I), none of the studies linking it with CS has been on the individual customer level. Similarly, while many proxies for performance at the individual customer level have been investigated (see Box III), none have linked customer level satisfaction to, arguably the most important business metric,

profitability at the customer level, like we do. In carefully considering the cost of implementing a customer satisfaction initiative and its allocation to the customer base using ABC analysis, we are able to point out that while such programs may lead to increased sales, revenue or even gross profits, the fully allocated costs of such programs may be so high that it may not be ultimately profitable for a vast majority of customers.

In this paper we report the results of a longitudinal study of a beverage distributor who initiated a customer satisfaction program with his customers.² We use a broad-based measure of customer satisfaction tailored to the company's operations, and compute customer profitability through the use of activity-based cost measures. The contributions of our research to the general management literature are in several areas. Increasing customer satisfaction is an important component of strategy in many organizations. The strategy literature often assumes (explicitly or implicitly) that there is typically a positive association between CS and CP. We find that increasing the level of customer service (such as higher frequency of sales visits) and CS does not necessarily result in higher customer profits for a typical business to business marketer. This finding is consistent with statements by marketing scholars who question the CS/CP relations assumed in some of the management literature.³

Another area of contribution relates to customer valuation models. Models of customer value often use the expected future profit sequence of the customer as one input (e.g., Rust, Zahorik and Keiningham 1995; Reichheld 1996). Customer satisfaction is one potential factor that influences expectations about the future profit sequence of customers (Ittner and Larcker 1998; Fornell 2001). While we show that a more satisfied customer is more likely to continue to

² Some other studies tracking the effects of satisfaction programs (Simester et al. 2000; Rust et al. 1999) have primarily looked at the firm or division level effects, while we focus on individual customer level profitability.

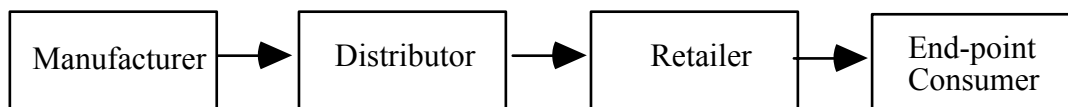
³ Dowling and Uncles (1997), in an analysis of customer loyalty programs, illustrate the revised focus on the economic implications of quality and customer satisfaction programs.

provide the same or more sales than a less satisfied customer, we highlight that the link between higher sales and higher profitability is more complex than is often assumed.

The rest of the paper is organized as follows. Section 2 describes the field research site, its customer satisfaction initiative and our measurement of customer profitability and customer satisfaction for its customer base. Section 3 presents the empirical model we develop to test the relationship of interest. Results of the empirical analysis are presented in Section 4. We provide a discussion of implications and limitations of our study and provide future research directions in the final section.

2. FIELD SITE

Beverage Supply Co. (BSC) is the exclusive distributor of a line of beverage products (such as Pepsi® Cola products) in a part of the mid-west region of the US.⁴ The supply-chain in this industry is as follows:



The manufacturer (such as PepsiCo, Inc.) grants exclusive distribution rights to independent distributors in designated geographical territories. The manufacturer maintains control of product offerings and pays for extensive nationwide marketing and may co-pay for local promotions. The product quality is controlled by the manufacturer. The distributor (such as BSC) is responsible for making products available and for providing sales and delivery

⁴ The exact identity and the location of the organization and the names of its products are withheld to preserve the confidentiality of the data.

services (such as shelf-space planning) to retailers in its geographical region. Retailers sell the product to the final (end-point) consumers. Retailers can influence consumer demand for BSC's products through their pricing, promotion, stocking and store-placement policies. BSC maintains exclusive distribution rights over the brands it distributes in its geographical territory, but there are many competitive brands that are available to retailers from other distributors. Overall, the market for BSC's products is very competitive.

BSC serves over 400 retail customers in its territory that differ sizably in volume, product mix ordered, and the level of customer services provided. BSC interactions with its retail customers occur within the boundaries of the following policies:

- BSC distributes the full set of SKUs (stock keeping units) available from the manufacturer--there are over 150 SKUs which may differ in packaging and/or beverage type.
- BSC charges the same wholesale price to all its customers (retailers), irrespective of volume purchased, thus there is no price differentiation across customers.
- BSC is restricted by its manufacturer from terminating a customer relationship due to poor profitability of an account, but is not constrained in selecting the level of service it provides to individual customers.

We had access to detailed operational data from BSC, including budgets and expenditure under different cost-heads, volume and gross margins of product sold to different customers that helped us estimate different measures of customer profitability of its customer base. In order to measure CS, we helped the BSC management in designing and administering annual rounds of customer satisfaction survey starting in 1996. BSC launched a major customer service initiative based on many of the findings from this first satisfaction survey. This created a natural setting allowing us

to evaluate the effect of new customer-focused initiatives undertaken by the firm to improve customer satisfaction on customer profitability. The initiatives primarily focused on increasing customer contact and communications through more sales calls and personal visits, more frequent deliveries, better monitoring of customer shelves, increase in customer service center staffing to improve response time, and the like. We now describe the measures of customer satisfaction and customer profitability we use in some detail.

2.1 Measuring Customer Satisfaction at BSC

There is a sizable literature on the determinants and measures of customer satisfaction (e.g., Fornell 1992; Anderson and Sullivan 1993; Anderson, Fornell, and Lehmann 1994; Hauser, Simester and Wernerfelt 1994; Bolton and Lemon 1999). The literature suggests different methods, time frame, and levels to measure customer satisfaction (e.g., Bolton and Drew 1991; Goodman, Broetzmann and Adamson 1992; Ittner and Larcker 1998). The relationship BSC has with each customer is a long-term one in which multiple interactions occur in any year. Only a subset of these interactions involves a purchase. The CS measures we use pertain to the ongoing satisfaction of a customer with the full set of interactions it has with BSC.⁵ Our study uses satisfaction and profitability measured twice at the individual customer level, once before (1996) and once after (1997) a major customer satisfaction initiative was undertaken.

