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TWO ESSAYS ON SATISFACTION

by

VISHAL M BINDROO

M.S. University of Central Florida, 2002

A dissertation submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy
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Major Professor: Raj Echambadi

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ABSTRACT

This dissertation consists of two essays that study the relevant boundary conditions to the relationship between the customer satisfaction and loyalty. Retaining current customers is critical to a firm's performance and has been well-established in the literature. Extant literature tells us that loyal customers are typically less price sensitive, spend more than non-loyal customers, less expensive to retain, and more importantly, provide new referrals through positive word of mouth.

In the first essay, drawing from decision justifiability theory, I posit that consideration set size and price-consciousness moderate the relationship between satisfaction and loyalty. At higher levels of consideration set sizes, the positive relationship between satisfaction and loyalty is likely to be weakened. However, this two-way interaction effect is seen to impact high and low price-conscious consumers differently. Specifically, I show that satisfied, low price-conscious consumers with higher consideration set sizes will be more loyal vis-a-vis high price-conscious consumers with similar satisfaction levels and set sizes. These theoretical hypotheses are tested in four separate studies. Specifically, I use secondary data and three experimental studies. All my hypotheses including the mediating role of decision justifiability are supported.

The second essay investigates the role of satisfaction on loyalty intentions for firms that offer both the product and the product-related augmented services. In the industry that I studied for this question, buying a product requires an extraordinarily high capital outlay; however, the profitability of the firm is dependent on the services offered to the customers. The services market is a very competitive market as well in this industry. So, how should a firm manage this portfolio that includes both products and services? I draw and extend the consumption system model proposed by Mittal, Kumar and Tsiros (*Journal of Marketing*, 1999). Specifically, I propose a curvilinear relationship for both product and services satisfaction on loyalty intentions

and posit synergistic interactions between them. I test this model using longitudinal data spanning five years across multiple countries that were obtained from a multinational company. Analyses reveal support for the proposed hypotheses.

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CHAPTER ONE: INTRODUCTION

1.1: Dissertation Overview

The purpose of this dissertation is to study the boundary conditions to the relationship between customer satisfaction and loyalty. The dissertation consists of two essays that focus on answering the following questions: (1) What is the role of competing brands on the firms strategy of retaining current customers through improvement of customer satisfaction? (2) Given that a large number of firms are providing a bundle of both product and related long-term services, how can firms successfully manage their resources across product and service offerings? This dissertation is focused on providing insights into the satisfaction-loyalty relationship, in the context of competition and consumption systems. Extant literature shows that in general consumers who are satisfied with their current purchase are more likely to repurchase the same product in the future. Recently researchers have started studying the relevant boundary conditions to this relationship. This dissertation adds to this line of research by addressing the above-mentioned set of research questions. While the first essay analyzes secondary and experimental data from the business to consumer context, the second essay uses the data from the firm in the business to business segment for the analysis.

The dissertation is organized into three chapters. Chapter 1 provides the overview about the central relationship of satisfaction-loyalty along with a brief description of the two essays in the dissertation. Chapter 2 and 3 comprise the two essays of the dissertation.

1.2: Satisfaction-Loyalty Relationship Overview

Satisfaction has been well researched in the literature (Ganesh et al 2000). It has been regarded as the fundamental determinant of long term consumer behavior (Oliver 1997). Over the years researchers have defined and measured satisfaction in different ways (Oliver 1997). In the past, researchers have focused on single transaction episodes to conceptualize satisfaction, while in more recent research, satisfaction has been conceptualized as the overall experience accumulated up to date (Johnson et al. 2001). One of the important advantages of using cumulative over single transactional satisfaction is its better predictive power for consequent consumer behavior (Anderson, Fornell and Lehmann 1994). In this dissertation, I use the conceptualization used by Anderson, Fornell and Lehmann's (1994; p. 54), who define customer satisfaction as an "overall evaluation based on the total purchase and consumption experience with the good or service over time."

Past research has linked customer satisfaction to purchase behavior, specifically retention (e.g. Anderson and Sullivan 1993; Bolton 1998; Jones and Sasser 1995; Mittal and Kamakura 2001; Rust and Zahorik 1993; Sambandam and Lord 1995). This emphasis has been largely due to the fact that the past research had identified customer retention as a key driver of firm profitability (Reichheld 1996; Reichheld and Sasser 1990). Recently, researchers have proposed the models that link satisfaction to retention and retention to profits (e.g., Anderson and Mittal 2000; Rust, Zahorik, and Keiningham 1995; Zeithaml, Berry, and Parasuraman 1996).

The concept of brand loyalty is considered strategically very important in order to obtain competitive advantage by firms, as brand-loyal consumers are less expensive to retain compared

to acquiring new customers (Mittal and Kamakura 2001). In fact, the costs of acquiring a new customer have been found to be up to six times higher than the costs of retaining the current one (Rosenberg and Czepiel, 1984). Oliver (1997 p. 392) defines loyalty as “a deeply held commitment to rebuy or repatronise a preferred product or service in the future”.

The central assumption behind satisfaction-building efforts is the notion that the relationship between satisfaction and loyalty is universalistic. However, research has shown that the direct effect of satisfaction on loyalty varies between industries, and in some cases the correlation between the constructs is very low (Johnson et al., 2001). Empirical results imply that the precise relationship between satisfaction and loyalty is much more complex than a straightforward linear relationship. In this dissertation, my focus is on providing insights about customers who are susceptible to defection despite being highly satisfied with the prior brand experience.

1.3: Essay 1 Overview

The reason for the low correlation between satisfaction and loyalty is an important issue to be investigated, primarily because of importance of this relationship for both managers and academic researchers. Recent research has tried to provide insights to this issue by including additional moderators and mediators between satisfaction and loyalty relationship, e.g., personal characteristics (Homburg & Giering, 2001), social norms (Fournier & Mick, 1999) and trust (Agustin and Singh 2005). However, past research has not studied the impact of consideration set size and price consciousness. Recently, Gupta and Zeithaml (2006) and Srinivasan, Vanhuele, and Pauwels (2008) called for future research to accommodate the role of competing alternatives in the satisfaction-loyalty contingency models, which they reiterated it as the topic of equal

importance for both academicians and managers. In this essay, I attempt to fill this research gap by investigating (1) if the relationship between satisfaction and loyalty is influenced by the size of consideration set, and (2) if the moderating role of consideration set size further depends on varying levels of price consciousness.

Using the theory of decision justifiability, I hypothesize that consideration set size and price-consciousness moderates the relationship between satisfaction and loyalty. I argue that at higher levels of consideration set sizes, the positive relationship between satisfaction and loyalty is likely to be weakened. Further I hypothesize that this two-way interaction effect is seen to impact high and low price-conscious consumers differently. Specifically, I show that the high price conscious consumers with higher consideration set sizes will be less loyal in comparison to the low price-conscious consumers with similar satisfaction levels and set sizes. I test the theoretical hypotheses in four separate studies using secondary data and three experimental studies. Using mixed models, I demonstrate the three-way interaction effect of satisfaction, consideration set size, and price-consciousness on brand loyalty.

To test the underlying theoretical mechanism of decision justifiability and replicate the findings from secondary data, I ran a series of experiments. In the first experiment, I replicate the results using the same product category (gasoline) and measures as used in secondary data. In the second experiment conducted using a different product category, in addition to testing the simple effects and moderators, I examined the underlying psychological processes through mediation analyses of decision justifiability. The results are found to be similar in both of these experiments and decision justifiability fully mediated the three-way interaction of consideration set size, satisfaction, and price-consciousness on loyalty. In the first two experiments, consideration set size and satisfaction variables were manipulated while price-consciousness was a measured

independent variable. In the third and final experiment, all three key variables were manipulated and the results are similar to those obtained in secondary data and the previous experiments.

1.4: Essay 2 Overview

In essay one, the focus was to understand the external impact of competitors on firms' strategy of retaining current customers through improvement in customer satisfaction. In the second essay, the focus is on internal factors to firms that offer a bundle of both product and services components. This research is important because more and more firms are providing product and long-term after-sales services (Reinartz and Ulaga 2008). Moreover, for the industry under observation in this essay, although buying a product requires an extraordinarily high capital outlay, the profitability of the firm is dependent on the additional services offered to the customers. Services market is a very competitive market as well in this industry. Therefore, profitably managing a portfolio that includes both products and services becomes important for any firm.

In this essay, I draw and extend the consumption system model proposed by Mittal, Kumar and Tsiros (1999). Drawing the explanations from need-gratification and dual-factor motivation theories, I propose a curvilinear relationship for both product and services satisfaction on behavioral intentions. The arguments are based on diminishing effect at higher levels for satisfaction's impact on behavioral intentions. Furthermore, I posit synergistic interactions between these two sources of satisfaction. Although, past research point towards positive interaction between them, I further investigate the joint impact on behavioral intentions towards product in the following two scenarios (i) congruence: similar levels of satisfaction with product

and services, and (ii) incongruence: different levels of satisfaction with product and services provided by firm.

My theoretical model was tested using longitudinal data spanning five years across multiple countries that were obtained from a multinational company (sample size =1030 observations). I use mixed model for estimation of variables in the model. Further to test the joint effect of product and services satisfaction, I use response surface methodology. Although new to the marketing field, response surface methodology has been consistently used in engineering and management fields to answer questions concerning the issues of relative impact of fit (and misfit) on various outcomes. In this methodology, Polynomial equation are used to generates three dimensional surfaces reflecting each of the independent variables' impact on the dependent variable, both individual and jointly. The interpretation from these three dimensional surfaces can help make in-depth insights. The results are consistent to my theoretical predictions and further show that it is comparably better for a firm to have higher product satisfaction than services satisfaction to obtain stronger behavioral intentions.

In summary, this dissertation will help in providing a more comprehensive understanding of the complicated relationship between satisfaction and loyalty. In this dissertation, I was able to address few of the limitations in existing theoretical and empirical studies of satisfaction and loyalty.

CHAPTER 2: THE ROLES OF CONSIDERATION SET SIZE AND PRICE CONSCIOUSNESS IN MANAGING CUSTOMER LOYALTY

2.1: Abstract

Companies spend enormous resources in order to enhance customer satisfaction ratings. The rationale behind these investments is that increased satisfaction leads to increased loyalty rates and higher loyalty rates boost corporate profits. However, recent evidence from academic literature and industry papers reveals that even highly satisfied customers defect from firms indicating the role of contingent factors in the satisfaction – loyalty relationship.

In this paper, I consider two such factors: consideration set size and price-consciousness. Drawing from perspectives on decision justifiability, I suggest that consideration set size will negatively moderate the relationship between satisfaction and loyalty. Furthermore, I argue that price-consciousness will moderate this two-way interaction between satisfaction and consideration set size. I test the theoretical hypotheses in four separate studies. Specifically, I use secondary data and three experimental studies. Results reveal support for most of the proposed predictions. Managerial implications and recommendations for future scholarly work are discussed.

2.2: Introduction

For years now, managing customer satisfaction has emerged as a major strategic initiative for firms (Mittal and Kamakura 2001), and hence firms make significant investments in order to increase customer satisfaction ratings (Jones and Sasser 1995) because satisfaction directly impacts loyalty (Fornell 1992). Among other things, customer loyalty is a key outcome for firms as it leads to increased revenues because loyal customers pay price premiums (Krishnamurthi and Raj 1991), and enhanced profitability for firms (Bolton, Lemon, and Verhoef 2004). Despite this strategic focus on satisfaction, industry statistics reveal that customer disloyalty is staggering (Reichheld 1996). More importantly, research studies consistently show that customers who switch are often satisfied with their prior brand experiences (c.f. Ganesh, Arnold, and Reynolds 2000), with overall switching among satisfied customers across many industries approaching an astounding 80% (Reichheld 1996).

In order to account for these anomalies, previous research has documented that the relationship between satisfaction and loyalty is contingent upon a variety of factors such as switching costs (Jones, Mothersbaugh, and Beatty 2000), involvement (Seiders et al. 2005), variety seeking (Homburg and Geiring 2001) etc. But there has been a notable omission because consideration of competing alternatives, a topic of considerable academic significance and managerial importance, has not been accommodated in these contingency models thus far prompting calls for future research in this area (Gupta and Zeithaml 2006, p. 734). I attempt to fill this research gap in this paper. Specifically, I am interested in (a) learning if the relationship between satisfaction and loyalty changes between consumers with “smaller” and “larger” consideration set sizes, and (b) learning if this two-way interaction between satisfaction and

consideration set size holds after accounting for consumer heterogeneity, as reflected by price-consciousness.

Why is it important to study consideration set size as a contingent factor? Literature recognizes that the consideration set formation is the outcome of the “search” stage in the decision making process (c.f. Sambandam and Lord 1995; Srinivasan and Ratchford 1991). A consideration set represents the availability and attractiveness of the alternatives (Howard and Sheth 1969). The size of a consideration set has been shown to be a major pertinent factor in the decision to remain loyal to a brand (Sambandam and Lord 1995).

While the decision to remain loyal to a currently consumed brand (henceforth called the focal brand) partly hinges on the prior experiences or satisfaction with the brand, consumers often compare between the attributes of the focal brand and the brands in the consideration set before justifying their decision to repurchase the focal brand (Thibaut and Kelley 1959). Nedungadi (1990) notes that change in market share, that is independent of the focal brand evaluation, can be understood by studying consideration set characteristics. As such, any examination of the decision to remain loyal to a brand cannot be made independently without considering the alternatives available in the consideration set, and hence consideration set size must be considered as a contingent factor in the satisfaction – loyalty relationship for a complete picture.

Since consideration set formation is endogenous to the “search” stage, an interesting question concerns whether the contingent model of satisfaction and consideration set size is likely to be different for consumers with varying levels of price-consciousness, who likely face different search costs (Kukar-Kinney, Walters, and MacKenzie 2007). It follows then that the specific types of comparisons made between the focal brand and the brands in the consideration

sets are likely to differ between high- and low- price-conscious consumers. As such, it is expected that consumers' level of price-consciousness will moderate the two-way interaction between satisfaction and consideration set size on loyalty.

The three-way hypothesis is tested in four separate studies that utilize both secondary and primary data. In study 1, I test the hypothesis on unique proprietary data consisting of multiple brands across several geographic markets in the retail gasoline category obtained from a national market research company. Then, using three separate laboratory experiments, I replicate the results obtained from the secondary data. Furthermore, I test the underlying theoretical mechanism using mediation tests in these laboratory experiments. The collective results obtained from these four studies provide new insights into the highly complex relationship between satisfaction and loyalty.

The format of the paper is as follows. First, I highlight the relevant theoretical perspectives to develop the theoretical framework of the proposed contingencies to the satisfaction – loyalty relationship. Specifically, I draw my theoretical underpinnings from decision justifiability theory (Inman and Zeelenberg 2002) to formulate the hypotheses. Next, I discuss the four different studies and the associated results involving tests of both moderation and mediation. Then, I discuss the research implications and managerial recommendations of my paper. Finally, I conclude by discussing avenues for future scholarly research.

