Essays on Extended Service Contract Purchase Decisions

by

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A thesis submitted in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

in

Marketing

Faculty of Business
University of Alberta

Abstract

People buy extended service contracts (ESCs) or extended warranties for their purchased products to protect them against break-down or failure beyond the duration or coverage of base manufacturer warranties. In this thesis, I study two factors that affect ESC purchase decisions, namely brand equity and ESC information availability strategies.

In essay 1, I study an important dependency between product and ESC purchase decisions by investigating the association between brand equity and ESC purchase likelihood. I conceptualize two potential effects of brand equity on ESC purchase decisions. On the one hand, higher brand equity might be associated with higher product value for buyers. This additional value comes from positive brand associations in addition to a product's utilitarian or monetary value. Higher value is in turn associated with a higher likelihood of insuring products, and people might be more likely to purchase ESCs for products with higher brand equity. I refer to this as the value effect. On the other hand, higher brand equity might be correlated with higher perceived product reliability or quality, which implies that people might be less likely to purchase ESCs for products with higher brand equity. I refer to this as the reliability effect. Empirical analysis of a scanner panel data set and a stated choice survey provide evidence for the dominance of the value effect over the reliability effect, resulting in an overall positive association between brand equity and ESC purchase likelihood. This finding is consistent with findings in the insurance literature that generally find a stronger impact of the extent of loss than the probability of loss on insurance purchase decisions.

In essay 2, I study the effect of simultaneous vs. delayed ESC information availability strategies on shoppers' product and ESC purchase decisions. In the simultaneous strategy, ESC

information is displayed alongside product information while in the delayed strategy, ESC information is provided subsequent to shoppers' product purchase decision during the checkout. We draw from theory to propose that shoppers in the simultaneous scenario might experience a heightened perceived risk or need for insurance, which would influence their risk-handling strategies. Our analysis of stated choice data provides evidence that shoppers in the simultaneous scenario adopt additional risk-handling strategies. In this scenario, we observe a combination of effects that could be attributed to two distinctive response patterns. On the one hand, we observe lower sensitivity to ESC prices combined with buying ESCs for higher quality products (i.e. a reparative ESC-focused risk reduction strategy), while on the other hand, we observe a lower ESC purchase likelihood along with lower sensitivity to product prices (i.e. a preventative product-focused risk reduction strategy). These effects are consistent with expected patterns of behavior for consumers with high vs. low levels of risk or loss aversion. These patterns suggest that people in the simultaneous scenario might respond to a heightened need for insurance by undergoing a reparative ESC-focused mindset, a preventative product-focused mind-set, or a combination of both mindsets. These essays contribute new insights to the burgeoning literature on ESCs in marketing.

Preface

This research project received research ethics approval from the University of Alberta Research Ethics Board, Project Name "An investigation into factors that affect purchases of extended warranties for electronic products", ID: Pro00052660, November 27, 2014. The data for the pilot study in essay 2 was collected under research ethics approval from the University of Alberta Research Ethics Board, Project Name "The effects of product characteristics and transaction costs on consumers' product returns", ID: Pro00042242, September 20, 2013.

Dedication

This work is dedicated to my dear wife, Narges, who shared this entire journey with me while pursuing her own PhD in computer engineering. She helped me when I needed it most, and her presence was a source of love, comfort and joy for me during these years in Edmonton's long winters and its lovely summers.

My parents Kavous and Shahnaz have been a source of inspiration in my entire academic journey. I also dedicate this work to them and to my dear sisters Azita and Atena for their unending love and support.

Acknowledgments

I am especially thankful to my advisor, Paul R. Messinger, for his continuous support, patience, and contributions to this research. I have learnt a lot from his composure and thoughtfulness. I would also like to thank my two other supervisory committee members, Peter Popkowski Leszczyc and Yu Ma for their genuine care and insightful feedback on these essays.

I have received comments from Gerald Häubl, Wiktor Adamowicz, Joffre Swait, and Kenneth E. Train that helped me improve this work and I thank them for generously giving me their time. I also appreciate the helpful feedback I received from my external examiners Baohung Sun, and Ray Patterson who provided me with several interesting suggestions on how to improve and extend this work.

And last but not least, I thank all my friends at the University of Alberta School of Business, especially fellow PhD candidate Behnam Torabi, for the lively discussions and unforgettably fun times we had while working on our dissertations.

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Chapter 1 Introduction

Retailers are increasingly becoming service providers. Offering more services allows retailers to depend on a source of revenue that has higher and more sustainable profit margins than products. Extended service contracts (ESCs) or extended warranties offer one such opportunity. These offerings provide protection against durable product failure and extend the length and/or breadth of a manufacturer's base warranty.

Today, most retailers have forayed into this profitable market and ESCs have become a major driver of retailer profits. According to Consumer Reports (December 2003), extended warranties enjoy profit margins between 50% and 60% which points to their substantial impact on retailer bottom lines when compared to product profit margins of about 10%. In a revealing article Business Week (2004), reported that almost *all* of Circuit City's and almost half of Best Buy's operating income in 2003 came from extended warranties. Shortly after, Wal-Mart followed suit and started offering its own line of extended warranties in 2005 in addition to extending its electronic product selection to include high-end brands. According to this article's estimates, a 1% fall in warranty revenues as a result of Wal-Mart's entry into the high-end electronics and extended warranty markets would cause an 8% drop in Best Buy's operating profit and a 29% fall in Circuit City's profits (Business Week 2005). It is conceivable that Wal-Mart's strategic entrance into these markets might have presented a major blow to the other electronic retailers, potentially making the rival Circuit City more vulnerable to the global economic meltdown in 2008 which coincided with this retailer's ensuing bankruptcy.

Prior research has also documented a shift of power away from both manufacturers and retailers to consumers which exerts additional pressure on retail profit margins (Messinger and Narasimhan 1995). The substantial share of extended warranties and service contracts in retailer

profits signals a major strategic shift for retailers from a merely product-dominant strategic focus to one that incorporates service offerings as a second pillar of profitable retail management (Vargo and Lusch 2004).

This strategic shift calls for a better understanding of how consumers' choices of products and service offerings might be interrelated. Given the above developments, retail profit maximization objectives may not be adequately addressed through category management and product assortment optimization, as the service-product purchase inter-dependencies might necessitate joint optimization of the marketing mix for both products and service offerings, especially if consumers make these purchase decisions jointly or conditional on one another.

In this dissertation, we strive to answer two specific questions regarding consumers' ESC purchase decisions which also address their interdependency with product purchase decisions: 1) How do product brands affect consumers' decision to purchase an extended warranty for a product?, and 2) How do ESC information availability strategies (i.e., simultaneously available with product information vs. delayed and only available during checkout) affect consumers' product and ESC purchase decisions?

In Essay 1 (chapter 2), we provide an extensive review of the literature on ESCs and seek answers to the first question by investigating the effect of brand equity on ESC purchase decisions. We propose and conceptualize two potential effects of brand equity on ESC purchase likelihood. When brands signal product reliability to consumers, higher brand equity might lead to lower ESC purchase likelihood and when brands are considered to have a value beyond a product's utilitarian benefits, higher brand equity might lead to higher ESC purchase likelihood. However, we draw from past research to theorize that the positive value effect can dominate the negative reliability effect. Our analysis of data on product and extended warranty purchases from

an electronics retailer, plus a stated choice study, provide evidence for an overall positive effect of brand equity on ESC purchase decisions, and provide support for our main hypothesis.

In addition to our main hypothesis, we also test the role of several other factors in ESC purchase decisions in Essay 1. Specifically, we provide empirical evidence on the significant and positive effect of retailers' push strategies on consumers' propensity to buy ESCs. Our finding shows that a famous adage from the insurance literature also holds for ESCs: "… insurance is never bought; it is sold" (Knights and Morgan 1990). This finding highlights the impact of retailer sales tactics on consumers' decision making process in this category of offerings.

In Essay 2 (Chapter 3), we study the effect of ESC information availability strategies on both product and ESC purchase decisions. ESC attribute information, mainly price, is generally offered to buyers subsequent to their product purchase decisions during the checkout. However, ESC information can also be made available along with product attribute information which could give consumers more time to consider an ESC purchase. We pit the simultaneous vs. delayed ESC information availability strategies against one another in a choice experiment and compare their effect on consumers' choice taste parameters and risk reduction strategies. We predict that in a context where ESC prices lack product quality signals, i.e. they do not vary by brand and are merely a function of product price, some consumers might not only become less sensitive to ESC prices, but they might also purchase ESCs for higher quality products. This pattern is consistent with a reparative mind-set where the buyer prefers to have the ability to fix potential problems down the line if they occur. We also observe a second pattern of results as some people become less sensitive to product prices while becoming less likely to purchase ESCs. This pattern is consistent with a preventative mindset that aims to prevent product failure by investing more in the product purchase. These two patterns of behavior might be indicative of

segments in the market with respectively higher and lower risk or loss aversion levels. It is also likely that some buyers engage in risk reduction strategies comprised of a combination of both patterns above.

The two essays in this dissertation provide evidence on the importance of the interdependencies between the product and ESC purchase decisions, and highlight the need to consider these interdependencies in the marketing mix decisions for both products and ESCs. We conclude this dissertation in Chapter 4 with a summary of findings and discussion of the conclusions and limitations of both essays.

Chapter 2 Essay 1: Brand Equity and Extended Service Contract Purchase Decisions

2.1 Abstract

Purchasing extended service contracts (ESCs) that are offered alongside durable products insures buyers against product failure beyond manufacturers' warranty coverage. In an attempt to advance our understanding of the factors that influence ESC purchase decisions, we use the ISMS Durable Goods Dataset 1 and a stated choice dataset to explore the role of brand equity on ESC purchase decisions. Two potential effects of brand equity on ESC purchase decisions are conceptualized. On the one hand, higher brand equity might be correlated with higher perceived product reliability and quality, which would imply that people might be less likely to purchase ESCs for products with higher brand equity (the reliability effect). On the other hand, higher brand equity might be associated with higher product value for buyers. This additional value comes from positive brand associations in addition to a product's monetary value. Higher value is in turn associated with a higher likelihood of insuring products, and people might be more likely to purchase ESCs for the higher-equity brand (the value effect). We draw from past findings to argue that the value effect can dominate the reliability effect, resulting in an overall positive effect of brand equity on ESC purchase likelihood. Our results confirm this prediction. In addition to the role of brand equity, we study several factors that affect extended warranty purchases. Our analyses provide evidence for the significant role of retail stores' push strategies in positively affecting ESC purchase decisions. In line with our findings on the store effects, and the brands' value effect, we also find a negative effect of online purchases and a positive effect of product prices on ESC purchase likelihood.

2.2 Introduction

Extended service contracts (ESCs) that are offered by product manufacturers or retailers alongside durable products provide a more extensive and/or lengthier coverage of product purchases against possible failures. Several business articles have noted the substantial profitability of ESCs (Business Week 2004; Consumer Union 2004). Profit margins on ESC have been reported to be between 50%-60% (Business Week 2004). The significant impact of ESC sales on retail bottom lines and their distinctions from mere insurance products have spurred interest among researchers to better understand the factors that drive demand for these offerings. Recently, Chen et al. (2009) explored a number of product and consumer characteristics as well as retailer actions that affect consumers' ESC purchase decisions. We contribute to this stream of research in marketing by mainly examining the role that brands play in ESC purchases, and specifically study the role of brand equity on ESC purchase decisions. In addition, we study the role of retail stores, product prices, offline vs. online purchases, product category's hedonic-ness and several other covariates on ESC purchase likelihood.