The customer satisfaction measure used in the study is based on data from two surveys mailed to all customers of BSC in the first half of the years 1996 and 1997. The survey instrument was developed in early 1996 by the researchers with the benefit of extensive

⁵ Some authors use the term customer satisfaction narrowly and use that for only transaction-specific measurement, while using service quality for measurements taken for a time period (Parasuraman, Zeithaml and Berry 1988). Consistent with others (Bolton 1998) and with the terminology used in our survey, we use satisfaction for a customer's cumulative satisfaction with the provider's ongoing services.

consultations with the management of BSC. Two MBA student teams under our supervision conducted extensive site-based interviews of a cross-section of BSC's customers, and sales and delivery personnel to provide input for the design of the survey. We pre-tested the questionnaire to identify and correct any construction defects (e.g., ambiguous question) in the survey. The final survey included 35 specific items on individual areas of customer satisfaction with BSC. In addition, an item seeking overall satisfaction was also included in the survey instrument.

The surveys were mailed in April of each year in a packet that included a cover letter from the CEO of BSC and a stamped return envelope. In order to preserve independence and confidentiality, filled-in surveys were returned directly to us. We followed several steps as suggested by literature on survey research (Fowler 2002) in order to obtain a high response rate. The MBA student team contacted customers who didn't respond to the survey by phone and/or follow-up letter. Sales representatives of BSC also prompted customers to return the survey. An incentive was promised and provided (in the form of a small gift) to those customers who returned a filled-in survey. The survey asked that the respondent be the owner or the general manager of the organization that is a customer of BSC. We assume that the survey respondent reflects the collective experience of other people in the organization who may have interactions with BSC or make decisions pertaining to BSC.

BSC's customer population grew from 459 in 1996 to 471 in 1997. There was no evidence of a loss of a customer because of dissatisfaction with BSC's services. The increase in customers represented gaining of new customers in BSC's distribution area. According to BSC's management, none of these new customer accounts translated in any substantial changes in competitive dynamics for any existing customers. The survey response rate was 64% in 1996

and 51% in 1997. About 80% of the customers (374) responded to the survey at least one of the years 1996 and 1997 while about 36% responded in both the years.

About twenty-five items in the survey covered customer satisfaction with BSC's *delivery, service reliability, support, and on-going relationship*. Examples of such items are: "products are delivered in good condition;" "deliveries are accurate;" and "sales team keeps you informed about products--price promotions--and point-of-sale materials". We found that being businesses themselves, customers were very interested in how BSC could help them increase their profitability. Thus we also included about ten items related to customer satisfaction with the *value-added dimension* of BSC's services -- such as by increasing sales volume, decreasing costs, or facilitating inventory, shelf-space and order management were also included. Examples of these items include "we help you increase sales volume through--product facing--displays--new products;" "we help you sell other products;" and "we help you decrease costs by--good credit terms--timely replenishments--responsive service". Customers responded to these thirty-five statements by picking one of the five responses ranging from Very Satisfied (coded as 5) to Very Dissatisfied (coded as 1).

A summary customer satisfaction measure (TSAT) was derived based on an equally weighted average of all thirty-five questions. This operationalization is consistent with a component or attribute view of satisfaction, as distinct from overall satisfaction (Oliver 1993; Spreng, MacKenzie and Olshavsky 1996). The survey instrument also included a question directly seeking the rating for overall satisfaction (OSAT) with the distributor. The results of empirical analysis done with this alternate measure were qualitatively similar. Table 1 gives the distribution of satisfaction scores for the two years along with the change statistics.

[Table 1 about here]

The 1996 survey was the first systematic and extensive study BSC had undertaken with its customers. This study was prompted, in part, by complaints from customers about many aspects of BSC's services.⁶ Management used feedback from the 1996 survey when deciding to seek improvements in its levels of customer service. For example, a policy for a minimum number of sales visits to every customer (irrespective of size as measured by the customer's sales volume) was set, resulting in a substantial increase in the staffing for sales and customer service. Much effort was made to reduce spoilage of the beverage, which is typically due to breakages or product expiration at the customer site.

2.2 Customer Profitability Measures for BSC

Studies of CS/CP relations often focus on sales volume, sales revenue or gross profits. Sales volume at individual customer level captures retention, repeat purchases, and growth of customer accounts. Revenue, in addition, captures product-mix and selling price differences across customers. Gross profit adjusts revenue for cost of goods sold to customers. A major limitation of sales volume, revenue, or gross profit measures is that they do not recognize differences in the costs of providing service to individual customers. In the spirit of Niraj, Gupta and Narasimhan (2001), we argue that service costs that include cost associated with activities like sales, distribution, delivery, warehousing, order processing, etc. are not only substantial, they often vary a lot from customer to customer. Consider the following set of accounting identities to compute net profit from a customer:

⁶ As one BSC executive recalled: "We had customers constantly calling us wondering where their orders were, who their sales rep was, demanding more service, complaining about expired product and poor rotation in stores...Little communication existed between delivery persons and sales reps who were visiting the same customers...(it) became clear that we lacked customer knowledge."

Customer revenues = Customer sales volume X Sales price

Customer gross profit = Customer revenues – Cost of goods sold

Customer net profit = Customer gross profit – Customer service costs

Programs to increase CS can potentially affect each item above, possibly by affecting customer sales volume and, especially customer service costs. These costs can vary widely across customers resulting in substantially large differences in the net profitability of individual customers compared to variations in their sales volumes, revenues, or gross profits (see for example, Mabblerley 1996; Niraj, Gupta and Narasimhan 2001). To better understand the effect of CS initiatives on customer service costs, we focus on two measures of CP in our analyses: (i) customer gross profit (GP) and, (ii) customer net profits (NP). As mentioned before, BSC charges the same per-unit selling price to all customers irrespective of their size or satisfaction with BSC. Therefore, revenue or gross profit differences across BSC's customers are primarily due to differences in their sales volumes or their product mix, or both. The overall product-mix for BSC and for its individual customers remained stable during the period of our study.

The accounting system at BSC did not identify or allocate service costs to individual customer accounts. An activity-based costing (ABC) approach that tracks service cost differences across BSC's customers was developed for this research. The activities and drivers chosen were influenced by: (i) observation of the customer service process, (ii) interviews with employees and management of BSC, (iii) interviews with customers about BSC service levels, and (iv) data availability.