2.3: Theoretical Framework and Hypotheses

2.3.1: The Satisfaction—Loyalty Relationship

Customer satisfaction is defined as “an overall evaluation based on the total purchase and consumption experience with the good or service over time” (Anderson, Fornell and Lehmann 1994, p 54). A review of past studies on satisfaction and loyalty generally shows a significant positive relationship between satisfaction and loyalty (Fornell et. al. 2006; Ganesh, Arnold, and Reynolds 2000). However, industry statistics indicating that defection rates were high even for highly satisfied consumers (Reichheld 1996) prompted researchers to examine the contingent nature of the relationship between satisfaction and loyalty because the linear relationship between satisfaction and loyalty is perhaps more complicated than previously assumed (c.f. Homburg, Koschate, and Hoyer 2005). In this vein, several researchers have shown certain variables, i.e. length of experience (Bolton 1998), customer characteristics (Mittal and Kamakura 2001), switching costs (Jones, Mothersbaugh, and Betty 2000), involvement (Seiders et al. 2005) etc., will moderate the satisfaction – loyalty relationship. As such, these results based on contingency framework presents a valuable perspective in understanding the underlying reasons for customer defection even under conditions of high satisfaction. I now turn to an exposition of the theoretical variables that I employ in this paper.

2.3.2: The Moderating Role of Consideration Set Size

Consideration sets are defined as subsets of alternatives from all the available alternatives that consumers consider seriously while making purchase and/or consumption decisions (Hauser

and Wernerfelt 1990). They are typically formed after a search process (Sambandam and Lord 1995). Alternatives that fail to be part of consideration set for further evaluation do not have a chance to be selected in the final choice stage (Nedungadi 1990), and hence being a part of the consideration set is critical for brands. Research suggests that consumers form consideration sets because they either lack the cognitive resources (Howard and Sheth 1969) or the ability to evaluate all the available alternatives (Bettman 1979; Nedungadi 1990). Hence, in order to satisfice, consumers reduce active processing of all available brands to focus on a subset of all potential brands (see Howard and Sheth 1969). Therefore the decision to remain loyal to a brand hinges on the consideration set as consumers compare between the attributes of the focal brand and the brands in the consideration set before justifying their repurchase decision. In the literature on consideration sets, the most commonly studied characteristic of consideration set appears to be consideration set size (e.g. Desai and Hoyer 2000; Hauser and Wernerfelt 1990; Sambandam and Lord 1995; Srinivasan and Ratchford 1991).

There is a prevailing viewpoint that loyalty reflects choice or decision utilities and that consumers use different criteria and reasons to arrive at these utilities (see Auh and Johnson 2005). While making decisions to remain loyal to a brand, consumers not only consider previously purchased brands but also consider the alternative brands available in order to arrive at the best possible outcome for themselves and to justify their repurchase decision (e.g., Simonson 1989; Simonson and Nowlis 2000). This suggestion is further supported by the reason-based choice paradigm that states that consumer preferences to remain loyal can be explained by the number of reasons that are actually constructed by consumers to justify their decisions (See Kivetz 1999; Shafir, Simonson, and Tversky 1993).

Consumers develop reasons for their decision to remain loyal based on two different sources: (a) from the previously consumed focal brand and (b) from the alternatives available in the consideration set. An individual consumer who relies on prior satisfaction over the reasons developed by a consideration of alternatives is likely to make the decision to be loyal to the focal brand. In case of smaller set sizes, there are few attractive alternatives available to the consumer leading to a lower number of comparisons and reasons developed based on these alternative brands. This will lead to consumers relying more on the reasons developed from the experience with the previous consumed brand or satisfaction ratings of the focal brand to justify their repurchase decision. Hence, the relationship between satisfaction and loyalty will be primarily driven by the reasons developed due to the satisfaction with the focal brand. Thus I will see a stronger satisfaction-loyalty relationship in the case of a smaller consideration sets.

On the other hand, in case of larger set sizes, there are many alternative attractive brands available in the consideration set. Consumers who have larger consideration sets are also likely to have been exposed to more and varied benefits of different brands (Sambandam and Lord 1995), and are likely to generate multiple plausible reasons for purchasing the alternative brand(s). Hence, while making the repurchase decision consumers will not only be relying on reasons developed from the prior satisfaction with the focal brand but also on multiple plausible reasons developed from the alternative brands in the consideration set. As such, the presence of multiple plausible reasons generated from this larger consideration set makes it more difficult to justify the repurchase decision of focal brand. Therefore, I expect that the strong relationship between prior satisfaction and loyalty is likely to be mitigated by larger consideration set sizes which will result in a comparatively weaker relationship between satisfaction and loyalty.

2.3.3: The Moderating Role of Price Consciousness

Price consciousness is defined as the degree to which consumers focus on paying low prices (Lichtenstein et al. 1988). As shown by Lichtenstein, Bloch, and Black (1988), price-consciousness is an intrinsic trait that plays a part in the search stage of the decision making process. High price-conscious consumers typically face lower individual search costs due to enhanced psychological and utilitarian benefits from price searches compared to low price-conscious consumers, and as such engage in higher levels of search behaviors (Kukar-Kinney, Walters, and MacKenzie 2007; Lichtenstein et al. 1993).

I contend that the moderating impact of consideration set size on the satisfaction-loyalty relationship will largely depend on how easily consumers can compare across different brands present in the consideration sets. Prior literature indicates that in inter-brand comparison tasks, it is difficult to evaluate abstract dimensions such as quality but far easier to evaluate concrete dimensions such as price (Nowlis and Simonson 1997). Consumers with high levels of price-consciousness are likely to engage in high levels of search behaviors vis-a-vis low price-conscious consumers. More importantly, high price-conscious consumers make very different comparisons in terms of attributes vis-à-vis consumers who have low levels of price-consciousness. For low price-conscious consumers, non-price criteria such as product and service quality become critical determinants of product evaluation, whereas for high price-conscious consumers, price takes precedence over other criteria such as product quality, customer service etc. in arriving at the purchase decision (Homburg and Stock 2005).

Consumers with low levels of price-consciousness will mainly rely on the reasons developed from prior satisfaction with the focal brand to make the repurchase decision because

they are satisfied with the focal brand because of its intrinsic non-price attributes. More importantly, owing to the difficult nature of comparison of non-price attributes (Nowlis and Simonson 1997), it is not easy to generate compelling alternatives. For low price-conscious consumers with smaller consideration set sizes, fewer plausible reasons are developed from the alternative brands as well. As such, these low price-conscious consumers will rely mainly on reasons developed from satisfaction with the focal brand to make the repurchase decision.

For consumers with larger set sizes, the reason to repurchase the focal brand based on the prior satisfaction is not offset by the number of plausible reasons generated by the available alternatives in the consideration set because of the difficulty in comparing across non-price attributes. More importantly, the attachment with the focal brand is due to the intrinsic merits of the product itself. As such, this results in an easier justification of the repurchase decision based on satisfaction with the focal brand. In other words, consideration set size will have a weak moderating impact on satisfaction-brand loyalty relationship for low-price conscious consumers.

For consumers with high levels of price-consciousness, price is easily comparable. These consumers will not only rely on the reasons developed from prior satisfaction with the focal brand but will also rely on the plausible reasons generated from the alternatives. In case of smaller consideration set sizes, because fewer reasons will be developed from the alternative brands in the consideration set, consumers will rely mainly on reasons developed from prior satisfaction and will be easily able to justify their purchase decision. On the contrary, when the set size is larger, consumers are likely to generate multiple plausible reasons for purchasing the alternative brand(s). The ease of comparison of the price attribute helps in comparing reasons between the focal brand and the multiple alternatives. Therefore, reasons to repurchase the focal brand based on the previous satisfaction will be offset by the number of plausible reasons

generated by the available alternatives, resulting in difficulty to justify the repurchase decision. Hence I expect that there will be a significant difference in the slopes for satisfaction for smaller consideration sets vis-à-vis larger consideration sets for high price-conscious consumers. In other words, consideration set size will have stronger moderating impact on satisfaction-brand loyalty relationship for high-price conscious consumers.

Based on the above discussion, I suggest:

H₁: Price-consciousness will moderate the effect of consideration set size on satisfaction-loyalty relationship. Specifically, the moderating effect of consideration set size on satisfaction is stronger when consumers are high on price-consciousness but weaker when the consumers are low on price-consciousness.

2.3.4: The Mediating Role of Decision Justifiability

The theorizing thus far has been based on the premise that people will intend to be loyal to a brand only when they have strong reasons to justify it. The need to justify the decision to oneself might be due to anticipation of regret, or due to indulging in rational preference behavior, or even to reflect desire to enhance one's self-esteem (Simonson 1989). Justification prompts more thorough decision making which leads to searching for more rational alternatives (Malaviya and Sivakumar 2002). Inman and Zeelenberg (2002) showed that strong reasons for a decision result in lower subsequent regret because consumers rationalize the choice as being the best under the circumstances. Also, in addition to their own evaluations, consumers choose alternatives that are perceived as most justifiable to others who would evaluate their choices (Simonson 1989). Choices that are based on strong convincing reasons lead to lower post-decisional dissonance as well (Heitman, Lehmann, and Herrmann 2007). I formally test this theoretical mechanism that justifiable reasons will enhance brand loyalty. In other words,

perceived decision justifiability will mediate the impact of consideration set size, satisfaction and price-consciousness on brand loyalty.

H₂: The effects of satisfaction, consideration set size, and price-consciousness on brand loyalty will be mediated by decision justifiability.

To test the hypotheses, I use secondary data and three experimental studies. In the methodological section, I start by first describing the study using secondary data. This includes data collection procedures, measures used in the instruments, development of the model, and the statistical analyses. Next, I describe the three experimental studies and related data collection procedures, including the experimental design and samples, the measurement instruments used, the manipulation checks, and the statistical procedures.

2.4: Study 1

2.4.1: Method

Data. The main objective of study 1 is to provide a preliminary test of the hypotheses. The secondary data used for the analysis was obtained from a leading marketing research company and contains multiple brands from the gasoline product category. The data was collected across 21 geographic markets in United States. The cross-sectional data were obtained from a survey of the panel members and contained 5365 observations.

Dependent variable. Brand loyalty was measured by a single item asking respondents to indicate the number of times they would choose a specific brand of gasoline out of the next 10

purchases of gasoline. This metric has been used in the loyalty literature before to assess loyalty (Baldinger, Blair, and Echambadi 2002).

Independent variables. The key construct of satisfaction was measured on a five point scale. Respondents were asked “taking all things into consideration, how satisfied have you been with the following gasoline brands. Consideration set was measured by asking respondents to name all the brands of gasoline they would consider buying. Price-consciousness was coded using effect coding. Two senior managers with extensive experience of over 20 years in the gasoline industry coded the brands as quality brands and price brands. The inter-rater reliability was 100%. If the focal brand chosen was one of the price (quality) brands, then consumers were rated as high price-conscious (low price-conscious) consumers.

Although the dependent and independent variables used in this study are single-item, Mittal and Kamakura (2001) suggest that single-item scales are indeed acceptable for commercial studies with large number of observations. Table 2.1 provides the operational description of the dependent and independent variables in my model.

Control variables. Total annual household income was used as a control variable to control for income-specific consumption effects. Also, it is possible that favorability of impression might affect repurchase intentions and hence I controlled for the favorability of brand impression. I also created dummies for controlling brand-specific effects.

[Insert Table 2.1 about here]

Model and estimation. I used mixed effect models to analyze the data. A key feature of mixed models is that both random effects and fixed effects can be specified to extract multiple

sources of variation. Since 21 different geographic markets (DMAs) were used to collect the data, there is a distinct possibility that evaluations by people from the same markets may be more similar among themselves than any other two evaluations taken at random. I controlled for the positive correlations that may arise because of market-specific characteristics by modeling geographic markets as random effects. The model was estimated using mean-centered variables for ease of interpretation.

The estimated mixed effects model can be specified as follows:

$$y_{ij} = X_{ij}\beta + Z_i b_i + \epsilon_{ij} \quad (1)$$

where y_{ij} represents the brand loyalty of the i^{th} respondent for the j^{th} market. X_{ij} is the $N \times p$ model matrix corresponding to the fixed effects. Specifically, I used satisfaction, consideration set size, price-consciousness and the cross-products of all three variables as fixed effects. Z_i is the $N \times q$ model matrix that represented the market-specific heterogeneity using a random effects specification. ϵ_{ij} is the $N \times 1$ vector of errors for each observation. These models were estimated using the SAS Mixed procedure.

2.4.2: Results

Collinearity checks. First, I checked for collinearity problems in the data using multiple diagnostics on the uncentered data: bivariate correlations, variance inflation factors, and the condition indices. These multiple measures revealed no major collinearity problems. Also, I randomly sampled observations and estimated multiple models from the comprehensive dataset. The coefficients of the simple effects were relatively stable, again indicating no collinearity

problems. Table 2.2 provides the correlation matrix of the mean-centered variables used in the model.

[Insert Table 2.2 about here]

Endogeneity checks. Does satisfaction affect the size of the consideration set? To check this issue, I conducted a median split of both satisfaction and consideration set size variables. If there was a causation issue, respondents with higher satisfaction ratings would have smaller consideration sets and respondents with lower satisfaction would have had larger consideration sets and the other two cells would not differ from chance. Chi-square tests indicated that all four cells were well represented and that these numbers were significantly greater than predicted by chance. Thus I can be assured that there appears to be no causal connection between satisfaction and consideration set size in this data.¹

Regression results. Table 2.3 provides the results of the mixed effects regression model. Starting with interpretation of the simple main effects, estimate of satisfaction, at means levels of consideration set size and price-consciousness, is found to be positive and significant ($\beta = .17$; $p < .01$). As expected, there was a negative relationship between consideration set size and brand loyalty ($\beta = -.16$; $p < .01$). The third independent variable, price-consciousness, exhibited a non-significant simple effect ($\beta = .28$; ns). With respect to two way interactions in the model, only the interaction of consideration set size and satisfaction ($\beta = -.04$; $p < .05$) was significant, indicating that, in general, consideration set size does have a moderating effect on the relationship between satisfaction and brand loyalty. Higher levels of consideration set sizes weakened the relationship between satisfaction and loyalty.

¹ Similar tests were conducted for relationship between price-consciousness and consideration set size.

H₁ posits a three-way interaction among satisfaction, consideration set size, and price-consciousness. The interaction coefficient of satisfaction, consideration set size, and price-consciousness is significant ($\beta = -.03$; $p < .05$).² Hence H₁ is supported. In order to interpret the specific results, I graphically plotted the results of the three-way interaction (see Figures 2.1 and 2.2). Specifically, the simple slopes of satisfaction at varying levels of consideration set sizes for low and high price-conscious consumers were shown for three specific values of consideration set sizes to plot: mean values of consideration set size, 1.5 standard deviations above, and 1.5 standard deviations below the mean values of consideration set size. Statistical t-tests indicate that the simple slopes at lower and higher levels of consideration set size are significantly different for high price-conscious consumers but not for low price-conscious consumers.

[Insert Table 2.3 and Figure 2.1, 2.2 about here]

2.4.3: Discussion

The results from the secondary data are consistent with the first hypothesis and are in the expected direction. The results also show that there is a simple effect of satisfaction and consideration set on brand loyalty implying that an increase in consideration set size leads to lower levels of loyalty whereas the satisfaction positively impacts loyalty. Additionally, the three-way interaction between satisfaction, consideration set size and price-consciousness reveals interesting and potentially important conclusions. While there was a difference in the slopes for

² Including market concentration (total number of brands available in the specific market) as the control variable in the overall model did not change the results.

consideration set sizes for high price-conscious consumers, there was no such difference for low price-conscious consumers.