We develop two arguments on the potential effects of brand equity on ESC purchase decisions. According to a *value argument*, brands constitute a source of value for consumers aside from the product's monetary or utilitarian value. The insurance literature documents that people are more likely to purchase insurance for products of higher value (Zweifel and Eisen 2012). The reason is that for assets of higher value, the potential extent of loss is higher. Based on this value argument, consumers assign a higher value to brands with higher brand equity and are more likely to insure them through ESC purchases, leading to a positive effect of brand equity on ESC purchases.

However, according to a *reliability argument*, higher equity brands provide stronger signals of unobserved product attributes such as product reliability and quality. Researchers in the insurance literature report that the probability of loss can play a role in insurance purchase decisions despite consumers' debatable ability in predicting this probability accurately. The reliability signals that consumers receive from a higher equity brand can potentially decrease their estimates of the probability of product failure. Based on this argument, buyers might perceive higher-equity brands to be more reliable, which discourages them from purchasing ESCs and leads to a potentially negative effect of brand equity on ESC purchases when brand equity is high.

While both positive and negative effects of brand equity on ESC purchase likelihood are conceivable, it remains an empirical question whether both of these forces can be observed or one of them dominates the other in real world. In the former case, the two forces could cancel each other out, and create a neutral overall role for brand equity in ESC purchase decisions. However, if one of these forces dominates the other one, we would be able to observe an overall positive or negative effect of brand equity on ESC purchase decisions.

Our review of the literature on factors that affect insurance purchases, suggests that the value effect might indeed dominate the reliability effect. In order to test this prediction, we analyze revealed preference data from a large sample of transactions at a major US electronics retailer. We also collect and analyze data from a simple product and ESC choice study which attempts to simulate an online shopping experience. The results provide evidence for the existence of an overall positive effect of brand equity on ESC purchase likelihood, favoring the dominance of the value effect over the reliability effect.

We further investigate the role of retail stores' push strategies on ESC purchase decisions. Retailers are likely to employ push strategies to drive ESC sales and our results provide evidence for their significant impact on ESC sales. In addition, we explore the role of product prices, online versus offline product purchases, and utilitarian versus hedonic nature of product categories on ESC purchase likelihood. The role of several other covariates on ESC purchase likelihood is also examined within these analyses.

In sum, the main purpose of this article is to empirically investigate the effect of brand equity on ESC purchase decisions. We test our hypothesis for the existence of an overall positive effect of brand equity on ESC purchase decisions using the ISMS Durable Goods Dataset 1 and a stated choice study. We also investigate store effects on ESC purchase decisions as well as several important relationships suggested in the literature.

The rest of this article is organized as follows. We first review the relevant literature and lay out the conceptual framework to develop our hypotheses. Next, we discuss the scanner dataset used in our analyses. This section is followed by the presentation of our analysis methodologies, and model estimations along with the discussion of results for the scanner dataset (ISMS 1). We next present the procedures for our primary stated choice data collection effort, along with data description, and estimation results. We conclude this essay by a discussion of our findings and their implications for marketing research and practice.

2.3 Background

Understanding consumer decision making has been one of the cornerstones of marketing research. Marketing scholars have studied consumer decision making in a myriad of contexts (For some diverse examples, see Häubl and Trifts (2000), Kunreuther et al. (2002), and Lee and Beatty (2002)). A substantial part of research on decision making deals with decision making

under uncertainty and sheds light on how marketing mix variables can affect decision outcomes when consumers face incomplete information (De Palma et al. 2008; Erdem and Keane 1996). In such contexts, consumers might rely on marketing mix variables to provide them with informative cues concerning unobserved product or service attributes. In this essay, we study consumer decision making for a specific class of insurance products called extended service contracts (ESCs) whose purchase is directly related to consumer uncertainty about product attributes.

ESCs or extended warranties[1] are service contracts offered by manufacturers, retailers or third parties that insure durable product purchases against potential failure in the future. While the terms and conditions of ESCs might vary from one product category to another or from one retailer to another, their raison d'être is to extend a durable product's manufacturer's warranty in terms of the types of failures covered and/or the length of coverage.

Insurance products have been extensively studied in the insurance literature. However, despite several commonalities, ESCs are distinctively different from common insurance products such as fire, flood, or life insurance. A key difference is that ESCs are not stand-alone products as they are purchased to complement durable product purchases. Consequently, a decision of whether or not to purchase an ESC is not only affected by buyers' perception of the likelihood of product failure and individual levels of risk aversion, but is also largely driven by both observed and unobserved product attributes as well as product-related marketing activities.

Another distinction between common insurance products and ESCs concerns their pricing structure. Many insurance products require a commitment to pay monthly fees for an extensive

[1] "Extended service contract (ESC)" and "extended warranty" are interchangeably used in this thesis.

number of years whereas ESCs require a one-time lump-sum payment that is often proportional to the insured product's price. In contrast to ESCs, common insurance products also offer the chance to drop out at any time during the coverage period.

Despite the mentioned differences between ESCs and common insurance products, marketing interest in understanding ESC purchase decisions might mainly stem from some recently-revealed data on the substantial impact of ESC sales on retailer profits. Improving our understanding of factors that influence consumers' ESC purchase decisions can help retailers improve their offerings to better meet consumer needs and fine-tune their marketing and sales activities. With ever-falling profit margins and competitors that rely on more accurate and timely information thanks to the availability of big data sources and high processing power, the retail industry can benefit from a better understanding of the factors that affect ESC purchase decisions to better optimize marketing mix decisions across both products and service offerings.

In this section, we review relevant literature from the insurance and marketing literatures and provide an overview of the existing knowledge on ESC purchase decisions and relate them to the questions addressed in this essay.

2.3.1 Related research on insurance products

Extended warranties can be categorized as a specific class of insurance products whose purchase is conditional on a durable product purchase. Despite their differences from insurance products, ESCs have major commonalities with general insurance products. In this section, we review main findings from the insurance literature that can inform our attempt to better understand ESC purchase decisions.

2.3.1.1 Demand for insurance products by individuals

Purchasing extended warranties stems from consumers' need to reduce uncertainty associated with potential future losses and helps them achieve peace of mind (Slovic et al. 2004). The need for insurance arises from the fact that risk-averse consumers are confronted by the possibility of substantial loss to their assets. According to prospect theory, negative outcomes "loom larger" than positive outcomes, and people's tendency to avoid losses is stronger than their tendency to acquire gains (Kahneman and Tversky 1979). The possibility of loss prompts people to pay an insurer to bear the risk of loss on their behalf (Dionne and Harrington 1992). Insurers are able to assume these risks by diversifying their portfolios over different categories of risk comprised of relatively independent events and by taking advantage of the law of large numbers that makes the risk-bearing act economically feasible for them (Johnson et al. 1993).

The price of an insurance offering is a major factor in shaping the demand for that offering. Evidently, price has a negative effect on demand for insurance products. In theory, rational risk-neutral economic agents facing a probabilistic distribution of potential losses are willing to pay a price equivalent to the expected value of potential losses to insure an asset. However consumers' willingness to pay for insurance may diverge from this optimal reservation price due to several factors, including their risk aversion. Risk aversion can affect the price elasticity of demand for insurance products and hence the demand itself.

In economic theory, risk aversion is taken to be equivalent to the diminishing marginal utility as represented in the concavity of a person's Von Neumann-Morgenstern utility function. In practice, risk aversion is a typical characteristic of human beings and concerns the preference of an individual to accept a more certain payoff/loss over a less certain payoff/loss of equal or greater value (Tversky and Fox 1995; Tversky and Kahneman 1981). When faced with insurance

purchase decisions, risk-averse consumers are more likely to pay a price premium for the insurance (an immediate small loss) in order to protect themselves against a higher, albeit uncertain loss in the future. Consequently, consumers with higher levels of risk aversion are more likely to purchase insurance products.

Insofar as the eventual benefit of insuring is derived when a loss is incurred, it is no surprise that the perceived probability of the occurrence of loss can affect demand for insurance products (Zweifel and Eisen 2012). Research indicates that a higher perceived probability of loss has a positive impact on insurance purchase likelihood.

Demand modellers in the insurance literature frequently assume that probability of loss is known to consumers (Browne and Hoyt 2000). However, recent research suggests that consumers might be unable to correctly estimate the probability of loss (Johnson et al. 1993), might underestimate it in some contexts or overestimate it in others (Zweifel and Eisen 2012) or entirely neglect it in some other contexts (Huysentruyt and Read 2010). Despite this body of evidence on people's disability to accurately perceive the probability of loss or effectively use it, we cannot dismiss the fact that people are likely to use rough estimates of the probability of loss in their insurance purchase decisions.

A robust finding in the insurance literature concerns the role of asset value or, equivalently, the potential *extent* of loss, in shaping demand for insurance products (Ganderton et al. 2000; Zweifel and Eisen 2012). Losses associated with a higher value asset exert a greater impact on a consumer's wealth and well-being, making her more likely to protect it with an insurance. The insurance products literature is mainly concerned with the effect of monetary value on insurance purchase decisions. Nevertheless, the consumer behavior and marketing literature informs us that

product value may also come from sources other than product price. This idea will be further explored in subsequent sections of this essay.

In summary, the insurance literature informs us about four major determinants of demand for insurance products, namely, the price charged for insurance, the value of the asset to be insured, the probability of the occurrence of loss and consumers' risk aversion. In particular, this literature suggests that the person-specific factor, namely risk aversion, plays a strong role in these decisions. The important role of risk aversion is intuitive as the effect of other insurance demand drivers could also be affected by a person's risk aversion, making them more prone to purchasing insurance. For example, more risk averse consumers might be less sensitive to the price of insurance. Hence, in order to better understand insurance purchase decisions we need to understand how perceptions of risk can be affected in a retail environment.

2.3.1.2 Perceptions of risk, the retail context, and product attributes

Consumers' decisions under risk and uncertainty are influenced by how they perceive the risks and rewards associated with choosing different alternatives. Warranties mitigate financial and performance risks associated with a durable product purchase. However, risk perceptions are subjective and might depend on cultural, personal and contextual factors.

At a personal level, consumer decisions and perceptions might be affected by several biases inherent to the human nature such as representativeness, availability, and anchoring (Tversky and Kahneman 1974a). Prior research also indicates that consumers frequently overestimate low probabilities of loss and underestimate higher probabilities (Zweifel and Eisen 2012). This is a regression towards the mean effect and highlights the general uncertainty associated with perceptions of risk. Despite the overall importance of individual-level biases, the retail context

that is comprised of marketing- and product-related factors, can also affect consumer perceptions of risk. Since these effects fall within the purview of marketing, we turn our attention to how elements in the retail context can affect perceptions of risk and consequently ESC purchase decisions.

Research in psychology and consumer behavior provides strong evidence that consumer choices can be affected by context (Hamilton et al. 2007; Hedgcock et al. 2009; Huber et al. 1982; Tversky and Simonson 1993). For example, Simonson (1989) finds evidence for the compromise effect suggesting that brands gain share when they become compromise alternatives in a choice set. The insurance literature also documents similar effects. For example Johnson et al. (1993) find that decisions involving risk can be manipulated and distorted by framing. Chen et al. (2009) show that unadvertised promotions are more likely to increase consumers' risk aversion through elevating their positive mood which leads to their higher propensity to purchase ESCs. They also show that people are more likely to buy ESCs for products that are on promotion.

In addition, product attributes can directly affect perceptions of risk associated with purchasing a product or the potential extent of loss incurred in case of product failure. Product attributes are especially influential in extended warranty decisions where the need for an extended warranty evidently depends on the likelihood of the products' satisfactory functionality.

