

Spring 3-11-2015

# Effect of Customer Heterogeneity on Online Pricing: Just Noticeable Differences in a Competitive Service Industry

Saloni Vastani  
*Georgia State University*

Follow this and additional works at: [https://scholarworks.gsu.edu/bus\\_admin\\_diss](https://scholarworks.gsu.edu/bus_admin_diss)

---

## Recommended Citation

Vastani, Saloni, "Effect of Customer Heterogeneity on Online Pricing: Just Noticeable Differences in a Competitive Service Industry." Dissertation, Georgia State University, 2015.  
[https://scholarworks.gsu.edu/bus\\_admin\\_diss/49](https://scholarworks.gsu.edu/bus_admin_diss/49)

This Dissertation is brought to you for free and open access by the Programs in Business Administration at ScholarWorks @ Georgia State University. It has been accepted for inclusion in Business Administration Dissertations by an authorized administrator of ScholarWorks @ Georgia State University. For more information, please contact [scholarworks@gsu.edu](mailto:scholarworks@gsu.edu).

## **PERMISSION TO BORROW**

In presenting this dissertation as a partial fulfillment of the requirements for an advanced degree from Georgia State University, I agree that the Library of the University shall make it available for inspection and circulation in accordance with its regulations governing materials of this type. I agree that permission to quote from, to copy from, or publish this dissertation may be granted by the author or, in his/her absence, the professor under whose direction it was written or, in his absence, by the Dean of the Robinson College of Business. Such quoting, copying, or publishing must be solely for the scholarly purposes and does not involve potential financial gain. It is understood that any copying from or publication of this dissertation which involves potential gain will not be allowed without written permission of the author.

*Saloni Firasta Vastani*

## **NOTICE TO BORROWERS**

All dissertations deposited in the Georgia State University Library must be used only in accordance with the stipulations prescribed by the author in the preceding statement.

The author of this dissertation is:

Saloni FirastaVastani  
J. Mack Robinson College of Business  
Georgia State University  
35 Broad Street, NW  
Atlanta, Georgia 30303

The director of this dissertation is:

Detmar W. Straub, Ph.D.  
J. Mack Robinson College of Business  
Georgia State University  
35 Broad Street, Suite 806  
Atlanta, GA 30303

Effect of Customer Heterogeneity on Online Pricing: Just Noticeable Differences in a  
Competitive Service Industry

BY

Saloni Firasta Vastani

A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree

Of

Executive Doctorate in Business

In the J. Mack Robinson College of Business

Of

Georgia State University

GEORGIA STATE UNIVERSITY  
J. MACK ROBINSON COLLEGE OF BUSINESS  
2014

Copyright by  
Saloni Firasta Vastani  
2014

## ACCEPTANCE

This dissertation was prepared under the direction of the Saloni Firasta Vastanis Dissertation Committee. It has been approved and accepted by all members of that committee, and it has been accepted in partial fulfillment of the requirements for the degree of Doctoral of Philosophy in Business Administration in the J. Mack Robinson College of Business of Georgia State University.

*Richard D. Phillips, Dean*

### DISSERTATION COMMITTEE

Detmar W. Straub, Ph.D., Committee Chair

*Director, Ph.D. Program and Distinguished Professor, J. Mack Robinson College of Business,  
Georgia State University*

Jagdish N. Sheth, Ph.D., Committee Member

*Charles H. Kellstadt Professor of Marketing, Goizueta Business School, Emory University*

Denish Shah, Ph.D., Committee Member

*Assistant Professor of Marketing, J. Mack Robinson College, of Business, Georgia State  
University*

# TABLE OF CONTENTS

TABLE OF CONTENTS.....	v
LIST OF TABLES.....	vii
LIST OF FIGURES.....	viii
LIST OF ABBREVIATIONS.....	ix
ABSTRACT.....	x
1.0 INTRODUCTION.....	1
1.1 Research Domain.....	1
1.2 Research Perspective.....	4
1.3 Research Approach.....	4
1.4 Summary.....	5
2.0 LITERATURE REVIEW.....	9
2.1 History of Behavioral Pricing Research.....	9
2.2 Pricing Thresholds.....	13
2.3 Response to Pricing Actions.....	15
2.4 Service Industry Characteristics.....	16
2.5 Price Dispersion in Online Markets.....	19
2.6 Price Perception and Customer Heterogeneity.....	20
3.0 Just Noticeable Difference Theory.....	23
3.1 Key Constructs of Just Noticeable Difference Theory.....	24
3.2 Applications of Just Noticeable Difference Theory.....	25
3.3 Just Noticeable Difference Theory and Marketing.....	28
4.0 RESEARCH METHODOLOGY and design.....	31
5.0 DATA COLLECTION AND ANALYSIS.....	33
5.1 Data Collection.....	33
5.2 Data Description.....	33
5.3 Data Analysis Strategy.....	34
5.4 Hypothesis Testing.....	37
6.0 FINDINGS.....	44
6.1 Study 1 – Pricing Threshold Range.....	44
6.2 Study 2 - Effect of Customer Attributes.....	49
7.0 DISCUSSION.....	58
8.0 CONTRIBUTION.....	63
8.1 Contribution to Practice.....	64
8.2 Contribution to Theory.....	65

9.0 CONCLUSIONS .....	67
9.1 Limitations .....	67
9.2 Future Research.....	68
9.3 Summary .....	69
REFERENCES .....	71
APPENDIX A: A Historical Time Line .....	81
APPENDIX B: Constructs and Measures.....	84



## LIST OF TABLES

Table 2.4-1 Service Industry Features .....	17
Table 5.3-2 Coding Periods .....	35
Table 5.4.2-3 Hypothesis, Measures, and Tests.....	43
Table 6.1-4 Post-Hoc Comparisons for Price Decrease.....	48
Table 6.2-5 Effect of Customer Attributes .....	54
Table 6.2-6 Regression Results: Relative Price.....	55
Table 6.2-7 Hypothesis and Results.....	57

## LIST OF FIGURES

Figure 5.4 -1 Research Model.....	37
Figure 5.4.1-1 Pricing Timeline.....	38
Figure 6.1-1 Customer Attrition .....	46
Figure 6.2-1 Purchase Behavior Post Pricing Action: Loyalty.....	50
Figure 6.2-2 Purchase Behavior Post Pricing Action: Motivation .....	51
Figure 6.2-3 Purchase Behavior Post Pricing Action: Channel Type.....	53
Figure 7.0-1 Purchase Behavior Post Pricing Action: All Channels .....	62

## **LIST OF ABBREVIATIONS**

CSA – Comparison Shopping Agent

JND – Just Noticeable Difference Theory

SEO – Search Engine Optimization

SEM– Search Engine Marketing

## **ABSTRACT**

Online sales for both products and services are on the rise globally and are projected to increase by 10% annually to \$370 billion by 2017 (Lomas 2013). Price is a key management lever for firm performance (McKinsey 2002) and key determinant of purchasing decision for a consumer (Bishop 1984, Doyle 1984, Sawyer and Dickson 1984, Schechter 1984). However, customers do not remember exact price but have a band of prices that are acceptable (Monroe 1973) (Olson 1976)(Monroe 1969).

This research uses Just Noticeable Difference (JND) theory as the theoretical lens to study online pricing thresholds in a retail service industry. This quantitative field study uses three and half years of non-contractual transactional and customer level data from a B2C company to evaluate the hypotheses. Two phased investigations are conducted. Study 1 empirically determines the pricing threshold range for the service industry. Study 2 examines the effect of pricing action on purchase frequency based on customer heterogeneity and competitive prices.

Contributions are three-fold. Theoretically, the study furthers the conceptual understanding of the pricing thresholds in the digital marketplace by using real customer level data. Second, the application of JND theory in a non-contractual B2C sector confirms that pricing thresholds for the service industry are higher than consumer goods industry. Third, this research confirms the varying effects of customer attributes (loyalty, motivation, and online purchase channel) on pricing thresholds. These findings are key to implementing a differentiated pricing strategy across channels and customer types to maximize firm performance and increase customer retention.

# 1.0 INTRODUCTION

## 1.1 Research Domain

Despite several studies confirming that small changes in price can increase or decrease profitability by 20% to 50%, firms pay little attention to pricing research (Hinterhuber 2004). Fewer than 5% of the Fortune 500 companies invest in a dedicated pricing team (Society 2012). Although, retailers confirm that some pricing practices are more effective than others (Monroe and Petroschius 1981), McKinsey & Company notes that fewer than 15% of companies systematically research pricing (Hinterhuber 2004). Additionally, only 9% of business schools actually teach pricing (McCaskey and Brady 2007). For these reasons, research in understanding the influences of price on consumer purchase behavior in the marketplace should enable companies to be more deliberate in their pricing strategy and improve revenue performance.

Price is a key determining factor for purchase decisions (Varki and Colgate 2001, Kohli and Suri 2011). For a buyer, price is a sacrifice to obtain the product or service (Dodds and Monroe 1985, Mazumdar 1986, Monroe and Chapman 1987). Customers do not often know or remember the price (Monroe and Lee 1999), but instead have a reference price in mind (Ofir, Raghuram et al. 2008). They may encode price as a macro concept such as “cheap” or “expensive,” which is a more meaningful way to remember price (Zeithaml 1982, Dickson and Sawyer 1990) than the objective price. Additionally, extant literature confirms that buyers have a range of prices that are acceptable or that they are willing to sacrifice for the product (Sherif 1963, Monroe 1971). This range has an upper and lower limit or threshold for intended purchase and is also frequently called it as latitude of acceptance (Monroe, 1990). Hence, there is a distinction between objective price and perceived price (Allen, Harrell et al. 1976, Olson 1976). All prices within the differential thresholds are perceived as equal and are acceptable to a buyer.

Research in the area of behavioral pricing began in the early 50's and continues to evolve in contemporary times to further understanding how customers perceive, recall and remember price. Understanding behavioral pricing is important for both traditional and online markets. According to Rigby (2014), "the digital lens will change how people perceive and manage every activity in life and business" (Rigby 2014 p84). The 2013 Forrester Research report mentions that ecommerce generated \$262 billion in retail online sales, and are expected to increase by 13% in 2014. Internet sales in the United States alone currently account for 8% of total retail sales in 2012 or \$231 billion. By 2017, online sales are expected to beat brick-and-mortar sales with a compound growth rate of 10% and reach \$370 billion (Lomas 2013). The number of retailers selling both products and services online in the United States and around the world is rapidly on the rise.

For both online and traditional markets, much of the literature in behavioral pricing focuses on consumer goods. Findings from the consumer goods industry many times cannot be directly applied to the service industry. The service industry has unique characteristics such as intangibility of product, involvement of customer in the production (Zeithaml, Parasuraman et al. 1985). In the service industry, price plays a critical role due to demand-based pricing or yield management techniques where capacity is relatively fixed and perishable (Varki and Colgate 2001). Playing on price, the travel and hospitality industries (including airlines and hotels) have used yield management techniques for several years and have increased profitability by over 8%. Yet, in spite of the significant influence of price, there are limited studies specifically evaluating the price thresholds in the service industry for online prices.

Early researchers in behavioral pricing noted that different customers are willing to pay different prices for the same product. Today, we are familiar with the price dispersion on the Internet for products and services alike. An airplane flight on a commercial airliner typically has

over 1,200 different prices for taking a passenger from the same point A to the same point B. Indeed, on the Internet, customer heterogeneity, brand loyalty and competitive forces influence the magnitude of price dispersion (Ghose and Yao 2011, Pathak 2012).

Moreover, customers pricing thresholds vary based on customer's income and motivation for purchase (Stoetzel 1954, Monroe, Della Bitta et al. 1977). Pricing thresholds or the latitude of price acceptance also vary by customer attributes. For example, customers enrolled in a loyalty program may have a wider price band because they psychologically associate other derived membership benefits of participating in the loyalty program such as free upgrades or preferential treatment. Customer motivation or use of a service may influence the threshold as well. Corporate as compared to self-paid customers may have different latitudes of price acceptance. Literature research confirms that corporate and self-paid customers value difference product/service attributes and their criteria for purchase decision varies greatly (Knutson 1988).

Additionally, marketplace dynamics cannot be ignored in understanding the latitude of price acceptance. Competitor price changes translate in effect to changing the firm's relative price position in the marketplace. A decrease in price by a competitor can now make the firm's services appear more expensive to a buyer and vice versa.

Acquisition channel may also influence the customer's sense of relative price. Customers coming through the search engine or comparison shopping agent (CSA) may be aware of competitor prices versus customers coming directly to a corporate website who may not be and who may have a different price band.

Literature points to a gap in understanding the influence of customer heterogeneity in overall price thresholds (Nijs, Srinivasan et al. 2007). Yet there are no studies examining price variation on the Internet at a channel level in the context of JND. A study of these differences in customer attributes in the context of service industry in an online marketplace provides

additional insights for developing a differentiated pricing strategy to increase profitability and customer retention.

## **1.2 Research Perspective**

The study uses Weber's law of Just-Noticeable Difference as a theoretical framework. This theory was initially developed and applied in psychophysics. Just-Noticeable Difference, abbreviated as JND, is the "smallest detectable difference between a starting and secondary level of a particular sensory stimulus" (Monroe 1973 p70). It is also known as least perceptible difference and differential threshold.

Marketers have used this theory in many ways. Marketing has used this theory to make improvements just above or just below the differential threshold. Negative changes such as product size, price increase, or quality changes are set based on thresholds where consumer will least notice the change and, to the contrary, more positive changes such as bigger size or promotions are set just above this noticeable threshold. In the context of price, a firm can increase or decrease the price by the same magnitude, but the consumer may not view the price change equally (Monroe 1973). When increasing prices, companies aware of the threshold effect can raise prices just below the upper threshold to maximize firm performance when reducing prices, companies can reduce price just below the lower threshold to get the desired results. The theoretical lens provides insight into influence of customer heterogeneity on online pricing thresholds in a non-contractual service industry.

## **1.3 Research Approach**

This quantitative study uses three and half years of non-contractual transactional data and customer level data from a B2C company in the \$100 billion parking industry. Parking industry is a good fit for this research endeavor as product differentiation in parking is minimal and



consumer choices are more focused on price versus non-price attributes. Non-contractual data is a better way to evaluate immediate price impacts. In a contractual setting, the revenue from a customer can be estimated and competitive prices may not have an immediate impact on firm performance. In a non-contractual setting, however, the firm is motivated to keep the relationship with the customer alive since the customer can switch easily and share the wallet with other competitors (Dwyer 1997).

Contributions are three-fold. Theoretically, this study furthers the conceptual understanding of the pricing thresholds for online purchases using real transactions and customer level data. Second, the application of JND theory in a non-contractual B2C service industry yields additional insights by determining that price thresholds are higher in the service industry (between 27%-37%) as compared to the consumer goods industry (23%) for historically benchmarked prices. Third, this research demonstrates the influence of customer heterogeneity and competitive markets in determining the differential price thresholds. These findings will enable firms to implement a differentiated pricing strategy across channels and customer segments to maximize profits and customer retention.

#### **1.4 Summary**

This research study is organized as follows:

##### Chapter 2: Literature Review

This chapter reviews the previous research in the pricing literature stream as it relates to behavioral pricing. This chapter also provides a brief history of the behavioral pricing research and the existing knowledge and insights in this stream of literature. The chapter elaborates a few quantitative studies that explore the role of price and perceived price in consumer purchasing behavior particularly as it relates to pricing thresholds, pricing in service industry, price

dispersion on the Internet and customer heterogeneity. Further review of this literature confirms the gap in understanding the influence of price changes on online purchase frequency in the service industry and in light of customer heterogeneity.

### Chapter 3: Just Noticeable Difference Theory

JND theory and its applications are described in this section. This theoretical framework of JND theory and its constructs are explained and elaborated in this section. Its application in psychology, psychophysics, and marketing domains are discussed. Previous studies that include JND in the context to understand pricing behavior are elaborated in this section. This literature study reveals that there are no studies in the service industry to understand pricing thresholds using JND at a channel level in the online marketplace.

### Chapter 4: Research Methodology:

Chapter four describes the research approach and methodology underlying this study. It explains the reasons why a quantitative field study is most appropriate to examine the research question. The study tries to answer the “what” question, which lends itself to a quantitative study. At what level of price changes are just noticeable differences by consumers? What influence does customer heterogeneity have on online price –purchase frequency link in the service industry? This is a longitudinal study that examines the effect of price on purchasing frequency in a non-contractual setting. Non-contractual data lends itself to reveal immediate effect of price changes hence is better suited for this study.

### Chapter 5: Data Collection and Analysis

Chapter five elaborates the data collection and analysis strategy. The study spans a period of three and half years and uses data from a B2C firm in service industry. The study uses three datasets: customer/transactional level data, pricing actions and competitor prices. Four price changes occurred during this time-period: three price increases (9%, 27% and 37% over base

price in period 1) and one price decrease (27% increase over base price in period 1/7% decrease over prior period). Study 1 examines the empirical price threshold and compares the validity of price threshold from literature in the consumer goods industry. Study 2 models the price-purchase frequency link at a channel level to understand the influence of customer heterogeneity and competitor prices. The hypothesis to be tested are also described and elaborated in this chapter.

#### Chapter 6: Results

This chapter details the statistical methods used to determine the results. Study 1 uses raw frequencies and ANOVA to review the JND pricing threshold and compares it to thresholds in the consumer goods industry. Test of mean differences comparing purchase frequencies of periods following a pricing action are studied to understand purchase frequency variations in each subsequent period. The results indicate that the threshold is between 27% to 37% of price in the base period. Study 2 explores customer level data and develops regression models to understand the effect of customer attributes such as loyalty, motivation for purchase, and channel type on purchase frequency. Influence of competitor prices is also studied. Results confirm that after a pricing action, customer attributes effect purchase frequency although not equally. Customer loyalty has the highest explained variance followed by motivation for purchase and channel type.