Due to the nature of the secondary data used, I could not rule out a covariation effect of other unmeasured variables on my results. Additionally, I was unable to empirically test the theoretical explanation that decision justifiability mediates the three way interaction of consideration set size, satisfaction, and price-consciousness on brand loyalty. Therefore, to test the proposed theory and further strengthen the results with high internal validity, I conducted three experimental studies. In study 2, I replicate the results from study 1 within a more controlled experimental setting in the gasoline industry context. Study 3 which uses a different product category, i.e. hotels, tests the theoretical explanation of decision justifiability. I also use a different operationalization of loyalty here in study 3. Also, while the key variables of satisfaction and consideration set sizes were manipulated in studies 2 and 3, price-consciousness was measured. Study 4 was done by manipulating price-consciousness

2.5: Study 2

2.5.1: Method

Design and procedure. The design was a 2(satisfaction: high vs. low) X 2 (consideration set size: large vs. small) X 2 (price-consciousness: high vs. low) between-subjects design. Respondents were 257 undergraduate students at a Southeastern University who completed the study in return for partial course credit. Participants were randomly assigned to one of the four conditions, with price-consciousness measured in this study.

Scenario. Participants were asked to imagine that they had previously purchased a specific brand of gasoline and were either happy (high satisfaction) or unhappy (low satisfaction)

with that brand of gasoline. Next, they read that it is time for them to again buy gasoline and since they are living in small/large town, there are 2 (small consideration set size) or 15 (large consideration set size) brands available in the market including the brand they purchased last time. All the brands in both the small consideration set size or large consideration set size conditions were acceptable choices. Next, respondents provided measures on loyalty, price-consciousness, covariates and manipulation checks. The covariates included in this study are variety seeking, product familiarity, scenario believability, and effort as these variables may affect the dependent variables.

Dependent measure. Brand loyalty measure was measured asking respondents to indicate the number of times they would choose a specific brand of gasoline out of the next 10 purchases of gasoline, the same as the one used in study 1.

Independent measure. Price-consciousness was measured in this study. I adapted a five item scale from Lichtenstein, Ridgway and Netemeyer (1993). The five items were: (1) I am not willing to go extra effort to find lower prices (R), (2) I will shop at more than one store to take advantage of low prices, (3) the money saved by finding lower prices is usually not worth the time and effort(R), (4) I do not shop in more than one store to find lower prices (R), and (5) The time it takes to find low prices is usually not worth the effort (R). The items loaded on single factor allowing us to use the summated scale to create a single measure. The alpha score was 0.80 indicating a high reliability. I then performed a median split to group respondents into low and high groups on price-consciousness.

Manipulation checks. An ANCOVA was used to assess the satisfaction manipulation. Participants rated satisfaction using a seven point scale (1 = strongly disagree, 7 = strongly

agree). This three-item scale was adopted from Mittal and Kamakura (2001). The three items were (1) happy with brand in last purchase, (2) satisfied with brand in last purchase, and (3) disappointed with brand in last purchase (R). The alpha was 0.93 indicates high reliability. I used measured satisfaction as the dependent variable and the manipulated variables of satisfaction, consideration set size, and price-consciousness and estimated this model using an ANOVA. Only the main effect of satisfaction was significant indicating that my manipulation of satisfaction was indeed successful.

2.5.2: Results

The 2 (satisfaction) x 2 (consideration set size) x 2 (price-consciousness) model was estimated using an ANCOVA model. Results are provided in table 4. The main effect of satisfaction on brand loyalty was significant ($F(1, 241) = 1080.19, p < .001$). There was also a significant main effect of consideration set size on loyalty ($F(1, 241) = 363.19, p < .0001$). To check the direction of the effect, I compared the means on the dependent variable for small ($\mu = 5.62$) and large consideration sets ($\mu = 2.34$) indicating that larger set sizes engender lower loyalty. The third variable of price-consciousness was also significant in this model ($F(1, 241) = 4.91, p < .05$). With respect to two way interactions in the model, only the interaction of consideration set size and satisfaction ($F(1, 241) = 10.02, p < .001$) was significant. H_1 posits a three-way interaction among satisfaction, consideration set size, and price-consciousness. The interaction coefficient of satisfaction, consideration set size, and price-consciousness is significant ($F(1, 241) = 7.79, p < .05$). Thus H_1 is supported. Indeed, price-consciousness moderates the impact of consideration set size on the satisfaction-loyalty relationship.

[Insert Table 2.4 and Figure 2.2 about here]

I graph the complex three way interaction to better understand the relationship. The moderating effect of consideration set size is much stronger for high price-conscious consumers than low price-conscious consumers. The means of the factors are provided in table 4. In panel A of figure 2, where price-consciousness is low, there is no difference in the effect of consideration set size on satisfaction and loyalty as evidenced by a test of the contrast 2.93 - 0.12 vs. 8.55 - 5.31) which was found to be non-significant ($p > .34$). Conversely in panel B, where price-consciousness is high, a moderating effect of consideration set size on satisfaction and brand loyalty is indeed significant. This contrast (2.45 - .05 vs. 8.53 - 4.41) was significant ($p < .01$).

2.5.3: Discussion

The results of the experimental study are consistent with the three-way hypothesis. In addition, I was also able to show significant simple effects. Brand loyalty was sensitive to the number of alternatives in consideration set. As the consideration set size increases, consumers are less likely to be brand loyal. The simple effects of satisfaction and price-consciousness were also significant. This study replicates the results found in the secondary data using the same gasoline product and same operational measure of the dependent variable i.e. brand loyalty. As such, this study demonstrates the robustness of my finding from the secondary data in a new experimental setting. The goal of my next study is to test the mediation effect of justifiability and also obtain additional robustness of the results by testing the hypotheses using a different product category, and by changing the operational measures of brand loyalty.

2.6: Study 3

2.6.1: Method

Design and procedure. The design was a 2 (satisfaction: high vs. low) X 2 (consideration set size: large vs. small) X 2 (price-consciousness: high vs. low) between-subjects design.

Respondents were 240 undergraduate students at a large Southeastern University who completed the study in return for partial course credit. Participants were randomly assigned to one of the four conditions. Similar to the last experimental study, price-consciousness was measured.

Scenario. Participants were asked to imagine that they had previously stayed at a specific hotel and were either happy (high satisfaction) or unhappy (low satisfaction) with that specific hotel. Next they read that it is time for them to again visit the small/large town and need to book a hotel. There are 2 (small consideration set size) or 15 (large consideration set size) hotels available for booking, including the one they last stayed at and all these hotels are acceptable. Next, respondents provided their response on measures on loyalty, decision justifiability, price-consciousness, and select covariates. The covariates included in this study are variety seeking, product familiarity, scenario believability, and effort.

Dependent measure. Brand loyalty was measured using two items from Seiders et al. (2005): (1) how likely are you to stay more often in Hotel S in the future? (2) how likely are you to continue choosing Hotel S?. Decision justifiability was measured using three items drawn from Inman and Zeelenberg (2002): (1) How justifiable is the decision to continue choosing Hotel S? (2) How easy to defend is the decision to continue choosing Hotel S? (3) How logical is the decision to continue choosing Hotel S? The three items loaded on single factor and the Cronbach alpha of 0.90 indicates high reliability. I used the summated scale to create a single

measure of decision justifiability. Similar to study 2, price-consciousness was measured using a 5-item scale adapted from Lichtenstein, Ridgway and Netemeyer (1993). Again, the items loaded on single factor and coupled with a Cronbach alpha of 0.81 allowed us to use the summated scale to create a single measure of price-consciousness. I then performed a median split to group respondents into low and high on price-consciousness variable.

Manipulation checks. An ANOVA was used to assess the satisfaction manipulation. As before, participants rated satisfaction using a seven point, three-item scale adapted from Mittal and Kamakura (2001). The alpha was 0.93 revealing high reliability. This measured satisfaction was used as the dependent variable and the manipulated variables of satisfaction, consideration set size, and price-consciousness as the independent variables. ANOVA results indicate that only the main effect of satisfaction was significant indicating that my manipulation of satisfaction was indeed successful.

2.6.2: Results

The main dependent variable, brand loyalty was subjected to 2 (satisfaction) x 2 (consideration set size) x 2 (price-consciousness) model estimated using an ANCOVA. The main effect of satisfaction was significant ($F(1, 229) = 1113.40, p < .001$). There was also a significant main effect of consideration set size on loyalty ($F(1, 229) = 2.94, p < .08$). A comparison of the means on the dependent variable for small ($\mu = 7.45$) and large consideration sets ($\mu = 7.22$) indicates that larger set sizes engender lower loyalty. The third variable of price-consciousness was not significant ($F(1, 229) = 0.84; ns$). In case of the two-way interactions, none of the three effects were significant. The three-way interaction of satisfaction, consideration

set size, and price-consciousness is significant ($F(1, 229) = 19.79, p < .05$) indicating support for H_1 .

I tested the mediating effect of justifiability by following the procedures suggested by Baron and Kenny (1986). First, as discussed earlier, I found a significant three-way effect of satisfaction, consideration set size, and price-consciousness on brand loyalty ($F(1, 229) = 19.79, p < .03$). Second, there was also a significant effect of three way interaction of satisfaction, consideration set size, and price-consciousness on the mediating variable of decision justifiability ($F(1, 229) = 106.16, p < .01$). Finally, I added decision justifiability in the original model with the brand loyalty as the dependent measure. The three-way effect of consideration set size, satisfaction and price-consciousness on brand loyalty became non-significant ($F(1, 228) = 7.60, NS$), while the effect of decision justifiability on brand loyalty was still significant ($F(1, 228) = 105.96, p < .001$) implying that decision justifiability fully mediated the combined effect of consideration set size, satisfaction and price-consciousness on brand loyalty supporting H_2 .

2.6.3: Discussion

The main goal of this study was to empirically test the mediation effect of decision justifiability. In my study, decision justifiability fully mediates the three-way impact on brand loyalty. Also, the other results of this experimental study were consistent with the previous two studies. In summary, I was able to replicate the results using a different product category, i.e. hotels, with a different operationalization of the dependent variable. While this study further demonstrates the robustness of my finding in terms of the three-way interaction, the key variable

of price-consciousness was measured. The goal of next study is to replicate the three-way interaction by manipulating all three variables including price-consciousness.

2.7: Study 4

2.7.1: Method

Design and procedure. The design was a 2 (satisfaction: high vs. low) X 2 (consideration set size: large vs. small) X 2 (price-consciousness: high vs. low) between-subjects design. Respondents were 213 undergraduate students at a large Southeastern University who completed the study in return of partial course credit. Participants were randomly assigned to one of the eight conditions.

Scenario. Participants were told that in general, they believe that price is (NOT) the most important criteria for them while deciding to choose any product/service. They do (NOT) shop at different stores/websites to take advantage of low price, because they believe the money saved by this is (NOT) worth the effort. They have never been (ARE) on a tight shopping budget. Next they were asked to imagine that they had previously stayed at a specific hotel and were either happy (high satisfaction) or unhappy (low satisfaction) with that specific hotel. Then they read that it is time for them to again visit the small/large town and need to book a hotel. There are 2 (small consideration set size) or 15 (large consideration set size) hotels available for booking, including the one they last stayed at and all these hotels are acceptable. Next, respondents provided their response on measures on loyalty, justifiability, price-consciousness and select covariates. As before, the covariates included in this study were variety seeking, product familiarity, scenario believability, and effort.

Dependent measure. Similar to study 3, brand loyalty was measured as using two items (1) how likely are you to stay more often in Hotel S in the future? (2) how likely are you to continue choosing Hotel S? (Seiders et al. 2005).

Manipulation check. Price-consciousness was measured by a single item: “In the above scenario, the most important criterion for choosing any hotel was price.” This measured value of price-consciousness was used as the dependent variable in an ANOVA model with the manipulated factors of satisfaction, consideration set size, and price-consciousness). Only price-consciousness was significant revealing that my manipulation of price-consciousness worked. I also checked if the manipulation of satisfaction worked using the approach employed in studies 2 and 3. ANOVA results reveal that the manipulation of satisfaction worked as well.

2.7.2: Results

An ANCOVA was used to test the model. The main effect of satisfaction was significant ($F(1, 199) = 545.84, p < .001$). There was also significant main effect of consideration set size on loyalty ($F(1, 199) = 3.45, p < .10$). A comparison of loyalty means for small ($\mu = 8.18$) and large consideration sets ($\mu = 7.50$) indicates that larger set sizes engender lower loyalty. The third variable of price-consciousness was not significant ($F(1, 199) = 0.03; ns$). In case of the two-way interaction, only satisfaction X price-consciousness was significant ($F(1, 199) = 4.62, p < .05$). The three-way interaction among satisfaction, consideration set size, and price-consciousness was also significant ($F(1, 99) = 4.34, p < .05$) supporting H_1 even with a manipulated price-consciousness variable.

2.7.3: Discussion

The main objective of this experiment was to see if I could successfully manipulate price-consciousness, which is considered as a personality trait and difficult to manipulate. Both the manipulation checks for satisfaction and price-consciousness were found to have worked. As in the previous three studies, the three-way interaction hypothesis was found significant.

2.8: General Discussion

My paper takes up the call made by Gupta and Zeithaml (2006) in accounting for competition in evaluating loyalty towards firms. Consideration set formation is a critical step in the buying process (Srinivasan and Ratchford 1991). Set size is a primary factor in evaluating loyalty because a consumer makes a decision to be loyal by also considering the perceived attractiveness of available alternatives (Sambandam and Lord 1995). Drawing from decision justifiability theory, I extend the arguments from the extant literature to suggest that consumers compare between their previously consumed brands with the alternatives in a consideration set in order to justify their repurchase decision. Therefore, I incorporate consideration set size, measured as the number of alternative brands in a consumer's choice set, as a key contingent factor in the satisfaction-loyalty relationship. My suggestion that consideration set size will moderate the satisfaction – loyalty relationship such that the impact of satisfaction on loyalty is weakened at higher levels of consideration set sizes is borne by the empirical results from an analysis of the secondary data and three experiments. Incorporating set size as a contingent factor is an important addition to the satisfaction literature.

Does the contingent relationship between consideration set size and satisfaction on loyalty hold after accounting for consumer heterogeneity in terms of evaluation costs? Extant literature suggests that varying levels of price-consciousness reflects differing search costs (see Kukar-Kinney, Walters, and MacKenzie 2007). High price-conscious consumers have lower search costs and focus on price as their predominant attribute of comparison, whereas consumers low on price-consciousness have higher search costs and focus on non-price attributes (that are difficult to compare) in order to make inter-brand comparisons. I suggested that the moderating effect of consideration set size on the satisfaction-brand loyalty relationship is stronger for high price-conscious consumers, whereas it is weaker for low price-conscious consumers. This three-way interaction was supported in all four studies demonstrating the robustness of this effect. My results showed that high price-conscious consumers are less likely to repurchase a brand when the number of brands in the consideration set is large. More importantly, this result holds even for highly satisfied, high price-conscious consumers implying that consumers will remain loyal to the focal brand as long as the prices are low. On the other hand, for low price-conscious consumers, varying consideration set sizes do not seem to impact the relationship between satisfaction and loyalty.

I explain this result using decision justifiability theory wherein consumers attempt to justify their repurchase decision by comparing between the previously consumed brands and the alternatives in the consideration set. For low price-conscious consumers who shop based on difficult-to-compare non-price attributes, prior satisfaction outweighs the reasons generated from an evaluation of the alternatives in the consideration set, and hence the decision to justify the repurchase decision is much easier even when the set sizes are large. This mechanism operates differently for high-price-conscious consumers. Because prices are easily compared, the reasons

generated from alternatives in the consideration set generally outweigh prior satisfaction, and hence consumers are not able to justify their repurchase decision of the focal brand unless the focal brand is the lowest price alternative. My results also show that loyalty rates are highest only for those high price-conscious consumers with smaller set sizes.