The sensitivity of risk perceptions to external factors has clear implications for research in marketing on extended warranties. A substantial part of uncertainty regarding whether or not to insure durable product purchases against future loss stems from the un-observability of such important product attributes as product quality, reliability and failure rates. These unobserved attributes are often likely to be inferred from observed product attributes. Consequently,

observed product attributes can play an important role in ESC purchase decisions insofar as they affect perceptions of risk, product failure likelihood, or the perceived value of products. In the next section, we will review the extant literature on warranties and extended warranties in the marketing literature and identify gaps in our knowledge that will be addressed in this essay.

2.3.2 Prior research on warranties and extended service contracts

Different aspects of warranties have been studied in several disciplines. For example, the legal, legislative, engineering, supply chain and accounting aspects of warranty provisions have been studied in their respective disciplines. For summary papers dealing with these aspects of warranties, the interested reader is referred to the work by Murthy and Djamaludin (2002) and Thomas and Rao (1999). However, warranties have also been studied from behavioral, economic and marketing perspectives which are more relevant to our attempt to understand *consumers'* ESC purchase decisions. We mainly focus on this latter body of work as they are more relevant to consumer purchase decisions and only refer to warranty research from other disciplines as needed.

2.3.2.1 Research on manufacturer warranties

The larger part of research in marketing on warranties concerns manufacturers' base warranties rather than extended warranties. According to this body of work, warranty provisions can serve several purposes. First and foremost, they offer protection for product purchases and insure them against unexpected failure (Lutz 1989). This insurance function reduces consumer uncertainty and the risks associated with a purchase. Second, warranties can signal product quality (Srivastava and Mitra 1998). Hence, they can be used as a promotional tool (Murthy and

Blischke 2010). Manufacturers can gain a stronger competitive position by offering warranties with better terms and conditions to exhibit their trust in the reliability of the products they offer. As a result, offering warranties per se, becomes a new dimension or *attribute* of the product and enables consumers to form expectations about product reliability based on a product's warranty.

Several rationales for the provision of warranties have been put forth. Chu and Chintagunta (2011) test four major theories proposed in the literature on the economic rationale for warranty provisions. In their study of the U.S. computer server and automobile markets, they find support for the theory that warranty provision acts as a sorting mechanism across customers with heterogeneous levels of risk aversion. They do not find evidence for the theory that manufacturers might use warranties as an incentive to reveal and improve quality. In fact, using warranties to signal product quality is becoming less common. For a warranty to signal quality, the manufacturer has to lengthen base warranties (Soberman 2003). However, more and more manufacturers are shifting towards offering minimal warranties with their products in several medium-ticket product categories. Research shows that one reason for this trend is the negative externality imposed by buyers who purchase optional extended warranties, on the warranty redemption costs of manufacturers (Lutz and Padmanabhan 1995).

In addition to the above body of work, warranty policy and warranty menu design issues have also been studied in the literature (Li et al. 2012; Padmanabhan and Rao 1993b). However, we are more interested in extended warranties and extended service contracts which are inherently different from manufacturer warranties, and we will explore them in more detail.

2.3.2.2 Research on extended service contracts

Research on extended warranties in marketing is more recent and sparse. We review some of the main findings from this nascent literature which address a diverse set of issues.

As mentioned in the previous section, an ongoing decline in the length of warranties offered by manufacturers and a shift towards offering ESCs can be observed in product markets (Heese 2012). In line with this observation, Padmanabhan and Rao (1993a) find that an optimal menu of warranty offerings for a manufacturer would comprise of a base warranty, desired by the least risk-averse market segment, plus additional insurance for the more risk averse segments through ESCs. They also show that risk averse buyers might expend less effort on product maintenance which points toward the existence of consumer moral hazard in this market. In fact, later research shows that consumer moral hazard and usage heterogeneity affect their willingness to pay, and consequently the demand for extended warranties (Padmanabhan 1995).

Desai and Padmanabhan (2004) study the role of extended warranty offerings in channel coordination and find that it is optimal for manufacturers or independent third party providers to sell extended warranties through the retailer. Along these findings, Heese (2012) further shows that if consumers make their product and warranty decisions simultaneously, the manufacturer experiences a pressure to reduce its base warranty. According to this researcher, retailers could benefit if buyers considered both the product and ESC purchase simultaneously.

A few researchers have started investigating the factors that affect consumers' decisions regarding ESC purchases. According to findings from the insurance literature, consumers are more likely to insure an asset for which they have higher affection, holding constant the amount of compensation in case of loss (Hsee and Kunreuther 2000). Chen et al. (2009) report similar findings in their analysis of ESC purchases for electronic products. They find that consumers are

more likely to purchase extended warranties for product categories that are considered more hedonic than utilitarian. They argue that consumers attach an additional value aside from the monetary value to purchases from more hedonic categories and this additional value warrants the higher proneness to protect these purchases from loss.

Prior work indicates that women are less likely to take risks than men due to their relatively higher risk aversion (Byrnes et al. 1999). This finding suggests that women might be more likely to purchase ESCs. However, Chen et al. (2009) do not find a significant effect for the role of gender on ESC purchases.

Chen (2007) finds that consumers are more likely to purchase ESCs during the early stages of a product's shelf life due to the higher uncertainty and risk associated with product purchase in that period. Chen (2007) also finds that quickly declining product prices decrease consumers' likelihood of buying ESCs.

In subsequent research, Chen et al. (2009) do not find any negative effect for manufacturer's warranty length on ESC purchase decisions which they attribute to lack of within-category variation of warranty length in their dataset. However, the results for this relationship have been mixed in the literature. In the competition between new entrants and established products in a market, signaling could lead to a situation where products with lower reliability might end up offering longer warranties (Balachander 2001). With the prevalence of such practices in the market, the warranty's reliability signal can diminish over time.

Chen et al. (2009) find that people who have used ESCs in the past are more likely to purchase ESCs. As these authors suggest, this effect might be due to an increase in these consumers' perception of product failure rates. This finding might also be partly due to self-selection, as consumers who have used ESCs in the past belong to a segment of the market with

higher risk aversion and are generally more likely to purchase ESCs regardless of past warranty usage.

In a more recent work, Jindal (2013) shows that consumer decision making in ESC purchase decisions is mainly influenced by loss aversion rather than diminishing returns (curvature of the utility function), or nonlinear probability weighting.

Researchers have also found evidence for the role of retail environment factors on ESC purchases. It has been shown that product promotions and unadvertised product promotions are likely to induce ESC purchases (Chen et al. 2009).

Our analysis of the literature identifies a major gap in our understanding of consumers' ESC purchase decisions. Marketers have long been promoting the creation of brands as intangible assets with substantial long-term value. However, it is not clear how brands affect ESC purchase decisions. Little work has explored the potential interactions between brands and ESCs. One notable exception is a recent study by Wang et al. (2012). These researchers show that ESCs might be not be priced optimally for different brands in the market. They find that ESCs are underpriced for some brands and overpriced for some others given the differences in product failure rates across brands.

Brands and brand equity are central concepts in marketing. Understanding how brands interact with extended warranties to shape consumers' purchase decisions in this category will contribute to the science of service marketing, and has clear substantive implications for retailers. Retailers who better understand the relationship between brand equity and extended warranty purchase decisions, can use this knowledge to make more optimal marketing mix decisions. We will attempt to fill this gap by developing our hypotheses based on relevant prior

research in this area, and empirically testing these predictions using both secondary and primary data.

2.4 Conceptual development

Relevant aspects of the insurance and marketing literatures that affect ESC purchase decisions have been reviewed in previous sections. Here, we will borrow from findings in the marketing and insurance literatures to predict potential brand equity effects on ESC purchase decisions. We first provide the theoretical background on brands and brand equity in marketing and then link them with findings in the insurance literature to develop our main hypotheses.

2.4.1 Brands and brand equity

Kotler (1991) defines brands as "a name, term, sign, symbol, or design, or combination of them which is intended to identify the goods and services of one seller or group of sellers and to differentiate them from those of competitors". This definition suggests two broad functions for brands: product identification and differentiation. The fact that brands can serve these functions implies that brands *contain information* which enables consumers to compare their respective products. In fact, brands contain and communicate important information especially on unobserved product attributes. Hence, it is no surprise that they play an important role in consumers' purchase decisions and it is to be expected that they might also play a role in extended warranty purchase decisions.

Brand knowledge accumulates in consumers' minds over time as they implicitly or explicitly experience the brand through exposure to its marketing activities or through product search, evaluation, or purchase (Brakus et al. 2009). This brand knowledge is the main antecedent to the creation of brand equity which can impact product market outcomes such as price premium

(Agarwal and Rao) and market share (Aaker 1991) as well as financial outcomes such as brand price in acquisitions (Mahajan et al. 1994).

Brand equity can be defined at the customer-, product-market or financial-market levels. Keller (1993) defines customer-based brand equity as "the differential effect of brand knowledge on consumer response to the marketing of the brand". According to this definition, consumers respond differently to brands based on their knowledge about those brands and this differential response leads to different product-market outcomes for brands. The differential impact of brand knowledge on product-market outcomes is indeed what we aim to understand about the role of brands in ESC purchase decisions. We are interested in understanding how consumer responses to ESC offerings are affected by their differential knowledge about brands. In order to investigate this relationship, we focus on understanding the impact of *brand equity* on consumers' ESC purchase decisions. Now, we will discuss drivers of demand for insurance products and relate them with brands' potential role in affecting the demand for extended warranties.

2.4.2 The role of brands on demand for ESCs

According to the insurance literature, the potential extent of loss has a strong impact on insurance product purchases (Zweifel and Eisen 2012). People are more likely to purchase insurance for assets that they consider to be of higher value. While the insurance literature is mainly concerned with monetary value, the marketing literature identifies other sources of value that can materialize for consumers in their purchase of products and services. At the product category level, Chen et al. (2009) identify the product category's hedonic position along the hedonic-utilitarian spectrum as one source of value. Brand equity comprises yet another source

of value beyond a product's monetary value. Consumers who purchase a product with high brand equity are likely to derive a value from the brand in addition to the utilitarian value the product affords them. This value can, for example, come from brand image, brand reliability or other positive associations in buyers' minds. If consumers do consider the brand value in their purchases, they might be more likely to purchase ESCs for brands with higher brand equity since product with better brands enjoy a higher total value. Imagine two people who are each buying a camera priced at $100. The camera that person A is buying carries a well-known brand while the camera that person B is buying is a no-name product. Although the branded product's price incorporates part of brand equity (i.e. in the form of a built-in premium over cost), the consumer does not consider the branded product as having the same value as the no-name product despite identical prices. It is not hard to imagine that person A might have a higher propensity to buy insurance for his camera while person B might be more reluctant to do so.[1] Such potentially differential behavior regarding ESC purchase for branded versus unbranded products can carry forward to products with different levels of brand equity. Hence, if a buyer perceives a higher value in a product with higher brand equity, an argument can be made for a potential positive effect of brand equity on ESC purchase likelihood for the product with higher brand equity; the combined monetary and brand value of the product will be relatively higher for a high-brand-equity product, which makes the buyer more likely to insure the purchase. We refer to this as the

[1] Some people might also be likely to purchase an ESC for the more risky choice in the same context. This is addressed in the 'reliability effect' argument in subsequent paragraphs.

value effect argument, which supports a positive impact of brand equity on ESC purchase decisions.[1]

In contrast to the previous argument favoring a positive overall effect of brand equity on ESC purchase decisions, another argument can be made that favors a potentially negative effect. According to the insurance literature, another determinant of demand for insurance products purchases besides the extent of loss is the probability of loss or in the case of ESCs, the probability of product failure. Product failure rates are directly related to perceived product quality and reliability. Pecht (2009) defines product reliability as "a measure of a product's ability to avoid failure". Zeithaml (1988) defines perceived product quality as "the consumer's judgement about a product's overall excellence or superiority". Most product quality and reliability information is unobserved to consumers and it has to be inferred from observed attributes.