#### Chapter 7: Discussion

This chapter discusses the results from the two studies particularly as it links to the previous research in behavioral pricing. Specifically, it examines the results in the context of the service industry. Possible explanations of the results are elaborated and findings are discussed in greater depth.

## Chapter 8: Contributions

Theoretical and practical contributions are elaborated in this chapter. This research study has three contributions. In a theoretical context, it furthers the conceptual understanding of the pricing thresholds for online purchases. Secondly, this study applies JND theory in a non-contractual B2C service industry for online prices and it yields that thresholds in the service industry are between 27% and 37% of historically benchmarked prices. Thirdly, this research evaluates the influence of customer heterogeneity and competitive markets in determining the differential price thresholds. These findings have direct implications for managers in determining differential pricing and promotions strategy at a channel level.

## Chapter 9: Conclusion, Limitations and Future Research

This chapter explains the limitations of the study and the overall generalizability of this research. Limitations of the study such as sample-based generalizations, use of archival data, operational biases are discussed. The chapter also elaborates future research opportunities that can strengthen the understanding, both theoretically and practically, of the role of pricing thresholds in online markets. Future studies can research the effect of other customer attributes and also study threshold effect in the global context with currency influences. The section concludes with briefly summarizing the contributions and implications of the study.

## **2.0 LITERATURE REVIEW**

Pricing is a key strategic lever used by management to increase profitability. A recent survey conducted by McKinsey & Company indicated that corporations left over 2% revenue on the table by pricing incorrectly (Marn and Rosiello 1992). In the 1990's, the airlines increased profitability by over 8% by using pricing as a key strategic lever to manage inventory. Hotels have increased revenue by 5% by optimizing pricing. Companies can increase their profitability by 20-50% by systematically implementing pricing strategy (Society 2012). Recognizing the importance of price as a revenue driver, a small number of Fortune 500 companies have groups dedicated to pricing or research pricing for their products (Hinterhuber and Liozu 2012).

### **2.1 History of Behavioral Pricing Research**

In the academic arena, researchers have studied pricing and pricing behavior for more than fifty years and a rich stream of literature exists in the domain of behavioral pricing. Literature in the pricing area evolved from a neoclassical view of price as an economic variable that only affects demand and supply to more of a behavioral science. Contemporary research is focused on information processing or cognitive models to understand the role of price in purchase decisions. Thus contemporary scientific work is focused on all aspects of pricing information, from how consumers acquire it, perceive it, process it and recall it (Monroe and Lee 1999).

Early discoveries in behavioral pricing were documented by Scitovszky (1944), who observed that a consumer has two prices in mind for every product: a historical price and an actual price. The historical price contributes to forming a sense of a normal or fair price in the minds of the consumer. If the actual price is different from the historical price, then consumers form an opinion of whether the product was reasonable, cheap or expensive. He further

observed that “cheap” was viewed as a sign of lower quality and, accordingly, expensive products are considered to be of higher quality. He also noted that retailers used the higher price to give the buyers a higher sense of quality of the product. But, to indicate a promotional offer, they scratched out the higher price and just displayed the lower price and it provided a buyer a sense that he or she was getting a good deal.

Almost a decade later, Stoetzel (1954) explained that buyers do not really know the fair price for a product and are unsure of the quality. Purchase decisions are driven by income level and need for the product; moreover, different buyers pay different prices for products of different quality and value as it relates to their context. Stoetzel (1954) then developed the notion of acceptable price ranges. He concluded that a product can have a set of acceptable prices or a band above which the product is considered to be too expensive and below which the buyers felt uncertain that the product could deliver adequate value or, maybe even, poor quality. The prices above or below the band were hence considered to be unacceptable prices.

Following these observations, Adam (1958) experimented with the width of acceptable price ranges. He noted that the width of the acceptable price range relates to the price uncertainty of the buyer. He further observed that the band of uncertainty was proportional to amount of the initial price. By then, Weber, Fechner and Bernoulli had proposed that the range of price is logarithmic in nature and that different consumers have different ranges based on their income levels. Just a couple years later Foulhe (1960) observed that familiar products have a narrower range as compared to unfamiliar products.

In the 1960's, a few more researchers such as Gabor and Granger (1961) further experimented with acceptable price ranges. Their observations concluded that the last price paid as well as the competitive price available in the marketplace influences the price range. In a

competitive marketplace, buyers compare the prices as well as the corresponding qualities of product and deficiencies (Gabor and Granger 1966, Sowter, Gabor et al. 1969).

In the three decades prior to 1970, as the marketplace changed, pricing research evolved to reflect time as a construct. Most researchers used empirical observations or survey data to validate findings. The finding of these researchers confirmed that buyers have several acceptable prices, however, the judgment on “just” price or “fair” price was based on several factors. To appropriately evaluate consumer response to pricing behavior, the use of a comparative framework became popular. Researchers also concluded that the prices varied based on customer’s need of the product, wealth, competing brands, magnitude of the price and familiarity of the product itself.

In the period between 1970 to 2000, research on pricing and buyers’ response to price evolved further into understanding the way consumers processed price information. In this time period, scholars such as Kent Monroe published seminal papers in the field (Monroe 1971) (Monroe 1973) (Mazumdar and Monroe 1990). Research examined both conscious and unconscious tendencies exhibited by the buyer. Contextual signals, both objective and subjective influences in purchasing decisions, were tested with sophisticated experimental methods. The influence of price on brand name and quality perceptions further enhanced the role of price in marketing. The notion that price also serves as a product attribute than merely an economic variable (Rao and Gauschi 1982), (Bhagwati and Srinivasan 1982) was brought forth. In addition to brand name and packaging, price as an extrinsic cue of a quality indicator became widely understood (Zeithaml 1988).

During this time, research in the area of information acquisition, cognitive processing, and remembering vs. knowing are explored. Price also carries and communicates attributes such as quality, and brand image and fairness. From this work, researchers concluded that price

fairness was an antecedent to overall customer satisfaction. Extant literature dwells on the relationship of price-quality and price-brand perception.

In the last couple of decades, the research in behavioral pricing has continued to develop deeper insights in price perception and consumer decision-making in the global context and in the e-commerce area. Sheth and Parvatiyar (2001) have studied the influence of price and contextual variables that influence relationship marketing across countries. Appendix A summarizes the historical timeline of behavioral pricing research.

Given that the overall pricing literature in the field is vast, this paper focuses on the literature related only to online pricing in the US. With a large percent of sales conducted over the Internet, analyzing effectiveness and customer psychology in online purchases is becoming important. With the introduction and increase in e-commerce, research exploring pricing strategies of online offerings can yield interesting insights into purchasing behavior over the Internet. Buying behavior on the Internet exhibits tendencies that may be different than in-store buyers (Ba and Pavlou 2002). Consumers have a higher level of price transparency on the Internet and are able to compare competitor pricing with ease, thus reducing search costs. Consumers also assume and expect to receive the lowest price (for comparable products) online. Retailers are exploring price partitioning tactics to perceptually improve the price of the products (Xia and Monroe 2004).

Secondly, on the Internet the issue of trust and uncertainty are higher (Ba and Pavlou 2002). Since consumers cannot touch and feel the product, brand name carries a higher weight, and many times price is taken as a synonym for quality. Further research continues to be developed on dynamic pricing strategies, personalized pricing, pricing in social media (Chatterjee and McGinnis 2010, Grewal, Ailawadi et al. 2011, Weisstein, Monroe et al. 2013). Companies such as Lexis-Nexis and Amazon are already exploring personalized pricing



strategies. As more of the population, in all demographics and ages, purchases products and services on the Internet, communications and effectiveness of pricing action and promotions on the Internet will evolve rapidly.

Historically, most research studying the perceptual increase and decrease in price used experiments and surveys as a tool to understand purchasing behavior. Few studies have used real transactional level data to understand consumer responses to pricing actions. Now, with the availability and accessibility of large data, both structured and unstructured, researchers are able to study the influence of pricing actions on consumer behavior with real world data. This study likewise uses real transactional and customer level data to examine the phenomenon.

## **2.2 Pricing Thresholds**

Price has a significant influence on consumer buying behavior (Kohli and Suri 2011). Price is sacrificed in exchange for value (Mazumdar 1986, Zeithaml 1988), (Monroe and Krishnan 1985). As Warren Buffet quoted Graham (1959 p.192), “Price is what you pay, value is what you get”. Much of the decision on what to buy and the quantity of purchase is determined by price. Extant literature suggests that consumers use psychological reference points to make buying decisions (Kalyanaram and Winer 1995). Reference points particularly influence consumer purchase decisions. Several studies have reviewed the way consumers form these reference points. Studies also confirm that consumers have a range of acceptable prices or a latitude of price that they are willing to consider for the product. A price over the upper limit of this range may reduce their purchase intentions. There is a lower limit as well, under which a consumer may purchase more of the same product or may infer that the product or service is of a poor quality (Brucks, Zeithaml et al. 2000) and choose not purchase the product. However,

within the range, the consumer does not perceive a price difference, which is to say that the demand is relatively stable.

The range is determined by both subjective and objective contextual factors, although the formation of perceptions is what ultimately drives behavior. Initial product price and competitor price is one of these contextual factors that structures a consumer psychological perception of an acceptable price range. Consumers' own price awareness, income level, or even intention to use may influence the range (Monroe, Della Bitta et al. 1977). It may vary based on industry or historical practices by retailers. Some researchers have attempted to model the threshold as a function of firm, relative competition and consumer motivation (Han, Gupta et al. 2002).

There is also considerable literature devoted to the study of reference price. Reference price is defined as a price that the consumers compares against for the product they are intending to purchase (Rajendran and Tellis 1994). It is the price a consumers uses as a benchmark price. Many studies have focused on the ways consumer acquire, remember and recall a reference price. Studies have used both past prices, recent prices and competitive prices to estimate the role and formation of reference price (Rajendran and Tellis 1994)

Much of the research in the area of price and price perception has been carried out in consumer goods. Many studies have used grocery stores or supermarkets (Desai and Talukdar 2003), or other retail outlets, and varied their methodologies from surveys to experiments to gather data on consumer response to pricing action (Marmorstein, Grewal et al. 1992). Data analysis outside of grocery store (scanner data) area will lead to an advanced understanding of price as a variable (Malhotra, Peterson et al. 1999). Literature review demonstrates that there are limited studies examining the role of online price perception in the service industry in a non-contractual setting and none that have used JND as a theoretical lens.

### **2.3 Response to Pricing Actions**

Against this background of why consumers purchase certain products, it is important to note that they respond differentially to pricing action increases and decreases based on the level of change, store image and brand name of the product (Gupta and Cooper 1992). Consumers are more sensitive to the magnitude of increases in price vs. magnitude of decrease in price (Kalyanaram and Winer 1995). This can be related back to the theory of loss aversion (Tversky and Kahneman 1991), where consumers are more perceptible to loss (price increase) as compared to price decrease (gain). A study in 2001 found that in the coffee industry, the thresholds for price increases are smaller than for price decreases or discounts (Han, Gupta et al. 2002). Consumers only changed their purchase intention when the change in price was over a certain level and the threshold levels were different for name brands versus store brands (Gupta and Cooper 1992). In terms of price increases, the consumer may not notice relatively minor price increases if they are within the range (Kalwani and Yim 1992, Kalyanaram and Winer 1995), and higher price increases are also subject to a saturation effect, particularly for luxury products (Jacoby, Chestnut et al. 1978). The consumer may perceive a price decrease but may not respond because they may be expecting a further price drop (Mela, Gupta et al. 1997, Kopalle, Mela et al. 1999). Additionally, beyond a certain level of price reduction, change in consumer purchase intention is minimal. Thus there appears to be a saturation effect that can be attributed to consumers' limitations such as stockpiling products, transporting, monetary limits (Gupta and Cooper 1992). The service industry differs in this case. In the service industry, stockpiling may be difficult or even impossible at times.

In a study published on grocery store products in 2006, the authors confirm the impact of the brand on the size of the threshold. The study notes that thresholds of price elasticity were shown in 76% of all brands, with 29% being based on historical prices, 16% on competitive

prices, and 31% on both historical and competitive effects. For competitive benchmarked pricing, the elasticity change beyond the threshold for gains or price decreases was 15% and for losses or price increases, it was 17% (Pauwels, Srinivasan et al. 2007). Smaller thresholds of less than 15% may be thought of as an assimilation effect in the perceived price by the consumer (Kalyanaram and Winer 1995, Pauwels, Srinivasan et al. 2007).

Researchers have confirmed that price creates perception and that this communicates certain attributes about the product to the consumer. Price is not only an economic variable but also a conveyor of product traits such as quality, fairness, and brand image (Brucks, Zeithaml et al. 2000). A 1991 study stressed that in perception of a price the rightmost digit of price signals some product attributes to the consumer (Schindler 1991). Prices ending in “00” may indicate a regular price whereas a “99” ending indicates sale price and an “88” indicates lowest price. Many retailers use prices ending in .9 as a threshold (Gedenk and Sattler 1999).

## **2.4 Service Industry Characteristics**

Service is defined as a “process of doing something for someone else” (Merriam-Webster 2014). It does not include any reference of goods as a primary exchange. Over the last few decades, the economy has shifted from a goods economy to a service economy. Firm orientation has also changed from manufacturing-driven to services-driven, particularly in developed countries. Subsequently, production and marketing activities adapted the manufactured goods orientation to fit the characteristics of a services industry (Davies, Brady et al. 2007, Gebauer and Fleisch 2007). More firms today are producing services than manufactured goods and hence services require more research attention (Vargo and Lusch 2008).

Four differences have been identified between goods and services industries. These are:(1) intangibility (2) inseparability of production and consumption, (3) heterogeneity, and (4)

perishability (Zeithaml, Parasuraman et al. 1985, Lovelock and Gummesson 2004). Marketing further developed concepts and models to identify characteristics in the services industry to move from transaction-based to relationship-based marketing (Berry 1983). Service quality is conceptualized as customer perceptions and not engineering standards (Grönroos and Shostack 1983), and the notion of brand equity has been re-conceptualized customer equity (Rust 2000). In spite of this movement to more service orientation, goods-based research continues to be a dominant paradigm in marketing (Fern and Brown 1984, Lovelock and Gummesson 2004, Vargo and Lusch 2004). Similarly, academic literature envisions producing services to be highly similar to producing goods rather than providing services (Vargo and Lusch 2008). Table 2.4-1 lists the unique characteristics of the service industry.

Table 2.4-1 Service Industry Features

Unique Service Features	Marketing Problem
Intangibility	<ul style="list-style-type: none"> <li>• Intangible, unlike goods</li> <li>• Cannot protect through patents</li> <li>• Cannot readily display or communicate</li> <li>• Prices difficult to set</li> </ul>
Inseparability	<ul style="list-style-type: none"> <li>• Consumer involved in production</li> <li>• Other consumers involved in production</li> </ul>
Heterogeneity	<ul style="list-style-type: none"> <li>• Standardization and quality control difficult</li> </ul>
Perishability	<ul style="list-style-type: none"> <li>• Cannot be inventoried</li> </ul>

Adapted from (Zeithaml, Parasuraman et al. 1985)

In the service industry, consumers exhibit different purchase behaviors as compared to purchase of goods. For example, a consumer may perceive the price decrease but may not purchase as they may be expecting the price to decline further (Mela, Gupta et al. 1997, Kopalle,

Mela et al. 1999). However, beyond a certain level of reduction in price, the consumer does not continue to purchase more. This saturation effect is attributable to limits of a consumer such as stockpiling products, transporting, monetary limits (Gupta and Cooper 1992). In the service industry, stockpiling is difficult or not possible in some cases. This is an important consideration to understand differentiated customer response between consumer and service industry.

Pricing is not only used as a lever for increasing profitability or also as a demand management tool when capacity is fixed. The hospitality industry has used revenue management techniques since the 1980's and now increasing utility companies and governmental agencies are using pricing to control demand to match existing capacity. Industries where capacity is fixed can effectively use price as a management tool. In a paper published by Prof. Donald Shoup, of UCLA, notes the importance of pricing in parking (Shoup and Association 2005). He specifically elaborates the ways in which free parking is in fact expensive. Some numbers quoted in the study highlight the cost of free parking both from a revenue loss standpoint but also from a quality of life viewpoint. In Los Angeles, cars travelled about 950,000 miles annually just looking for parking, and consumed 47,000 gallons of gasoline while emitting 730 tons of carbon dioxide in only a 15-block area of the Westwood Village. Additionally, one out of every three cars in the city's downtown were circling around looking for parking. Traffic causes delays, pollution and wastage of time and resources. The paper suggests using pricing as a lever to manage this demand. Pricing high encourages in lower usage during peak times and vice versa. A San Francisco based program, SFPark is doing exactly that, in the city of San Francisco. High demand parking spaces are priced higher with a goal of having a two spots always available at each block and reach a capacity of 85% overall. The program adjusts the rates on a monthly basis but the price can change based on time of day or day of week. This

program has reduced city congestion and traffic from cars circling around to find parking by 30%.