These results have important implications for managers. It is imperative that brands that compete on prices minimize the set sizes of their consumers by reducing the perceived attractiveness of the alternatives. One way to accomplish this would be to promise “everyday low prices” so as to ensure minimal brand switching among high price-conscious consumers. The offshoot of such strategies could be that the consideration set sizes for these consumers could dwindle over time. For brands that compete on non-price attributes, differentiation on non-price attributes is a critical strategy. These brands do not have to worry about perceived competition as long as they satisfy their consumers on the attributes that are valued by their consumer base. My empirical results also have additional implications for managers. Managers tend to focus in isolation on improving the satisfaction ratings of their products and services. I show the importance of perceived competition and highlight the impact of the presence of alternative brands on brand loyalty. These results suggest different strategies for price and non-price brands. For price brands, satisfaction is not an insulation mechanism as even satisfied consumers are likely to switch in the presence of attractive competing brands. These firms are better off in reducing the set sizes of their consumer base by through focused strategies. For quality or non-price brands, satisfaction is a good insulation mechanism and perceived competition does not seem to matter.

Besides demonstrating the three-way interaction of satisfaction, set size, and price-consciousness in all four studies, I also empirically demonstrated the theoretical mechanism. My

results are robust across different methodologies (secondary data and experiments), samples (real-life consumers and college students), product categories (gasoline and hotel), and using different operationalizations of the brand loyalty variable.

Like all empirical research, my study has several limitations which give rise to future research opportunities. First, my dependent variable in all studies involved measuring repurchase intentions. Although extant literature notes high correlations between attitudinal and behavioral loyalty (see Oliver 1997), it would be worthwhile to validate my model with actual loyalty behaviors. Second, I used cross-sectional data to test my hypotheses. Past research has shown that both satisfaction and consideration sets are dynamic in nature (Mittal, Kumar, and Tsiros 1999; Desai and Hoyer 2000), so the present study can be extended utilizing longitudinal data in order to accommodate temporal considerations. Third, the present conceptualization involves set size which is one characteristic of consideration sets. One could test to see whether my theoretical model holds with the consideration of additional set characteristics. There is growing theoretical interest in the notion of consideration set heterogeneity (see Chakravarti and Janiszewski 2003). For example, if the consideration set sizes are equal for two consumers but there are sufficient differences in set composition, one interesting question could be whether consideration set heterogeneity conditions the relationship between satisfaction and loyalty. Fourth, this study has been conducted by using data from often consumed goods and services. Testing the theoretical model on durable goods would go a long way in generalizing the results to other settings as well.

In conclusion, empirical results from four studies support my key premise that consideration set size conditions the relationship between satisfaction and loyalty and that this two-way relationship is different at varying levels of price-consciousness. It appears that

satisfaction is an insulation mechanism from competition for brands that target low price-conscious consumers whereas satisfaction does not offer the same protection for brands that target high price-conscious consumers.

Table 2.1: Operationalization of Variables (Study 1)

Variable Name	Actual Measures and Measurement Scale
<u>Dependent Variable</u>	
Brand Loyalty	<ul style="list-style-type: none"> Think of the next 10 times you might need to buy gasoline. Out of the next 10 purchases of gasoline, how many would be for each brand of gas listed below.
<u>Independent Variables</u>	
Satisfaction	<ul style="list-style-type: none"> Taking all things into consideration, how satisfied have you been with following gasoline brands
Consideration Set Size	<ul style="list-style-type: none"> Which brands of gasoline would you consider buying from the list below
Price consciousness	<ul style="list-style-type: none"> Two senior managers with extensive experiences in the gasoline industry coded the brands as non-price and price brands. If the focal brand chosen was one of the price (quality) brands, then respondents were rated as high price-conscious (low price-conscious).
<u>Control Variables</u>	
Favorability	<ul style="list-style-type: none"> How favorable is your overall impression of the brand?
Income	<ul style="list-style-type: none"> Total annual household income

Notes: Brand-specific, and market-specific controls were used as well.

Table 2.2: Correlation Matrix of Variables (Study1)

Variable	Mean	S.D.	1	2	3	4
1. Brand Loyalty	7.17	2.65	1.00			
2. Satisfaction	.00	1.09	.09	1.00		
3. Consideration Set Size	.00	2.37	-.18	-.09	1.00	
4. Price Consciousness	-.43	.89	-.01	-.03	.06	1.00

Table 2.3: Parameter Estimates from the Mixed Effect Model (Study 1)

Variables	Parameter Estimate
Intercept	5.60** (.32)
Satisfaction (S)	.17** (.05)
Consideration Set Size (C)	-.16** (.02)
Price Consciousness (P)	.20 (.17)
$S \times C$	-.04* (.02)
$S \times P$.04 (.04)
$C \times P$.03 (.02)
$S \times C \times P$	-.04* (.02)
Income	.07* (.03)
Favorability	.33** (.05)
-2 Log Likelihood	20877.70
AIC	20881.70
BIC	20883.80

* $p < .05$.

** $p < .01$.

Notes: Standard errors are provided in parentheses. Model was estimated with both market and brand-specific control variables.

Table 2.4: Means in Experimental Studies

Consideration Set Size	Satisfaction	Price Consciousness	Study 2	Study 3	Study 4
Low	Low	Low	2.93 (1.84)	1.85 (1.52)	2.54 (1.80)
Low	Low	High	2.45 (.76)	1.40 (.67)	1.79 (.93)
Low	High	Low	8.56 (1.10)	5.75 (1.11)	5.62 (1.36)
Low	High	High	8.54 (1.17)	6.20 (.76)	6.29 (.75)
High	Low	Low	.12 (.33)	1.33 (.79)	1.67 (1.47)
High	Low	High	.06 (.23)	1.23 (.61)	1.59 (.98)
High	High	Low	5.31 (1.62)	6.10 (.83)	5.88 (1.22)
High	High	High	4.41 (1.99)	5.68 (1.34)	5.87 (1.02)

Notes: Standard deviations are provided in parentheses.

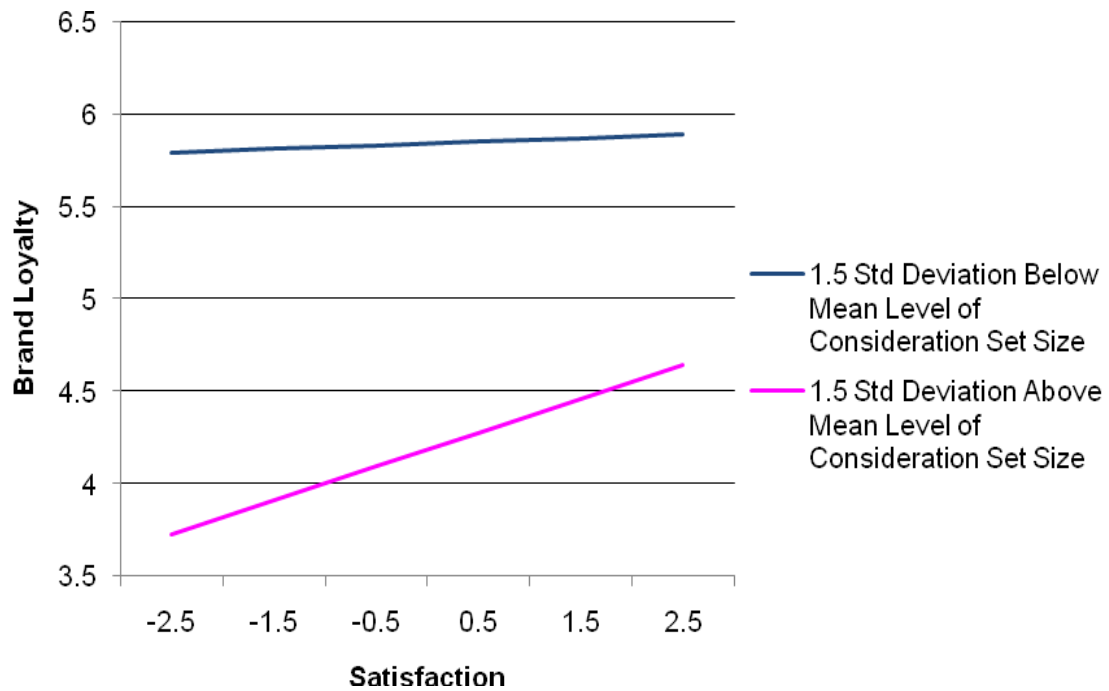


Figure 2.1: The Moderating Effects of Consideration Set Size and Price Consciousness on Satisfaction-Brand Loyalty Relationship for Low Price Consciousness (Study1)

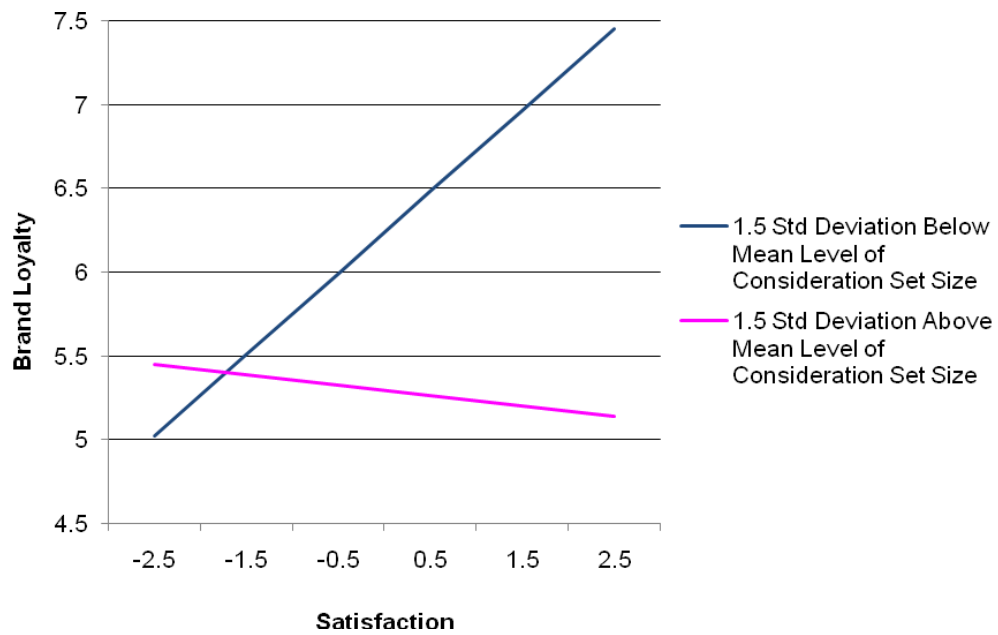


Figure 2.2: The Moderating Effects of Consideration Set Size and Price Consciousness on Satisfaction-Brand Loyalty Relationship for High Price Consciousness (Study1)

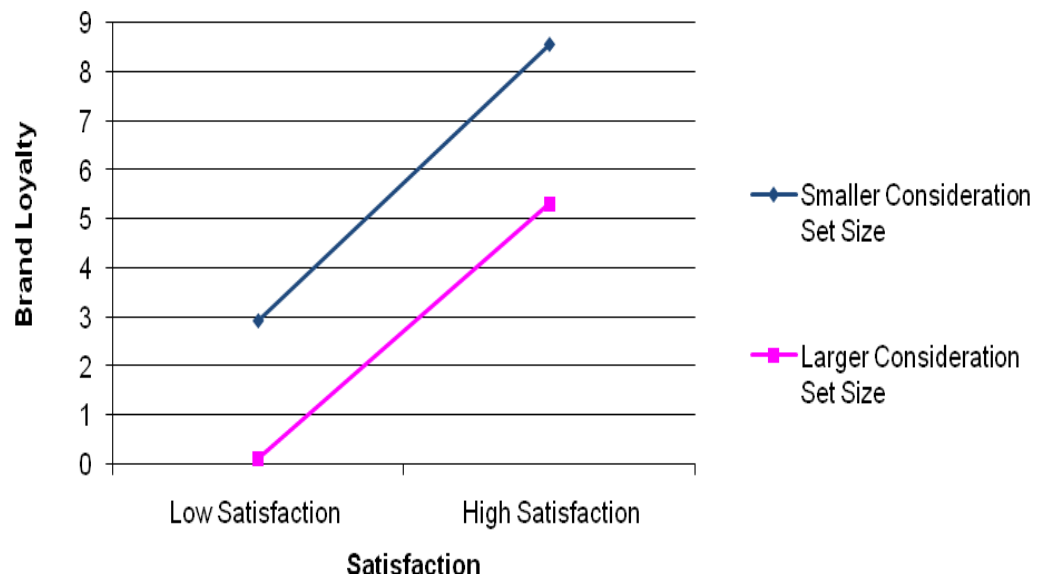


Figure 2.3: The Moderating Effects of Consideration Set Size and Price Consciousness on Satisfaction-Brand Loyalty Relationship for Low Price Consciousness (Study2)

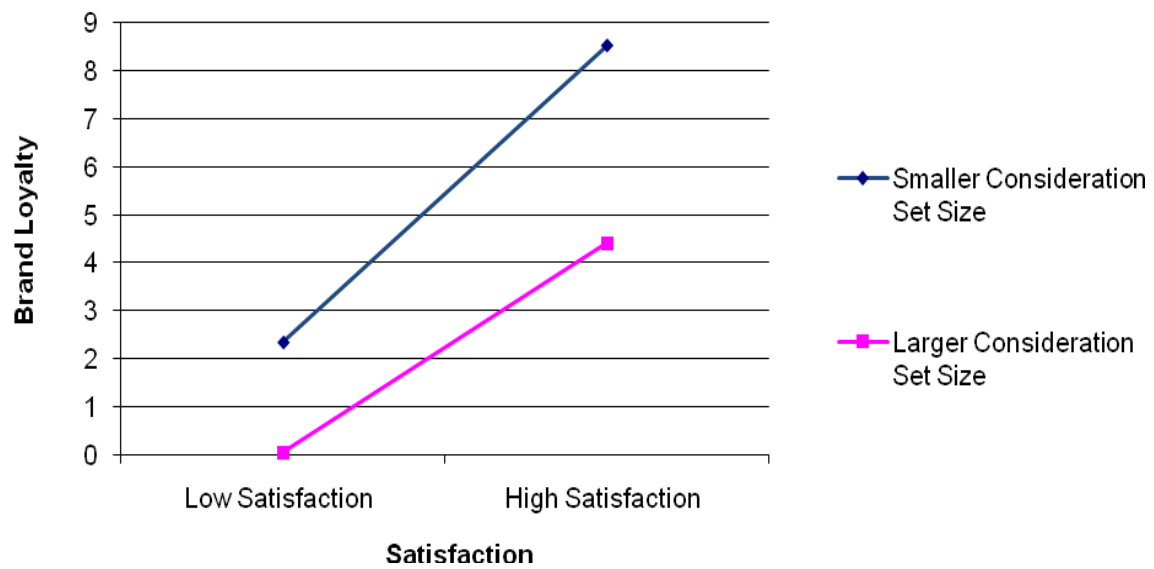


Figure 2.4: The Moderating Effects of Consideration Set Size and Price Consciousness on Satisfaction-Brand Loyalty Relationship for High Price Consciousness (Study2)

CHAPTER 3: THE SYNERGISTIC ROLES OF PRODUCT AND SERVICES SATISFACTION ON LOYALTY

3.1: Abstract

In this paper, I investigate the role of satisfaction on loyalty for firms that offer both product and product-related augmented services. This research builds on recent research that recommends firm to develop product-related service offerings that complement their product offerings (Reinartz and Ulaga 2008). Studying consumers' satisfaction towards the product bundle will help uncover the exact nature of the relationship between customer satisfaction and loyalty. The strategy of offering augmented services as a part of a consumption system will not only help in stabilizing and securing cash flows from traditional product-based exchanges, but will also help deliver growth in saturated markets, protect against uncertainty and generate new sources of stable cash flows beyond manufacturers' core businesses. I draw from and extend Mittal, Kumar and Tsiros (1999) to model the satisfaction-loyalty relationship. Specifically, I propose a curvilinear relationship for the effect of product and services satisfaction on loyalty intentions and investigate the joint effect of product and services satisfaction levels on customer loyalty intentions.