Information about unobserved product attributes such as quality can in turn be conveyed through brands. For example, brands have been shown to signal product quality (Dawar and Parker 1994), even in brand extensions (Moorthy 2012; Wernerfelt 1988) and brand alliances (Rao et al. 1999). Montgomery and Wernerfelt (1992) show that brands can reduce the uncertainty associated with product quality. Higher brand equity has also been shown to be associated with lower levels of risk (Rego et al. 2009). The association between brand equity and product quality is such that Aaker (1991) recognizes perceived quality as one of the dimensions of brand equity.

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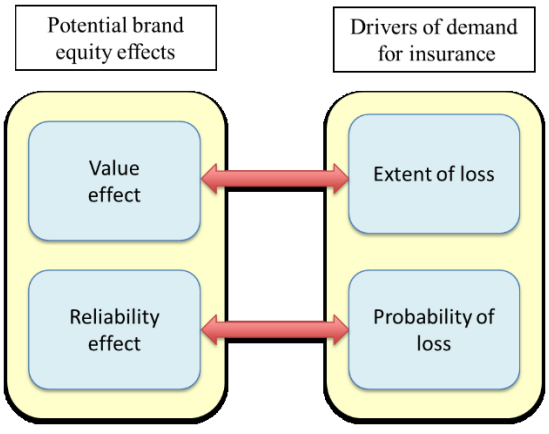
[1] Despite the intuitiveness of the value effect, we conducted a survey that provides evidence for heterogeneous brand valuations among US consumers for major TV brands in our scanner data (See Appendix 2-1.).

Consequently, it is safe to say that brands can alleviate consumers' uncertainty about unobserved product attributes and are likely to play a role in ESC purchase decisions. This effect would in turn modify consumers' perceptions of the probability of product failure and affect ESC purchase decisions. From this perspective, higher brand equity can have a negative effect on the purchase of extended service contracts for their respective products. We refer to this as the *reliability effect* argument.

The above theoretical accounts point towards the existence of two conflicting roles for brands in ESC purchase decisions. It is not readily clear which of these two forces might dominate the other one or whether they cancel each other out. However, it is possible to theorize the potential direction of the resultant of these two forces with some help from findings for insurance products.

As illustrated in Figure 2-1, the value effect and the reliability effect arguments, respectively, have a one-on-one correspondence with two drivers of demand for insurance products: the extent of loss, and the probability of loss.

Figure 2-1 Correspondence of value and reliability effects with insurance demand drivers



Findings on insurance products tend to provide stronger support for the role of potential extent of loss rather than the probability of loss on insurance purchases. For example, prior

research indicates that consumers might be unable to correctly estimate the probability of loss (Johnson et al. 1993), underestimate or overestimate it in some contexts (Zweifel and Eisen 2012) or entirely neglect it in some other contexts (Huysentruyt and Read 2010). If consumers are unable to correctly account for the probability of loss in their insurance purchase decisions, they might also be unable to incorporate the effect of brand equity on failure probability in their purchase decisions, which in turn reduces reliance on a brand's reliability effect. In addition, since product failure is generally a rare event, consumers might focus more heavily on what the potential loss is rather than whether the loss is likely to occur. These observations tip the balance in favor of the dominance of the value effect over the reliability effect.

Another argument that provides support for the domination of the value effect over the reliability effect can be derived from prospect theory and loss aversion. According to this theory, negative outcomes "loom larger" than positive outcomes (Kahneman and Tversky 1979). In other words, people's tendency to avoid losses is stronger than their tendency to acquire gains. If products are likely to fail despite their quality levels (i.e. potential negative outcome), information that supports the prevention of a negative outcome (i.e. the value effect of brand equity which encourages insuring the product) might be weighed more heavily than information that does not help to prevent such an outcome (i.e. the reliability effect of brand equity that discourages insuring the product).

A third argument can also be made favoring the value effect. Quality itself can be a source of value in the sense that people might perceive higher quality products as more valuable. The marketing literature provides some support for this relationship. For example, Dodds et al. (1991) and Sweeney et al. (1999) report a positive association between perceived product quality and perceived product value.

The above arguments point toward the domination of the value effect of brands over their reliability effect in ESC purchase decisions. Given the existing findings in support of the value effect, we predict brand equity to have an overall positive effect on ESC purchase likelihood which brings us to our first hypothesis:

H1: Brand equity has an overall positive effect on ESC purchase likelihood.

Hypotheses 1 predicts how brand equity might affect ESC purchase likelihood. If the above hypothesis is supported by the data, retailers can directly benefit from incorporating this information in their marketing mix decisions to influence demand for ESCs. In our next hypothesis, we will study the effect that retail stores play on ESC sales.

2.4.3 The role of retail stores on ESC purchase decisions

There's a saying in the insurance industry about insurance purchase decisions: "…life insurance is never bought; it is sold" (Knights and Morgan 1990). This saying points to the reluctance of the average consumer to actively pursue insurance products, which puts these offerings into the "unsought products" category and highlights the important role of salespeople in driving insurance sales. This may also be true for ESC purchase decisions which provide a type of insurance. In fact, the media report how retailers and manufacturers push extended warranty sales.[1] For example, Circuit City's ESC revenues dropped from 3.6% of total sales in 2002 to 3.3% in 2003. The company started a campaign in which employees were instructed to

[1] http://www.consumeraffairs.com/news04/2005/walmart_warranties.html

focus more intensely on selling ESCs. As a result of this campaign, ESCs rose to 4.1% of Circuit City's sales in 2004 (Business Week 2005).

To the best of our knowledge, no empirical study has tried to empirically document the significant effect that retailers might play on ESC purchase decisions. Retailer effects can result from salespeople training, sales push strategies, promotions or a combination of these elements. Our next hypothesis concerns the role of retailers on ESC purchase decisions. In order to study this effect, we define *ESC selling power* as "the ability of a store in selling ESCs" and operationalize it in subsequent sections.

H2: Stores' ESC selling power has a significant positive effect on buyers' propensity to purchase ESCs.

Testing hypothesis 2 will provide empirical evidence on the potential effect of store-specific effects on extended warranty sales.

2.4.4 Secondary hypotheses

Hypotheses H1 and H2 have been the main focus of this essay. However, in our attempt to test the above hypotheses, we developed and tested additional hypotheses for the relationships of other relevant factors with ESC purchase likelihood. To formalize findings related to these factors, and replicate or strengthen past findings, we propose and test them as our secondary hypotheses. In addition, we control for the effect of several variables on ESC purchase likelihood in our models, which will be described in this section.

2.4.4.1 Online versus in-store ESC purchases

Our next hypothesis concerns how consumers respond to ESC offers in an online versus offline environment. If hypothesis 2 is true, we would also expect a less strong or potentially a negative relationship between online transactions and ESC purchases. This is an indirect store effect where the absence of store-level push strategies, such as in-store advertising or persuasive appeals by salespeople, leads to a significantly lower propensity to purchase ESCs for online purchases. This leads to our third hypothesis:

H3: Consumers are significantly less likely to purchase ESCs for products purchased online versus offline.

Taken together, hypotheses 2 and 3 lend credence to the important role of store-level strategies in selling ESCs.

2.4.4.2 The role of product price on ESC purchase decisions

There is evidence in the literature that people are more likely to insure purchases involving a higher extent of loss; that is, more valuable belongings are more likely to be insured (Zweifel and Eisen 2012). This finding is the main justification for the existence of a value effect for brand equity. Intuitively, the extent of loss in the purchase of durable products is equal to or proportionate to the product's price. This leads us to expect that higher-priced products are more likely to induce ESC purchases due to their higher monetary value which in turn translates into higher replacement costs and higher extent of loss. We explore this relationship by testing our fourth hypothesis:

H4: People are more likely to purchase extended warranties for products with higher prices.

In addition to H1-H4, we also investigate the effect of several other important variables on ESC purchase decisions. These include the hedonic variable used in Chen et al. (2009), and the demographic variables age, sex, and income. Chen et al. (2009) show that people are more likely to buy extended warranties for hedonic product categories than utilitarian categories and we attempt to replicate their finding while controlling for this effect.

Previous findings indicate that females might be more likely to purchase insurance products as they are in general considered to have higher levels of risk aversion (Byrnes et al. 1999). Income has also been previously shown to have a negative effect on ESC purchases. Age can potentially have a positive effect on ESC purchases; people might become more risk averse as they age. Furthermore, in order to control for the effect of familiarity with electronic categories, we include a buyer's total purchase dollar value as a covariate. We also include brand sales to account for the possibility that brands with higher sales sell more ESCs. The squared product price is included for a potentially diminishing returns effect of price. Finally, we include ESC prices which are evidently expected to have a negative effect on ESC purchase likelihood.

According to the insurance literature, risk aversion is a major personal driver of insurance purchases. People who have purchased ESCs in the past have basically identified their type and belong to the segment of the market with higher risk aversion. Hence, these buyers should on average be more likely to purchase ESCs due to their type regardless of whether they have used an ESC in the past. To account for this effect, we also include the number of past ESCs

purchased in any product category prior to each product purchase, and normalize it by dividing to the number of products purchased prior to that occasion.[1]

In the next section, we explain our operationalization of the main variables of interest, namely brand equity and the stores' ESC selling power.

2.5 Operationalization of the main variables

The main focus of this essay is to understand the role of brand equity on ESC purchase likelihood. We use two data sources to test this relationship; a revealed preference scanner data set, and a stated choice market simulation data set. All hypothesized relationships are tested using the scanner data, but we mainly test the brand equity and product price effects with the stated choice data along with some relevant covariates.

2.5.1 Operationalizing brand equity in the scanner data

Brand equity can be measured in several ways. Customer-based brand equity measures can be formed from consumers' attitudes, associations, attachments, and loyalties toward a brand (Ailawadi et al. 2003; Keller 1993). Product-market measures can be derived from market outcomes, such as revenue premium (Ailawadi et al. 2003) and market share (Aaker 1996). Some researchers have also used what is referred to as "residual approaches". The basic assumption of these approaches is that *if* all determinants of brand choice including product attributes are accounted for in a brand choice model, the model residual would contain information on brand equity (Kamakura and Russell 1993). The nature of our scanner panel data

[1] Chen et al. (2009) use the weighted average of past ESC purchases to account for this effect in their model.

necessitates operationalizing brand equity via a product-market measure. Unfortunately our data do not have enough product attribute information to warrant the use of the above residual-based approaches. Our product attribute information is restricted to price and product category. However, another product-market measure, namely brand market share, can be calculated in our dataset. Aaker (1996) identifies brand market share as a summary measure of brand equity. Using market shares to develop a brand equity measure is not without precedent. For example, at the firm level, Simon and Sullivan (1993) extract the portion of market shares that can be attributed to brand equity and use it in developing a financial measure of brand equity. We use quarterly brand market shares to create our brand equity variable. Specifically, our brand equity measure for the scanner data consists of the residuals of the regression of lagged quarterly brand market shares on product prices and current-period quarterly brand sales. We will now discuss the suitability of creating our brand equity variable based on brand market shares, and the different steps taken to address potential issues.

Evidently, market share can also be affected by non-brand factors such as advertising share, price levels, and distribution coverage (Simon and Sullivan 1993). Prior research has documented the existence of a positive relationship between advertising share and brand equity (Yoo et al. 2000). In fact, top brands spend as much as 20% more than a runner-up brand on advertising. Hence, the impact of advertising share on market share does not pose a major problem to *brand market share*'s suitability as a basis for creating the brand equity variable, due to the positive correlation of advertising share with brand equity.