## **2.5 Price Dispersion in Online Markets**

In the literature, there is an emerging stream of research on price dispersion (or variation in prices) for homogeneous goods in the online markets. Price dispersion affects customers' perception of value and behavior which in turn affects sales and profitability (Gailey, Dixit et al. 2012). Differences in customer search costs and terms of sale influence price dispersion (Stigler 1961), (Borenstein and Rose 1995, Zhao 2006). Customer heterogeneity is noted as a primary motivator for price dispersion, but the literature further suggests that imperfections in market conditions (Grewal, Gotlieb et al. 1994, Lindsey-Mullikin and Grewal 2006), customer learning (Johnson, Moe et al. 2002), and loyalty to brand (Chen and Hitt 2001) play a role in price dispersion.

A study of price dispersions in the books and CD business suggests that Internet-only retailers have the least price dispersion, traditional retailers are second, and multi-channel retailers have the highest price dispersion (Ancarani and Shankar 2004). The study also confirms that online markets offer retailers more opportunities to offer a variety of prices across channels.

A study by Biswas, Dutta et al. (2006) evaluated low price guarantees and perceived role of price. The study found that effects of price guarantee are higher when the price dispersion is high. The levels of penalty associated with the purchase affect customer behavior positively.

A study conducted by (Zhao 2006) on grocery store prices is consistent with the literature linking price dispersion to consumer heterogeneity, consumer search, and competition. This study researched price dispersion under three conditions: (1) a particular brand across stores, (2)

across brands but with a product category, and (3) longitudinally across a brand. The research shows positive correlation between price dispersion and consumer heterogeneity, consumer search, and competition.

Search costs and customer heterogeneity are often cited as reasons for price dispersion in a brick and mortar marketplaces (Stigler 1961, Borenstein and Rose 1995, Zhao 2006).

However, consolidated search engines provided detailed price and retailer comparisons, thus reducing the search cost of the customers and hence fewer variations in prices. However, research confirms that online markets also have some price dispersion (Pathak 2012).

Comparison shopping agents (CSA) and websites make prices transparent and search costs lower (Pathak 2012). A study by Ghose and Yao (2011) confirms that price elasticity is higher for online customers due to higher market transparency and higher competition. However, price thresholds may also vary based on customer specific attributes. Additionally, customers that come directly through the company website may exhibit different pricing perceptions than those coming through search engines. The current study examines the influence of channel types and customer attributes on responses to pricing actions.

## **2.6 Price Perception and Customer Heterogeneity**

The “law of one price” states that demand and supply for homogeneous products or services determine price (Isard 1977 p.942). However, both marketing scholars and economists agree that one price is rarely a reality. Same products are sold at different prices by different sellers or by the same sellers to different consumers (Gailey, Dixit et al. 2012).

Consumer purchase intention and behavior vary based on the context and motivation for purchase (Bettman 1970, Monroe, Della Bitta et al. 1977). Price perception also varies by customer segment. The propensity to switch versus propensity to continue buying is contextual



for each segment and can depend on several factors such as competition, brand loyalty and customer learning (Gailey, Dixit et al. 2012).

Firms value longer term or loyal customers (Sheth and Parvatlyar 1995, Blattberg and Deighton 1996, Blattberg, Getz et al. 2001). Many studies suggest that loyal customers have a lower cost to serve and are less price sensitive, and, hence, respond to price differently than casual customers (Shaffer and Zhang 2000, Bowen and Chen 2001, Taylor and Neslin 2005). For example, Delta airlines charged its frequent flyer customers more than casual customers (Sanburn 2012). On the other hand, studies also confirm that loyal customers perceive higher levels of a sense of betrayal and unfairness when they learn that they paid higher prices (Feinberg, Krishna et al. 2002, Tsai and Lee 2007). Loyal customers do not always pay higher prices (Reinartz and Kumar 2000), and may be less sensitive to price increases (Shaffer and Zhang 2000, Bowen and Chen 2001, Taylor and Neslin 2005).

Loyal customers also respond differently to promotions. In a study published in the *Journal of Consumer Marketing*, researchers examined consumer perception differences in various promotional offerings (Campbell and Diamond 1990). Specifically this study compares free or extra product promotions versus discounts. It concludes that consumers notice monetary promotions more than non-monetary promotions. However, large monetary promotions also make the consumer skeptical. It further noted that in the premium consumer segment, nonmonetary promotion carried a higher value.

Another study examining the relationship between price framing across various segments confirms that loyal customers respond to more value based offers such as free gift cards versus prospective customers who respond more favorably to discount type offers (Weisstein, Monroe et al. 2013). These studies confirm that with respect to pricing and promotions actions, loyal customers exhibit different preferences than casual customers.

A study of perception in online hotel and airline pricing concluded that price is linked to buyer's perception of quality and perception of trust and fairness of the brand (Chun-Fang and SooCheong 2006, Anuwichanont 2011). It further elaborates that since online products and services are intangible, consumers use price as a determining factor for decision making on quality of the service (Oh 2000, Chun-Fang and SooCheong 2006). A study comparing the importance of perceived trust versus perceived price on consumer purchase decision further confirms that perceived trust is a stronger influencer of online shoppers (Kim, Xu et al. 2012).

In summary, literature review in this area confirms that price perception may vary by customer segment and their acquisition channel. However, there are no studies examining the threshold differences at a channel level in the online marketplace.

### 3.0 Just Noticeable Difference Theory

Extant literature suggests that when humans respond to physical stimuli, they have an upper and lower sensory threshold within which changes in stimuli are not noticed. Just Noticeable Difference theory (or JND) seeks to quantify this relationship (Ekman 1959). As mentioned earlier, JND theory finds its roots in psychophysics, a discipline that seeks to quantify the magnitude between the intensity of the stimuli and the corresponding perception of the stimuli. JND theory originated in the early 1800's and is to this date considered one of the foundational theories of experimental psychology.

Ernst Weber (1795-1878) was one of the first people to scientifically quantify the human response to stimuli and is a founding father in this discipline. Weber's law states that “over a large dynamic range, and for many parameters, the threshold of discrimination between two stimuli increases linearly with stimulus intensity” (Dehaene 2003 p.146). Weber's initial experiments were involved with detectable differences between weights. In the experiment, a subject picks up two objects with different weights. Weber noted that the subject could only detect a difference if the difference in weight between the two objects were above a certain amount. Therefore, if the difference in weight was small, the subject did not perceive the difference in weight between the two objects. This threshold is called a just noticeable difference (JND). If more than 50% of the subjects could notice the difference, it became a threshold. Weber went further to demonstrate that the magnitude of JND was proportional to the magnitude of the original stimuli.

Based on the published work of Weber, a German physicist called Gustav Theodor Fechner started his own experiments to quantify the relationship between the stimuli

and perception. His research revealed that there is a relationship between the physical stimuli and the effect on the mind. His work in this domain is referred to as “outer psychophysics” (Murray 1990). He, also, went on to explore the inner psychophysics where he explained that the human nervous system has oscillations in activity and that physical stimuli add to the oscillation activity. After a particular threshold of activity is exceeded, only then can the subject recognize the physical stimuli change (Murray 1990). He further quantified this relationship and noted that the change in intensity of a stimulus and its perception is logarithmic. When the intensity changes by a multiplicative constant factor, the subject perceives an additive increase of the stimulus or the relative difference versus the absolute difference in perception. Weber and Fechner did several experiments with sound and weight sensation and human perception changes and differential thresholds. Over the years, the findings of Fechner have been criticized by some studies and some of this findings were reevaluated (Krueger 1989), but generally the theory is still being used in psychophysics.

### **3.1 Key Constructs of Just Noticeable Difference Theory**

Weber’s law states that the proportional changes in magnitude will correspond to the small, equally, perceptible changes in response: Weber’s law is a hypothesis about how this threshold change can happen (Monroe 1971). For example:

$$\Delta I / I = k$$

Where,

$\Delta I$  : Detectable Difference

I: Initial intensity

k: Constant

Fechner, further quantified Weber’s work (thus often referred to as the Weber-Fechner law) and it can be represented as,

$$S = k * \log I$$

Where,

S: Magnitude of the response

k and a: Constants

I: Initial intensity

When an individual noticed the difference more than 50% of the time, it qualified as a threshold. The law is often referred to as Weber-Fechner Law and JND theory is still used as one of the foundational theories in psychology and is used in many disciplines such as psychology, marketing and other fields working with human senses.

### **3.2 Applications of Just Noticeable Difference Theory**

Since its discovery in the early 1800's, JND theory was key to the discipline of psychophysics and has been extensively used to understand the human response to physical stimuli. In schools of psychology, it is taught as one of the foundational theories. In the last two centuries, most of Weber's and Fechner's experiments related to understanding human perception of the sense of sound, sight, smell, touch and speech have been the basis of much deeper research and application areas for JND theory.

In the acoustics literature, the theory has been applied to further quantify and understand the relationship between sound and perceptual differences of pitch, tone, and level of sound or loudness. The difference of perception of tones was studied by A.W. Mills in a study published in 1958 (Mills 1958). This study quantified threshold differences for temporal and intermural differences of pure tones. Pitch has the lowest noticeable threshold at a constant or Weber's k is .003 versus for level of sound or loudness is .10. Hence, if someone is slightly off pitch while singing a song, it is easily detectable versus adjusting the voice volume, which would need to be adjusted by a higher or lower amount than the pitch.

A study by D.H. Klatt confirms that in the English language, the duration of phonetic segments serves as a perceptual cue (Klatt 1976). Another study explores the effect of tempo or speed of speech based on JND (Quené 2007). It concludes that JND for tempo is 5%, a percentage which means that a speaker would have to speak 5% faster or slower for the audience to notice the difference (Eefting and Rietveld 1989). Speech related studies also explore learning disabilities such as dyslexia (Mcanally and Stein 1996) and a dyslexics measure of audible frequency. Many studies, including perceptual differences in foreign language accents, politeness, speech rhythm and frequency, have been conducted with JND theory to further the understanding and quantify the effect of the physical stimulus.

In the area of sight, the theory has enhanced the understanding of visual perception and has been applied to understanding human psychology, which has a variety of applications in our technologically driven world today. Scientists conclude that in human vision there is a certain level of perceptual redundancy. An experiment by Zhang, Lin et al. (2008) estimates the perception visual difference in images based on number of pixels. This study captures the perceptible threshold in human vision in detecting color. Similar studies exploring the way the human eye perceives and measures reality and virtual reality (Cutting and Cutting 1997, Rohrer, Lashley et al. 2011) as it is being used in the gaming industry. Tactile perception in the blind (Wang, Hsu et al. 2000, Hötting, Rösler et al. 2004) and color blindness (Pearlman, Birch et al. 1979) have led to some interesting discoveries as well.

Touch is another area of study that has applied JND theory. Researchers have studied human perception of softness and the tactile discrimination abilities (Srinivasan and LaMotte 1996). Researchers in the early 1900's also carried out experiments to understand the perceptible differences in sensation of pain (Stoll and Greene 1958). A 1947 study measures the perceived difference in pain by inducing pain by thermal radiation; it used a pain scale to

measure the effect (Hardy, Wolff et al. 1947). Similar studies explored the perception of odor and addition or deletions of certain elements and their effect on odor perceptions (Pangborn and Trabue 1967, Zamora, Alaiz et al. 2001, Le Berre, Beno et al. 2008).

Most of studies on taste and perceptible differences increase the concentration of solution to measure the perceptible difference. Methods have involved random or successive increments so that results are not clear and many times are subjective based on the personality of the subjects (Pfaffmann, Bartoshuk et al. 1971).

Inter-sensory studies have also used JND theory to explore the dominance of one sense over another sense. A 2002 study by Ernst and Banks explores the relationship between vision and touch (Ernst and Banks 2002). The researchers explain that when we look at an object and touch it with our hands, both sight and touch supply signals to the brain to estimate properties of the object. The study confirms that vision dominates the perception. Similarly, experiments exploring the effect of sound on vision were conducted (Bertelson and Aschersleben 2003, Morein-Zamir, Soto-Faraco et al. 2003).

JND has also been used to quantify the cognitive perception of numbers and scales. Scientists argue that if cognitive processes follow conceptual processes then they should also hold to the psychophysics laws (Nieder and Miller 2003). Experiments conducted on numerical scales concluded that certain sensory and perceptual share the same mechanisms and neural coding processes.

JND has also been applied to obesity, and psychiatric conditions, aging (Gilmore and Murphy 1989, Poliakoff, Ashworth et al. 2006) and as a measure of happiness thresholds (Ng 1996).

In summary, JND theory has a wide degree of application in various disciplines that relate to human behavior and the effect of physical stimuli. The literature stream on this theory

is rich and relevant to the present research. Researchers continue to fine-tune the studies to further the understanding of differential thresholds.

### **3.3 Just Noticeable Difference Theory and Marketing**

The discipline of marketing has extensively used JND theory in developing insights into further understanding various aspects of human perception of packaging, branding and pricing of goods and services. Weber's law is integral to marketing (Henderson Britt 1975). Studies in marketing have tried to understand the consumer perception of size of the product, changes in colors, labeling as well price and promotions. Product improvements or changes in size are made below or above the JND threshold to manage consumer perception (Britt and Nelson 1976, Nancarrow, Wright et al. 1998). Negative changes such as product size, price increase or quality changes are set based on thresholds where consumer will least notice the change and, on the contrary, more positive changes such as larger sizes or promotions are set just above the noticeable threshold. A candy manufacturer steadily changed the size of the basic milk chocolate bar 14 times in 23 years by one sixteenth of an ounce (Kamen 1977). JND theory has been widely used to balance consumer perception of quality and price. Companies apply the thresholds to manage quality and price ratios to improve profitability. Manufacturers substitute less available or more expensive material in exchange for lower cost more available materials when noticeable differences are minimal. For example, when faced with a shortage, General Motors used Chevrolet engines instead of the Oldsmobile engines (Kamen 1977).

From a consumer-centric viewpoint, the theory has been used to measure the effectiveness of scale and magnitude of change in the emerging field of sensory marketing. For many years now, firms have used the five human senses to reach consumers and create perceptions of a brand or brand personalities. In the last couple years, the field of sensory



marketing has received renewed attention and focus. In 2014, *Journal of Consumer Psychology* published a special issue on embodiment and sensory perception, primarily focusing on ways sensory inputs can drive consumer behavior. A recent article, touches upon this science consolidating many experiments done by consumer goods and service companies to improve the sensory perception of the brand through the use of smell. It discusses experiments done in cars, banking centers and even, for pencils (HBR 2015).

Seminal work in behavioral pricing and JND was carried out by Kent Monroe in the 70's and was published in the *Journal of Marketing Research* (Monroe 1973). Prior to this work price was viewed as an economic outcome variable and not as a number that could induce behavioral changes in consumers. Monroe's research confirmed that there are thresholds above or below which consumers will not change their purchase intention. Above a certain threshold, the consumer-perceived value of the product decreases and below a certain pricing threshold, the perceived value of the quality of the product decreases.

There has also been contradictory evidence about the applicability of JND to price, particularly in certain industries. Some researcher have used the "fair price theory" instead to explain that as prices rise, a constant price difference between brands is more important in establishing product market share, based on the industry context and competitive landscape. (Kamen and Toman 1970).

Most research in the area has focused on the consumer goods industry. Studies have used scanner data available from the grocery stores. Industry will benefit from studies relating to price as a variable than are focused on other than grocery store data (Malhotra, Peterson et al. 1999). There are no studies that examine JND theory in context of the service industry. Second, differential online pricing thresholds have not been studied at a channel level.

Examination at this level may yield additional insights for pricing strategy practitioner and increase the conceptual understanding of online price bands based on customer heterogeneity.

## 4.0 RESEARCH METHODOLOGY AND DESIGN

This is a quantitative field study using archival data from a unit of \$20 billion group in the travel industry. The parking services company has a national and international presence and well recognized as a pioneer in technology in the field. Parking is a \$100 billion industry worldwide. The parking industry is a good fit for this study. There is little product differentiation in the industry which makes it a good candidate to study buying behavior primarily related to price factors alone. Additionally, the industry is highly competitive allowing consumers to have many choices. The research study uses three and half years of transactional data and customer level data from a B2C company in a parking service industry in a non-contractual setting. Non-contractual data is a good way to evaluate immediate price impacts. In a contractual setting, revenues can be easily forecast and competitive pricing, thus, does not have an immediate impact on firm performance. In a non-contractual setting, the firm is motivated to keep the relationship with the customer alive since the customer can switch easily and share her/his wallet with other competitors (Dwyer 1997).

This research study seeks to answer a “What” question: What level of price variation causes a customer to respond by changing the frequency of purchase or not purchasing? What influence does customer heterogeneity have on online price perception in the service industry? Since the research seeks to answer the “What” question, it is appropriate to use a quantitative study method. This study does not measure customer perceptions directly. Instead, it seeks to understand the perceptions through the levels of price changes over the three-year period and subsequent behaviors of consumers.

Thus this study uses frequency of purchases by individual consumers as the unit of analysis. A parking location with over 1300 spaces was selected for analysis. The location was selected for the following reasons. One, this location receives a majority of the sales from the online channel and this research is hypothesizing about the online setting as a sales channel. Additionally, over the span of time in the study, online prices were increased three times and decreased one time at this location, making it a good candidate for study.

## 5.0 DATA COLLECTION AND ANALYSIS

### 5.1 Data Collection

This study uses three and half years of transaction and customer level data from one location. It is important to use transactional level data to review repeat purchases following three price increases and a single decrease. The data also facilitates calculation of the repeat purchases for a customer. Three and half years span is chosen as a time period because high fidelity data was available for this period.