My theoretical model is tested using longitudinal data spanning five years across multiple countries that were obtained from a multinational company (sample size =1030 observations). I use mixed models to estimate the variables in the proposed model. I test the joint effect of product and services satisfaction using response surface methodology. The results reveal support for the proposed hypotheses. This essay will provide managers with insights on how to allocate resources across product and service spaces and to manage product and service revenues over time.

3.2: Introduction

Customer satisfaction (CS) has become an important focus of corporate strategy during the past two decades (cf. Anderson, Fornell, and Lehmann 1994; Homburg, Koschate, and Hoyer 2005; Oliver 1997; Rust, Zahorik, and Keiningham 1995), and has gained increased attention in the marketing literature during the past decade. Yet, research has repeatedly shown that CS is able to explain only less than 25% of the variance in repeat purchase (Rust et al 1999; Szymanski and Henard 2001). In fact, customer loyalty (CL) studies have found that approximately 65% of customers who defect report, prior to defection, that they were satisfied or very satisfied (Reichheld 1996). One reason why CS is not able to completely explain CL behaviors may be related to the type of satisfaction being investigated. Traditionally, CS research has been dominated by the concept of customers' satisfaction towards the physical product offering (or service offering, in case of service firms), with less or no attention devoted to the augmented service(s) accompanying the firm's main product/service offering(s). However, in reality, firms have increasingly begun to market their product offerings as consumption systems characterized by a significant product and a services subsystem (Mittal, Kumar and Tsiros 1999; Reinartz and Ulaga 2008). Hence, it is my belief that conceptualizing CS in terms of consumption systems that encompass both the product offering and the product-related augmented services offered along with it, rather than in terms of mere product offerings, might help uncover the exact nature of the relationship between CS and CL.

In this paper, I focus on understanding how customers' satisfaction towards a firm's product and product-related augmented services will jointly affect CL behaviors. I am motivated by recent findings by researchers who recommend firms to develop product-related services offerings that complement their product offerings. The strategy of offering augmented services

as a part of a consumption system is not only critical to stabilize and secure cash flows from traditional product-based exchanges - they also deliver growth in saturated markets, protect against uncertainty and generate new sources of stable cash flows beyond manufacturers' core businesses (Reinartz and Ulaga 2008). The literature on satisfaction with consumption systems argues that satisfaction is dependent jointly on not only the product, but also associated services offered by the firm (Mittal, Kumar and Tsiros 1999). I center on the interaction between customers' satisfaction towards a product and the associated services offered by a manufacturer, as they relate to customer loyalty.

My central thesis is that there is a synergistic effect of product and services satisfaction³ on CL, and that the effects of product and services satisfaction on loyalty behaviors may be curvilinear. Past research on satisfaction with consumption systems has assumed the effect of product and services satisfaction on loyalty to be linear. However, in light of recent evidence that the relationship between CS and CL is curvilinear (Agustin and Singh 2005; Homburg, Koschate, and Hoyer 2005; Mittal and Kamakura 2001), I also explore the exact nature of the relationships between product and services satisfaction on customer loyalty in a consumption system setting. In this context, it would also be useful to understand how congruence or incongruence in product and services satisfaction levels jointly affects customer loyalty intentions. Examining the above issues is significant because joint management of the product and services subsystems can help in efficient allocation of resources across the two, leading to higher profitability (Anderson, Fornell and Rust 1997; Reinartz and Ulaga 2008). In firms where

³ In this paper my usage of the term services satisfaction refers to the satisfaction towards associated services that are offered along with the product/service offering.

the product and the services provider are different, these research questions have major implications for coordinating and managing channels to achieve higher customer retention.

Theoretically, this research intends to address a glaring gap in CS research, that of the synergy between product and services satisfactions as they predict loyalty intentions. Further, to my knowledge, the functional structure of product and services subsystems has not been jointly examined in extant CS research. Additionally, the issue of congruence and incongruence in product and services satisfactions levels has not been explored in extant literature, which I intend to do in this study. In the next section, I review the extant literature on CS and CL, and present my conceptual framework. I then present my theoretical logic for my curvilinear and interaction hypotheses. I assess my theorizing in the context of a large engineering firm which offers both products and associated services, as part of a consumption system. Finally I report and discuss my results, and conclude with future research directions and limitations.

3.3: Conceptual Framework and Hypotheses

3.3.1: Satisfaction Overview

Though several definitions of the construct are prevalent in the marketing literature, I define CS as “an overall evaluation based on the total purchase and consumption experience with the good or service over time” (Anderson, Fornell and Lehmann 1994, p 54). In other research, customer satisfaction has been conceptualized as the result of a customer’s perception of the value received in a transaction or relationship (Blanchard and Galloway, 1994; Zeithaml et al., 1990). Customer loyalty, on the other hand, results from customers’ beliefs that the quantity of value received from one supplier is greater than that available from other suppliers (Hallowell

1996). The reason why managers have found CS important and interesting is due to its hypothesized effect on customer loyalty intentions, which in turn affect firm profitability. Several studies have confirmed the positive relationship between customer satisfaction and loyalty intentions (Anderson and Sullivan 1993; Bearden and Teel 1983; Bolton and Drew 1991; Fornell 1992; Ganesh et al. 2000; LaBarbera and Mazursky 1983; Oliver 1980; Oliver and Swan 1989), positive link between loyalty and profitability (e.g. Fornell and Wernerfelt 1988; Kordupleski, Rust, and Zahorik 1993) and the relationships among satisfaction, loyalty, and profitability (Anderson and Fornell 1994; Reicheld and Sasser 1990; Rust, et al. 1995; Zeithaml et al. 1990). CS has also been found to be related to other favorable marketing outcomes such as repeat purchase intentions (Seiders 2005; Yi 1990), post-purchase attitude (Yi 1990), premium prices (Krishnamurthi and Raj 1991), behavioral loyalty (e.g. Mittal and Kamakura 2001), new referrals through positive word-of-mouth (Zeithaml 2000), and market share (Anderson and Sullivan 1993). The abundance of research attention towards customer satisfaction has ultimately resulted in the construct being widely used by practitioners, so much so that several different forms of company, industry, and even national satisfaction measures have come to existence (Fornell 1992; Fornell et al. 1996).

3.3.2: Services Satisfaction

Much of the literature in CS research referred to in the previous section pertains to product offerings (e.g. Bearden and Teel 1983; Fornell 1992; Fornell et al 1996) rather than to service offerings. Nevertheless, several studies have also investigated the path of satisfaction formation in the context of service offerings (e.g. Bolton and Drew, 1991; Mittal, Ross and

Baldasare 1998; Oliva et al., 1992). Not surprisingly, similar to the case of products, high services satisfaction not only helps in repurchase decisions but it also leads to obtaining service upgrade decisions (Bolton, Lemon, and Verhoef 2008). Though the CS literature distinguishes between product-based satisfaction and satisfaction in the context of services (e.g., De Ruyter et al 1997), I do not make such distinction as I recognize that product companies are actually in the business of delivering services (Reinartz and Ulaga 2008).

Researchers have often treated satisfaction in the service context and service quality as synonymous concepts (e.g., Zeithaml et al 1996). Due to the similarity between the two concepts, some researchers have even advocated the interchangeable use of these constructs (e.g., Boulding et al., 1993; Rust and Zahorik, 1993). Though seemingly similar, there exist several differences between services satisfaction and service quality. While the concept of customer satisfaction is based on the “Disconfirmation Paradigm”, i.e., the discrepancy between a customer’s prior expectations and his/her perception regarding a purchase, service quality is the comparison of service expectations with actual performance perceptions (Zeithaml 1990; Parasuraman et al 1985). Moreover, it is necessary that customers must have experienced a service in order to achieve satisfaction, whereas, perceived service quality is not necessarily experience-based (Oliver, 1993; Rust and Oliver, 1994). With respect to causality, one stream of research posits that CS is positively and significantly related to perceived quality (attitude), which in turn is related to behavioral intentions (e.g., Bitner 1990), while another posits alternate causal models in which service quality leading to satisfaction (e.g., Cronin and Taylor 1992).

In summary, past satisfaction literature has studied satisfaction of product and service offerings, and service quality, to the neglect of satisfaction towards augmented and associated product-related services offered by firms. In this paper, I address the issue of satisfaction towards

product-related services through the lens of Mittal et al.'s (1999) consumption system. Firms have increasingly resorted to the strategy of offering both product and service as a bundled consumption system, as a means to differentiate their product offering against competitors (Reinartz and Ulaga 2008) and to provide an overall consumption experience to consumers. Consumption systems can comprise several subsystems, of which the product and associated services are key subsystems from the consumers' perspective (Rust and Oliver 1994). Thus, it follows that measuring customers' satisfaction with both these two subsystems is key to overall experience with the consumption system over time.

In addition to investigating customer satisfaction towards product and services subsystems, it is also important to understand the functional structure of the satisfaction - intention link for the individual product and services subsystems. Early stage satisfaction research has mostly modeled a linear impact of satisfaction on loyalty intentions (e.g. Bloemer and Kesper 1995; LaBarbera and Mazursky, 1983). However, inconsistent findings about linear relationship between satisfaction and loyalty have prompted practitioners (e.g., Coyne 1989) and researchers to examine the non-linear functional structure of the satisfaction–loyalty link (see Anderson and Sullivan 1993; Homburg, Koschate, and Hoyer 2005; Seiders et al. 2005). Streukens and De Ruyter (2004) notes that failing to account for the nonlinearity in the functional form of the satisfaction – loyalty link will result in model misspecification. Understanding the functional structure of satisfaction - loyalty relationship can also help managers to determine the preferred level of customer satisfaction (Mittal, Ross and Baldasare 1998).

3.3.3: Functional Structure of Satisfaction-Intention Link

In this section, I review briefly different research findings in support of the non-linear relationship between satisfaction and loyalty. Oliva, Oliver, and MacMillan (1992) show that overall satisfaction and performance are related nonlinearly to repurchase intentions or loyalty. Research shows satisfaction and dissatisfaction have different affective consequences (Oliver 1997), which may be related differentially to loyalty. More recent research has found support for curvilinearities that involve either increasing or decreasing returns of satisfaction on loyalty (Agustin and Singh 2005; Jones and Sasser 1995; Mittal and Kamakura 2001). The difference in findings can be attributed to the nature of the loyalty variable: the satisfaction-behavior link exhibits increasing returns, whereas the satisfaction-intention link exhibits diminishing returns (Mittal and Kamakura 2001).

Several theoretical frameworks have been used to explain the nature of the non-linear effects of the satisfaction-loyalty link. Mittal, Ross, and Baldasare (1998), used prospect theory to show that high levels of positive or negative performance of an attribute will have a much smaller impact on overall satisfaction than intermediate performance on that attribute. Prospect theory states that marginal values of both gains and losses decrease with increase in impacting sizes (Kahneman and Tversky 1979). Homburg, Koschate, and Hoyer (2005) used this argument to explain the impact of overall satisfaction impact on willingness to pay. Ngobo (1999) argued that the utility in engaging in relationship with a brand will increase with corresponding increase in loyalty until a threshold point, after which the effect of satisfaction on loyalty increased only at the decreasing rates, which ultimately results in lower benefits for firms. This is the phase where benefits outweigh the costs. After a certain level of satisfaction was reached, a ceiling

effect occurred, where loyalty simply seemed to levels out. Agustin and Singh (2005), used need-gratification and dual-factor motivation theories to empirically demonstrate that satisfaction have a curvilinear relationship on loyalty intentions with decreasing incremental effect.

I build on the arguments used by Agustin and Singh (2005), to develop my curvilinear hypotheses for the impact of product and services satisfaction on loyalty. I propose that the effects of product and services satisfaction depict systematic curvilinearities that are captured by linear and quadratic effects. I expect a decreasing incremental effect for satisfaction, where for higher values of satisfaction; a unit change has an increasingly smaller effect on loyalty intentions. Similar to Agustin and Singh (2005), I use the Maslow's (1943) need gratification and Herzberg's (1966) dual-factor theories to develop my theoretical arguments and state formal hypotheses for the nature of the curvilinearity of product and services satisfaction, as they relate to loyalty intentions.

According to Oliver (1997), satisfaction can be conceptualized as the degree of need fulfillment in an exchange transaction. Consumer evaluations of product satisfaction are based on the degree to which the product meets, fails to meet or exceeds a consumer's expectations of the product (Agustin and Singh 2005). Satisfaction evaluations are thus driven by questions such as "Did the product work?," "Was the price fair", etc. (Iacobucci, Grayson and Ostrom 1994). Based on Houston and Gassenheimer (1987), I believe that fulfillment of economic, product-specific goals is a core and basic need in market-based exchanges, and therefore conceptualize the need for satisfaction from the product offering to be consistent with the hygiene role in need-gratification theories (Agustin and Singh 2005). Since satisfaction is likely to have a hygiene effect on loyalty intentions, until a certain level of satisfaction, it will have a positive effect on loyalty, but after that, higher values of satisfaction will have an increasingly smaller effect on

loyalty intentions. Thus, I propose an “inverted J” shaped curve to depict the nature of the effects of product satisfaction on loyalty intentions, where satisfaction has a decreasing incremental effect beyond some point of expectation fulfillment.

Figure 3.1 shows the functional structure of the satisfaction-loyalty (S-L) relationship. The part of the S-L curve to the left of point B depicts the conditions where the satisfaction evaluations about the product offering are likely to influence consumers’ efforts to pursue and to maintain relational exchanges (loyalty intentions). In this region, when the product offering fails to fulfill basic consumer expectations, consumers’ norms for episode performance are negatively disconfirmed on the basis of an experience stream of ongoing exchanges (Agustin and Singh 2005). In other words, the effect of satisfaction on loyalty intentions is linear in the AB region of the S-L curve. In contrast, beyond point B, I can envision conditions where product performance meets or exceeds customer expectation norms. However, beyond point B of expectation fulfillment, satisfaction is not sufficient to influence loyalty intentions further, and therefore has a decreasing incremental effect on loyalty. After the point of expectation fulfillment, the necessary condition for loyalty intentions would be the fulfillment of a higher order need that relates to social aspects of an exchange, e.g., consumer’s trust in the firm (cf. Agustin and Singh 2005; Garbarino and Johnson 1999). Thus, I formally hypothesize:

H₁: Product satisfaction has a decreasing incremental effect with positive linear and negative quadratic effect on behavioral intentions towards product.