Seven different major activity areas at BSC were identified: order processing, sales, delivery, expedited delivery, quality management, purchasing, and warehousing. Costs of these

activities were allocated to individual customers using nine different cost drivers. Figure 2 provides an overview of the ABC system and the abbreviations we used for each cost driver.

[Figure 2 about here]

These nine cost drivers can be classified into the following four categories:

1. Volume-related - sales volume (VOL)
2. Complexity-related - number of stock-keeping units purchased (SKU), number of sales orders (ORDFREQ), number of sales trips (SALESTOP), and number of delivery trips (DELSTOP)
3. Efficiency-related - number of expedited deliveries (EXPEDITE), and number of product units spoiled due to breakage or expiration (SPOILAGE)
4. Infrastructure-related - sales miles (SALEMILE), and delivery miles (DELMILE)

The first category represents volume-related drivers—the greater the number of units shipped to a customer, the greater the volume-driven customer service costs. Complexity-related drivers capture variables that represent diversity in the resource need for different BSC customers, such as those created by the difference in the number of SKUs ordered and customer order pattern. Thus a customer ordering 5000 units of a SKU spread over fifty purchase orders a year needs more resources to fulfill orders compared to a customer that orders the same number of total units spread over only five purchase orders. Efficiency-related variables include activities at the customer-interface that may be reduced by more efficient customer service and support. For example, expediting (EXPEDITE) can be reduced by better coordination of purchasing between BSC and its customers. Spoilage can be reduced by better monitoring of expiration dates and end consumer demand patterns for BSC products sold by customers. Distributor infrastructure-related variables affect activities that do not directly add any extra value of products or services

to BSC's customers. For example, customers do not gain any value from a salesperson or a delivery person traveling 20 miles as opposed to 2 miles to visit their site. Miles traveled is a cost driver that is a function of where BSC locates its warehouse in relation to its customer locations. All service costs except corporate management costs were fully accounted for and allocated to customers.

[Table 2 about here]

Distribution statistics for the nine cost drivers for the two years appear in Table 2. The ratios of the 90/10 percentile highlight the large differences across customers in the sample. For example, a ratio of 54.4 (5,281/97) for volume in 1996 means that the 90th percentile customer has over 54 times the volume sold of the 10th percentile customer. As noted earlier, BSC increased the level of customer service as a response to feedback from the 1996 survey. The summary distribution statistics for each of the nine cost drivers highlight the increase in customer service. The median number of sales stops went from 8 in 1996 to 48 in 1997. Increased sales calls helped the firm to address a variety of issues related to quality and reliability of service. For example, the median number of product units spoiled in 1997 reduced to zero compared to 39 in 1996.

Combining the unit sales volume and margin data with the estimates of service costs allocated to the customers based on the ABC approach developed for BSC gives us our different CP measures of interest. Table 3 presents some descriptive statistics on our profitability and service cost measures for 1996 and 1997. Notice that average unit volumes and gross profits increased while average net profits decreased in 1997. There is a large dollar decrease in net profits for the entire customer base despite a modest increase in sales volume and gross profits, since average customer service costs increased more than gross profits. In addition, it is

interesting to note that while the sales volume and gross profit distributions are quite similar in the two years, there is substantial increase in the spread of net profits across customers in 1997 as measured by the ratio of 90th percentile to 10th percentile.

[Table 3 about here]

3. Model Development

One stream of literature argues that there is a positive relationship between increases in CS and increases in CP (e.g., Reichheld 1996). This positive relationship between increases in CS and increases in CP could be due to either a positive revenue effect or a positive cost effect from actions taken to increase CS.

- *Positive Revenue Effect:* There is a positive response by customers to services targeted to improve customer satisfaction. Higher customer satisfaction leads to higher customer demand resulting in revenues greater than the associated customer costs.
- *Positive Cost Effect:* Sellers achieve “larger surpluses” due to reduced transaction costs from the ongoing exchanges with highly satisfied customers (e.g., fewer returns and complaints, and reduced account maintenance costs) compared to “smaller surpluses” from relatively less satisfied customers.

The predicted result of these positive effects is that more satisfied customers are more profitable. However, there is also the following counter veiling force:

- *Negative Cost Effect:* Increase in customer satisfaction comes at increased customer service costs. Sellers incur cost to achieve higher level of customer satisfaction. This could include increased manpower cost to improve customer contact, service and communications.

Thus the net impact of a satisfaction initiative resulting in higher customer satisfaction would depend on the relative magnitudes of these effects. Therefore, it is also possible that the costs to increase CS overshadow the benefits from increased CS. The Return on Quality (ROQ) framework proposed by Rust, Zahorik and Keiningham (1995) has raised a similar possibility before, i.e., "... it is possible to spend too much on quality" (p. 59). Ittner and Larcker (1998) also provide evidence inconsistent with an everywhere positive relation between customer satisfaction and customer profitability for a telecommunication company. They report that revenue increased only for those customers who scored less than 80 (out of 100) on the customer satisfaction index (CSI). Their study did not examine costs associated with efforts to increase CS. However, if revenue growth is flat for those customers who scored above 80 on CSI, any costs incurred in improving CS of those will result in a reduction in their profitability.

Thus, the general hypothesis about the relationship between can be expressed as:

$$CP \propto \beta.CS$$

There are several ways to model CS/CP relations involving levels, differences, and percentage changes of CS and CP variables, each with its own merits and limitations (see Lambert 1998 for a discussion). In our analysis, we focus on examining the extent to which changes in CP measures can be explained by changes in the level of the CS variable. The change measures of CP and CS variables allow us to use a customer as its own control in evaluating CS/CP relations. Customers' evaluation of their satisfaction with BSC may be affected by differences in their experiences and preferences. The location and competition, specific to the customer, could also affect customer specific values of CP variables. The change metrics provides partial control for exogenous customer-specific factors that are outside the model, to the extent they remain

constant over time. A basic regression model for our analysis of relation between CS and CP can be written as:

$$(1) \quad \Delta CP (= CP_t - CP_{t-1}) = \alpha + \beta_1 \Delta Sat (= Sat_t - Sat_{t-1}) + \beta_2 (Other\ Variables) + \varepsilon$$

We have two observations for the customers who responded to both satisfaction surveys, one before and one after the customer satisfaction initiative was implemented. Equation (1) provides a means of identifying the satisfaction-profitability link in a natural field experiment like set-up. The intercept term α in equation (1) captures the effect of time varying macro-factors common to all customers. However, there are other variables that have customer-specific effect in this relationship. Among these, the observed factors (like size, nature of business -- whether the customer is a retail store or restaurant) can be included under other variables.