During the course of the study, I had complete and full access to current and archived documents and to managers in the organization. Multiple sources and modes of evidence, were used to gather the data. The positive relationship with both management teams and complete access to historic and current data increases the reliability of the findings by triangulating between different types of data.

### 5.2 Data Description

The researcher gathered three datasets:

1. January 2011 through June 2014 - Pricing actions

This data set is a historical account of the pricing action increases of decreases taken by the company from 2011 to 2014. The pricing actions are recorded on a weekly basis.

2. January 2011 through June 2014 - Transactional and customer data

This dataset includes transactional data including the date, quantity, customer identifier, channel and amount paid in each instance. This includes all online transactions for the location identified. In total, there are over 215,000 transactions in the dataset.

### 3. January 2013 through June 2014 - Competitor prices

Competitor prices over the period are listed by month in this dataset. For the purposes of the study, only two key competitors are included in the analysis. An average market price was identified and firm's price was compared relative to the market price for comparable service and quality.

## **5.3 Data Analysis Strategy**

Data was cleansed and appropriate quantitative techniques were followed to identify and remove outliers and null records. Where possible, data was time-ordered and conceptually ordered into graphs, charts, tables, and network designs. There are over 215,000 transactions in the transaction dataset. All the transactions included online purchase at a customer level over the span of three and half years. Data were organized into five periods. Each period begins on the date the pricing action took place and ends the day prior to the next pricing action. All customers that made a purchase in the first period remained in the database and the rest were deleted. The purchase frequency of the remaining customers was tracked after each pricing action.

Table 5.3-2 Coding Periods displays the pricing action timeline of the data. Each period represents the time interval between pricing actions. Each pricing action represents an increase/decrease over the initial price (i.e., period 1) and most recent price (i.e., prior period). An exploratory analysis of the data was conducted to assess the characteristics and nature of the dataset and determine basic frequencies, descriptive statistics and measures for central tendencies (Hartwig and Dearing 1979).

In total, there are over 215,000 transactions in the dataset. All customers that did not make at least one purchase in period one were removed from the dataset. The 13,068 customers

that made a purchase in base period 1 remained in the dataset. The purchase frequency of these 13,068 customers was then tracked over the span of the study. Over the three and half years, there were four pricing actions (i.e., 9%, 27%, 37% and 27% increases over the initial base price). Time intervals after each pricing actions are : 4.5, 7.5, 15 and 5 months. The time interval following pricing actions was coded into periods. Period one was the base period and ended before the first pricing action, similarly period two started the day of the first pricing action and ended the day before the second pricing action. Periods three, four and five are categorized similarly. Since, each period encompassed a different time span the repeat purchases standardized by month.

Table 5.3-2 Coding Periods

Start Date	End Date	Period	Price Increase from Base Period	Price Increase from Prior Period	Period Length (Months)
11/1/10	10/31/11	1	Base	Base	12
11/1/11	3/16/12	2	9%	9%	4.5
3/17/12	10/31/12	3	27%	17%	7.5
11/1/12	1/31/14	4	37%	7%	15
2/1/14	6/30/14	5	27%	-7%	5

Each transaction also had other information that shed light into some of the customer characteristics. The loyalty card membership information along with the purchase channel was present. Customers having a loyalty card number are coded as loyal and versus others are noted as transactional. Customers purchasing through the corporate channel are coded as corporate

paid and others are coded as self paid. Similarly, customers coming through directly to the website are coded as direct versus customers coming through a search engine are coded as search.

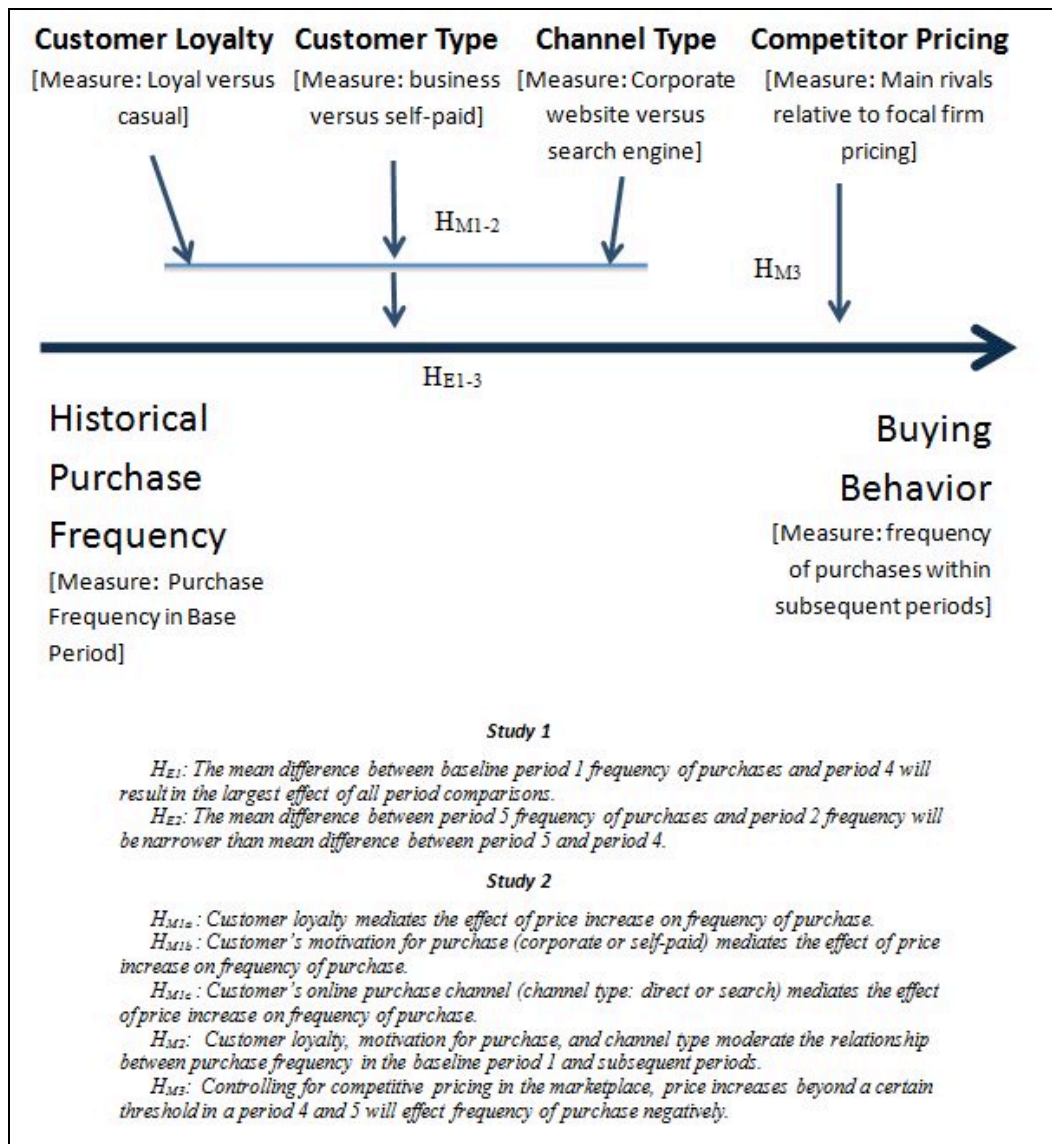
The studies track repeat purchase behavior of these 13,068 customers over the following three and half years period and evaluates the impact on purchase frequency after each pricing action. Study 2 further analyzes patterns of the frequency of customer purchase and retention after each pricing action in association with personal attributes such as loyalty, motivation for purchase, channel type and in light of competitive prices in the marketplace.



## 5.4 Hypothesis Testing

Two studies are conducted in this research paper. Study 1 examines empirically what price changes influence purchase frequency. And study 2 evaluates the effect of customer heterogeneity on the online price –purchase frequency link in a service industry. The research model, Figure 5.4 -1 Research Model, depicts the overall model and hypotheses developed for the two studies.

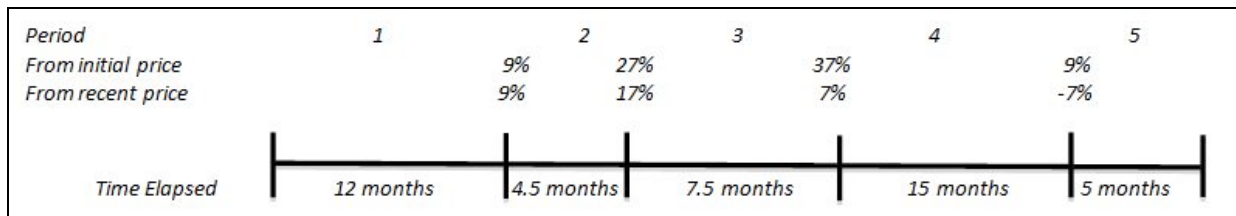
Figure 5.4 -1 Research Model



### 5.4.1 Study 1 – Pricing Threshold Range

The location in this study instituted varying price changes across three and half year time period as shown in Figure 5.4.1-1 Pricing Timeline below. The first exploratory hypothesis will utilize descriptive statistic to identify where the largest customer declines or increases occurred during these time periods.

Figure 5.4.1-1 Pricing Timeline



#### ***Price Increase***

JND theory postulates that when price increases are within the customers’ acceptable price range, the customer does not perceive the price difference and demand is relatively unchanged. What one would expect to see therefore is that large decreases in customer base (as in period 1) will occur whenever the upper JND threshold is reached. The threshold in the consumer goods industry is 23% (Pauwels, Srinivasan et al. 2007) and the expectation is that threshold in the service industry will be higher due to the unique characteristics of the service industry discussed earlier. Hence, the hypothesis is:

*H<sub>E1</sub>: The mean difference between baseline period 1 frequency of purchases and period 4 will result in the largest effect of all period comparisons.*

Rationale: In period 4 price was increased from 27% to 37% of initial price. Since, JND have occurred in other industries in the 17-23% range for pricing increases, the prediction is that the baseline period will show fewer differences with the subsequent period that does not exceed the threshold range (Pauwels, Srinivasan et al. 2007). In consumer goods, 17% for competitively benchmarked products and 23% for historically benchmarked products is noted as the threshold for losses or price increases. These thresholds will be used to compare results.

### ***Price Decrease***

Since the price in period 5 was reduced by 7%, restoring the price to a previous level under the JND threshold, the expectation is to see a difference in frequency of purchase between period 4 and period 5. Hence the next hypothesis is:

*H<sub>E2</sub>: The mean difference between period 5 frequency of purchases and period 2 frequency will be narrower than mean difference between period 5 and period 4.*

Rationale: In consumer goods, 15% noted as the threshold for gains or price decreases (Pauwels, Srinivasan et al. 2007). These thresholds will be used to compare the results in the service industry.

#### 5.4.2 Study 2 – Effect of Customer Attributes

Study 2 examines the effect of different attributes of customer such as customer loyalty, motivation for purchase and acquisition channel on frequency of future purchase.

### ***Attribute Level***

JND theory postulates that when price increases are within the customers' acceptable price range, the customer does not perceive the price difference. The expectation is to see

therefore is that large decreases in customer base with a specific attribute (as compared to the aggregate level) will occur whenever the upper JND threshold is reached for the specific customer type.

*H<sub>M1a</sub>: Customer loyalty mediates the effect of price increase on frequency of purchase.*

Rationale: Firms value longer term or loyal customers (Sheth and Parvatlyar 1995, Blattberg and Deighton 1996, Blattberg, Getz et al. 2001) and literature suggest that loyal customers are less price sensitive, and, hence, respond to price differently than transactional customers (Shaffer and Zhang 2000, Bowen and Chen 2001, Taylor and Neslin 2005). Loyal customers are less sensitive to price changes and may hence have a wider range of acceptable prices. Customers belonging to the company's loyalty program are identified as loyal customers. In the dataset, customers that do not participate the company's loyalty program are classified as transactional customers.

*H<sub>M1b</sub>: Customer's motivation for purchase (corporate or self-paid) mediates the effect of price increase on frequency of purchase.*

Rationale: Many studies have focused on product attribute that is more important to corporate versus self-paid customer (Dolnicar and Otter 2003). A study by Knutson (1988), confirms that self-paid customers are more concerned about safety and security of the services purchased as compared to corporate customers. Studies confirm that purchase behavior differs between corporate and self-paid consumers and they value different product or service attributes. Corporate customers bound by company reimbursement policy and may not have the flexibility

in purchase decision. Corporations are able to get better prices for their employees and are highly price sensitive. On the other hand, self-paid customers are not bound to policy and can exhibit JND and brand preference in purchase decision.

*H<sub>M1c</sub>: Customer's online purchase channel (channel type: direct or search) mediates the effect of price increase on frequency of purchase.*

Rationale: JND theory explains that when price increases are within the customer's acceptable price range, the customer does not perceive the price difference and demand is relatively unchanged. Customers coming through a search engine may have better knowledge of the competitive prices (Pathak 2012). On the contrary, customers coming directly through a corporate website may have different price bands.

### ***Attribute Level Comparison***

It is also be important to know the extent of influence of each attribute. The next hypothesis compares each attribute to demonstrate which has the greater influence.

*H<sub>M2</sub>: Customer loyalty, motivation for purchase, and channel type moderate the relationship between purchase frequency in the baseline period 1 and subsequent periods.*

Rationale: Loyalty, motivation and channel type will be modeled as moderators and compared against each other's contribution to the explained variance.

### ***Competitor Price Change Effect***

*H<sub>M3</sub>: Controlling for competitive pricing in the marketplace, price increases beyond a certain threshold in a period 4 and 5 will affect frequency of purchase negatively.*

Rationale: Since one of the ways customers develop a reference price is based on relative competitor pricing, if competitor price goes up, in effect the firm's relative price goes down, and based on economic theory, demand will go up. This is a hypothesis that controls for competitor price changes on the focal firm's price changes. Monthly competitor data is available for periods 4 and 5 to test the hypothesis.

Table 5.4.2-1 Hypothesis, Measures, and Tests below summarizes the measures that are tested to evaluate the studies. Appendix B lists the constructs.

Table 5.4.2-3 Hypothesis, Measures, and Tests

	Hypothesis	Measures and Tests
<b><i>STUDY 1</i></b>		
H <sub>e1</sub>	The mean difference between baseline period 1 frequency of purchase and period 4 will result in the largest effect of all period comparisons.	A hypothesis comparing the mean of frequency of purchase of baseline period when prices are decreased.
H <sub>e2</sub>	The mean difference between period 5 frequency of purchases and period 2 frequency will be narrower than mean difference between period 5 and period 4.	A hypothesis comparing the mean of frequency of purchase of baseline period to the mean of period when prices decreased.
<b><i>STUDY 2</i></b>		
H <sub>M1a</sub>	Customer loyalty mediates the effect of price increase on frequency of purchase.	A moderation hypothesis testing whether loyalty, motivation, channel type attenuates the impact of price change on buying frequency.
H <sub>M1b</sub>	Customer's motivation for purchase (corporate or self-paid) mediates the effect of price increase on frequency of purchase.	A moderation hypothesis testing whether loyalty, motivation, channel type attenuates the impact of price change on buying frequency.
H <sub>M1c</sub>	Customer's online purchase channel (channel type: direct or search) mediates the effect of price increase on frequency of purchase.	A moderation hypothesis testing whether loyalty, motivation, channel type attenuates the impact of price change on buying frequency.
H <sub>M2</sub>	Customer loyalty, motivation for purchase, and channel type moderate the relationship between purchase frequency in the baseline period 1 and subsequent periods.	A moderation hypothesis testing whether loyalty, motivation, channel type attenuates the impact of price change on buying frequency.
H <sub>M3</sub>	Controlling for relative pricing in the marketplace, price increases beyond a certain threshold in a period 4 and 5 will effect frequency of purchase negatively.	A hypothesis controlling for competitor prices, in predicting frequency of purchase in periods 4 and 5.

## 6.0 FINDINGS

Whereas many quantitative analyses focus on statistical significance, there is little point in doing so in this case. The N in all hypotheses is so large that all effects will be statistically significant (Lin et al., 2013; Guo and Straub, 2014, forthcoming). We know this *a priori* and, indeed, it proves to be the case in data analysis in this thesis. The focus therefore needs to be on explained variance i.e., effect size, as argued by Lin et al. (Lin et al., 2013; Guo and Straub, 2014, forthcoming). In this case, the loss or gain of raw weighted frequencies of purchases across periods also interprets the extent of the likely impact of JND across time periods. Results of the statistical tests conducted to test the hypothesis are listed below.

### 6.1 Study 1 – Pricing Threshold Range

#### *Price Increase*

Since, JND has occurred in other industries in the 17-23% range for price increases, the expectation is that the baseline period will show fewer differences with the subsequent period that does not exceed the threshold range (Pauwels, Srinivasan et al. 2007). Therefore, the hypothesis is:

*H<sub>EI</sub>: The mean difference between baseline period 1 frequency of purchases and period 4 will result in the largest effect of all period comparisons.*

During the course of the study, customer attrition level varied after a pricing action. At the end of the study period, only around 60% of the initial customers survived. In fact, after the third pricing action (a 37% price increase), only 34% of the customers remained. Many returned



after the price reduction in the following period 5, raising the number of customers at the end of the period used in the study.

For this hypothesis, the expectation is that if there is a noticeable difference, it will be shown through difference between the frequencies of purchase when the price changes. A change in purchase behavior as a result of the pricing action is called a response threshold (Monroe 1971). In such a case, a consumer may choose to shop around and go to a competitor or find an alternative option.