Nevertheless, market price levels and distribution issues can still affect market share by reducing its presumed correlation with brand equity. However, these problems can be minimized when market price levels and distribution coverage issues are accounted for (Aaker 1996).

Firstly, we control for product price in our model. Secondly, our data comes from one retailer's network of stores; since it is in the retailers' best interest to always have an inventory proporationate to a product's expected sales figures, it seems safe to assume that distribution-related factors may not have a major impact on brand market shares in our dataset, as the retailer presumably prevents distribution issues or distribution issues might be shared across stores. Calculating brand market shares on a quarterly basis also averages out potential inventory shocks. In addition, we control for store-specific factors that affect ESC sales in our models.

The above evidence and arguments suggest that brand market share could contain brand equity information. However, brand market share may not be directly used as a proxy for brand equity. We take the following steps to develop our brand equity variable.

First, we define quarterly brand market share as " the percentage of sales of a given brand in all product categories across all stores in each quarter". Calculating market shares across stores and product categories reduces local pricing or distribution influences on market shares by averaging out unobserved shocks, and the resulting variable is better able to capture the relatively more stable underlying brand equity.

Since market shares are affected by consumer purchases, our quarterly market share variable might suffer from endogeneity arising from simultaneity. Simultaneity is addressed by using the one-period lagged quarterly market share. In addition, lagged values are less likely to be influenced by current shocks, which is a desirable feature.

As the final step to create our brand equity variable, we regress lagged quarterly market shares on product prices and current-period quarterly brand sales count. Then we use the residuals of this regression as our brand equity measure. Regressing out product price and brand sales from lagged quarterly brand market shares produces a more reliable brand equity measure

that has a zero correlation with these two factors. As a result of these operations we create a residual-based brand equity measure for the scanner dataset.

2.5.2 Operationalizing brand equity in the stated-choice data

To test our main hypothesis, we also collect primary data on product and extended warranty choices in a simple online shopping task involving TV and camera purchases. As part of the post-purchase survey, we ask participants to respond to a 10-item consumer-based brand equity scale developed by Yoo and Donthu (2001). Brand equity scores are calculated for each person for the brands of the products they have chosen to buy. This second data set addresses potential concerns about the suitability of our residual-based brand equity measure described in the previous section and will be described and analyzed in the later sections of this essay.

2.5.3 Operationalizing ESC selling powr in the scanner data

To operationalize stores' ability to sell ESCs, or ESC selling power, we construct a variable in this manner: for each product category at each store, we define store ESC selling power as the percentage of products that were sold along with ESCs in all other product categories at that store. Finding a significant positive effect of this variable on ESC purchases would show that being good at selling ESCs in non-focal product categories positively affects ESC purchases in focal categories. Such a result would provide evidence for the existence of an overall store effect on ESC sales across all product categories.

In the next section, we will introduce our scanner dataset and provide detailed information about the variables.

2.6 Dataset I: scanner data

We use scanner data to test all hypotheses, and we also use stated choice data to test our main hypothesis on the effect of brand equity. We will describe the scanner data here, and the second dataset will be described later after the data collection procedure is explained.

Our scanner data come from the ISMS Durable Goods Dataset 1 (Ni et al. 2012) which includes transactions for a sample of households at a major U.S. electronics chain between December 1998 and November 2004. In the original dataset, each transaction including product purchases, ESC purchases, and discounts comprise a unique observational record. For each household, we match and combine related product and ESC purchases into one record.

After cleansing the data and excluding product categories for which no ESCs were sold, our dataset includes 54369 product purchase occasions of 74 brands in 30 main product categories at 629 retail locations by 17796 households. We call this dataset "dataset I". Each observation in dataset I pertains to a product purchase occasion by a household. In 21.1% of the cases, product purchases are accompanied by ESC purchases and 38.5% of the households have purchased at least one ESC during the 6-year period. For each observation, a dummy variable (called *ESC purchased*) indicates whether an ESC was purchased for the product in that purchase occasion. [1] We use this variable as the dependent variable in all models that use the scanner data. Table 2-1

[1] The original ISMS 1 data set does not clarify whether the term *"household"* refers to an individual within a household or not, e.g. the head of household who actually pays for purchases. However, we find this to be the more plausible case as compared to a situation where the purchases of several people within a household are recorded under the same household ID. Our data includes age, and income information for the head of the household which suggests that this interpretation may be justified. Hence, we will use the terms *buyer* and *household* interchangeably, to refer to a single individual, presumably the head of the household.

and Table 2-2 provide summary statistics on our dataset and some of the major variables used in our models.

Table 2-1 Summary statistics for non-categorical variables in dataset I

Variable	Mean	Std. Dev.	Min.	Max.
Brand equity[1]	-2.33×10^{-12}	0.05	-0.10	0.16
Store ESC selling power	0.19	0.06	0	0.83
ESC purchase ratio	0.16	0.30	0	1
Quarterly brand sales	247.34	374.50	1	1723
Hedonic score	-0.70	1.72	-3.97	3.25
Past purchase dollar sum	809.70	1466.88	0	32627
Product price	292.57	382.63	5.97	5759.99
ESC price[2]	63.08	68.07	2.99	960
Age	48.37	13.14	18	98

Table 2-2 Summary statistics for categorical variables in dataset I

Variable	No. of levels	0	1
ESC purchased (DV)	2	42890	11479
Online transaction dummy	2	53851	518
Sex dummy (male=1)[3]	2	18623	35746
Discounted Product	2	54050	319
Income	9	–	–
Stores	629	–	–
Households	17796	–	–
Brands	74	–	–
Main product categories	30	–	–
Product subcategories	80	–	–
Quarters	24	–	–

[1] Negative values for brand equity arise since its values come from the residuals of a regression.

[2] ESC prices for product purchases that did not accompany an ESC purchase, were calculated based on average ESC prices of each brand in each product category. For TV sets, these average prices were imputed for each TV brand in each screen size.

[3] Less than 15% of values for sex, income, and age were missing. Missing age values were imputed by the average age in the data. Missing sex and income values were imputed through a random sampling process that did not change the observed proportions of different levels within each variable. The latter two imputations are expected to add some white noise to these variables. Our results are robust regardless of these imputations.

Now, we will define the main explanatory variables introduced in the preceding tables. *ESC purchase ratio* is constructed as the percentage of a household's past purchases for which ESC was purchased. Income is coded from 1 to 9 where larger values indicate higher income. The actual income levels corresponding to these values are not known. Age refers to the age of the household head in increments of two years. Product and ESC price summaries are shown in their original scale in Table 2-1 and are in dollars. In our model, we divide all price variables by 1000. We also added a quadratic term for price due to its potentially non-linear effect. Product price will be mean-centered in our analyses to eliminate the multi-collinearity resulting from the inclusion of its quadratic term in the model.

Past purchase dollar sum is the the dollar sum of product purchases prior to the current purchase occasion for an individual. We use this variable as a rough proxy for knowledge about electronics products. This variable is also divided by 1000 in the model.

Discounted product is a dummy variable that equals 1 if the product being bought was discounted. *Quarterly brand sales* and *extended warranty price* were also normalized using a logarithmic transformation to remove their skewness.

In addition to the above variables, we also create a dummy variable to identify ESC decliners from potential ESC buyers. A substantial number of households have never purchased any ESCs. These households, which we label as "*ESC decliners*", comprise a segment of consumers in the market with presumably lower levels of risk aversion in their electronic purchases. This group might or might not employ alternative risk-reduction mechanisms and are unlikely to be significantly affected by marketing factors that affect ESC purchase decisions.

We classify households with at least two product and zero ESC purchases as ESC decliners. Consequently, we define "*potential ESC buyers"* are households that have either purchased at

least one ESC or have only purchased one product without buying an ESC for it.[1] This group is more likely to be affected by marketing activities and product characteristics in their ESC purchase decisions and might exhibit a different response to the factors we are studying in this essay. Table 2.3 summarizes the observations for these two groups.

Table 2-3 Summary statistics for decliners vs. potential buyers

Market segment	Percentage of households	Percentage of observations	Average income
Potential ESC buyers	66.3%	61.3%	5.95
ESC decliners	33.7%	38.7%	5.93

Table 2-4 shows the number of households with given product and ESC purchases in dataset I. The first column of data in this table shows the number of households who have never purchased an ESC comprising about 61.4% of the households. ESC decliners have been classified as those households in the pink column of Table 2-4 with more than one product purchase. In addition, we can see a trend in this table: as the number of product purchases increase, the likelihood of buying ESCs decreases. This can be the result of accumulated product knowledge and we account for this effect by including total expenditure[2] as a rough proxy for product knowledge.

The product categories in dataset I are shown in Table 2-5 along with their respective product and ESC sales figures. Some of these categories are further divided into smaller subcategories.

[1] Households with only one product purchase and no ESC purchase are classified as potential ESC buyers, since these households might not have had the opportunity to exhibit their type (i.e. potential buyer vs. ESC decliner).

[2] The variable is called 'past purchase dollar sum' in our models.

Our hedonic scores were calculated for those subcategories and we use the subcategories as a categorical independent variable in our models to account for category effects.[1]

Similar to Chen et al. (2009), we defined the *hedonic score* variable for the product sub-categories within dataset I based on the work of Okada (2005). We collected data from 155 US adult Amazon MTurk participants for this variable as part of the data collection described in Section 2.10.

Table 2-4 Number of households (HHs) with specific transaction counts in dataset I

		Number of ESC purchases												Total
		0	1	2	3	4	5	6	7	8	9	10	11	
Number of product purchases	1	5016	1624	0	0	0	0	0	0	0	0	0	0	6640
	2	2558	945	318	0	0	0	0	0	0	0	0	0	3821
	3	1377	694	253	115	0	0	0	0	0	0	0	0	2439
	4	750	415	196	108	28	0	0	0	0	0	0	0	1497
	5	458	277	174	86	36	17	0	0	0	0	0	0	1048
	6	298	183	111	61	26	16	5	0	0	0	0	0	700
	7	144	95	66	41	26	15	7	1	0	0	0	0	395
	8	110	81	47	33	23	14	6	1	1	0	0	0	316
	9	80	56	32	28	17	15	5	3	2	1	0	0	239
	10	49	38	25	22	8	9	6	3	1	1	0	0	162
	11	32	31	19	14	13	5	5	7	0	2	1	0	129
	12	21	18	14	12	6	7	3	9	0	2	1	0	93
	13	12	7	7	11	2	5	4	0	2	1	1	0	52
	14	15	9	5	7	7	5	3	7	2	0	0	0	60
	15	9	7	2	5	5	2	4	4	0	0	0	2	40
Total		10929	4480	1269	543	197	110	48	35	8	7	3	2	17631[2]

[1] The actual number of sub-categories used in the analyses is slightly more than the ones shown in Table 2-6, as we combined very similar sub-categories for data collection on the hedonic variable.

[2] 165 households had total transactions higher than 15 and are not shown in this table, but included in analyses.