Changes in customer profits (either GP or NP) can vary cross-sectionally due to size of interaction between BSC and the customer. As pointed out before, customers vary greatly in the volume they purchase from BSC. This volume variation can overwhelm all other factors unless explicitly controlled for. Therefore, we first include a customer size variable among the regressors. We operationalize this variable as the total units (cases) purchased by the customer in the year 1995 ($Volume_{95}$), a year prior to the time when satisfaction was measured for the first time⁷.

The literature often predicts that the relationship between CS and CP is not linear (Anderson and Mittal 2000) and it might depend on either the size of the customer, or on the baseline level of customer's satisfaction. Oliver, Rust and Varki (1997) for example point out the so-called customer delight effect, which implies that return on increasing an already highly

⁷ In order to alleviate the concerns about potential endogeneity, we did not use the volume for 1996 since satisfaction measurement was already underway for part of the year.

satisfied customer to a still higher (delight) level might be substantially higher than the return related to a similar type of change in a customer who is starting from a relatively lower level of satisfaction. We include three terms to capture the above non-linearities in evaluating the effect of satisfaction on profitability. The squared term is included to capture the possible convexity or concavity in the relationship. The other two terms are special types of interaction terms of ΔCS with volume and starting level of satisfaction for the customer. In particular, we interact ΔCS with $1/Volume_{95}$ (i.e., the reciprocal of size) and $1/TSAT_{96}$ respectively. In addition to reversing the interpretation of the interaction parameter, these also imply different curvatures in the interaction effects due to the asymptotic nature of the reciprocal variables.⁸ Our regression equation thus becomes:

$$(2) \quad \Delta CP = \alpha + \beta_1 \Delta CS + \beta_2 Volume_{95} + \beta_3 \Delta CS^2 + \beta_4 \frac{\Delta CS}{Volume_{95}} + \beta_5 \frac{\Delta CS}{TSAT_{96}} + \beta_6 (Other\ Variables) + \varepsilon$$

As pointed out in table 3, the customers in our sample vary substantially in their size (Volume). Therefore, to minimize bias due to heteroskedasticity, we adopt a weighted least square procedure by dividing both sides of the equation by a firm size variable (Greene 2001).⁹ To alleviate endogeneity concerns, we once again choose $Volume_{95}$ as the firm size variable to divide all terms of the equation. This is like an instrumental variable, which is free from the endogeneity concerns and is highly correlated with the volume for 1996 and 1997.

In order to control for other observable differences, we include two dummy variables, *Chain* (=1, if customer is part of a Chain, i.e., has 2 or more stores under the same top management; 0 otherwise) and *Premise* (=1, if customer serves the beverage for consumption on

⁸ We analyze other non-linear transformations in various combinations (multiplying by sat_{96} and $Volume_{95}$ instead of division, including other higher order terms and interactions) but choose these three for their significance, interpretability and better model-fit (as given by R-squared).

⁹ When we estimate the equation without dividing by size, we indeed find a lot of evidence of heteroskedasticity as captured by standard tests like Breusch-Pagan's test (Green 2001).

its own premises like a tavern; 0 for pure retailers who sell the beverage for outside consumption only). ‘Chain’ variable is included to cover the possibility that the customers who are part of a chain may not have the same flexibility in responding to changes in satisfaction with BSC as their procurement practices could be guided by a central policy. ‘Premise’ variable is included to control for differences between eating establishments and others. We did not divide these two variables by $Volume_{95}$ as these are here purely for control.¹⁰ Our final estimation equation is given as equation 3 below:

$$(3) \quad \Delta CP' = \alpha(1)' + \beta_1 \Delta CS' + \beta_2 Volume'_{95} + \beta_3 \Delta CS^{2'} + \beta_4 \left(\frac{\Delta CS}{Volume_{95}}\right)' + \beta_5 \left(\frac{\Delta CS}{TSAT_{96}}\right)' + \beta_6 Chain + \beta_7 Pr emise + \varepsilon'$$

where ' indicates a transformed variable or error term, i.e., divided by $Volume_{95}$.

We estimated equation (3) for the two CP variables of interest, namely gross profit (GP) and net profit (NP) using the least squares techniques. The results are presented and interpretations provided in the following section.

4. Results

In estimating equation (3), we excluded those customers who did not complete either one of the two surveys and a few very small, “occasional” customers – who are not resellers of the beverage. These were large customers, like churches, who buy beverages at wholesale prices for special events such as picnics. Exclusion or inclusion of these customers in the estimation sample had no material impact on our analyses and results. The estimation sample had a total of 152 customers (about a third of the entire customer base). This sample consisted of customers

¹⁰ We estimated the equation with or without the transformation for these variables and the results remain identical.

who are slightly above larger on an average on volume but were not significantly different on any other important characteristics such as product mix, satisfaction or other control factors.

4.1 Regression Results

The weighted least squares estimates of the two regression equations are provided in Table 4. The first column gives the result for the GP equation, where we find that all the satisfaction related variables have statistically significant impact on GP (i.e., $\beta_1 > 0$, $\beta_3 > 0$, $\beta_4 < 0$ and $\beta_5 < 0$). This implies that there is statistically significant association between satisfaction and gross profit in our sample and that such a relationship is non linear. Since β_1 and β_3 are both positive we can conclude that for a given change in the satisfaction score, the more satisfied customers generate a greater incremental gross profits than less satisfied customers.