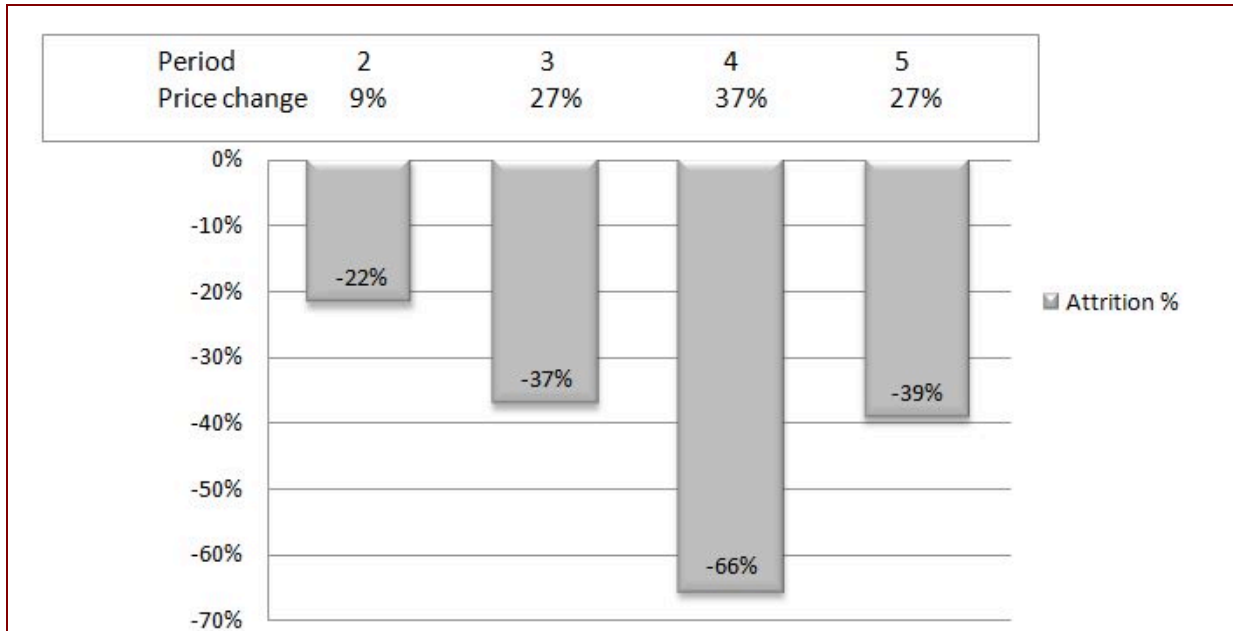
Results of the descriptive statistic are highly informative. In period 4, the largest drop in customer purchases occurred as compared to baseline period 1 with its 37% price increase; this resulted in a loss of 66% of the customers. Even though the losses in the other periods were not as high, they are still substantial, resulting in losses of 22%, 37% and 39%.

Losses after baseline period 1 and period 2 are similar indicating that some customers are noticing changes. There is a 9% price increase that results in 22% customer loss in period 2. The next increase of 27%, in period 3, results in additional loss of 15% more customers, totally to 37% attrition. In period 4, when the price cumulative price increase is 37% over base price, 66% of customers respond by not purchasing. Based on this data, one can conclude that the rate of customer attrition increased greatly after the cumulative price increase of 37%. Just an additional 7% increase (over price in period 3) in price resulted in an additional attrition of 29% or a cumulative attrition of 66%. See Figure 6.1 -1 Customer Attrition.

In the following period 5, price was reduced to period 3 price level or to 27% increase off baseline price (7% off recent price). At this price points, 27% of the customers returned. This further confirms that the pricing threshold is between 27% and 37% price increase from base price in period 1, and once the price is restored to below the threshold, customers return. As a result of these observations, the proposition is that this cumulative price change range is 27-37%.

A one-way ANOVA was conducted to demonstrate differences in customer purchase behavior the period following each pricing action. Results confirm that major

Figure 6.1 -1 Customer Attrition



differences exist among the purchase frequency after each pricing action.  $F(4, 65334)$  value of 261.562 was obtained. A value of  $F$  higher than 1 confirms that frequency of purchase is affected by the price changes. The effect size was calculated using Eta squared of 0.016. Cohen classifies .01 as small effect size, .06 as medium effect and .14 as large effect (Cohen 1992). The results indicate a small effect size. However, since the sample size is large, small differences are statistically significant.

Since this study tests the sample groups several times, in effect, the chances of finding at least one significant difference by chance is increased or is inflated. Post-hoc, Bonferroni tests are conducted to manage the problems of multiple comparisons. Bonferroni correction adjusts for the problem of assuming all hypothesis tests are statistically independent and hence false. To

refine the results from the analysis, Bonferroni test was conducted. All tests are developed using SPSS 21. The original research model for study 1 was tested to assess the effect of pricing action on repeat purchase frequency. There are differences in customer purchase frequency between baseline period 1 and periods 2-5 and p-value is less than 0.05. As the hypothesis claims, the largest differences are between base period 1 and period 4. See Table 6.1-4 Post-Hoc Comparisons.

Table 6.1-4 Post-Hoc Comparisons

	Mean Purchase Frequency	Mean Difference to Period 1	Eta squared vs. period 1	f <sub>2</sub>
Period 1	0.1700			
Period 2	0.1170	0.0530	0.014	0.002
Period 3	0.1230	0.0470	0.011	0.005
Period 4	0.0900	0.0800	0.043	(0.027)

Based, on the results, the highest difference is between period 1 and period 4. The hypothesis is not rejected. For consumer goods industry, JND is 17% for price increases for competitively priced product and is around 23% for historical benchmarked products. One explanation for the higher threshold in this analysis can be associated with the characteristics of the service industry.

### ***Price Decrease***

The price in period 5 was reduced by 7%, which is a small amount; the firm later set the price to be under the JND threshold, and thus the expectation is to see a difference in frequency of purchase between period 4 and period 5. Hence the next hypothesis is:

$H_{E2}$ : *The mean difference between period 5 frequency of purchases and period 2 frequency will be narrower than mean difference between period 5 and period 4.*

In exploring Figure 6.1 -1 Customer Attrition demonstrates that many customers returned in period 5 after the price decrease. The price drop during in period 5 was 7% as compared to previous price in period 4 or 27% as compared to the base period 1. Once the price was decreased to under 27% of base price, most customers returned. This small price decrease was sufficient to generate higher purchases and customer base was restored to period 3 levels.

*ANOVA* results confirm that mean differences exist between period 4 and period 5 frequency of purchase. As expected, Eta squared of period 5, is closer to period 2 and period 3 than period 4. See Table 6.1-5 Post-Hoc Comparisons for Price Decrease. The hypothesis not rejected.

Table 6.1-5 Post-Hoc Comparisons for Price Decrease

	Mean	Mean Difference to Period 1	Eta squared vs. period 1	$f_2$
Period 1	0.1700	-	-	-
Period 2	0.1170	0.0530	0.014	0.002
Period 3	0.1230	0.0470	0.011	0.005
Period 4	0.0900	0.0800	0.043	(0.027)
Period 5	0.0980	0.0720	0.014	0.002

In Study 1, an important finding was the statistical significance of the model for frequency of purchase at different levels of pricing action. Results confirm the effect of

relationship between price change and purchase frequency holds at certain JND thresholds. In general, the data supports the theoretical framework. The study confirms that service industry thresholds will be likely higher than consumer goods industry.

## **6.2 Study 2 - Effect of Customer Attributes**

Study 2 examines the relationship between customer attributes of loyalty, motivation for purchase, and channel type with repeat purchase frequency following a pricing action. Same dataset as above was used to test the first hypothesis in this study.

### *Attribute Level*

The study hypothesizes that based on certain attributes, customers will have a different threshold for acceptable prices. First, a review at descriptive statistics is done to identify where the largest customer declines or increases occurred during these time periods based on the customer attributes.

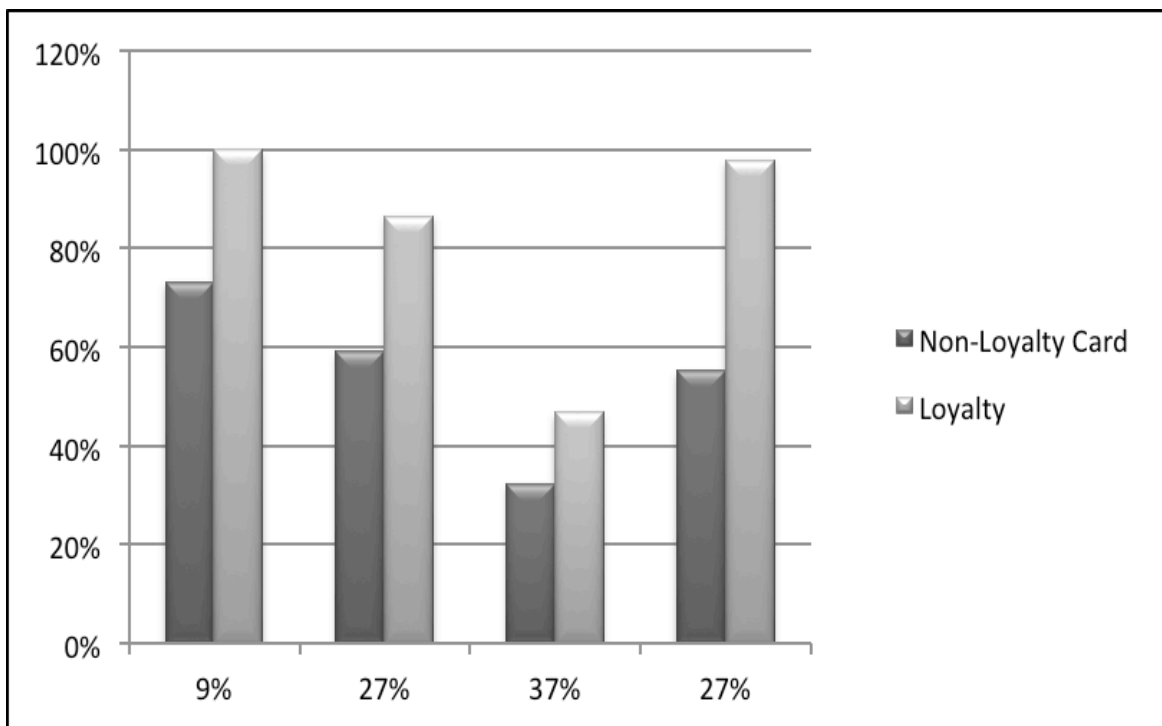
*H<sub>M1a</sub>: Customer loyalty mediates the effect of price increase on frequency of purchase.*

A simplified assumption that customers that are a part of the loyalty card program are loyal customers is used to test this hypothesis. Based on some exploratory analysis, approximately, 12.5% or 1,637 of the customers in the database have loyalty cards. Based on literature study, loyal customers have stronger relationship attributes towards the firm and higher allegiance to the brand and value the rewards of being part of the loyalty program will reduce price sensitivity.

After the third price increase (37% over base price), 47% of the customers that were part of the loyalty program had repeat purchases as compared to 32% that of the customers that had

repeat purchases that did not have a loyalty card. Figure 6.2-1 Purchase Behavior Post Pricing Action: Loyalty shows that customer retention based on the loyalty attribute at different pricing actions. The gap between retention percentages is greater at lower prices and narrows as prices increase. The loss of loyal customers as compared to non-loyal customers beyond certain price point is higher. However, when prices are lowered, the reacquisition of loyal customers is also higher. Loyalty cardholders hence have an overall a higher retention in event of price changes. Based on this information, one can infer that customers that participate in the loyalty program have a response threshold higher than 37% for price increases.

Figure 6.2-1 Purchase Behavior Post Pricing Action: Loyalty

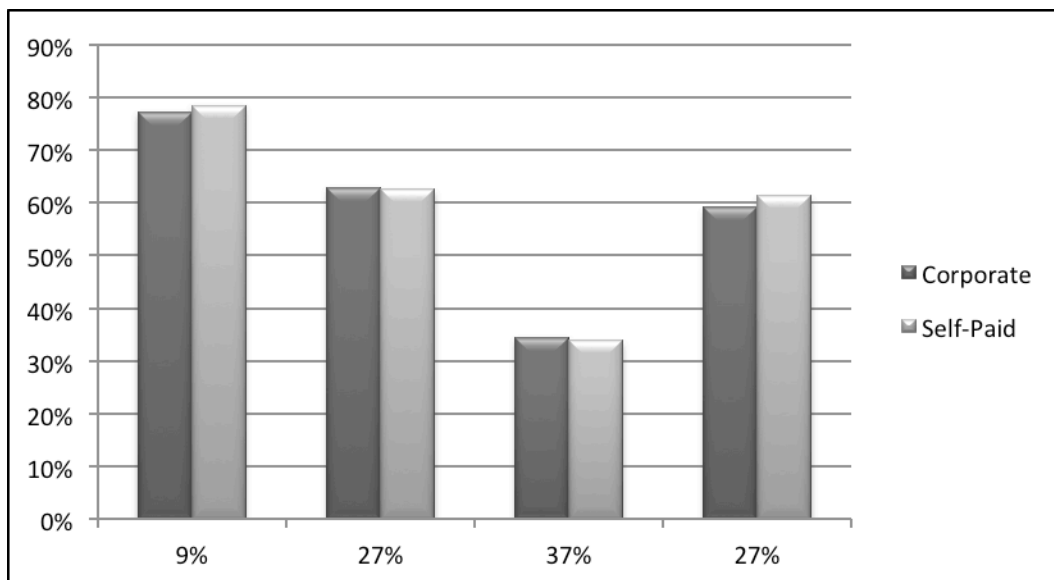


A regression model was developed to evaluate the effect of the loyalty attribute. Loyalty has a significant explanatory power and  $B_L = -0.134$ . Hypothesis is not rejected.

$H_{M1b}$ : Customer's motivation for purchase (corporate vs. self-paid) mediates the effect of price increase on frequency of purchase.

Business customers are bound to company purchase policy. On the contrary, self-paid customers are less sensitive to price changes, and may exhibit higher brand preference and less price sensitivity. Post the third pricing action around 34% of the self-paying customers had repeat purchases versus 35% of corporate customers. This percent was similar indicating pricing has similar responses for both corporate and self-paying customers. Largest decline in customers occurred between the 27% to 37% price increase, hence based on exploratory analysis of the data, one can infer that the JND band for corporate and self-paid customers follows the overall price band of the dataset. Figure 6.2-2 Purchase Behavior Post Pricing Action: Motivation shows the effect on repeat purchase based on the motivation attribute.

Figure 6.2-2 Purchase Behavior Post Pricing Action: Motivation



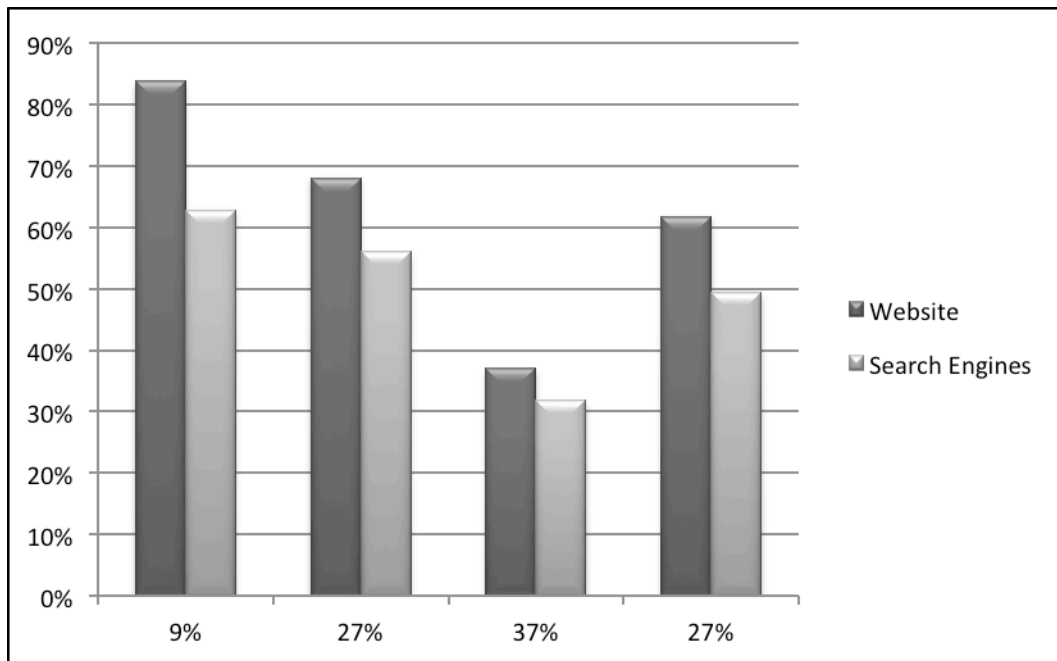
Results from the regression model, demonstrate that motivation has standardized coefficient of 0.070. Hence, translating to the result that self paid are only slightly more likely to continue to purchase in event of a price change. Hypothesis is not rejected.

*H<sub>MIC</sub>: Customer's channel type (channel type: direct or search) for purchase mediates the effect of price increase on frequency of purchase.*

This hypothesis posits that customers purchasing through a direct corporate website will have a lower level of channel type as compared to customers coming through a search engine and hence are less price sensitive. The hypothesis proposes that customers coming directly to the website, may not be shopping for the best price until the price crosses a certain threshold. Around 33% of the customers purchase directly to through the corporate website versus 77% were acquired through search engines. After the third pricing action, only 37% of customers had repeat purchases versus 32% that came through search engines. Decline in customers coming through directly to website was at a higher pace. Interestingly, after the fourth pricing action, a price decrease, slightly more of the customers acquired through the corporate website returned as compared to the search customers. Figure 6.2-3 Purchase Behavior Post Pricing: Channel Type shows the effect on repeat purchase based on customer channel type.