Table 2-5 Major product categories with ESC sales in dataset I

Product category	Unit sales	ESCs sold	ESC sales ratio
Audio devices	8149	2079	0.26
Televisions	6611	1867	0.28
Video devices	6337	1185	0.19
Phones and faxes	4991	864	0.17
Computers and notebooks	4399	1537	0.35
Speakers and subwoofers	4132	831	0.20
Cameras and camcorders	3825	1107	0.29
Computer printers	3325	370	0.11
Computer monitors	2599	299	0.12
Networking	1697	153	0.09
DirecTV systems	1369	258	0.19
Electronic games	1356	220	0.16
Telecorders	639	122	0.19
Peripherals	582	22	0.04
Radios	568	81	0.14
Computer input devices	548	13	0.02
Headphones	526	18	0.03
Scanners	472	71	0.15
Universal remote controls	343	12	0.03
Auto power amplifiers	335	105	0.31
Ranges and microwave ovens	285	49	0.17
Automotive security	250	23	0.09
Refrigerators and freezers	221	74	0.33
Washers	194	25	0.13
Analog components	192	42	0.22
Dryers	176	25	0.14
FRS radios	149	15	0.10
Satellite dishes	117	26	0.22
Dishwashers	96	12	0.13
Calculators	17	2	0.12

Participants were asked to rate 52 product subcategories[1] within dataset I on both a hedonic and a utilitarian 8-point Likert scale anchored at the endpoints as 'not at all utilitarian/hedonic and extremely utilitarian/hedonic'. Hedonic products were defined as 'products whose consumption primarily involves aesthetic or sensual pleasure, fantasy, and fun. These products are fun, pleasant, or enjoyable.' Utilitarian products were defined as 'products whose consumption is more goal-oriented and accomplishes a functional or practical task. These products are useful, practical, or functional.' For each subcategory, we subtracted the mean utilitarian rating from the mean hedonic rating to arrive at the hedonic score for that subcategory. Table 2-6 includes the resulting scores for this variable.

Table 2-6 Hedonic score for product subcategories within dataset I

Product subcategory	Hedonic rating mean	Utilitarian rating mean	Hedonic rating S.E.	Utilitarian rating S.E.	Hedonic score
Auto CD player	4.55	3.09	0.17	0.17	1.45
Auto satellite radio	4.96	2.94	0.15	0.17	2.02
Camcorder	3.94	4.01	0.15	0.16	-0.07
CD boom box	4.85	2.57	0.17	0.17	2.27
CD player	4.53	3.28	0.16	0.17	1.26
Cell phone	4.25	5.59	0.16	0.13	-1.34
Computer monitor	2.92	5.45	0.18	0.13	-2.52
Computer printer	1.88	5.85	0.17	0.12	-3.97
Cordless phone	2.55	4.81	0.16	0.15	-2.26
Desktop computer	3.48	5.49	0.17	0.12	-2.01
Digital camera	4.16	4.60	0.15	0.15	-0.44
Electronic game consoles	5.98	2.74	0.12	0.18	3.25
Facsimiles	1.76	4.31	0.16	0.18	-2.54
Home phones	2.16	4.40	0.16	0.17	-2.24

[1] Some subcategories in the dataset had vague names and could not be clearly identified. For these subcategories, the average hedonic score of these 52 subcategories, i.e. -0.63, was imputed in the analyses. The imputed values comprised 4123 observations (7.5%) in dataset I.

Product subcategory	Hedonic rating mean	Utilitarian rating mean	Hedonic rating S.E.	Utilitarian rating S.E.	Hedonic score
Laptops	3.95	5.61	0.18	0.12	-1.65
Microwave ovens	2.05	5.59	0.16	0.14	-3.54
Mouse and keyboard	2.11	5.63	0.16	0.12	-3.52
PDA (Personal Digital Assistant)	2.54	3.95	0.17	0.17	-1.41
Portable audio player	4.70	3.31	0.15	0.17	1.39
Projection TV	5.05	2.82	0.17	0.17	2.22
Speakers	3.90	4.02	0.17	0.18	-0.12
Clock radios	2.21	4.19	0.16	0.18	-1.98
TV sets larger than 30"	5.46	3.35	0.15	0.17	2.11
TV sets smaller than 30"	3.12	3.29	0.17	0.18	-0.17
Woofer or subwoofer	4.64	2.50	0.18	0.18	2.14
Digital Video player/recorder	4.11	4.26	0.17	0.17	-0.14
Home VCR	3.48	3.47	0.19	0.19	0.01
Mini Component System	2.72	3.82	0.18	0.18	-1.10
DirecTV system	4.44	3.24	0.19	0.18	1.20
Internet and network hardware	3.18	5.49	0.20	0.15	-2.31
Audio visual receiver	3.19	4.13	0.18	0.17	-0.94
Telecorder (Phone conversation recorder)	2.15	4.47	0.17	0.17	-2.32
Headphones	4.05	4.36	0.17	0.17	-0.30
Scanner	2.24	5.14	0.16	0.15	-2.89
Universal remote control	3.20	4.79	0.19	0.15	-1.59
Auto power amplifier	2.80	3.84	0.19	0.18	-1.04
Auto security devices	1.48	5.28	0.15	0.16	-3.80
Cassette changer	2.29	3.37	0.19	0.20	-1.08
Answering machine	1.47	4.81	0.14	0.17	-3.34
Two-way radio	2.50	4.39	0.17	0.17	-1.88
Satellite dish	4.12	3.80	0.19	0.19	0.32

2.7 Methodology

We use four different model specifications to analyze the data and test our main hypotheses. The more complex models provide robustness checks for the simpler models and the different model specifications allow us to more rigorously test our hypotheses under the assumptions that each model implies. Although, we provide model comparison measures such as AIC and BIC

when available, this is not a model-fitting or predictive modeling attempt and our main interest does not lie in finding the best fitting model We expect the more complex models to provide checks and corroborate or disprove the findings of simpler models. In this section, we provide details on each of these methodologies, the rationale behind their usage, and the implications of their results.

2.7.1 Random intercept Logit and Probit models

Each observation in our data set pertains to a product purchase. We are interested in modeling whether for each of these product purchases an ESC was purchased or not. Hence, Our DV is a dummy variable indicating the ESC purchase or lack thereof. This data structure would suggest the use of a Logit choice model. However, since we are dealing with panel data, in many cases we observe several purchases by the same households, which suggests that the error terms in our Logit model might not be independent across observations. In fact, the response of each household could depend on a set of unobserved factors that vary from one household to another. To account for the correlated nature of error terms for households with more than one transaction, we allow each household to have a random intercept. This provision also accounts for potential unobserved heterogeneity in the data.

We later build a case for analyzing the data using a Heckman selection model as well. Since that model uses Probit sub-models, we also estimate a random intercept Probit model in order to be able to compare the change in coefficients across the models with and without sample selection.

2.7.2 Generalized estimating equations (GEE)

The Logit model with random intercepts provides us with individual specific effects. However, we are also interested in the population average effect of the relationships under study. Although these two effects can be equivalent in linear models, this may not be the case in non-linear models such as the Logit model. We can use a GEE model proposed by Liang and Zeger (1986) and Zeger and Liang (1986) to infer the population averaged effects for our variables of interest.

GEE is a semi-parametric extension of GLM to longitudinal data that uses quasi-likelihood estimation. In quasi-likelihood estimation, unlike likelihood estimation that requires us to specify the joint distribution of a subject's observations, only the relationship between the outcome mean and covariates, and the relationship between the outcome mean and variance need to be specified (Zeger and Liang 1986). GEE fits a marginal model by making the expected value of response conditional on fixed effects only. This is in contrast with random effect models where the expected value of response is conditional on both the fixed and random effects. In this model, the dependency of observations is accounted for by specifying an a priori correlation structure for observations. For estimation, GEE takes the residuals of a naïve regression and estimates a working correlation matrix that is used as a covariate to refit a new regression in an iterative process, thus accounting for the correlated nature of the data (For more details on GEE, the interested reader is referred to Agresti and Kateri (2011)).

For a GEE model with a Logit link function, the model specification takes the following form. Let y_{ij} denote the binary ESC purchase decision for person i on the jth purchase occasion, and

let $\mu_{ij} = E(y_{ij})$ represent the mean of these responses with the variance given for the binomial distribution as $v_{ij}(\mu_{ij}) = \mu_{ij}(1 - \mu_{ij})$.

The GEE model with a Logit link function for the mean responses is described by equation 2.1:

$$\ln\left(\frac{\mu_{ij}}{1-\mu_{ij}}\right) = x_{ij'}\beta \qquad \text{Equation 2.1}$$

The model also estimates a within-subject correlation of observations (α) which is assumed to be constant across subjects (i.e. an exchangeable correlation matrix for the responses). These correlations can also be allowed to vary across subjects. However, the covariance structure is often treated as nuisance in GEE models and the estimates produced by GEE for the coefficients β and their variances are consistent even when the covariance matrix is mis-specified (Zeger and Liang 1986). As a result, the constant correlation across observations is not restrictive. For the details of the quasi-likelihood estimation procedure of a GEE for binary outcome, the interested reader is referred to section 3 of Zeger and Liang (1986).

There is a clear relationship between the GEE and the GLM estimates. For the linear case where the response is Gaussian with an identity link the population-average and subject-specific estimates are the same when an exchangeable correlation matrix is specified for the GEE. In addition, Zeger et al. (1988) show the following relationship between the GEE and the random effects Logit estimates,

$$\beta_M = \left[\left(\frac{16\sqrt{3}}{15\pi}\right)^2 V + 1\right]^{-1/2} \beta_{RE} \qquad \text{Equation 2.2}$$

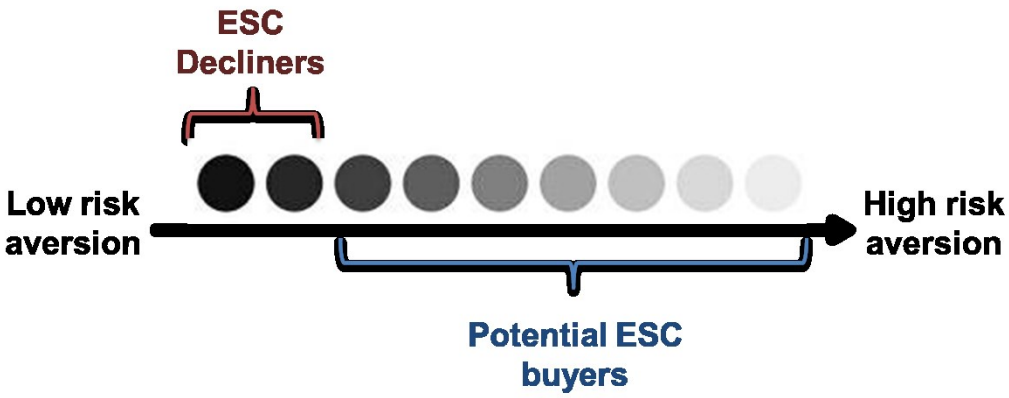
Where β_M represents the marginal estimates produced by GEE and β_{RE} refers to the random effects Logit estimates with V representing the variance of the random effects.

In sum, by averaging over the random individual effects, the GEE model provides estimates for our effects of interest at the population level.

2.7.3 Heckman Probit (Heckit model)

As shown in Table 2-3, about 33.7% of the households in our dataset have never purchased an ESC during the entire six-year observational period. It might be safe to assume that the market consists of two segments in terms of ESC buying behavior. One segment has a predisposition to avoid ESC purchases and is hardly affected by marketing variables in their ESC purchase decisions. We identify buyers with at least two product purchases who have declined ESC purchase offers in all purchase occasions as ESC decliners. The other segment, however, comprises a fraction of the market that consists of potential ESC buyers. People in this segment are not necessarily averse to ESC purchases and might have even purchased ESCs in the past.

Figure 2-2 Graphical depiction of the spectrum of risk aversion and ESC purchase behavior



Our data supports the existence of an ESC decliner segment (See Table 2-4). If a large fraction of buyers have a strong predisposition against ESC purchases, it is not reasonable to include their purchase data in a model which is studying the impact of some variables on ESC purchase likelihood. Their membership in the decliners' segment would perfectly predict their

response to ESC offerings. However, eliminating these households from our analysis would introduce a sample selection bias. In order to exclude the ESC decliner segment from analysis while preventing the sample selection bias and the resulting endogeneity, we also model our data using the Heckman Probit (Heckit) model. The Heckman Probit model allows us to study our hypotheses in the target population for ESCs, comprised of people with relatively higher risk or loss aversion levels. Since insurance decisions are partly driven by personal attitudes toward risk or loss, limiting our analysis to potential ESC buyers in the Heckit model would allow us to test our hypotheses within the actual members of the target market for ESCs, i.e. potential ESC buyers.