Turning to the interaction parameters β_4 and β_5 , a more complicated relationship emerges. First, the negative signs for these parameters imply that these interaction effects are negative and thus work to offset the main effect of change in satisfaction as captured by β_1 . The magnitude of these interaction effects depends on the magnitude of the interacting variables (the inverse of size, i.e., $1/\text{Volume}_{95}$ and the inverse of baseline satisfaction, i.e., $1/\text{TSAT}_{96}$). Thus the interaction effects are larger for smaller volume customers and also for customers with a lower baseline level of satisfaction. Finally, the interaction effects decrease at a decreasing rate as the size or baseline level of satisfaction increases. One interesting finding is that size per-se has no direct effect on change in customer profitability (β_2 not significantly different from zero), however, its interaction effect with change in satisfaction has a significant effect. Given the directions and magnitudes of the main and interaction effects described above, the total effect of

change in satisfaction on GP can be summarized as follows: the effect is positive and increasing at a declining rate both with the size of the customer and with the baseline level of satisfaction.

The two control variables and the volume variable do not seem to have any significant impact on the changes in gross profit. The results remain the same if we re-estimate the model without these controls but we prefer to leave those terms in the final equation for reasons explained in the previous section.

[Table 4 about here]

The NP regression estimates are given in the second column. The satisfaction related effects are all statistically significant and in the same direction as in the gross profit regression reported earlier. However, the magnitudes of these parameters (β_1 , β_3 , β_4 and β_5) are higher compared to their GP regression counterpart signifying that effects are much more pronounced when NP is the dependent variable. The higher magnitude of the parameter β_5 indicates that the interaction effect of the baseline level of satisfaction is much stronger. What this implies is that for sufficiently low levels of TSAT96, the negative interaction effect could overwhelm the positive main effect of change in satisfaction and overturn the conclusion of generally positive relationship between satisfaction and profitability.

Thus we conclude that both gross and new profits are positively and non-linearly affected by the changes in satisfaction. However, the relationship between satisfaction and profitability (especially NP) might be negative if customers start at sufficiently low level of baseline satisfaction. Also, the positive effects are stronger for high volume customers and customer that are moderately to highly satisfied to begin with. Thus the benefits of increasing satisfaction for small customers with relatively low level of baseline satisfaction are more than offset by the cost of increasing their satisfaction. These results can be interpreted as consistent with the notion of

customer delight that implies that increasing the satisfaction of highly satisfied customers (to the level of “delighting” them) is likely to be more rewarding (Oliver, Rust and Varki 1997; Rust and Oliver 2000).

Further, unlike in the GP regression, the intercept (α) is negative and statistically significant when the dependent variable is NP. Recall that this parameter captures the effect of all the time varying macro factors and system-wide effects common to all customers. Given that the intercept is insignificant in the GP regression model, we conjecture that the general business and economic climate related factors that affect revenues and gross margins have not changed in the sample data. While we cannot rule out other macro factors that could affect the NP but not the GP, the result is suggestive that the increased cost of servicing the customer base to implement the new customer satisfaction initiative could be behind this. The increase in cost may simply be reflecting that the cost of increasing satisfaction from current level is indeed very high for the company. However, it could also result from inefficient expenditure or faulty design of the customer satisfaction initiative, or it could be due to competitive reaction forcing BSC to temporarily spend much more for the purpose. Subject to these possibilities, during our study period increase in satisfaction at BSC is associated with increase in gross profit, primarily due to increased demand. But, the system-wide costs incurred by BSC in implementing the customer satisfaction initiative also resulted in a significant and negative sample-wide change in profitability as evidenced by the negative and statistically significant estimated intercept parameter for the NP regression. For example, the service costs for the median customer went up by about \$465 (26%) during this period.

4.2 Numerical Illustration of Results

To further illustrate the non-linearity in the CS-CP relationship and to see the effect of customer satisfaction captured in the regression estimates in a more concrete manner, we present numerical illustrations in Table 5 that demonstrate the effects for customers of different sizes, different initial satisfaction levels and different levels of changes in satisfaction. In this table, we present the predicted change in GP and NP respectively in columns 4 and 5, taking into account only the impact of satisfaction related parameters (β_1 , β_3 , β_4 and β_5).

[Table 5 about here]

In Panel A of the table, we first illustrate the generally positive relationship between CS and CP. Recall from tables 1 and 3 that the average Volume is about 3000 units and average TSAT level in 1996 was about 4. The relationship between CS and GP, and CS and NP at this level is positive. We point out here that if the effect of all significant parameters is considered, then accounting for those system-wide effects, the CS-NP relationship is usually negative at most typical values found in our sample. We may recall from Table 3 that the NP for an average customer declines between 1996 and 1997 by about \$270 (21%), thus there are indeed strong system-wide effects. Subject to the possible caveats mentioned in our earlier discussions of significant α in the NP regression, we reiterate that the effect of increase in satisfaction *per-se* is positive for most typical customers, but the cost of bringing about increased satisfaction might be large, thus erasing the positive impact.

In the other three panels of Table 5, we illustrate the effects varying one underlying factor (given in columns 1, 2 and 3) at a time. In Panel B, we vary the Change in TSAT variable from a low of -0.2 to a high of 0.6 while keeping the other factors at close to the sample average values. In this panel, we point out the following: for an average customer, the GP as well as NP is

positively related with CS. However, NP effects are relatively stronger than the effects on GP, and also the changes in GP as well as NP are increasing at an increasing rate because of a larger parameter (β_3) for the squared term.

In Panel C, where we vary the baseline level of satisfaction, we illustrate first that at low level of baseline, the CS-NP relationship turns negative. This is an illustration of interaction effect overwhelming the main effect in this relationship. Next, notice again that the NP effects are stronger than GP effects, but now both the change in GP as well as NP shows concavity (i.e., tapering off of effect) as we move to higher baseline level of satisfaction. From these two, panels, we clearly illustrate the non-linear and complex nature of the CS-CP relationship. In addition, we are able to show something akin to the customer delight effect: first that higher changes in satisfaction have disproportionately large impact, and second, the net impacts are higher for higher baseline levels of satisfaction.

Finally, in Panel D of Table 5, we vary the customer size and are able to show once again that effects are higher for larger customers, these are more pronounced for the NP relationship compared to the GP relationship and finally there is once again evidence of tapering off of the effect (concavity) with respect to customer size.