Figure 6.2-3 Purchase Behavior Post Pricing Action: Channel Type



The moderating effect of the channel type variable is tested in a regression model.

Channel type has a significant explanatory power with standardized coefficient of 0.02.

Hypothesis is not rejected.

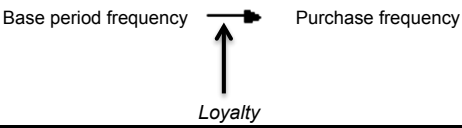
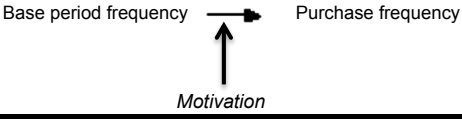
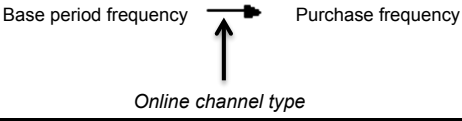
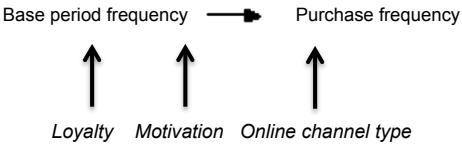
### *Attribute Level Comparison*

Exploratory and statistically analysis of the three attributes yielded some interesting observations. To compare these observations, a standard linear regression model is developed and the contribution of each moderator (loyalty, motivation, channel type) to predict purchase frequency after pricing action is compared. The hypothesis tested is:

*H<sub>M2</sub>: Customer loyalty, motivation for purchase and channel type positively moderates the relationship between frequency of purchase from baseline period 1 and subsequent periods.*

A regression model was developed to compare the explanatory power of the three customer attributes: loyalty, motivation and channel type. Results of the standardized coefficients of the moderators are compared to evaluate the contributions of the moderating variables. Refer to Table 6.2-6 Effect of Customer Attributes.

Table 6.2-6 Effect of Customer Attributes

Independent Variable/ Moderator	Model	Results
Base Period Frequency	Base period frequency → Purchase frequency	$B_{bp} = .300, t = 71.814^{**}, R^2 = .090$
Effect of loyalty attribute as a moderator		$B_l = -.134, t = -19.515^{**}$
Effect of motivation for purchase (corporate vs. self paid) as a moderator		$B_M = .070, t = 5.840^{**}$
Effect of online channel type(search vs. corporate website) as a moderator		$B_{PA} = .020, t = 3.955^{**}$
Effect of loyalty, motivation and online channel type as moderators		$B_{bp} = .331, t = 23.197^{**}, R^2 = .098$

\*\* All t-values significant at  $p < .05$ .

Loyalty has the highest explanatory power at -0.134. Channel type has the least explanatory power with standardized coefficient of 0.02, as is low compared to the other customer attributes. Based on these results, it can be inferred that the moderating effect of channel type, where a customer comes directly to the corporate website, is minimal. Motivation has standardized coefficient of 0.070, translating to the result that self-paid are slightly more likely to continue to purchase. This is contrary to the expectations. An explanation can possibly be impact of market forces, or changes in marketplace price positioning. This leads to the next hypothesis, to control for competitor prices.

$H_{M3}$ : *Controlling for competitive pricing in the marketplace, price increases beyond a certain threshold in a period 4 and 5 will negatively effect frequency of purchase.*

Since customers develop a reference price based on relative competitor pricing, when the competitor price goes up, in effect the firm’s relative price goes down and based on economic theory demand will go up. This hypothesis controls for competitor pricing. Competitor pricing data was available from January 2013 –June 2014 at a monthly interval. Monthly purchase frequency data for this time frame is correlated with the monthly competitor data. Linear regression model is developed to predict purchase frequency in period 4 and 5 based on purchase frequency data in period 1. Table 6.2-2 Regression Results: Relative Price states the results from the regression analysis and tests for differences in  $R^2$ .

Table 6.2-7 Regression Results: Relative Price  
Impact of Excluding Competitor Prices

Test	Models Compared		Change in R2	Effect Size†
	Full Model	Partial (Nested) Model		
Impact of not measuring effect of competitor prices	Future purchase frequency (period 4 and 5)= Base period frequency(period 1), Average price of two competitors	Future purchase frequency = Base period frequency	0.002	$f^2 = .112$
(only measuring base period frequency)				Medium

† Effect size ( $f^2$ ) is calculated by the formula  $(R^2_{full} - R^2_{partial}) / (1 - R^2_{full})$  (Chin, Marcolin et al. 2003); (Mathieson, Peacock et al. 2001). An effect size of .02 is small, .15 is medium, and .35 is large (Cohen 1992).

Regression results are consistent with expectations. Controlling for competitor prices improves the prediction ability of this model. A pseudo F test for the change in  $R^2$  is calculated

to be 1.68 (Mathieson, Peacock et al. 2001). The F value of greater than one confirms that adding competitor prices as a control variable had an effect on predicting the future purchase frequency of a customer. Effect size of 0.112 after controlling for competitive prices, demonstrates that there is medium effect of competitive prices on customer purchase frequency (Cohen 1992). Results are significant as the p-value is higher than 0.05. The hypothesis is not rejected.

In conclusion, important findings from study 2 are the statistical significance of specific customer attributes on purchase decision. Results confirm that customers with loyalty card have a higher retention rate after price increases and exploratory analysis confirms that loyalty threshold may be higher than 37% increase over historically benchmarked prices. The channel type (direct vs. search) was significant but had minimal contribution in predicting future purchase behavior. The effect of motivation for purchase indicates that self-paid customers return as higher prices, which is contrary to our initial hypothesis. One explanation can be competitor prices, where although the firm's prices increases, the relative price in the marketplace decreased as competitor price hikes were higher. In summary, results confirm the effect of certain customer attributes on future purchase frequency. The study also confirms that customer attributes affects the price bands at different levels. In general, the data supports the theoretical framework. Table 6.2-3 Hypothesis and Results summarizes the results of the hypothesis tests.

Table 6.2-8 Hypothesis and Results

	Hypothesis	Measures and Tests
<b><i>STUDY 1</i></b>		
H <sub>e1</sub>	The mean difference between baseline period 1 frequency of purchase and period 4 will result in the largest effect of all period comparisons.	Supported
H <sub>e2</sub>	The mean difference between period 5 frequency of purchases and period 2 frequency will be narrower than mean difference between period 5 and period 4.	Supported
<b><i>STUDY 2</i></b>		
H <sub>M1a</sub>	Customer loyalty mediates the effect of price increase on frequency of purchase.	Supported
H <sub>M1b</sub>	Customer's motivation for purchase (corporate or self-paid) mediates the effect of price increase on frequency of purchase.	Supported
H <sub>M1c</sub>	Customer's online purchase channel (channel type: direct or search) mediates the effect of price increase on frequency of purchase.	Supported
H <sub>M2</sub>	Customer loyalty, motivation for purchase, and channel type moderate the relationship between purchase frequency in the baseline period 1 and subsequent periods.	Supported
H <sub>M3</sub>	Controlling for relative pricing in the marketplace, price increases beyond a certain threshold in a period 4 and 5 will effect frequency of purchase negatively.	Supported

## 7.0 DISCUSSION

The literature review on behavioral pricing has limited studies in the service industry and even fewer studies that examine the influence of customer heterogeneity on purchase behavior. Moreover, there is limited research using real transaction level data and no studies that used Just Noticeable Differences (JND) as a theoretical lens to view behavioral pricing in the online service industry. With a motivation to address these gaps, this engaged scholarship research uses JND to evaluate pricing bands in a competitive service industry and to further the understanding of the influence of certain customer attributes on pricing thresholds. Two studies were conducted. Study 1 examines empirically what price changes influence purchase frequency. And study 2, evaluated the effect of customer heterogeneity on online price –purchase frequency link in a service industry.

The quantitative field study analyzes three and half years of transaction and customer level data from a firm in the service industry. It used non-contractual data from a firm in a competitive B2C area in the digital marketplace. The longitudinal study tracked online purchase behavior of over 13,000 customers over four pricing actions, three price increases and one price decrease.

The results indicate that the response price threshold in the service industry for historically benchmarked prices is likely between 27% and 37%. This threshold is higher than pricing threshold in the consumer goods industry that is estimated at 23% (Pauwels, Srinivasan et al. 2007). When customer is purchasing a product the cognitive skills of remembering, retrieving, and processing price information are the same. However, the response threshold, or the threshold where customer notices a price and changes behavior may be different for both industries. Intangibility of the product and customer involvement in the product in the service

industry (Zeithaml, Parasuraman et al. 1985) may result in the higher price threshold for service industry. In the service industry, the consumer is directly involved in the experience and the intangibility of the product may create a greater acceptability for higher price for a known service or brand. Another explanation can be that in online markets, price is linked to buyer's perception of quality and perception of trust and fairness of the brand (Chun-Fang and SooCheong 2006, Anuwichanont 2011). Particularly, where services are intangible, consumers use price as a determining factor for assessing the quality of the service (Oh 2000, Chun-Fang and SooCheong 2006). Alternatively, it can be the habitual processes of the customers personal purchase patterns. Role of habit and relationship with seller may also be associated with the higher price threshold. However, as the results of the study indicate, beyond certain price threshold, the customer is willing to move to alternative options.

Results price decrease hypothesis further substantiated the threshold range found in the first hypothesis. A small price decrease of 7%, generated a noticeably higher customer reacquisition. However, this price drop brought the price within the JND threshold. Based on these results, one can infer that, once, the price returned within threshold range, customers returned. With a price decrease, it put the price below the customer's acceptable range again, and the customer returns for the service experience. This phenomenon can be associated with preference for the service provider or brand preference. For existing customers, the sensitivity to gains, or price decreases in the service industry appear to be lower at 7% as compared to consumer goods industry at 15%. In the competitive service industry landscape, the price thresholds for gains or price decreases may be lower. This study does not test for new customers that tried the service at the lower price point. However, for customers that have experienced the service in the past, one can conclude the familiarity and satisfaction with the service provider may result in the customer's decision to return at the lower price. Frequency of purchase can be

another explanation, one that is not studied in this paper. Perhaps, customers that purchase more frequently are more sensitive to price as compared to infrequent buyers.

The study found evidence the certain customer attributes effect the magnitude of the acceptable price bands. However, it did not find evidence supporting that all customer attributes affected frequency of purchase equally. Loyalty had the highest influence on determining if the customer would purchase or not after a price increase. Results indicate that loyal customers have a price threshold of higher than 37% off historically benchmarked prices. The strength or richness of perceptual benefits loyalty programs in the service industry may results in the higher threshold. Brand loyalty can also be associated with higher threshold levels.

The online purchase channel has influence on predicted repeat purchase behavior in event of a price change. Companies are constantly adjusting the allocation of marketing dollars and is important to understand the return on investment from each channel to improve both marketing efforts and the consequently impact on the bottom line. Although, results indicate that both website and search customers have a similar price thresholds, they have slightly different behavioral traits in event of price change. Online customers are web savvy and whether they come via a search or directly to the website, may be more in relation to their ability to remember the website address versus awareness of price. However, the results confirm that search customers pay more than customers coming directly through the website. They also have a higher reacquisition when the price is lowered. Hence, companies investing in search efforts through CSA will yield higher paying customers.

Competitor prices influence the firm's relative price in the marketplace as well. And CSA makes prices transparent in the digital marketplace. For example, if magnitude of competitor price is higher as compared the firm's price increase, the firm's price may appear relatively cheaper. Including competitor prices in regression models for competitor service



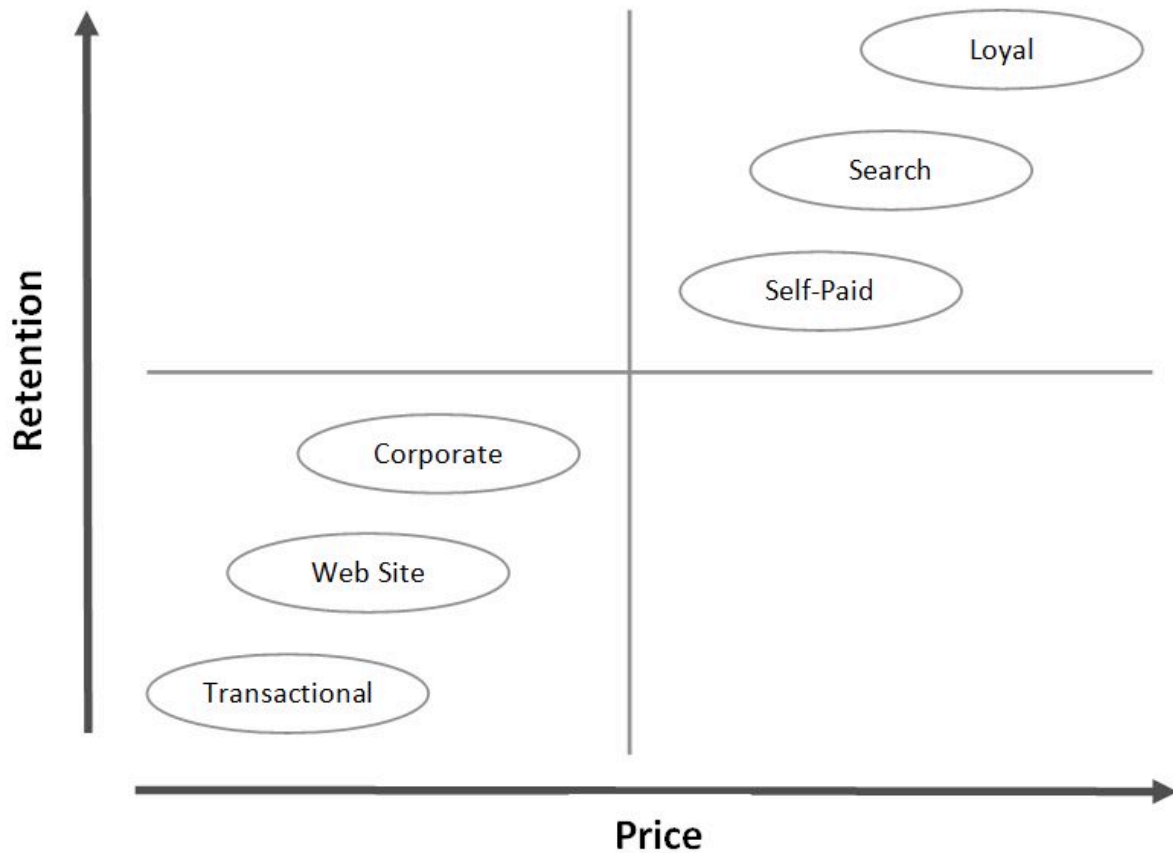
industry increases the ability to predict future purchases. The findings of this research confirm previous economic theory suggesting that changes in competitor prices impact firm's price perception in the marketplace.

Results on motivation attribute indicated that self-paid customer versus corporate-paid customers are more likely to return after each pricing action. Self-paid customers are not bound by company policy and can exhibit higher brand preference. In online markets, price is linked to buyer's perception of quality and perception of trust and fairness of the brand (Chun-Fang and SooCheong 2006, Anuwichanont 2011). At a higher price, do customer assume the services are of a higher quality?

An important learning from these studies is that the pricing bands in the service industry for both price increases and decreases are different that in a consumer goods industry. Secondly, although, certain types of customers have a wider band of acceptable prices, not all customer attributes influence pricing bands equally. Based on the findings of this research, customers can be broadly grouped into ones that will continue to pay higher prices and ones that will be quicker to leave when prices increase, see Figure 7.0-1 Purchase Behavior Post Pricing Action: All Channels. Loyalty cardholders, customers coming through search engine, and self-paid customers will pay more in the service industry. Loyal customers have much invested in the company with loyalty rewards, relationship, brand preference and habitual process. Customers coming through search engine have reviewed other choices and have chosen the firm from comparison shop and are willing to more for known the service, location or another personal preference. Self-paid customer have the freedom to choose and may be concerned about the safety of themselves and belonging which may be driver for their choice of a service provider. On the other hand, customers that will not pay more are transactional customers, customers coming directly to the corporate website, and corporate customers. Transactional customers

have no allegiance to the company, may not have used the service previously hence may not have a preference. They may not be aware of price partitioning tactics and other features of the offering and may be just a one-time purchase. Corporate customers are bound by company policies and price and may not have the leverage to continue purchasing when prices rise. Customers coming directly to the website are likely to have a narrower price band in mind and may be inclined to look for other alternatives when prices increase.

Figure 7.0-2 Purchase Behavior Post Pricing Action: All Channels



## 8.0 CONTRIBUTION

As discussed earlier, there are no studies of the literature of JND for online pricing in the services industry. Moreover there are limited studies comparing the effect of price changes and subsequent purchase behavior based on customer attributes such as loyalty, channel type, and motivation. In an attempt to address these gaps, this engaged scholarship research used JND to analyze and study pricing thresholds in a competitive service industry. Is there a theoretical explanation for what price changes affect future purchases? And, what influence does customer heterogeneity have on online price - purchase link in a service industry? The study provides three important contributions. Theoretically, the studies further the conceptual understanding of the pricing thresholds for online purchases. As more retailers move to the online markets, a deeper understanding of the role and influence of price and pricing thresholds in purchase frequency will directly impact firm performance. Secondly, the application of JND theory in a non-contractual B2C sector yields additional insights by determining that the price thresholds are higher in the service industry as compared to consumer goods industry. The different dynamics of service industry i.e. intangibility of product, involvement of customer may play a significant role in determining the higher thresholds. Of course, there are areas of overlap between service and product industry in behavioral economics, but not all studies can be directly applied to both domains. Studies focused on the service industry further the understanding of the intricacies, the unique characteristics and the distinct role that price plays in this sector. Thirdly, this research also has direct practical implications. The research assesses the influence of customer heterogeneity in determining the differential pricing thresholds. With these findings firms can

implement a differentiated pricing and promotions strategy across channels and customer segments with the objective to maximize profits and customer retention in the long run.