In addition, in the selection sub-model of the Heckit model, we allow brand equity to affect buyer type, i.e. whether people fall into the decliner or potential ESC buyer segments. This allows us to control for correlations between consumer type and brand equity; In other words, if relatively more risk aversive people (i.e., those who fall into the potential ESC buyer segment), also tend to buy higher brand equity brands, that relationship will be accounted for in the selection sub-model which allows us to measure the impact of brand equity on the extended warranty purchase after controlling for the possibility that more risk-averse buyers tend to buy better brands.

The Heckman Probit model is comprised of two Probit sub-models. One sub-model accounts for the selection process and determines whether a person belongs to the potential buyers vs. the decliners segment. The other sub-model accounts for the outcome or purchase decision. The errors for these two models are allowed to be correlated which allows the same set of unobserved factors to affect both segment membership and purchase decisions. A non-zero correlation will indicate that sample selection bias would exist if we were only to analyze the potential ESC

buyers by dropping the decliners and ignoring the selection process. Accounting for the correlation of unobserved factors that affect both segment membership and ESC purchase decisions enables us to measure unbiased estimates of the effects being studied within the 'potential ESC buyer' segment only.

The Heckman Probit sub-models are introduced in Equations 2.3 to 2.5. The dependent variable for person *i* in the selection sub-model is Z_i which takes the value of one if that person has been classified as a potential ESC buyer and zero otherwise. This variable is created based on the households' ESC purchase history in our data; for households with at least two product purchases and no ESC purchases we assign $Z_i = 0,$ and for the rest of households $Z_i = 1.$[1] Observations with $Z_i = 0$ are practically censored in the outcome sub-model.

The selection sub-model: $$\begin{cases} {Z^*}_i = {w'}_i\alpha + u_i \\ Z_i = \begin{cases} 0 & if\ \ {Z^*}_i \leq 0 \\ 1 & if\ \ {Z^*}_i > 0 \end{cases} \end{cases}$$ Equation 2.3

The outcome sub-model: $$\begin{cases} \begin{cases} {Y^*}_i = {x'}_i\beta + \varepsilon_i & if\ \ Z_i = 1 \\ Obs.excluded & if\ \ Z_i = 0 \end{cases} \\ Y_i = \begin{cases} 0 & if\ \ {Y^*}_i \leq 0 \\ 1 & if\ \ {Y^*}_i > 0 \end{cases} \end{cases}$$ Equation 2.4

Where $u, \varepsilon \sim BN\left[0, \begin{pmatrix} 1 & \rho \\ \rho & 1 \end{pmatrix}\right]$ Equation 2.5

The outcome sub-model specifies the decision whether to buy an ESC for a product or not. Y_i for each observation takes the value of one when an ESC is purchased for that observation and it is equal to zero otherwise. ${Z^*}_i$ and ${Y^*}_i$ are latent variables that are respectively defined as a

[1] Our results are robust to an alternative classification scheme where households with zero total ESC purchases are assigned the value of $Z_i = 0$.

linear-in-parameter combination of the explanatory variables in the selection and outcome sub-models. The model is calibrated using maximum simulated likelihood estimation.

In order for the Heckit model to be identified, some exclusion restrictions need to be applied. The vectors of variables X and W respectively driving the purchase and the selection processes can share several variables. However, some variables affecting the selection process should be excluded from the outcome sub-model and included in the selection sub-model for identification purposes. We use two demographic variables, namely age and sex, as our exclusion restrictions which are excluded from the outcome sub-model and included in the selection sub-model. The sets of X and W variables can easily be seen respectively in the Heckit outcome and Heckit selection sub-models in the estimation results provided in Table 2-7.

2.8 Results from the scanner data

As our main hypothesis, we study the effect of brand equity on the odds of purchasing an ESC for products in 30 main product categories using a sample of 17796 households. We also study the effect of a store's ESC-selling power on the odds of buying an ESC. The dependent variable in all models is a dummy variable (i.e. *ESC purchased)* which equals one when an ESC was purchased for a product and equals zero otherwise.

We test our hypotheses using three main model specifications and compare the results with a null Logit model that does not account for the correlated structure of responses for the same households.

In our first model, we use a mixed effects modeling approach and allow each household to have a random intercept in order to account for the potential correlations among the observations for each household, thus accounting for unobserved heterogeneity.[1]

In the second analysis, we investigate the same relationships at a population level. Using the GEE approach allows us to average over random effects across individuals and test whether our relationships hold at a population level. Interdependencies of the observations for each individual is accounted for by a within-subject correlation coefficient that is assumed to be constant across individuals.

In our third analysis, we recognize the existence of an ESC decliner segment and focus our analysis on the potential ESC buyers segment to test our hypotheses within this segment who comprise the target population for ESCs. We account for the endogeneity resulting from the sample selection process by allowing the unobserved factors governing the segment membership and purchase decisions to be correlated.

In addition to the above models, we analyzed a random effects Probit model, and a GEE with a Probit link model, to facilitate comparison of the effects with the Heckit model that uses Probit sub-models.

In order to control for product category effects, we include 80 product subcategory dummies in all estimated models. We also include 23 "fiscal quarter" dummies representing each quarter in our data to control for temporal effects.

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[1] Random intercept and slope models did not improve model fit over the random intercept models and have not been retained.

Table 2-7 summarizes our estimation results for all models. However, the "fiscal quarter" and product subcategory dummies are not displayed here due to space restrictions. The full results for each individual model are displayed in Appendix 2-4 and include all these suppressed fixed effects.

2.8.1 Model fit and comparison

In this paper, we aimed to test our hypotheses using different model specifications that take different perspectives on some of the underlying behavioral assumptions. Although, we are not looking for the best fitting model, a comparison of these models would be useful. However, before we compare these models, a discussion of model fit is in order.

All tested models were significant in terms of overall model fit. However, we further scrutinize the fit of our simplest model, namely the standard Logit model.

Our standard Logit model passes the Pearson Chi-square Goodness of Fit test (Chi^2 (54244) = 52911, p-value = 1.00). However, this test produces unreliable results when the Logit model includes continuous variables (Hosmer Jr and Lemeshow 2004). The Hosmer-Lemeshow Goodness of Fit test has been developed to address this issue. However, our standard Logit model does not seem to pass the Hosmer-Lemeshow GOF test with 10 prediction groups (Hosmer-Lemeshow GOF Chi^2 (8) = 131.3, p-value = .00). This is because the Hosmer-Lemeshow test is highly sensitive to deviations from perfect fit when sample size is large. Using simulation studies, Kramer and Zimmerman (2007) show that this test rejects the fit of models with more than 50000 observations in 100% of the cases. Our dataset has 54369 observations. As a result, both of the above goodness of fit measures seem inappropriate for our model.

Table 2-7 Estimation results for scanner data

Explanatory variables (Hypothesis #)	Standard Logit (S.E.)	Random Intercept Logit (Robust S.E.)	GEE with Logit link (Robust S.E.)	Random Intercept Probit (Robust S.E.)	GEE with Probit link (Robust S.E.)	Heckit Outcome (Robust S.E.)	Heckit Selection (Robust S.E.)
Intercept	-6.68*** (0.34)	-7.33*** (0.41)	-5.97*** (0.33)	-4.1*** (0.22)	-3.34*** (0.17)	-3.52*** (0.2)	-1.67*** (0.18)
Hedonic score	0.42*** (0.06)	0.62*** (0.08)	0.48*** (0.06)	0.35*** (0.04)	0.27*** (0.03)	0.24*** (0.04)	-0.06 (0.05)
Log of Extended warranty price (1000 dollars)	-1.74*** (0.04)	-2.05*** (0.05)	-1.66*** (0.04)	-1.13*** (0.03)	-0.9*** (0.02)	-0.97*** (0.03)	-0.44*** (0.03)
Product price (1000 dollars) (H4)	1.41*** (0.06)	1.78*** (0.08)	1.33*** (0.06)	1.01*** (0.04)	0.79*** (0.03)	0.94*** (0.05)	0.41*** (0.045)
Squared product price (1000 dollars)	-0.27*** (0.01)	-0.33*** (0.01)	-0.26*** (0.01)	-0.19*** (0.01)	-0.15*** (0.01)	-0.16*** (0.01)	-0.05*** (0.004)
Quarterly brand sales	0.05*** (0.02)	0.05*** (0.02)	0.05*** (0.01)	0.03** (0.01)	0.02*** (0.01)	0.02** (0.01)	0.01 (0.01)
Brand equity (H1)	1.82*** (0.39)	2.22*** (0.49)	1.73*** (0.38)	1.22*** (0.28)	0.96*** (0.22)	1.1*** (0.26)	0.77*** (0.27)
Store ESC selling power (H2)	2.00*** (0.18)	1.15*** (0.27)	1.14*** (0.21)	0.65*** (0.15)	0.65*** (0.12)	1.02*** (0.13)	1.01*** (0.19)
Past purchase dollar sum (1000 dollars)	-0.07*** (0.01)	-0.06*** (0.01)	-0.08*** (0.01)	-0.04*** (0.01)	-0.04*** (0.01)	-0.05*** (0.01)	-0.2*** (0.05)
Online transaction (H3)	-1.58*** (0.26)	-2.18*** (0.3)	-1.72*** (0.25)	-1.18*** (0.15)	-0.9*** (0.12)	-0.96*** (0.15)	0.19** (0.09)
ESC purchase ratio	1.45*** (0.04)	0.09 (0.07)	0.32*** (0.04)	0.06 (0.04)	0.18*** (0.02)	0.62*** (0.04)	293.88*** (15.93)
Discounted product	-0.04 (0.14)	-0.05 (0.18)	-0.02 (0.14)	-0.03 (0.1)	-0.004 (0.08)	-0.03 (0.1)	-0.03 (0.09)
Sex(male=1)	-0.16*** (0.02)	-0.23*** (0.04)	-0.18*** (0.03)	-0.13*** (0.02)	-0.1*** (0.02)	-	-0.047* (0.027)
Age	0.004*** (0.001)	0.01*** (0.001)	0.004*** (0.001)	0.004*** (0.001)	0.003*** (0.001)	-	0.002** (0.001)
Income (base= level 1)							
Income level 2	-0.07 (0.08)	-0.09 (0.12)	-0.03 (0.09)	-0.05 (0.07)	-0.03 (0.05)	-0.04 (0.05)	-0.05 (0.08)
Income level 3	-0.11* (0.06)	-0.15 (0.09)	-0.1 (0.07)	-0.08 (0.05)	-0.07* (0.04)	-0.08** (0.04)	0.01 (0.06)
Income level 4	-0.11* (0.06)	-0.15* (0.09)	-0.1 (0.07)	-0.08* (0.05)	-0.07* (0.04)	-0.09** (0.04)	0.04 (0.06)
Income level 5	-0.12** (0.06)	-0.17* (0.09)	-0.11* (0.07)	-0.09* (0.05)	-0.07* (0.04)	-0.1** (0.04)	0.05 (0.06)