5. Discussions and Conclusion

In this paper, we report the results of a longitudinal study of a beverage distribution company starting with the inception of its formal customer satisfaction program. We use ABC methodology to calculate two measures of customer profits, NP and GP. We also developed a broad-based measure of customer satisfaction tailored to the company's operations, and measured both satisfaction and profitability before and after the inception of the distribution

company's formal customer satisfaction program. The results we report highlight the complex relation between CS and CP. While there is an evidence of positive relationship between CS and gross profit, this effect varies by customer size and the customer's current level of satisfaction. In addition, we found that the cost of improving customer satisfaction could far outweigh the revenue increase for most customers.

There are three broad implications from our study. First, the results highlight that the cost of increasing satisfaction should be accounted for in any economic evaluation of satisfaction programs. While the ineffective use of resources cannot be ruled out for our field site, it is quite clear that the positive relationship posited by much of the customer satisfaction literature reaches its limit much sooner than generally believed. Therefore, firms should focus not just on the revenue impact but also on the increase in service costs. Second, allocating such costs to customers carefully based on activities required for increasing satisfaction, and not merely on revenues (like done for SG&A costs traditionally) is important in order to get an accurate account of whether such improvements are warranted. If NP is calculated by a simple revenue based allocation, the GP and NP regressions will have almost identical parameters, except the intercept. When costs are allocated based on activities different profitability profiles might emerge as we described on our sample. The third implication is on resource allocation. The complexities and non-linearities in the CS-CP link that we documented in this study imply that from a return on investment standpoint, not all customers are equal. In particular, improvement efforts (and dollars) should be directed towards larger customers and customers who are already relatively highly satisfied.

We next highlight some possible limitations of our research approach and directions for future research. The first limitation relates to the time frame of the study. The database used in

this research comprises current customer profitability measures at the individual customer level. It is possible that different associations exist between CS and CP than we report because we use too short a time-period. It could be argued that investments in CS by the firm at time t yield economic returns beyond year $t+1$ that we analyze. This long-term benefit explanation is similar to that given for capitalizing advertising costs and acquisition costs of new life insurance policies. We should point out that except for the relatively minor cost of actually conducting the first satisfaction study, virtually all the service costs for BSC were of a recurring nature, primarily staffing costs in sales, delivery, complaint resolution and customer service areas. We do not believe that mismatch in timing of accounting for costs and benefits of customer satisfaction is a major concern in our study.

A research design focused on individual CS/CP measures can also underestimate aggregate relationships when externalities exist across customers. Even if there are no financial returns to increases in CS at the individual customer level, there can be spillover benefits (such as referrals and word-of-mouth effects that bring in new customers). These externalities would show up in the growth in customer base and in the aggregate company level CP data. During the time period of our analysis, there was no substantial change in BSC's customer base. In fact, most of the increases in BSC's sales during this period were from retention and growth of the older customer accounts rather than from new customer accounts. Thus it is also probably not a major issue in this time frame. Indeed it will be desirable to come up with metrics that capture such indirect benefits, but to the best of our knowledge no study so far has reported using any such measure identifiable to individual customers.

There are also supply-chain wide implications of such programs that can be studied to understand the full implications of a decision to launch satisfaction initiatives. BSC is a part of a

larger supply-chain with links to an upstream manufacturer (and its suppliers) and links to downstream retailers (and their customers, who consume BSC's products). Our results have implications for interrelationships beyond just one link (distributor and retail customers) in the bigger supply chain. A generally consistent result in our sample is that more satisfied customers increased their purchases from BSC. Higher sales to more satisfied customers also benefit the upstream manufacturer through the higher volume of units it ships to BSC, and possibly through an ability to price higher. Our analysis does not include these upstream benefits. There was no evidence of any transfer payment relating to these benefits from the manufacturer to BSC. Future research could provide further insights on patterns of realization and distribution of gains in a supply-chain associated with customer satisfaction programs at one or more links of the supply chain.

The finding that the customer satisfaction increase from year to year was associated with decrease in a performance metric (NP) has been observed elsewhere. Wruck and Jensen (1994) report that from 1987 to 1993 substantial increases in quality levels at Sterling Chemical were accompanied by sizable decreases in earnings and stock price. One explanation is that Sterling Chemical felt that it needs to make the improvements due to more intense competition. Similarly, one could argue that an appropriate benchmark for us is BSC's profitability if it didn't implement the CS program.¹¹ Management at BSC may have viewed the sizable increase in CS-related outlays as a required defensive move to maintain (or even increase) its market

¹¹ Ittner and Larcker (1998) also note this problem: "We do not have an explicit estimate of organizational performance in the absence of quality program and system choices, so we cannot directly determine whether performance would have been lower (or even higher) than the observed value of TQM practices and nontraditional information and reward systems had not been adopted." (pp. 31-32)

position. Our data cannot answer this question but future research can perhaps attempt to answer the question with analytical and simulation-based methods.

Another alternative explanation here is that firms such as BSC and Sterling Chemical are making sub-optimal choices in their zeal to increase CS. Of course, increasing CS or quality is desirable as long as the additional costs of increasing CS and quality are less than the benefits received. It could be possible that managers underestimate these costs or overestimate related benefits. Underestimation of costs could prove to be very costly since it may not be possible or may be more harmful to cutback services or quality, once they are offered to customers. The results in this paper provide a strong motivation for a better understanding of costs and economic implication of CS and quality programs before committing to them.