## **8.1 Contribution to Practice**

The study provides a guideline to executives and manager in the pricing domain. As mentioned earlier, small changes in price can make 20% to 50% difference in the bottom line. Learning from the study, can be immediately applied to optimize and fine-tune pricing strategy for online sales of services.

Secondly, there is little discussion in literature about differential pricing at an online channel level in the service industry. This study is particularly useful to assess the price acceptability bands at a channel level and develop insights into understanding the role of customer heterogeneity in pricing thresholds. One of the major finding was that customer coming via a search engine pay more than one's coming directly to the corporate website. This is significant for companies determining online marketing efforts. Companies that invest in building a stronger SEO effort will yield better results and higher paying customers.

Pricing can be optimized at a channel level, hence maximizing overall revenue and increasing average price realized per customer. It provides an important framework for managers to develop segment specific pricing strategy and allocate marketing dollars. This study furthers this area of research by providing practitioners with real data driven insights on the role of price in purchase decisions and the price differentials at a channel level. Channel levels threshold differences can be exploited for higher retention and improving revenue performance.

Thirdly, the insights can help anticipate future demand and better forecasting ability at a channel level in event of a pricing or promotional action. It will help predict sales and profit impact on several levels of price increases and decreases. The findings from the study also

enable better revenue forecasting at a channel level and ability to anticipate customer behavior based on customer attributes. Several companies are experimenting with pricing strategies such as dynamic pricing and personalized prices. Ability to anticipate what types of customers will respond to pricing changes is becoming increasingly important for price setting and developing appropriate promotions tactics. It will help managers forecast which customers will alter their purchase decision, stay or leave after a price increase.

Lastly, knowledge about customer purchase behavior has utility from a consumer education point of view as well. Education about buying behaviors can enable prudent purchasing behavior. Awareness about one's own purchasing tendencies and cognitive recognition in repeat purchase tendencies can make for prudent shoppers.

## **8.2 Contribution to Theory**

Theoretically, this study furthers the conceptual understanding of the pricing thresholds and relative price positioning for the service industry and for e-commerce. Secondly, this study provides a methodological contribution. Historically, studies in the area of JND have primarily used two methods to validate findings. Individual level analysis to study the latitude in price ranges have primarily used experimental and survey design. Experimental design and survey has drawbacks. Subjects in an experimental environment may not actually make the same decisions in reality. The second approach is data driven (Van Heerde, Leeflang et al. 2001) (Kalyanam and Shively 1998). There are limited studies using a market level transaction level to examine price thresholds. In the current times, with access to large quantities of both structured and unstructured data, there are more opportunities to generate deeper insights on the influence of price on customer purchase decision. By using real data at not only a transaction level, but

also at a customer level, the study furthers the understanding of the influence of customer heterogeneity and the contextual purchase response to price changes.

Extant literature in the field of JND and price is primarily focused on consumer goods for online and retail channels. Service industry continues to grow and more people are shopping and booking services online. The focus on service industry generates new perspectives to enhance the overall theoretical understanding of the role of pricing thresholds in the service industry. Further, the theory validated in a competitive service industry context adds to a richer stream of literature in the domain.

Although customer heterogeneity has been cited as an important driver for price differentiation in the online and brick and mortar marketplace, there are limited studies exploring the specific attributes that influence the price preference and choice. This study further confirms the influence of specific customer attributes on pricing thresholds and provides additional insights to behavioral pricing literature.

## 9.0 CONCLUSIONS

In conclusion, the study has both theoretical and practical implications. However, there are limitations to the study that are elaborated below. Also, there are future research opportunities that can further strengthen the understanding of the pricing thresholds and influence of customer attributes in purchase decision.

### 9.1 Limitations

As in most research endeavors, this study also has certain limitations. In general, quantitative field study approaches are low on internal validity and high on external validity (Lusk, Pruitt et al. 2006, Jimenez-Buedo and Miller 2010). The study uses one industry and one sample and has limitations for sample-based generalizations (Venkatasubramanian, Rengaswamy et al. 2003). The problem of generalizability of the research from sample to population can be an issue. Although the findings may not be generalizable exactly to other industries they are directionally correct.

Secondly, using archival data has its limitations (Jarvenpaa 1991, Dougherty 1992). Use of archival data is criticized because of its inflexibility (Cook, Campbell et al. 1979) and the operational issues that may result because the data was collected by another person (Smith, Budzeika et al. 1986). Also, there are only a limited number of price changes that occurred in the time period. The price changes were not continuous (as one can do possibly in an experiment) and limit the analysis to the range of magnitude of the price change.

Thirdly, data is not collected specifically for this study so there may be other events that may have affected the purchase frequency. Other rival hypothesis may exist on the reasons to explain the repeat purchase variations. Alternatively, there may be macroeconomic variables or other events that make the data not appropriate for comparison over the period of time. These

variables may not have not been identified or separated. In this study, the moderations are controlled statistically but not experimentally controlled. There may also be a mild operation bias as only one measure is used per construct. Where possible, the researcher will attempt to identify and eliminate the biases.

These limitations should be viewed in light of the benefits this study offers. This study uses real transactional data and customer response to price is a real response. As compared to experiments, where a customer may think they would act a certain way but in reality may behave differently. The limitations are managed to ensure the reliability and validity of the data and the findings. In an attempt to eliminate biases and ensure rigor, significant events and data points in the history are triangulated and verified using multiple data sources (Miles and Huberman 1994, p267, Yin 2009).

## **9.2 Future Research**

The study generates areas of future research that will strengthen the understanding of the pricing bands in the service industry context and influence of customer attributes on pricing thresholds. In terms of future research, for one, the JND pricing thresholds can be applied to other service industries and verticals to validate the findings. Secondly, customer attributes such as age, gender, high vs. low frequency customers and income level can also have discriminating influence on purchase behavior. Such other moderating variables can be examined to validate their effect on the customer purchase behavior. Thirdly, this study uses purchase frequency as a dependent variable, alternative studies can use revenue per customer or quantity of purchase instead as the dependent variable to validate effect on pricing thresholds.

The study can be expanded in the global context as well. This study only reflects price variation in a single currency or US dollar. It can be extended into studying the influence of the



currency valuation fluctuation on pricing thresholds of the customer can be studied. With high inflation or devaluation of currency, do customers JND thresholds change within the same price band? This may yield interesting discoveries as we move into a more global marketplace.

Another important dimension that can influence JND bands is time element. Time interval between pricing actions, may effect the band. Over what time period do customer accept and adjust to new pricing levels? Or what is the elapsed duration of time between price increases above certain thresholds when price becomes important to a customer? Are there latitudes of time acceptance correlated with latitudes of price acceptance? This mental acclimatization to new price levels may also be related to inflation in the country and currency valuation or can be industry/marketplace specific. These studies will deepen the understanding of JND in pricing for other customer attributes as well as in a global context.

### **9.3 Summary**

The research of online pricing thresholds to understand customer purchase frequency in the context of the service industry has generated important perspectives and helped further the understanding of role of price in online markets. As a result of this research, the differences between products and services industry in the realm of pricing is further confirmed.

Customers are comprised of a mosaic of attributes and customer heterogeneity allows for differentiated pricing tactics in both service and product industry. This study demonstrates that specific customer attributes effects customer pricing thresholds at different levels. In this study certain customer attributes are studied and compared to understand their influence of pricing thresholds. Customers participating in the loyalty programs have higher acceptable price bands as compared to transactional customers. Similarly, motivation and online channel type have effect on purchase frequency but their price thresholds are lower.

Each customer can be looked at a mosaic of colors of various attributes. Presence of certain attributes or a combination of certain attributes may influence repeat purchase behavior. Managers can use the findings of the study to understand the customer attributes that effect purchase decision and develop customer clusters based on attributes that have a similar pricing thresholds to differentiate pricing and increase customer retention.

## REFERENCES

- Adam, D. (1958). Les réactions du consommateur devant le prix: contribution aux études de comportement, Sedes.
- Allen, J. W., et al. (1976). "Price awareness study." Washington, DC: Food Marketing Institute.
- Ancarani, F. and V. Shankar (2004). "Price levels and price dispersion within and across multiple retailer types: Further evidence and extension." Journal of the Academy of Marketing Science **32**(2): 176-187.
- Anuwichanont, J. (2011). "The impact of price perception on customer loyalty in the airline context." Journal of business & economics research **9**(8): 37-49.
- Ba, S. and P. A. Pavlou (2002). "Evidence of the effect of trust building technology in electronic markets: Price premiums and buyer behavior." MIS quarterly: 243-268.
- Berry, L. L. (1983). Relationship marketing, American Marketing Association.
- Bertelson, P. and G. Aschersleben (2003). "Temporal ventriloquism: crossmodal interaction on the time dimension: 1. evidence from auditory–visual temporal order judgment." International Journal of Psychophysiology **50**(1): 147-155.
- Bettman, J. R. (1970). "Information processing models of consumer behavior." Journal of marketing research: 370-376.
- Bhagwati, J. N. and T. Srinivasan (1982). "The welfare consequences of directly-unproductive profit-seeking (DUP) lobbying activities: Price versus quantity distortions." Journal of International Economics **13**(1): 33-44.
- Bishop, W. R. J. (1984). "Competitive Intelligence." Progressive Grocer.
- Biswas, A., et al. (2006). "Low price guarantees as signals of lowest price: The moderating role of perceived price dispersion." Journal of retailing **82**(3): 245-257.
- Blattberg, R. C. and J. Deighton (1996). "Manage marketing by the customer equity test." Harvard Business Review **74**(4): 136-&.
- Blattberg, R. C., et al. (2001). "Customer equity." Harvard Business School Press, Boston.
- Borenstein, S. and N. L. Rose (1995). Do airlines in chapter 11 harm their rivals? Bankruptcy and pricing behavior in US airline markets, National Bureau of Economic Research.
- Bowen, J. T. and S.-L. Chen (2001). "The relationship between customer loyalty and customer satisfaction." International journal of contemporary hospitality management **13**(5): 213-217.
- Britt, S.-H. and V. M. Nelson (1976). "The Marketing Importance of the "Just Noticeable Difference"." Business Horizons **19**(4): 38.

- Brucks, M., et al. (2000). "Price and brand name as indicators of quality dimensions for consumer durables." Journal of the Academy of Marketing Science **28**(3): 359-374.
- Campbell, L. and W. D. Diamond (1990). "Framing and Sales Promotions: The Characteristics of a Good Deal?" Journal of Consumer Marketing **7**(4): 25-31.
- Chatterjee, P. and J. McGinnis (2010). "Customized online promotions: Moderating effect of promotion type on deal value, perceived fairness, and purchase intent." Journal of Applied Business Research (JABR) **26**(4).
- Chen, P.-Y. and L. Hitt (2001). "Brand awareness and price dispersion in electronic markets."
- Chin, W. W., et al. (2003). "A partial least squares latent variable modeling approach for measuring interaction effects: Results from a Monte Carlo simulation study and an electronic-mail emotion/adoption study." Information Systems Research **14**(2): 189-217.
- Chun-Fang, C. and J. SooCheong (2006). "The Effects of Perceived Price and Brand Image on Value and Purchase Intention: Leisure Travelers' Attitudes Toward Online Hotel Booking." Journal of Hospitality & Leisure Marketing **15**(3): 49-69.
- Cohen, J. (1992). "A power primer." Psychological bulletin **112**(1): 155.
- Cook, T. D., et al. (1979). Quasi-experimentation: Design & analysis issues for field settings, Houghton Mifflin Boston.
- Cutting, J. and J. Cutting (1997). Principles of psychopathology: Two worlds, two minds, two hemispheres, Oxford University Press Oxford.
- Davies, A., et al. (2007). "Organizing for solutions: Systems seller vs. systems integrator." Industrial Marketing Management **36**(2): 183-193.
- Dehaene, S. (2003). "The neural basis of the Weber–Fechner law: a logarithmic mental number line." Trends in cognitive sciences **7**(4): 145-147.
- Desai, K. K. and D. Talukdar (2003). "Relationship between product groups' price perceptions, shopper's basket size, and grocery store's overall store price image." Psychology & Marketing **20**(10): 903-933.
- Dickson, P. R. and A. G. Sawyer (1990). "The price knowledge and search of supermarket shoppers." The Journal of Marketing: 42-53.
- Dodds, W. B. and K. B. Monroe (1985). "The effect of brand and price information on subjective product evaluations." Advances in consumer research **12**(1): 85-90.
- Dolnicar, S. and T. Otter (2003). "Which hotel attributes matter? A review of previous and a framework for future research."
- Dougherty, D. (1992). "A practice-centered model of organizational renewal through product innovation." Strategic Management Journal **13**(S1): 77-92.
- Doyle, M. (1984). "New Ways of Measuring Value." Progressive Grocer-Value. Executive Report.

- Dwyer, R. F. (1997). "Customer lifetime valuation to support marketing decision making." Journal of Interactive Marketing **11**(4): 6-13.
- Eefting, W. and A. Rietveld (1989). "Just noticeable differences of articulation rate at sentence level." Speech Communication **8**(4): 355-361.
- Ekman, G. (1959). "Weber's law and related functions." The Journal of Psychology **47**(2): 343-352.
- Ernst, M. O. and M. S. Banks (2002). "Humans integrate visual and haptic information in a statistically optimal fashion." Nature **415**(6870): 429-433.
- Feinberg, F. M., et al. (2002). "Do we care what others get? A behaviorist approach to targeted promotions." Journal of marketing research **39**(3): 277-291.
- Fern, E. F. and J. R. Brown (1984). "The industrial/consumer marketing dichotomy: a case of insufficient justification." The Journal of Marketing: 68-77.
- Fouilhe, P. (1960). "SUBJECTIVE EVALUATION OF PRICES-METHODOLOGICAL ASPECTS." REVUE FRANCAISE DE SOCIOLOGIE **1**(2): 163-172.
- Gabor, A. and C. W. Granger (1961). "On the price consciousness of consumers." Applied Statistics: 170-188.
- Gabor, A. and C. W. Granger (1966). "Price as an Indicator of Quality: Report on an Enquiry." Economica: 43-70.
- Gailey, E. D., et al. (2012). "Price Dispersion in the Airline Industry: A Conceptual Framework and Empirical Analysis." American Journal of Management **12**(1): 92-107.
- Gebauer, H. and E. Fleisch (2007). "An investigation of the relationship between behavioral processes, motivation, investments in the service business and service revenue." Industrial Marketing Management **36**(3): 337-348.
- Gedenk, K. and H. Sattler (1999). "The Impact of Price Thresholds on Profit Contribution - Should Retailers Set 9-Ending Prices?" Journal of retailing **75**(1): 2-4.
- Ghose, A. and Y. Yao (2011). "Using transaction prices to re-examine price dispersion in electronic markets." Information Systems Research **22**(2): 269-288.
- Gilmore, M. M. and C. Murphy (1989). "Aging is associated with increased Weber ratios." Perception & Psychophysics **46**(6): 555-559.
- Graham, B. (1959). "intelligent investor."
- Grewal, D., et al. (2011). "Innovations in retail pricing and promotions." Journal of retailing **87**: S43-S52.
- Grewal, D., et al. (1994). "The moderating effects of message framing and source credibility on the price-perceived risk relationship." Journal of consumer research: 145-153.
- Grönroos, C. and G. L. Shostack (1983). Strategic management and marketing in the service sector, Marketing Science Institute Cambridge, MA.

Gupta, S. and L. G. Cooper (1992). "The discounting of discounts and promotion thresholds." Journal of consumer research: 401-411.

Han, S., et al. (2002). "Consumer price sensitivity and price thresholds." Journal of retailing **77**(4): 435-456.

Hardy, J. D., et al. (1947). "Studies on pain: discrimination of differences in intensity of a pain stimulus as a basis of a scale of pain intensity." Journal of Clinical Investigation **26**(6): 1152.

Hartwig, F. and B. E. Dearing (1979). Exploratory data analysis, Sage.

HBR (2015). "The Science of Sensory Marketing." Harvard Business Review(March 2015).

Henderson Britt, S. (1975). "How Weber's law can be applied to marketing." Business Horizons **18**(1): 21-29.

Hinterhuber, A. (2004). "Towards value-based pricing—An integrative framework for decision making." Industrial Marketing Management **33**(8): 765-778.

Hinterhuber, A. and S. Liozu (2012). "Is it time to rethink your pricing strategy?" MIT Sloan Management Review **53**(4): 69-77.

Hötting, K., et al. (2004). "Altered auditory-tactile interactions in congenitally blind humans: an event-related potential study." Experimental brain research **159**(3): 370-381.

Isard, P. (1977). "How far can we push the " law of one price"?" The American Economic Review: 942-948.

Jacoby, J., et al. (1978). "A behavioral process approach to information acquisition in nondurable purchasing." Journal of marketing research: 532-544.