[Insert Figure 3.1 about here]

Providing additional services to the product can be seen as both a defensive (to retain current customers) and an offensive (acquisition of new buyers) strategy (Smith 1998), and can

help firms to build lasting and profitable relationships (Reinartz and Ulaga 2008). Past research shows that improvements in the service experience leads to higher repurchase intention towards the firm (Zeithaml, Berry, and Parasuraman 1996). The effect of satisfaction with ancillary services on the future product repurchase intention has been also shown to be present in both consumer (e.g., Mittal, Kumar and Tsiros 1999; Crosby and Stephens 1987) and industrial markets (Smith 1998). Similar to most of the research on product satisfaction, most research on satisfaction with product-related services has been hypothesized as following a linear pattern, with a few exceptions. Gale (1992) empirically showed that increase in loyalty intentions will be steeper for service improvements from “fair to good” versus improvements of “good to excellent”. Parasuraman (1998) emphasized on the diminishing sensitivity of service improvements towards behavioral intentions beyond the desired service level. Zeithaml, Berry, and Parasuraman (1996) empirically showed that impact of improvements in service on behavioral intentions towards company will show varying levels of slope. Zeithaml, Berry, and Parasuraman (1993), posited the existence of two levels of consumer expectations of services, viz. desired and adequate level of services, forming a zone of tolerance, and argued that if customers have relatively wide zones of tolerance for service, it could become more difficult for firms with superior service to earn customer loyalty.

Based on past research that has found evidence for curvilinearity of satisfaction with services, I posit that the functional structure of the satisfaction-loyalty relationship will be similar to that for product satisfaction. In other words, the effect of services satisfaction on loyalty intentions is linear in the AB region of the S-L curve in Figure 3.1. In contrast, beyond point B, satisfaction is not sufficient to influence loyalty intentions further, and therefore has a decreasing incremental effect on loyalty. Therefore, I hypothesize:

H₂: Services satisfaction has a decreasing incremental effect with positive linear and negative quadratic effect on behavioral intentions towards product.

3.3.4: Product and Services Synergies

Firms differentiate themselves from competitors and even create competitive advantage by providing integrated solutions in the form of associated services that are customized to their core product offering (Day and Wensley 1988). Through services like routine maintenance or equipment repair, firms can prevent customer relationships from becoming stagnant. Prior research on satisfaction with consumption systems has studied situations where the service provider and product manufacturer are distinctly different entities, e.g., car manufacturer and a dealer. Westbrook (1981) found significant correlation between satisfaction with retailer (services satisfaction) and satisfaction with the products purchased from the retailer (product satisfaction). Similar findings were reported by Oliver and Swan (1989) who found that satisfaction with the dealer (services satisfaction) was related significantly to satisfaction with the car (product satisfaction). Mittal, Kumar and Tsiros (1999) found that both the product and services subsystems of a consumption system influence each other, implying a “cross-over effect”, i.e. product satisfaction affects behavioral intentions toward the service provider and the satisfaction with services influences behavioral intentions toward the product manufacturer. Since my focus is on a single firm providing bundled product and services subsystems, the presence of the “crossover effects” in past research leads us to posit that in a setting where the same firm is providing both the product and services components of the consumption system, there will be a joint effect of product and services satisfaction, as they relate to behavioral intentions of loyalty.

In summary, when the same firm provides both products and services as part of a consumption system, product and services satisfaction together seem to have a synergistic effect on loyalty intentions. Further investigation of this joint impact on behavioral intentions results in two different scenarios that depend on combinations of the different levels of product and services satisfaction. For example, there could be a situation where consumers have exactly similar levels of satisfaction with product and services, called the congruence condition, and another situation where consumers have unequal levels of satisfaction with product and services provided by firm, called the incongruence condition.

Since past research has found adequate evidence for the positive effect of product and services satisfaction on behavioral intentions of loyalty, I expect that the congruence in product and services satisfaction to affect loyalty intentions similarly. Loyalty intentions should be most positive when product and services satisfaction are congruent. However, two fine-grained questions are at issue. The first involves whether congruence at low levels of product and services satisfaction would be expected to lead to the same positive behavioral outcomes as congruence at high levels of satisfaction. The second asks whether incongruence resulting from product satisfaction below that of services satisfaction will lead to the same negative behavioral outcomes as incongruence resulting from product satisfaction above that of services satisfaction.

In terms of the effect of congruence at low levels versus high levels of satisfaction, there is not a clear theoretical basis for predicting differences. However, the issue is an interesting one and as such, I conduct exploratory analyses below to examine if congruence at different levels of product/services differentially affects loyalty intentions.

However, the effect of different types of incongruence also warrants attention, and here there is some theoretical basis for expecting differences. Though the product and services

subsystems form an important part of consumption experience, the product subsystem is viewed as nucleus of the system. Therefore, when making the decision to recommend product, consumer reasoning will be primarily based on the satisfaction with the product. Therefore, at high levels of product satisfaction, incongruence due to lower level of services satisfaction will not affect behavioral intention so much as in the case of incongruence due to reduction in product satisfaction compared to high services satisfaction. For example, comparing two situations where (a) the product itself does not perform up to the expected level, but the services provided is of highest quality, and (b) a high quality product is accompanied by mediocre services, consumers will be more hesitant to recommend the former than the latter. Therefore, although I expect incongruence in general to be associated with lower level of behavioral intentions than congruence between the two types of satisfaction, I expect the influence of incongruence to be most negative when services satisfaction is higher than that of product satisfaction. Thus, I formally hypothesize as follows:

H_{3a}: There will be synergistic interaction between product satisfaction and services satisfaction on behavioral intentions towards product.

H_{3b}: The influence of incongruence between product and services satisfaction on behavioral intention towards product will be more pronounced when product satisfaction is lower than the services satisfaction. The effect of incongruence will be less pronounced when product satisfaction exceeds the services satisfaction.

3.4: Method

3.4.1: Sample and Data

I tested my hypotheses using secondary data obtained from a multinational company that operates in the power generation industry for more than a century. The company has global

manufacturing facilities across different continents. This firm is appropriate setting for testing my hypotheses since it sells both products and corresponding services, making it a marketer of consumption systems (Mittal et al 1999). Further, the customers of this company operate in industries varying from utility, industrial power generation to mechanical drive applications. In addition to building capital-intensive power plants for its customers, the company also provides detailed long-term service agreements. The service agreement includes full-scope operation, maintenance contracts and remote monitoring. The service agreement can be adapted to customer's exact needs based on scheduled inspections, preventive maintenance, remote monitoring, replacement parts programs and incentives. The firm's profitability is hugely dependent on the services including replacement parts etc offered to the customers.

Data was collected as part of their annual satisfaction surveys, as part of its ongoing customer satisfaction measurement program. The data obtained was collected across five years, from 2004 to 2008. In total, 1030 customers from Europe and USA, of whom 711 surveys were from USA customers and 319 from Europe. The dataset was collected for the company by third party marketing research firm. The marketing research firm sent emails to maintenance and engineering managers of the customer firms, requesting them to complete the surveys. Complete anonymity and confidentiality was assured. Although, I was not able to find the exact response rate for this survey, typical survey response rate is reported to be between 40 and 45% every year. The project manager of the multinational company confirmed that the sample was representative of the population served by the company.

3.4.2: Operationalization of Variables

Dependent variables. Behavioral intentions towards product was operationalized through a single item scale that measured customers' willingness to recommend product, with on a five point scale ranging from 1 = not at all likely to 5 = extremely likely. Respondents were asked "How likely would you be to recommend company's products". The scale for "willingness to recommend product" has been used in the past literature as the proxy for behavioral intention measure (Mittal, Kumar, and Tsiros 1999).

Independent variables. Overall satisfaction for product and services was measured on a five point scale ranging from very dissatisfied to very satisfied with neutral as a center level. Respondents were asked "Overall, how satisfied are you with product in general" and "Overall, how satisfied are you with company's services (Field Service, Factory Repair, Service programs)" for product and services respectively. These measures are consistent with past studies of customer satisfaction (Cooil et al.2007; Mittal, Kumar, and Tsiros 1999).

It must be noted that the survey has single item questions related to both the independent and dependent variables. Although, researchers have pointed out the concerns about use of single-item measures for constructs due to potential bias in the estimated relationships, however these measures in the large-scale commercial questionnaires have been used successfully employed by academic studies (e.g. Bolton and Drew 1991; Mittal, Kumar, and Tsiros 1999). Further, in case of longitudinal surveys, use of multi-item scale for lengthy questionnaires can reduce instead of increasing overall reliability (LaBarbera and Mazursky 1983). Table 3.1 provides the operational description of the dependent and independent variables in my model.

Control Variables. There are three control variables in the model. First, I controlled for the size of the purchasing company. Since a firm will be expected to spend fewer resources through additional services to impress small firms than large firms, size of the buyer firm is controlled to account for its influence on loyalty. Firm size is controlled in this study by measuring the type of gas turbine brought by the consumer firm. The size of gas turbines bought by the purchasing firm corresponds to the company's energy needs since larger companies have bigger energy needs than smaller companies. Second, I controlled for product and service value. Ostrom & Iacobucci (1995) highlighted the role of perceived value of purchase with future repurchase intention. Therefore, it becomes important to control for the impact of product and service value in my model. Third, I controlled for respondent location in the model to have a clean test of my hypotheses. Since this data was collected across USA and Europe, I created a dummy variable Euro (value = 1 for respondent firm from Europe and value = 0 for respondent firm from USA). In addition to these three control variables, I also created four dummy variables to accommodate five years of data collection period (2004 to 2008).

[Insert Table 3.1 about here]

3.4.3: Model Estimation

I used mixed effect models to analyze my data. Through mixed models one can specify both random effects and fixed effects to extract multiple sources of variation. A basic characteristics of these mixed effect models is the inclusion of respondent-specific effects into regression model in order to accommodate the within subject correlated responses. Since each responding firm has filled survey multiple times over years, responses may be more similar for

employees from the same firms than across employees from different firms. I controlled for the positive correlations that may arise from firm-specific characteristics by modeling firms as random effects. The model was estimated using mean-centered variables for ease of interpretation.

The estimated mixed effects model is specified as follows:

$$y_{ij} = X_{ij}\beta + Z_i b_i + \epsilon_{ij} \quad (3.1)$$

where y_{ij} represents the behavioral intentions of the i^{th} respondent for the j^{th} firm. X_{ij} is the $N \times p$ model matrix corresponding to the fixed effects. Specifically, I used product satisfaction, services satisfaction, and all possible interactions among the two as fixed effects. Z_i is the $N \times q$ model matrix that represented the firm-specific heterogeneity using a random effects specification. ϵ_{ij} is the $N \times 1$ vector of errors for each observation. These models were estimated using the SAS Mixed procedure.

In order to test my hypothesis regarding incongruence effect of product and services satisfaction on behavioral intentions towards product, I employed response surface methodology. Before I discuss about the analyses obtained using response surface methodology in the result section, it is important to provide detailed background about this methodology.

Response Surface Methodology: Response surface methodology has been used extensively in engineering and management, among various other disciplines, to answer questions concerning the issues of relative impact of fit (and misfit) on various outcomes. In the past, congruence questions were empirically answered by calculating difference scores between the two independent variables, which reflect the numerical gap between them, for example take the case of product and services satisfaction joint evaluation on the outcome, say repurchase

intention. Researchers have identified numerous problems with this difference score methodology (Edwards 1994, 2001; Edwards and Parry 1993). Difference scores methodology has been criticized for imposing unrealistic constraints on the relationships between the constructs under study (Edwards 2001).

One of the constraints in difference score methodology that directly impacts the current study is that researchers treat all forms of congruence and incongruence as equal. For example, consider the case of different sources of satisfaction in my present study. The two types of satisfaction i.e. product and services has been measured on a five point Likert-type scale. Under the difference score interpretation, if both product satisfaction and services satisfaction receive ratings of “1,” the result would be defined as being congruent. Of course, the same would be true if both received ratings of “3” or “5.” That is, perfect congruency would exist in each of these cases. However, it is irrational to assume that congruency resulting from joint evaluations of “1” would exert similar influences on outcomes as joint evaluations of “5.” Rather, as discussed in the theory section, congruency at low, moderate, or high levels of two sources of satisfaction will result in different outcomes.

With respect to incongruence or misalignment, a difference score methodology again assumes that all forms of misalignment are equal as well. For example, misfit resulting from higher services satisfaction than product satisfaction is treated the same as misfit resulting from higher levels of product satisfaction than services satisfaction. Again, this is an incorrect assumption as different forms of incongruence between two sources of satisfaction might lead to very different influences on its outcomes. Response surface methodology overcomes these deficiencies and helps researchers theorize about the impact of different types of congruence and incongruence on outcomes.

In this approach estimates from polynomial regression are utilized to create response surface graphs. In this kind of regression, estimation is done with a quadratic regression model with the two variables involved in the congruence question as independent variables (X and Y) and some outcome variable (Z) as the dependent variable. Polynomial equation is represented as follows:

$$Z = b_0 + b_1X + b_2Y + b_3X^2 + b_4XY + b_5Y^2 + e \quad (3.2)$$

Thus, if X is product satisfaction, Y is services satisfaction, and Z is behavioral intentions, one can conclude that alignment between product and services satisfaction would lead to enhanced behavioral intentions, and nonalignment would result in decreased behavioral intentions. Moreover, response surface methodology also helps researcher to empirically test the relationship between the two sources of satisfaction and behavioral intentions. For example, all forms of alignment are not equal; alignment at relatively low levels of satisfaction compared to alignment at higher levels would not likely to result in enhanced behavioral intentions. Further, I also hypothesize that all forms of misalignment are not same. For example, I hypothesize that misalignment resulting from higher services satisfaction compared to product satisfaction might result in more detrimental impact on behavioral intentions than misalignment resulting from higher product satisfaction than services satisfaction perceptions.

Through the use of polynomial equation, I can generate three dimensional surfaces reflecting each of the relationship individually. Though the interpretation from these three dimensional surfaces may seem difficult and confusing at first, one can make powerful conclusions with quick insights. This point can be elaborated through figure 3.2. Figure 3.2 contains three axes, labeled X, Y, and Z. Let us assume the X axis represents product satisfaction and the Y axis represents the services satisfaction. Let the two axes comprise the XY

plane, which represents the floor of the three-dimensional figure. Behavioral intentions are indicated on the vertical (Z) axis. Based on the particular combination of product (X) and services (Y) satisfaction for each point, a floating surface is developed. The shape of this floating surface indicates the highest and lowest points for the outcome variable.

[Insert Figure 3.2 about here]

Response surface methodology can help us conduct in-depth analyses (Edwards, 1994, 2001). For example, questions regarding the impact of two source of satisfaction's alignment on behavioral intentions involve understanding the shape of the surface along the line which product and services satisfactions are equal. This is the $X = Y$ line, represented in figure 3.2 with the solid arrow, which extends from the nearest corner to the furthest corner of the XY plane. On the contrary, questions regarding the effect of misalignment of the two sources of satisfaction on behavioral intention requires a focus along $X = -Y$ line. This line is represented in figure 1 by the dashed arrow, which extends from the left corner to the right corner of the XY plane. Along this line, product and services satisfaction are unequal and therefore misaligned. The points on the left side of the solid arrow reflect XY combinations in which product satisfaction exceeds its services counterpart. The points on the right side of the solid arrow reflect XY combinations in which services satisfaction exceed those of the product satisfaction.