Summary

The development of substantive body of knowledge about satisfaction–profitability relationship is a key challenge in marketing and strategy literatures. While there is sizable literature on satisfaction, much of that is focused on the final consumer context rather than business-to-business context. Attempts to link satisfaction and profitability at the individual customer level in this context are so far in their infancy. Most of the work done so far has not been at individual customers and we argue that understanding the relation at that level is critical for obtaining important insight in operational aspects of implementing a customer satisfaction initiative. Decisions about the design of performance measures are more informed when our knowledge base about satisfaction–profitability relationships is grounded in reliable research. Managers can make more informed decisions about investing in CS initiatives when they better understand satisfaction–profitability relationship and their determinants. For example, a decision to dramatically expand customer satisfaction initiatives may not be easily reversible without

customer perceptions about quality being negatively affected. The findings in the paper warrant further analysis in multiple avenues. Any individual company study requires replication and extension on data from other companies in varied contexts. Research on companies in other industries, in other parts of the supply chain, and with different types of CS programs would assist in probing the generalizability of our findings. Moreover, the customer profitability measures we examine are annual measures. Subsequent research could well examine a longer-time horizon as is found in many customer valuation models. Such valuation models are particularly appropriate when investments in customer relationships are heavily front-ended and where the likely benefits occur over multiple years.

Table 1

Customer Satisfaction Measure Distribution Statistics

Measure Description	N	Mean	Percentile		
			10 th	50 th (Median)	90 th
TSAT 1996	301	3.96	4.82	3.96	3.25
OSAT 1996	301	4.25	5.0	4.0	4.0
TSAT 1997	240	4.11	4.80	4.11	3.41
OSAT1997	239	4.33	5.0	4.0	3.0
Change in TSAT	170	0.13	0.94	0.06	-0.62
Change in OSAT	169	-0.01	1.0	0	-1

Notes:

1. TSAT is calculated as the average response to 35 satisfaction questions about various dimensions of satisfaction in the survey and OSAT is the response to a single-item question about overall satisfaction.
2. Change statistics are reported only for the customers who responded to surveys in both years.

Table 2

Customer Service Cost Drivers Distribution Statistics

<u>Service Factors</u> 1996 [N=459]	Mean	Percentile		
		10 th	50 th (Median)	90 th
Volume - cases	2130	5281	1163	97
Number of SKUs	25.8	52	19	4
Order Frequency – per year	56.3	112	52	8
Sales Stops – per year	19.7	52	8	2
Delivery Stops – per year	56.3	112	52	8
Expedited Delivery – per year	1.6	6.5	0	0
Spoilage - cases	127	370	39	0
Sales Miles – per year	195	520	90	18
Delivery Miles – per year	644	1500	468	104
1997 [N=471]				
Volume - cases	2137	5332	1113	101
Number of SKUs	25.8	59	19	4
Order Frequency – per year	54.7	48	48	24
Sales Stops – per year	41	48	48	24
Delivery Stops – per year	54.7	96	48	24
Expedited Delivery – per year	1.98	12	0	0
Spoilage - cases	56.5	144	0	0
Sales Miles – per year	496	960	360	120
Delivery Miles – per year	663	1440	480	144

Note:

Statistics is reported for the entire customer base. As noted in the text, the sample that responded to both surveys is materially similar to the overall customer base, except for being slightly larger on an average.

Table 3

Customer Profitability Measure Distribution Statistics

1996 [N=459] <u>Profitability Measure</u>	Mean	Percentile		
		10 th	50 th (Median)	90 th
Volume - cases	2130	5281	1163	97
Gross Profit (GP) - \$	3897	9510	2116	185
Customer Service Cost - \$	2580	5707	1794	324
Customer Net Profit (NP) - \$	1297	3666	193	-588
1997 [N=471]				
Volume - cases	2137	5332	1113	100
Gross Profit (GP) - \$	3909	9599	2106	184
Customer Service Cost - \$	2797	5777	2259	394
Customer Net Profit (NP) - \$	1029	4021	60	-
				1406

Note:

Statistics is reported for the entire customer base. As noted in the text, the sample that responded to both surveys is materially similar to the overall customer base, except for being slightly larger on an average.

Table 4
Regression Results

Dep. Variable	<u>ΔGP</u>	<u>ΔNP</u>
Adjusted R²	<u>0.36</u>	<u>0.76</u>
Estimated Coefficients		
α	-64.74 (46.36)	-885.05** (99.26)
β_1	686.5** (207.6)	1255.14** (444.58)
β_2	0.048 (0.037)	0.025 (0.080)
β_3	200.76** (49.2)	383.15** (105.31)
β_4	-34811** (4150)	-48433** (8885.1)
β_5	-1831.2* (826.5)	-3952.4* (1769.5)
β_6	-0.026 (0.493)	0.009 (0.10)
β_7	-0.0793 (0.048)	0.195 (0.10)

The estimated equation is given below, the DV is either ΔGP or ΔNP:

$$\Delta CP = \alpha + \beta_1 \Delta CS + \beta_2 Volume_{95} + \beta_3 \Delta CS^2 + \beta_4 \left(\frac{\Delta CS}{Volume_{95}} \right) + \beta_5 \left(\frac{\Delta CS}{TSAT_{96}} \right) + \beta_6 Chain + \beta_7 Pr emise$$

Notes:

1. Numbers after parameter estimates (in parentheses) are standard errors.
2. ** indicates statistically significant at 1% level; * indicates statistically significant at 5% level.

Table 5

Simulation Results from Estimation Regression

Panel A: The CS-CP Relationship				
Volume₉₅	TSAT 1996	Change in TSAT	Predicted Change in GP	Predicted Change in NP
3,000	4.0	-0.5	-58.4	-29.7
3,000	4.0	0.5	158.7	221.2
3,000	4.5	-0.5	-83.8	-84.6
3,000	4.5	0.5	184.2	276.1
Panel B: Effect of Change in Satisfaction				
Volume₉₅	TSAT 1996	Change in TSAT	Predicted Change in GP	Predicted Change in NP
3,000	4.0	-0.2	-35.4	-34.9
3,000	4.0	0.2	51.5	65.5
3,000	4.0	0.4	119.0	161.7
3,000	4.0	0.6	202.5	288.5
Panel C: Effect of Base Satisfaction Level				
Volume₉₅	TSAT 1996	Change in TSAT	Predicted Change in GP	Predicted Change in NP
3,000	2.5	0.5	21.4	-79.2
3,000	3.0	0.5	82.4	56.5
3,000	3.5	0.5	126.0	150.6
3,000	4.0	0.5	158.7	221.2
Panel D: Effect of Customer Size				
Volume₉₅	TSAT 1996	Change in TSAT	Predicted Change in GP	Predicted Change in NP
200	4.0	0.2	19.0	20.3
1,000	4.0	0.2	46.8	59.0
3,000	4.0	0.2	51.5	65.5
5,000	4.0	0.2	52.4	66.8
10,000	4.0	0.2	53.1	67.8

Note:

TSAT is calculated as the average response to 35 satisfaction questions about various dimensions of satisfaction in the survey.