Jarvenpaa, S. L. (1991). "Panning for gold in information systems research: second-hand data." Information Systems Research: Contemporary Approaches and Emergent Traditions: 63-80.

Jimenez-Buedo, M. and L. M. Miller (2010). "Why a trade-off? The relationship between the external and internal validity of experiments." Theoria. Revista de Teoría, Historia y Fundamentos de la Ciencia **25**(3): 301-321.

Johnson, E. J., et al. (2002). "On the Depth and Dynamics of Online Search Behavior." Advances in consumer research **29**: 8.

Kalwani, M. U. and C. K. Yim (1992). "Consumer price and promotion expectations: an experimental study." Journal of marketing research: 90-100.

Kalyanam, K. and T. S. Shively (1998). "Estimating irregular pricing effects: A stochastic spline regression approach." Journal of marketing research: 16-29.

Kalyanaram, G. and R. S. Winer (1995). "Empirical generalizations from reference price research." Marketing Science **14**(3\_supplement): G161-G169.

- Kamen, J. M. (1977). "Controlling 'just noticeable differences' in quality." Harvard Business Review **55**(6): 12-164.
- Kamen, J. M. and R. J. Toman (1970). "Psychophysics of prices." Journal of marketing research: 27-35.
- Kim, H.-W., et al. (2012). "Which is more important in Internet shopping, perceived price or trust?" Electronic Commerce Research and Applications **11**(3): 241-252.
- Klatt, D. H. (1976). "Linguistic uses of segmental duration in English: Acoustic and perceptual evidence." The Journal of the Acoustical Society of America **59**(5): 1208-1221.
- Knutson, B. J. (1988). "Frequent travelers: making them happy and bringing them back." The Cornell Hotel and Restaurant Administration Quarterly **29**(1): 82-87.
- Kohli, C. and R. Suri (2011). "The price is right? Guidelines for pricing to enhance profitability." Business Horizons **54**(6): 563-573.
- Kopalle, P. K., et al. (1999). "The dynamic effect of discounting on sales: Empirical analysis and normative pricing implications." Marketing Science **18**(3): 317-332.
- Krueger, L. E. (1989). "Detection of intraword and interword letter repetition: A test of the word unitization hypothesis." Memory & cognition **17**(1): 48-57.
- Le Berre, E., et al. (2008). "Just noticeable differences in component concentrations modify the odor quality of a blending mixture." Chemical senses **33**(4): 389-395.
- Lindsey-Mullikin, J. and D. Grewal (2006). "Imperfect information: the persistence of price dispersion on the web." Journal of the Academy of Marketing Science **34**(2): 236-243.
- Lomas, N. (2013). "Forrester: US online retail sales to rise to \$370 BN by 2017 (10% CAGR) as ecommerce motors on with help from tablets and phones." TechCrunch (March 13) <http://techcrunch.com/2013/03/13/forrester-2012-2017-ecommerce-forecast>.
- Lovelock, C. and E. Gummesson (2004). "Whither services marketing? In search of a new paradigm and fresh perspectives." Journal of service research **7**(1): 20-41.
- Lusk, J. L., et al. (2006). "External validity of a framed field experiment." Economics letters **93**(2): 285-290.
- Malhotra, N. K., et al. (1999). "Marketing research: A state-of-the-art review and directions for the twenty-first century." Journal of the Academy of Marketing Science **27**(2): 160-183.
- Marmorstein, H., et al. (1992). "The value of time spent in price-comparison shopping: survey and experimental evidence." Journal of consumer research: 52-61.
- Marn, M. V. and R. L. Rosiello (1992). "Managing price, gaining profit." Harvard Business Review **70**(5): 84-94.
- Mathieson, K., et al. (2001). "Extending the technology acceptance model: the influence of perceived user resources." ACM SigMIS Database **32**(3): 86-112.

- Mazumdar, T. (1986). Experimental investigation of the psychological determinants of buyers' price awareness and a comparative assessment of methodologies for retrieving price information from memory, working paper, Virginia Polytechnic Institute and State University.
- Mazumdar, T. and K. B. Monroe (1990). "The effects of buyers' intentions to learn price information on price encoding." Journal of retailing.
- McAnally, K. I. and J. F. Stein (1996). "Auditory temporal coding in dyslexia." Proceedings of the Royal Society of London. Series B: Biological Sciences **263**(1373): 961-965.
- McCaskey, P. H. and D. L. Brady (2007). "The current status of course offerings in pricing in the business curriculum." Journal of Product & Brand Management **16**(5): 358-361.
- McKinsey, C. (2002). Mckinsey Quarterly.
- Mela, C. F., et al. (1997). "The long-term impact of promotion and advertising on consumer brand choice." Journal of marketing research: 248-261.
- Merriam-Webster (2014). "Service." Merriam-Webster.com. (Merriam-Webster, n.d. Web. 15 Dec. 2014. <<http://www.merriam-webster.com/dictionary/service%3E.>>).
- Miles, M. B. and A. M. Huberman (1994). Qualitative Data Analysis. Thousand Oaks, CA, Sage Publications
- Mills, A. W. (1958). "On the minimum audible angle." The Journal of the Acoustical Society of America **30**(4): 237-246.
- Monroe, K. B. (1971). "Measuring price thresholds by psychophysics and latitudes of acceptance." Journal of marketing research: 460-464.
- Monroe, K. B. (1973). "Buyers' subjective perceptions of price." Journal of marketing research: 70-80.
- Monroe, K. B. and J. D. Chapman (1987). "Framing effects on buyers' subjective product evaluations." Advances in consumer research **14**(1): 193-197.
- Monroe, K. B., et al. (1977). "Contextual influences on subjective price perceptions." Journal of Business Research **5**(4): 277-291.
- Monroe, K. B. and R. Krishnan (1985). "The effect of price on subjective product evaluations." Perceived quality: How consumers view stores and merchandise: 209-232.
- Monroe, K. B. and A. Y. Lee (1999). "Remembering versus knowing: Issues in buyers' processing of price information." Journal of the Academy of Marketing Science **27**(2): 207-225.
- Monroe, K. B. and S. M. Petrosius (1981). "Buyers' perceptions of price: An update of the evidence." Perspectives in consumer behavior **3**: 23-42.
- Morein-Zamir, S., et al. (2003). "Auditory capture of vision: examining temporal ventriloquism." Cognitive Brain Research **17**(1): 154-163.



- Murray, D. J. (1990). "Fechner's later psychophysics." Canadian Psychology/Psychologie canadienne **31**(1): 54.
- Nancarrow, C., et al. (1998). "Gaining competitive advantage from packaging and labelling in marketing communications." British Food Journal **100**(2): 110-118.
- Ng, Y.-K. (1996). "Happiness surveys: Some comparability issues and an exploratory survey based on just perceivable increments." Social Indicators Research **38**(1): 1-27.
- Nieder, A. and E. K. Miller (2003). "Coding of cognitive magnitude: Compressed scaling of numerical information in the primate prefrontal cortex." Neuron **37**(1): 149-157.
- Nijs, V. R., et al. (2007). "Retail-price drivers and retailer profits." Marketing Science **26**(4): 473-487.
- Ofir, C., et al. (2008). "Memory-based store price judgments: The role of knowledge and shopping experience." Journal of retailing **84**(4): 414-423.
- Oh, H. (2000). "The effect of brand class, brand awareness, and price on customer value and behavioral intentions." Journal of Hospitality & Tourism Research **24**(2): 136-162.
- Olson, J. C. (1976). Consumer response to price: attitudinal, information processing perspective (condensed version), College of Business Administration, Pennsylvania State University.
- Pangborn, R. M. and I. M. Trabue (1967). "Detection and apparent taste intensity of salt—acid mixtures in two media." Perception & Psychophysics **2**(11): 503-509.
- Pathak, B. K. (2012). "Comparison shopping agents and online price dispersion: a search cost based explanation." Journal of theoretical and applied electronic commerce research **7**(1): 64-76.
- Pauwels, K., et al. (2007). "When do price thresholds matter in retail categories?" Marketing Science **26**(1): 83-100.
- Pearlman, A. L., et al. (1979). "Cerebral color blindness: an acquired defect in hue discrimination." Annals of neurology **5**(3): 253-261.
- Pfaffmann, C., et al. (1971). Taste psychophysics. Taste, Springer: 75-101.
- Poliakoff, E., et al. (2006). "Vision and touch in ageing: crossmodal selective attention and visuotactile spatial interactions." Neuropsychologia **44**(4): 507-517.
- Quené, H. (2007). "On the just noticeable difference for tempo in speech." Journal of Phonetics **35**(3): 353-362.
- Rajendran, K. N. and G. J. Tellis (1994). "Contextual and temporal components of reference price." Journal of marketing **58**: 22-34.
- Rao, V. R. and D. A. Gautschi (1982). "The role of price in individual utility judgments: Development and empirical validation of alternative models." Research in Marketing.
- Reinartz, W. J. and V. Kumar (2000). "On the profitability of long-life customers in a noncontractual setting: An empirical investigation and implications for marketing." Journal of marketing **64**(4): 17-35.

- Rigby, D. K. (2014). "Digital-physical mashups." Harvard Business Review **92**(9): 84-92.
- Rohrer, J. D., et al. (2011). "Clinical and neuroanatomical signatures of tissue pathology in frontotemporal lobar degeneration." Brain **134**(9): 2565-2581.
- Rust, R. T. (2000). "Valarie A. Zeithaml, and Katherine N. Lemon " Driving Customer Equity: How Customer Lifetime Value Is Reshaping Corporate Strategy.
- Sanburn, J. (2012). Delta Appeared to Overcharge Frequent Flyers for Weeks – Was That Legal? Time Magazine.
- Sawyer, A. G. and P. R. Dickson (1984). "Psychological perspectives on consumer response to sales promotion." Research on sales promotion: Collected papers: 1-21.
- Schechter, L. (1984). "A normative conception of value." Progressive Grocer, Executive Report **2**: 12-14.
- Schindler, R. M. (1991). "Symbolic meanings of a price ending." Advances in consumer research **18**(1): 794-801.
- Scitovszky, T. (1944). "Some consequences of the habit of judging quality by price." The Review of Economic Studies **12**(2): 100-105.
- Shaffer, G. and Z. J. Zhang (2000). "Pay to Switch or Pay to Stay: Preference-Based Price Discrimination in Markets with Switching Costs." Journal of Economics & Management Strategy **9**(3): 397-424.
- Sherif, C. W. (1963). "Social categorization as a function of latitude of acceptance and series range." The Journal of Abnormal and Social Psychology **67**(2): 148.
- Sheth, J. N. and A. Parvatiyar (2001). "The antecedents and consequences of integrated global marketing." International Marketing Review **18**(1): 16-29.
- Sheth, J. N. and A. Parvatlyar (1995). "Relationship marketing in consumer markets: antecedents and consequences." Journal of the Academy of Marketing Science **23**(4): 255-271.
- Shoup, D. C. and A. P. Association (2005). The high cost of free parking, Planners Press Chicago.
- Smith, P. C., et al. (1986). "Guidelines for clean data: Detection of common mistakes." Journal of Applied Psychology **71**(3): 457.
- Society, P. P. (2012). "<Professional\_Pricing\_Society\_Executive\_Summary\_of\_Results.pdf>." The Journal of Professional Pricing **Fourth Quarter 2012**.
- Sowter, A. P., et al. (1969). "The influence of price differences on brand shares and switching." European Journal of Marketing **3**(4): 223-230.
- Srinivasan, M. A. and R. H. LaMotte (1996). Tactual discrimination of softness: abilities and mechanisms. Somesthesia and the Neurobiology of the Somatosensory Cortex, Springer: 123-135.
- Stigler, G. J. (1961). "The economics of information." The journal of political economy: 213-225.

- Stoetzel, J. (1954). "Le prix comme limite." La Psychologie Economique, Librairie Marcel Riviere et Cie, Paris: 183-188.
- Stoll, A. M. and L. C. Greene (1958). The relationship between pain and tissue damage due to thermal radiation, Am Physiological Soc.
- Taylor, G. A. and S. A. Neslin (2005). "The current and future sales impact of a retail frequency reward program." Journal of retailing **81**(4): 293-305.
- Tsai, D. and H.-C. Lee (2007). "Will you care when you pay more? The negative side of targeted promotions." Journal of Product & Brand Management **16**(7): 481-491.
- Tversky, A. and D. Kahneman (1991). "Loss aversion in riskless choice: A reference-dependent model." The Quarterly Journal of Economics: 1039-1061.
- Van Heerde, H. J., et al. (2001). "Semiparametric analysis to estimate the deal effect curve." Journal of marketing research **38**(2): 197-215.
- Vargo, S. L. and R. F. Lusch (2004). "Evolving to a new dominant logic for marketing." Journal of marketing **68**(1): 1-17.
- Vargo, S. L. and R. F. Lusch (2008). "From goods to service (s): Divergences and convergences of logics." Industrial Marketing Management **37**(3): 254-259.
- Varki, S. and M. Colgate (2001). "The role of price perceptions in an integrated model of behavioral intentions." Journal of Service Research **3**(3): 232-240.
- Venkatasubramanian, V., et al. (2003). "A review of process fault detection and diagnosis: Part III: Process history based methods." Computers & chemical engineering **27**(3): 327-346.
- Wang, H., et al. (2000). An effective approach to detect lesions in color retinal images. Computer Vision and Pattern Recognition, 2000. Proceedings. IEEE Conference on, IEEE.
- Weisstein, F. L., et al. (2013). "Effects of price framing on consumers' perceptions of online dynamic pricing practices." Journal of the Academy of Marketing Science **41**(5): 501-514.
- Xia, L. and K. B. Monroe (2004). "Price partitioning on the internet." Journal of Interactive Marketing **18**(4): 63-73.
- Yin, R. (2009). Case study research: Design and methods, Sage Publications, Inc.
- Zamora, R., et al. (2001). "Influence of cultivar and fruit ripening on olive (*Olea europaea*) fruit protein content, composition, and antioxidant activity." Journal of agricultural and food chemistry **49**(9): 4267-4270.
- Zeithaml, V. A. (1982). "Consumer response to in-store price information environments." Journal of consumer research: 357-369.
- Zeithaml, V. A. (1988). "Consumer perceptions of price, quality, and value: a means-end model and synthesis of evidence." The Journal of Marketing: 2-22.

Zeithaml, V. A., et al. (1985). "Problems and strategies in services marketing." The Journal of Marketing: 33-46.

Zhang, X., et al. (2008). "Just-noticeable difference estimation with pixels in images." Journal of Visual Communication and Image Representation **19**(1): 30-41.

Zhao, Y. (2006). "Price Dispersion in the Grocery Market\*." The Journal of Business **79**(3): 1175-1192.

## APPENDIX A: A Historical Time Line

	<ol style="list-style-type: none"> <li>1. A consumer has two prices in mind for every product; a historical price and an actual price.</li> <li>2. Lower price was viewed as a sign of lower quality and expensive product were considered of higher quality.</li> </ol>	(Scitovszky 1944)	Experiments / Empirical Observations
	<ol style="list-style-type: none"> <li>1. Purchase decisions are driven by income level, and need of the product, and different buyers pay different prices for products of different quality and value as it relates to their context.</li> <li>2. A product can have a set of acceptable prices</li> <li>3. Price is logarithmic in nature proportional to amount of the initial price.</li> <li>4. Price range is influenced by last price paid as well as by competitive price available in the marketplace.</li> </ol>	(Stoetzel (1954) (Adam (1958) (Fouilhe 1960), (Weber, Fechner and Bernoulli)(Gabor and Granger 1961), (Gabor and Granger 1966), (Sowter, Gabor et al. 1969)	Experiments / Empirical Observations

	<ol style="list-style-type: none"> <li>1. JND and price relationship is explored with contextual variables.</li> <li>2. Research examined both conscious and unconscious tendencies exhibited by the buyer.</li> <li>3. Studies confirmed the influence of price on brand name and quality perceptions. Price is not only an economic variable but also carries attribute qualities of a product.</li> <li>4. Research in the area of information acquisition, cognitive processing, remembering vs. knowing were explored.</li> </ol>	<p>(Monroe 1971) (Monroe 1973) (Mazumdar and Monroe 1990) (Rao and Gautschi 1982), (Bhagwati and Srinivasan 1982). (Zeithaml 1988).</p>	<p>Experiments / Surveys</p>

	<ol style="list-style-type: none"> <li>1. Perceptions of price fairness, on consumer buying intentions are studied.</li> <li>2. Influence of price on consumer perceptions of fairness, customer satisfaction and customer experience are confirmed.</li> <li>3. Research exploring pricing strategies of online offers yields interesting insights into purchase behavior over the Internet. Buying behavior on the Internet exhibits tendencies that may be different than in-store buyers, influence of price is stronger.</li> <li>4. Effect of pricing strategies on consumer behavior on the Internet including dynamic pricing, personalized pricing, price partitioning are being explored.</li> </ol>	(Chatterjee and McGinnis 2010, Grewal, Ailawadi et al. 2011, Weisstein, Monroe et al. 2013) (Xia and Monroe 2004) (Ba and Pavlou 2002)	Experiments / Survey / Transaction data

## APPENDIX B: Constructs and Measures

Construct	Measure	Variable Type
Loyalty	Loyalty card members vs. Casual customers	<i>Moderator variable</i>
Channel Type	Search vs. Direct customers	<i>Moderator variable</i>
Motivation	Business vs. Self-paid customers	<i>Moderator variable</i>
Relative Price	Average price of key competitors	<i>Control variable</i>
Purchase Frequency	Frequency of repeat purchase	<i>Dependent variable</i>