Furthermore, one can make substantial inferences also based on the nature of surface. The nature of surface can be of following three types: (a) concave (dome-shaped surface); (b) convex (bowl-shaped surface); (c) saddle (combination of upward and downward curvature to produce a saddle-shaped surface). Looking at the concave surface in figure 3.2, one can conclude that alignment is usually better than misalignment. On the other hand convex surface,

represented in figure 3.3, leads us to believe that misalignment is better option as the extreme evaluations of outcome are obtained at higher misalignments. More than these simple visual interpretations, response surface methodology can also be used to explore the statistical significance of these surface characteristics (Edwards 2001; Edwards & Parry, 1993).

Employing statistical F-tests on the unrestricted polynomial regression equation presented above, one can test hypotheses such as if all forms of alignment leads to equal influence on outcome variable, or whether all forms of misalignment are same (For details see Edwards 2001; Edwards & Parry, 1993).

[Insert Figure 3.3 about here]

Thus to summarize the above description, response surface methodology has been shown to be better than widely utilized alternative approaches such as difference score (Edwards and Parry 1993). It can provide us with the necessary basis for an in-depth understanding of features of surfaces corresponding to quadratic regression equation (Edwards and Parry 1993). This methodology also includes a set of procedures for estimating and interpreting three dimensional surfaces relating two variables to the outcome (Edwards 2001).

3.4.4: Results

Collinearity checks. First, I checked for potential collinearity in the data using multiple diagnostics on the uncentered data, including bivariate correlations, variance inflation factors (VIF), and the condition indices. The highest bivariate correlations, VIF, and condition indices among the explanatory variables were .44, 1.29, and 1.67 respectively, which revealed no major

collinearity problems (Mason and Perreault 1991). Table 3.2 provides the correlation matrix of the mean-centered variables used in the model.

[Insert Table 3.2 about here]

Regression results. I subjected the data to a mixed effects regression model specified in equation (1). H_1 posits a curvilinear relationship between product satisfaction and behavioral intentions towards product. Results from Model 1 in Table 3.3 indicate that the main effect of product satisfaction on behavioral intentions towards product is both positive and significant ($b = .41$; $t = 12.13$, $p < .0001$). The impact of the squared term of product satisfaction on behavioral intentions towards product is negative and significant ($b = -.04$; $t = -1.81$, $p < .10$). Therefore, it is evident that the effect of product satisfaction on behavioral intentions towards product follows a curvilinear relationship thereby supporting H_1 .

Similarly, H_2 posits a curvilinear relationship between services satisfaction and behavioral intentions towards product. Results from table 3.3 indicate that the main effect of services satisfaction on behavioral intentions towards product is both positive and significant ($b = .10$; $t = 3.04$, $p < .001$). In addition, squared term of services satisfaction on behavioral intentions towards product is negative and significant ($b = -.06$; $t = -2.33$, $p < .05$). Therefore, I am able to see a curvilinear effect of services satisfaction on behavioral intentions towards product thereby supporting H_2 .

With respect to H_{3a} , the 2-way interaction of product satisfaction by services satisfaction interaction was significant ($b = .07$; $t = 2.44$, $p < .01$). This is consistent with my hypothesis suggesting a synergistic interaction of product and services satisfaction on behavioral intentions towards product. None of the control variables were significant in this model.

[Insert Table 3.3 about here]

To test hypothesis 3b, I generated three axes surface graph as illustrated in figure 3.4. In this figure, the X and Y axes comprise the XY plane, the “floor” of my three dimensional figure, represented by product satisfaction and services satisfaction. Behavioral intention towards product is indicated on the vertical Z axis extending upward from the bottom.

Response surface methodology can be used for further analyzing these resulting surfaces (Edwards 1994, 2001). To answer questions relating to the impact of congruence or fit between product and services satisfaction on behavioral intentions towards product, I focus on the line $X = Y$, which extends from the nearest to the furthest corners of the X, Y plane. Conversely, in order to answer questions relating to effect of incongruence or misfit between product and services satisfaction on behavioral intentions towards product, I should explore the shape of the surface along another line of interest, the $X = -Y$ line, which moves from the left corner to the right corner of the X, Y plane. I can see that across this line product and services satisfactions are unequal and therefore incongruent. To be more precise, on the left side of the X, Y plane, I will see services satisfaction exceeds over product satisfaction, whereas on the right side of the plane product satisfaction exceeds over services satisfaction.

The results for the test of H_{3b} provide a more in-depth analysis of the effect of incongruence. Hypothesis 3b states that behavioral intentions towards product will decline as the incongruence between product and services satisfaction increases, the declines becoming more severe when services satisfaction exceeds product satisfaction, than when product satisfaction exceeds services satisfaction. Therefore, here my focus is to understand the changes along the X

= -Y line. My expectation is that the slope of the surface will be steeper on the left side of the surface ($Y > X$) than on the right side of surface ($X > Y$). Also, I can confirm hypothesis 3 by understanding about the conditions along $X = Y$ line, such that behavioral intentions towards product will increase as $X = Y$ line moves from lower to higher levels.

In order to test the hypothesis 3b, I will need to set product satisfaction (X) = - services satisfaction (Y) in the equation 3.2 and solve for X and X^2 , which represents slope and curvature of the surface. Solving the equation I find that slope of surface at the point $X = 0$ is represented by $b_1 - b_2$ and curvature of the surface along the $X = -Y$ line is represented by the quantity $b_3 - b_4 + b_5$. These values can provide important features of the shape of the surface. A positive value for the quantity $b_1 - b_2$ indicates the surface is increasing as it crosses $X = Y$, whereas the negative value for the same quantity indicates that the surface is decreasing. In case the value is zero, the surface has achieved its maximum or minimum along the $X = Y$ line. With respect to the quantity $b_3 - b_4 + b_5$, the negative value indicates concave (dome-shaped) and positive value indicates a convex (bowl-shaped) surface. (Edwards 2001).

To obtain support for hypothesis 3b, following two conditions should be met: (1) I should be able to see a concave (dome shaped) curvature for the shape of the surface along line $X = -Y$, and (2) the slope of the surface along the incongruence ($X = -Y$) line must be in anticipated direction. I expect to see a concave (dome shaped) curvature because I have predicted that the behavioral intentions towards product will reduce with increase in incongruence between product and services satisfaction. Looking at the results in table 3.4, under $b_3 - b_4 + b_5$ column, this condition is significant ($F_{(1,1024)} = 15.63, p < 0.01$) for behavioral intentions towards product. Regarding the slope of the surface along the $X=-Y$ line, I predicted that the slope of the surface will be steeper for $Y > X$ side of the $X = Y$ line than on the $X > Y$ side. In my case, I should see

the slope of surface to be positive as they move across $X = Y$ line. As indicated by the significant values for $b_1 - b_2$ in table 3.4, this condition was met for behavioral intentions towards product ($F_{(1,1035)} = 38.44, p < 0.01$). Combining results from condition one and two, I can find strong support for my H_{3b} , that the effect of incongruence is more pronounced when product satisfaction is lower than the services satisfaction.

[Insert Table 3.4 and Figure 3.4 about here]

Turning to the effect of the different forms of congruence, I would like to understand if the congruence between two independent variables, product satisfaction and services satisfaction at lower levels and higher levels will result in difference in impact on behavioral intentions towards product. Let us start by examining the shape of surface along the $X = Y$ line (nearest to the furthest corner of the X, Y plane) and corresponding information in table 3.4. Putting Product Satisfaction (X) = Services Satisfaction (Y) in the equation 1 and solving for X and X^2 . Results indicate that the curvature of the surface along $X = Y$ line is represented by the quantity $b_3 + b_4 + b_5$ and in addition, the slope of the surface at the point $X = 0$ ($Y = 0$) is represented by $b_1 + b_2$. Looking at the corresponding negative value for $b_3 + b_4 + b_5$ in table 3.4 (Column labeled “shape along the $X = Y$ line”), I can conclude that the surface for behavioral intentions towards product is concave (negative value); however curvature is not significant ($F < 1$). With reference to slope of the surface, the significant value for $b_1 + b_2$ ($F_{(1,1024)} = 104.04, p < 0.01$), indicate that the surface is rising at the point at which $X = 0$ for behavioral intentions towards product. Putting these two results together, I can conclude that the curvature is steeper at the lower levels of line $X = Y$. My results for H_{3a} had demonstrated that the two types of satisfaction will have synergistic effect on behavioral intentions towards product. The analyses from the response surface methodology

provide further details by showing that moving along Product Satisfaction (X) = Services Satisfaction (Y) line, the improvements in the behavioral intentions towards product will be remarkably higher for joint movement of product and services satisfaction from lower to moderate levels in comparison to joint movement from moderate to higher levels for product and services satisfaction.

Finally, in order to make accurate interpretations of the results obtained by focusing on the $X = Y$ and $X = -Y$ lines, few other conditions are needed to be cross-checked in response surface methodology. They are related to the three features of response surface methodology, i.e. stationary point of the surface, principal axes of the surface, and shape of the surface along lines in XY plane. Although, the results are based on surface along lines XY plane, I also need to understand the principal axes of the surface. In case of concave surfaces, the first principal axis reflects the line along which the downward curvature for the surface is minimized and second principal axis reflects the line along which the downward curvature is maximized (Edwards and Parry 1993). For interpreting the results based on $X = Y$ and $X = -Y$ lines, the principal axes also needs to be oriented along $X = Y$ and $X = -Y$ lines. My incongruence analyses for H_{3b} were based on movement along the $X = -Y$ line, with the underlying assumption that these effects are most pronounced on this $X = -Y$ line. However, if the first principal does not fall along line $X = Y$ and the second principal does not fall along $X = -Y$, these effects will be more pronounced along the principal axis. Looking at figure 3.5 and 3.6, I can safely conclude that principal axis are parallel along $X = Y$ and $X = -Y$ line. Thus, I am reassured that the above interpretations are correct. If it was not the case, this would have resulted in inaccurate attributions about the real relationships underlying the surface (Schminke, Ambrose, and Neubaum 2005).

[Insert Figure 3.5 and 3.6 about here]

3.5: General Discussion

Essay 2 extends the consumption model provided by Mittal, Kumar, and Tsiros (1999) by (i) discussing the functional structure of the satisfaction-loyalty relationship, and (ii) capturing the interaction between the product and services satisfaction. Drawing from the previous work on satisfaction-behavioral intention based on prospect theory (e.g. Mittal et al. 1998) and need fulfillment (Agustin and Singh 2005), I extend the current literature by demonstrating the curvilinear impact of both product and services satisfaction on behavioral intention towards the product. Additionally I was successfully able to show the interaction between product and services satisfaction.

Further, through my investigation of interaction between product and services satisfaction I was not only able to show the joint impact on the behavioral intentions towards product in the case of congruence but also pointed out the differential impact in the case of incongruence between two sources of satisfaction. Specifically, I demonstrated that this incongruence between product and services satisfaction will have larger influence on behavioral intention towards product when the product satisfaction is lower than services satisfaction. In other words, I will see smaller slope for behavioral intention towards product as the incongruence between product and services satisfaction increases with product satisfaction always being greater than services satisfaction. I was able to empirically show this finding by use of response surface methodology.

To my knowledge, the use of response surface methodology is new to the marketing literature and indeed to the satisfaction literature. This methodology holds great potential to

answer many more complex questions about the joint effect of two sources of satisfaction on loyalty. By applying this methodology, I can draw firm conclusions regarding the surface corresponding to the different levels of two sources of satisfaction. For example, I can track the exact nature of the impact from product satisfaction on behavioral intention towards the product for all the different levels of services satisfaction. This methodology can be extended to most of the research dealing with paired measures of individual level constructs (Edwards 2001).

These results have important implications for managers. The consumption model of satisfaction related to product and services subsystem should be able to explain the relative weight given to each of the subsystem. The result from this study provides manager with insights on how to allocate resources across the product and services and to manage product and services revenues over time. The results indicated that customer behavioral intention ratings are more weighted on product quality over the services received by them. However, mere improvements on product cannot provide desired results and therefore quality improvements in product need to be complimented by improvements in services quality. In addition, this study shows the decreasing sensitivity to improvements in both sources of satisfaction, which in turn cautions managers, not to invest in satisfaction related activities after certain point as it does not correspondingly lead to profitability through increase in behavioral intentions.

All studies have limitations, and this one is no exception. Past research has shown that satisfaction is dynamic in nature (Mittal, Kumar, and Tsiros 1999). Even though my data was collected across period of five years it did not give us the opportunity to accommodate temporal considerations. Two data-related issues limited us from doing so. First, there were only less than one third of the responding firms who had completed this survey across all five years and second the number of data points over the years varied dramatically. Another limitation is that the model

was tested using the data obtained from the single firm. One extension to this research would be to test the model with multiple firms for broader generalizability.

In conclusion, empirical results from the study with the support of analyses using response surface methodology provides insightful information about the combined impact of product and services satisfaction on the behavioral intentions towards the product. The study shows that increase in both product and services satisfaction will lead to decreasing marginal sensitivity towards behavioral intentions.

Table 3.1: Operationalization of Variables

Variable Name	Actual Measures and Measurement Scale
Dependent Variable	
Behavioral intentions towards Product	<ul style="list-style-type: none"> • How likely would you be to recommend company's product
Independent Variables	
Product Satisfaction (X)	<ul style="list-style-type: none"> • Overall, how satisfied are you with product in general
Services Satisfaction (Y)	<ul style="list-style-type: none"> • Overall, how satisfied are you with company's services (Field Service, Factory Repair, Service Programs)
Control Variables	
Euro Dummy	<ul style="list-style-type: none"> • 0 = If the respondent company was from USA • 1 = If the respondent company was from Europe
Product Value	<ul style="list-style-type: none"> • How do you rate the overall value of Product
Service Value	<ul style="list-style-type: none"> • How do you rate the overall value of Services

Notes: Year specific dummies were also used.

Table 3.2: Correlation Matrix of Variables

	1	2	3	4	5	6
1. Product Satisfaction (X)	0.008					
2. Services Satisfaction (Y)	0.472	0.008				
3. Product Satisfaction ² (X ²)	-0.427	-0.155	0.888			
4. Services Satisfaction ² (Y ²)	-0.193	-0.369	0.286	0.791		
5. X * Y	-0.175	-0.218	0.443	0.567	0.396	
6. Behavioral Intentions Towards Product	0.716	0.497	-0.333	-0.220	-0.139	3.074

Notes: Diagonal values represent means for the construct

Table 3.3: Parameter Estimates From Mixed Effects Model

Dependent Variable	Behavioral Intentions Towards Product
Variables	
Intercept	3.02*** (0.07)
Product Satisfaction (X)	0.41*** (0.03)
Services Satisfaction (Y)	0.11*** (0.03)
Product Satisfaction ² (X ²)	-0.04* (0.02)
Services Satisfaction ² (Y ²)	-0.06** (0.03)
X * Y	0.07** (0.03)
Product Value	0.35*** (0.03)
Service Value	0.06* (0.03)
Europe Dummy	-0.02 (0.06)
-2 Log Likelihood	1964.7
AIC	1968.7
BIC	1974.9

* $p < .10$.

** $p < .05$.

*** $p < .01$.

Notes: Standard errors are given in parentheses. Model estimated with year-specific control variables.