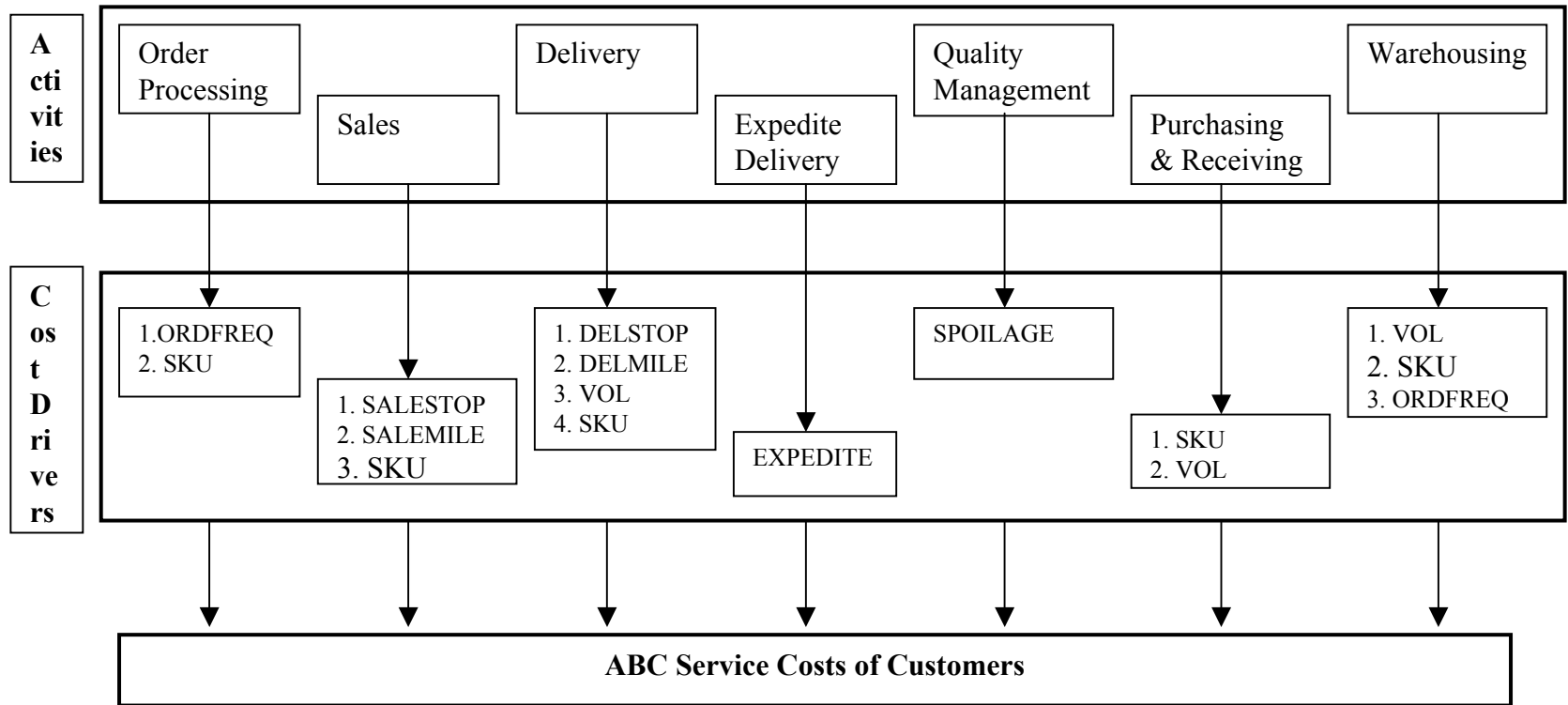
Figure 1

Research Linking CS and CP
Representative Papers

Level of Analysis

		Individual	Aggregate
Performance Metric	Profitability	Box IV This study	Box I 1. Firm level ROI (Anderson et al. 1994) 2. Firm level ROA (Nagar 1999) 3. Firm level sales and net profits (Bernhardt et al. 2000) 4. Firm and sector level operating profits, retained profits and net profits (Yeung and Ennew 2001)
	Other Proxies	Box III 1. Repurchase Intention (Zeithaml et al. 1996) 2. Customer retention / duration (Bolton 1998) 3. Retention and revenue (Ittner and Larcker 1998)	Box II 1. Labor productivity (Anderson et al. 1997) 2. Customer Loyalty (Fornell 1992) 3. Market share (Anderson et al. 1994, Rust and Zahorik 1993)

Figure 2
Customer Service Activities and Their Cost Drivers



Note: Where there are multiple cost drivers for an activity area, BDI Management provided estimates of the percentage of the activity's costs to be assigned by individual drivers.

1. **Activity Descriptions:** Order Processing – Includes receiving orders from customers and processing for delivery; Sales – Includes visits to customers by salesmen for taking orders or account maintenance and relationship building; Delivery – Visits to customers by delivery personnel for delivering orders; Expedite Delivery – A special emergency delivery visit in response to a stockout; Quality Management – Product return and/or replacement due to breakage or expiration; Purchasing & Receiving – Includes placing orders to manufacturer, receiving and reconciling orders etc.; Warehousing – Includes activities in the distributor's warehouse including holding, stock-maintenance and physical movements.

2. **Driver definitions:** VOL - Sales volume; ORDFREQ - Number of sales orders; SKU - Number of stock-keeping units purchased by customer; SALESTOP - Number of sales trips; SALEMILE – Sales miles traveled (SALESTOP x distance to customer); DELSTOP - Number of delivery trips; DELMILE – Delivery miles traveled (DELSTOP x distance to customer); EXPEDITE - Number of expedited deliveries; and SPOILAGE - Number of product units spoiled due to breakage or expiration.

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