Table 3.4: Additional Analyses for Response Surface Methodology

Dependent Variable	Shape along the $X = Y$ line		Shape along the $X = -Y$ line	
	$b_1 + b_2$	$b_3 + b_4 + b_5$	$b_1 - b_2$	$b_3 - b_4 + b_5$
Behavioral Intentions Towards Product	0.52**	-0.03	0.30**	-0.17**



Figure 3.1: S-L Curve

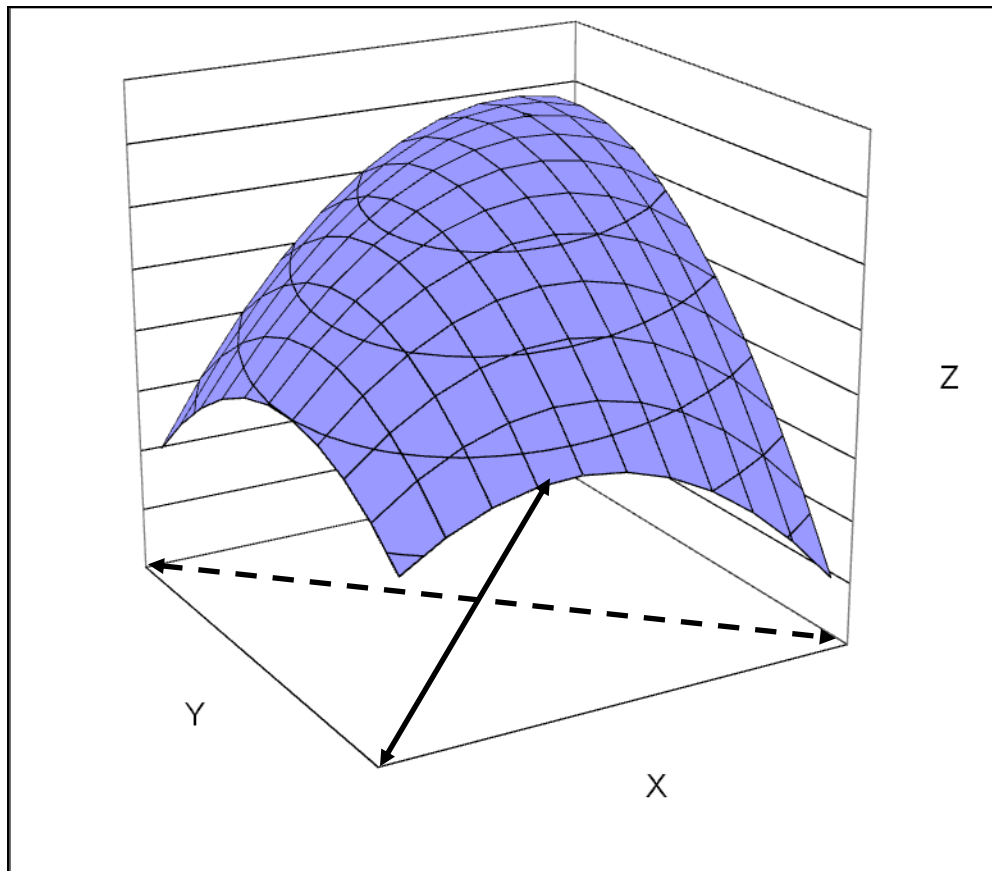


Figure 3.2: Example for Response Surface Methodology: Concave (Dome Shaped)

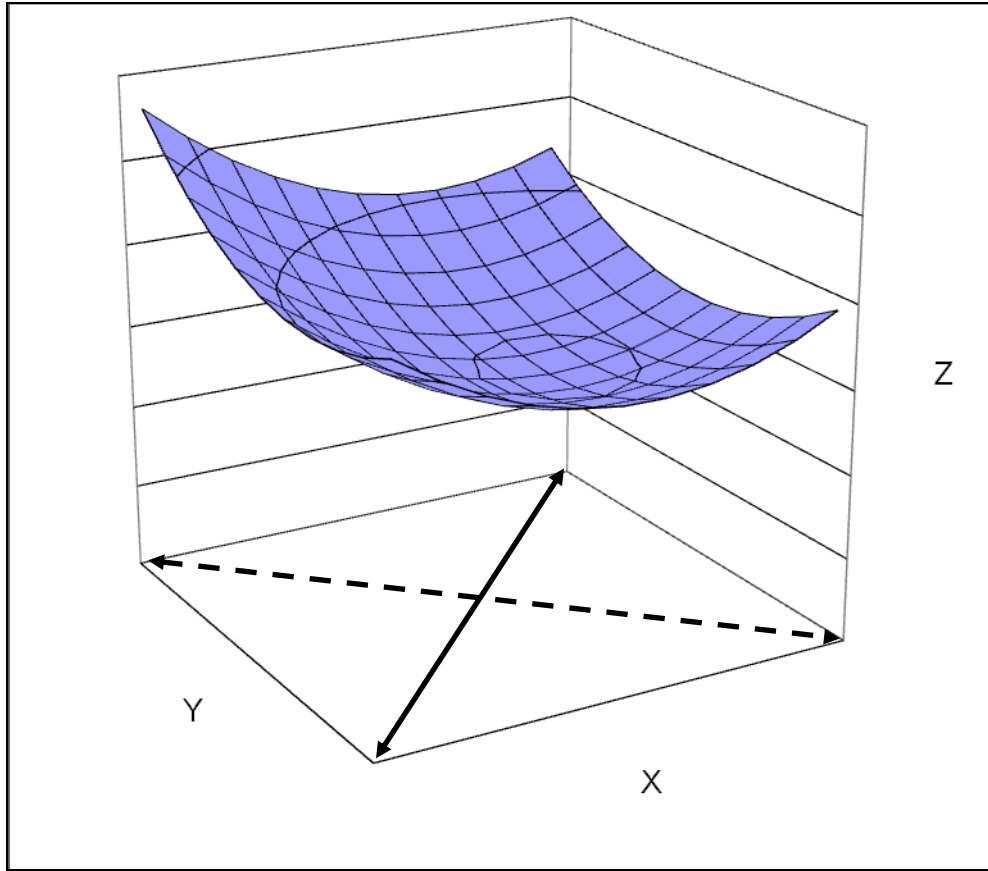


Figure 3.3: Example for Response Surface Methodology: Convex (Bowl Shaped)

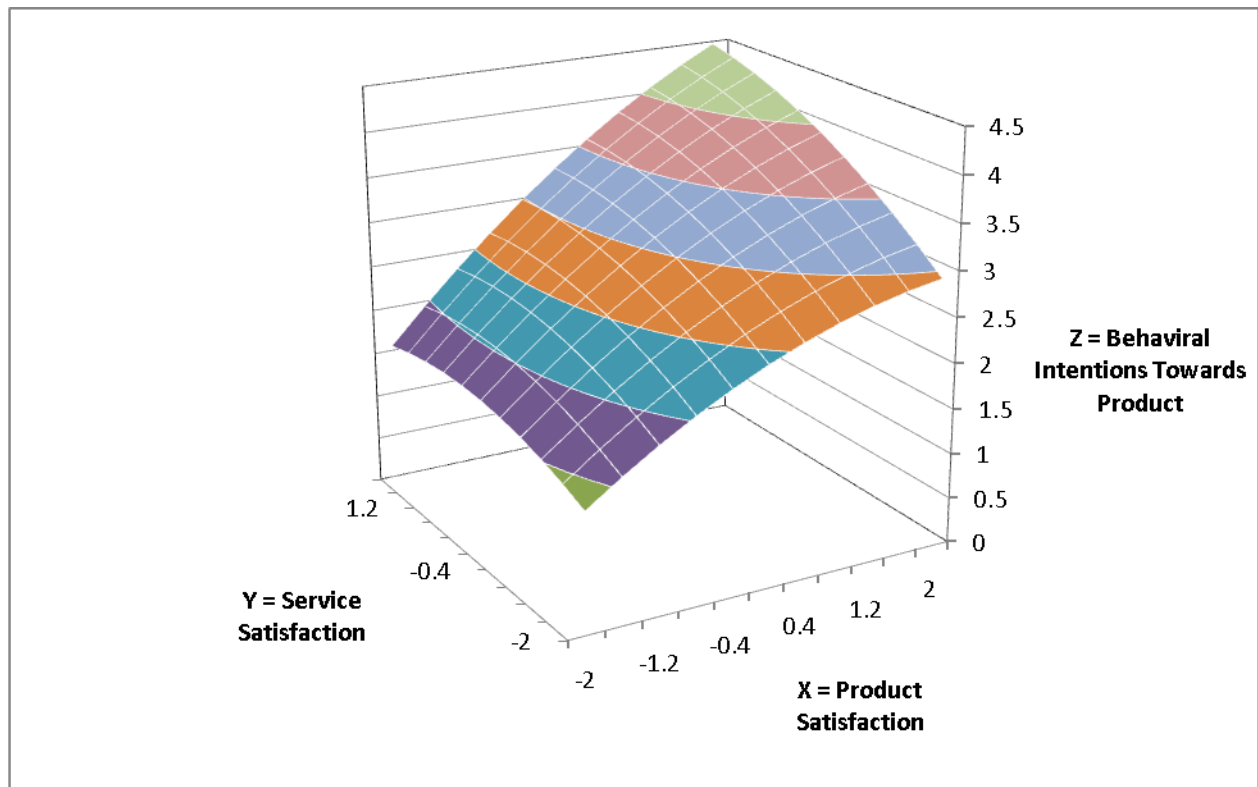


Figure 3.4: Response Surface Methodology for Analyzing the Impact of Product and Services Satisfaction on Behavioral Intentions

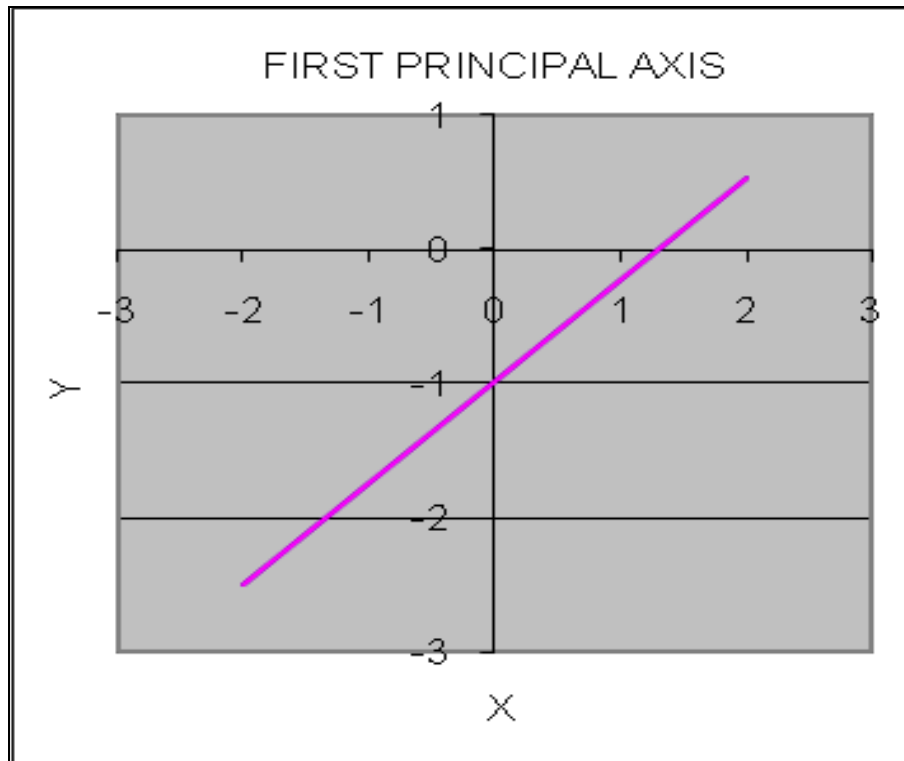


Figure 3.5: First Principal Axis for Response Surface analysis

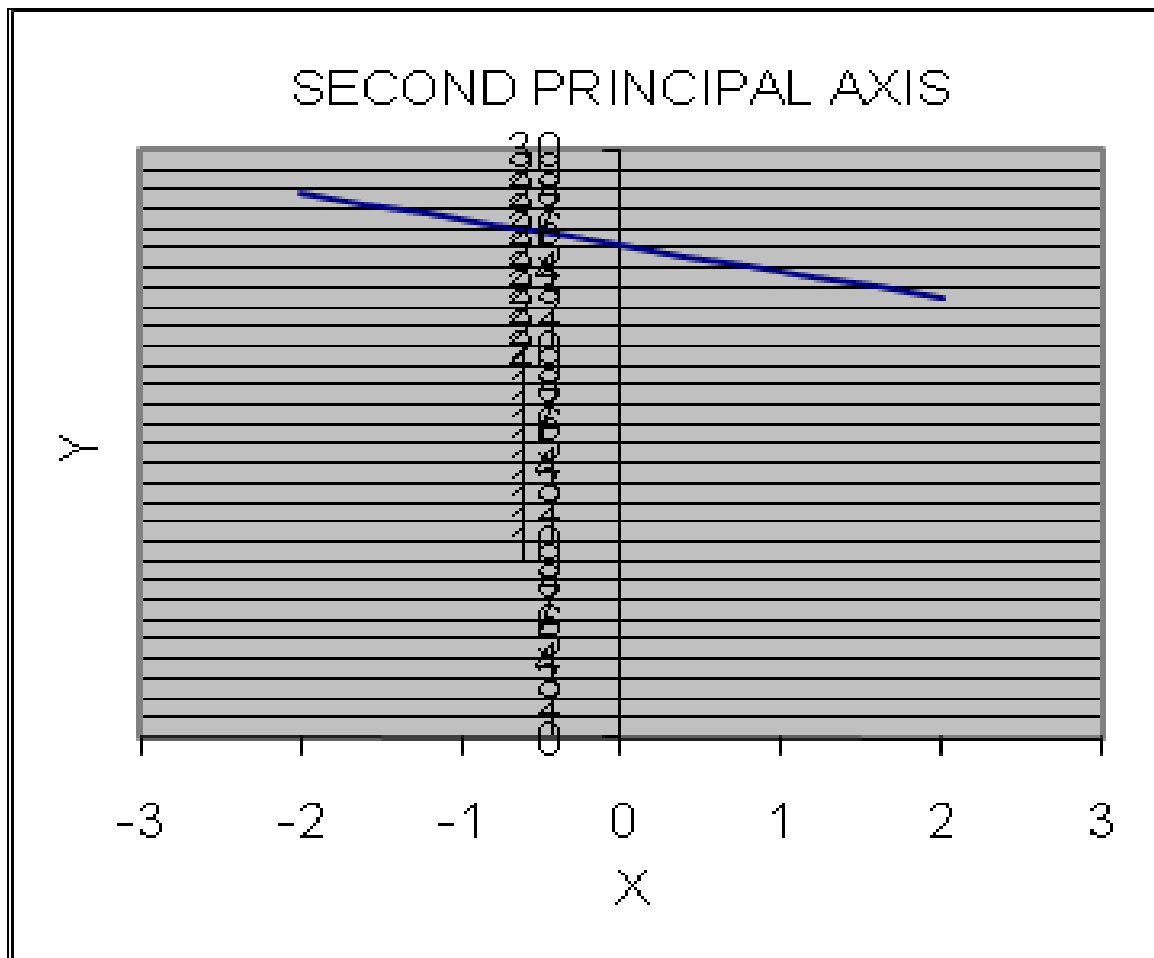


Figure 3.6: Second Principal Axis for Response Surface analysis

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