Explanatory variables (Hypothesis #)	Standard Logit (S.E.)	Random Intercept Logit (Robust S.E.)	GEE with Logit link (Robust S.E.)	Random Intercept Probit (Robust S.E.)	GEE with Probit link (Robust S.E.)	Heckit Outcome (Robust S.E.)	Heckit Selection (Robust S.E.)
Income level 6	-0.19*** (0.05)	-0.3*** (0.08)	-0.21*** (0.06)	-0.17*** (0.04)	-0.13*** (0.03)	-0.14*** (0.04)	0.01 (0.05)
Income level 7	-0.29*** (0.05)	-0.45*** (0.08)	-0.32*** (0.06)	-0.25*** (0.05)	-0.2*** (0.03)	-0.2*** (0.04)	-0.04 (0.05)
Income level 8	-0.31*** (0.06)	-0.42*** (0.09)	-0.31*** (0.07)	-0.23*** (0.05)	-0.18*** (0.04)	-0.19*** (0.04)	-0.1* (0.06)
Income level 9	-0.37*** (0.05)	-0.57*** (0.08)	-0.43*** (0.06)	-0.32*** (0.05)	-0.25*** (0.04)	-0.23*** (0.04)	-0.08 (0.05)
Model parameters / statistics							
Intraclass correlation (ICC)	-	0.39*** (0.02)	-	0.39*** (0.01)	-	-	
σ^2(Variance of random intercepts)	-	2.08*** (0.13)	-	0.65*** (0.04)	-	-	
α (within-subject corr.)	-	-	0.166*** (0.008)	-	0.167*** (0.01)	-	
ρ (corr. of errors)	-	-	-	-	-	0.60*** (0.03)	
Log likelihood	-23486	-22999	-	-23001	-	-42268++	
AIC	47221	46248	49227+	46253	49170+	85030	
BIC	48325	47361	-	47366	-	87230	
McFadden's R^2 (Adjusted)	0.1619 (0.1574)	0.1793 (0.1785)	-	0.1792 (0.1784)	-	-	
Overall model fit	LR Chi2(123)=9076 p-value =.00	Wald Chi2(123)= 4596 p-value=.00	Wald Chi2(123)= 5383 p-value=.00	Wald Chi2(123)= 4999 p-value=.00	Wald Chi2(123)= 5801 p-value=.00	Wald Chi2(121)= 5384 p-value=.00	

Significance codes: <0.01 '***'; <0.05 '**'; <0.1 '*'

Time effects (quarters) and product category fixed effects are also part of the above models but have been suppressed in this table. The full models can be found in the Appendices.

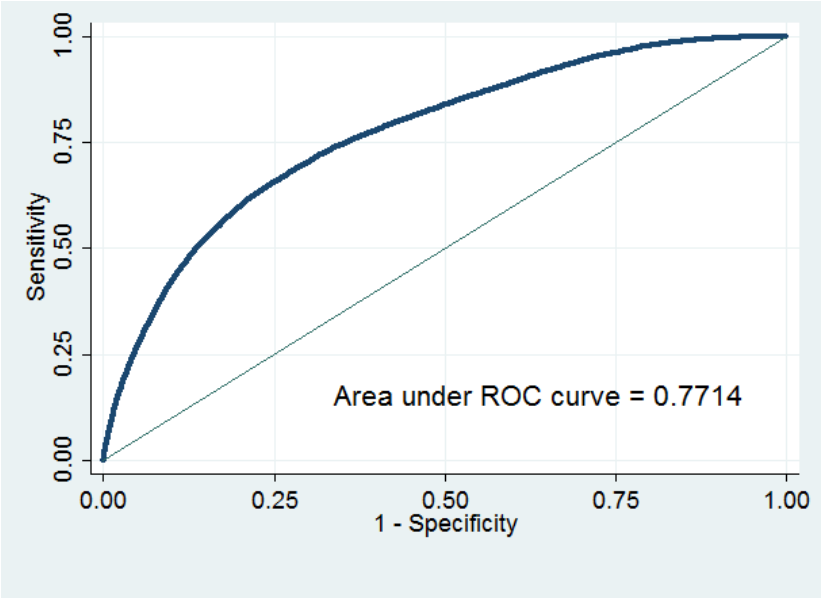
+ Quasi-AIC (QIC: For GEE models, there is no log likelihood function, hence no AIC or BIC).

++ Log Pseudo-Likelihood

One substitute to goodness of fit measures for Logit models is to calculate the hit rate from a classification table of predicted vs observed events and non-events (DV=1 is an event, and DV=0 is a non-event). Hit rate can be defined as the percentage of observations correctly predicted for a model. The hit rate for our standard Logit model with a conventional cut-off predicted probability of 0.5 is 0.805, which is comparable to hit rates reported in the literature (e.g. See (Chen et al. 2009).

However, according to Hosmer Jr and Lemeshow (2004), we can find a more complete description of the model's classification accuracy by calculating the area under the model's ROC curve (Receiver Operating Characteristic). This area ranges from zero to one, and "provides a measure of the model's ability to discriminate between those subjects who experience the outcome of interest versus those who do not."(Hosmer Jr and Lemeshow 2004).

Figure 2-3 The ROC curve for the standard Logit model



The ROC curve for our standard Logit model is displayed in Figure 2-3. In this figure, sensitivity refers to the correctly-predicted percentage of non-events, and specificity is the correctly-predicted percentage of events. According to Hosmer Jr and Lemeshow (2004), when the ROC area falls between 0.7 and 0.8, the model has acceptable discrimination power. The Area under the ROC curve for our standard Logit model is 0.77. In addition, the model's McFadden's R-squared value equals 0.16 which is close to reported numbers in the literature with similar datasets.

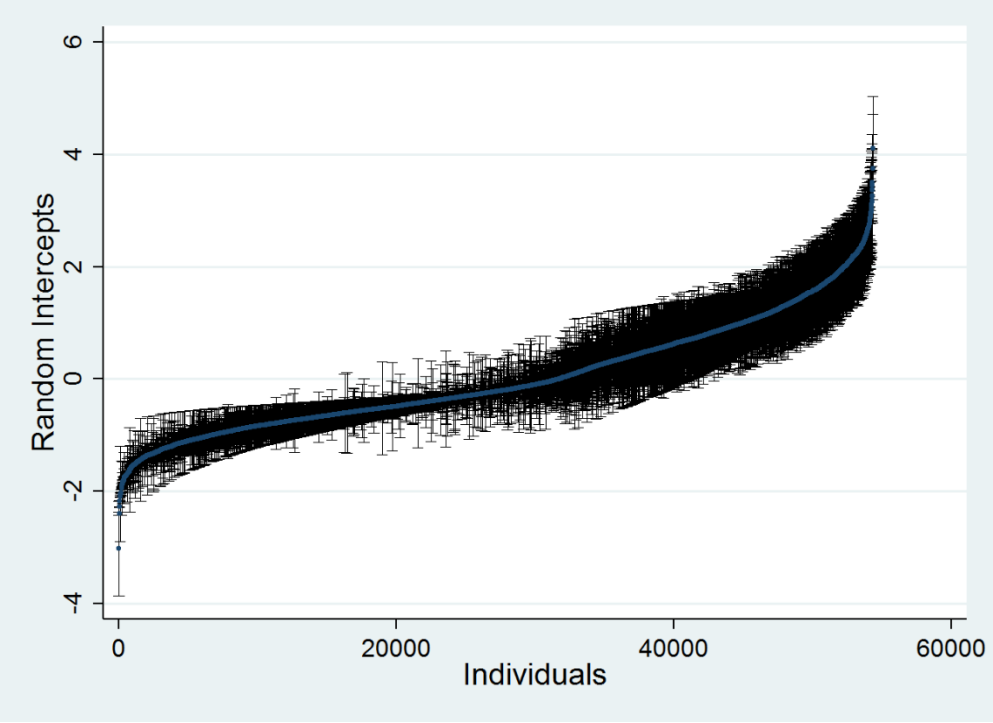
The above discussion shows that the standard Logit model has an acceptable fit with the data. Our model comparisons which follow show that the more complex models improve upon this fit and represent the data better.

For the purpose of model comparison, we are able to calculate the Akaike's Information Criterion (AIC) and Bayesian Information Criterion (BIC) for all models except for the GEE. For the GEE model we can use an equivalent to AIC, called Quasi-AIC (QIC), proposed by Pan (2001). AIC and BIC can be easily used within the same group of models for model comparison purposes. However, there is disagreement on the appropriateness of using AIC across non-nested models; for example, using AIC to compare a Heckit model with a Logit may not be appropriate. AIC depends on Log Likelihood values which might be calculated using a different normalizing constant in non-nested models. Perhaps more importantly, two Probit sub-models are estimated in the Heckit model, which makes it difficult to compare this model's fit with the other models.

The comparison of AIC and BIC values of the Logit and the random intercept Logit model indicates that a random intercept model provides a better fit than a standard Logit model. Hence, accounting for unobserved heterogeneity and the correlated responses of the same households is warranted.

The caterpillar plot in Figure 2-4 shows the distribution of the random intercepts for the random intercept Logit model. The blue line represents the conditional modes along with their error bars. The plot demonstrates that the random household intercepts are significantly different from zero for a sizable number of households.

Figure 2-4 Caterpillar plot for random household intercepts



The Logit and Probit versions of the random intercept models contain the same information and merely use different error distributions and are scaled differently. The effect sizes from the random-intercept Probit model are smaller than the effect sizes from the random intercept Logit model by a scaling constant which is to be expected. We merely estimated the Probit and Probit-link models to facilitate comparison of the results with the Heckit model that uses Probit links in its sub-models.

The GEE model allows for the dependency between observations by allowing for a within-subject correlation that is assumed to be constant across households. This correlation, denoted by α, is non-zero (0.167 for GEE with a Probit Link) and has an expected positive sign indicating the existence of shared unobserved factors that affect a household's decisions.

Our Heckit model accounts for the existence of a sample selection bias when we only consider potential ESC buyers as our main sample and ignore ESC decliners. This model accounts for the exclusion of ESC decliners in our analysis by correlating the effect of unobserved factors across its selection and outcome sub-models. This correlation is highly significant and positive (ρ=0.60). This result indicates that some similar unobserved factors drive both the selection and the outcome process which justifies the use of Heckman correction. The Heckit model shows considerably higher AIC values than the other models. This difference is due to the large structural difference between the Heckit and other models and the fact that the Heckit model uses estimates two sub-models. As a result, AIC or BIC values cannot be used to compare the Heckit model with the other models. However, the Heckit model allows us to investigate the relationships of interest within potential ESC buyers by excluding "ESC decliners" and controlling for sample selection effects.

The estimated GEE models are also informative. Although we cannot directly compare them with the other models using the calculated information criteria, the GEE models allow us to test our hypotheses at the population level.

The results from the GEE and Heckit models provide additional insights and support for our hypotheses. Now, we focus our attention to reviewing the individual effects in our estimation results and their implications for our hypotheses.

2.8.2 Discussion of results

We use *ESC purchased* as the dependent variable in all our models. This variable equals one if an ESC was purchased for a product and equals zero otherwise. Our first hypothesis predicts an overall positive effect of brand equity on ESC purchase likelihood. We operationalize brand equity as the residuals from the regression of lagged quarterly brand shares on product prices and current-period total brand sales. As shown in Table 2-7, the effect of brand equity on ESC purchase likelihood is highly significant and positive across all models. Both simple and random effects Logit models indicate a strong positive relationship for brand equity on ESC purchase likelihood at the individual level. The population averaged effect for this variable from the GEE models are also significant with comparable effect sizes.

The Heckit model also confirms the above result. It is to be noted that the dependent variable in the selection sub-model of the Heckit is *potential ESC buyer.* This variable equals one if a person has been categorized as a *potential ESC buyer*, and equals zero if a person has been categorized as an *ESC decliner* (See section 2.6 for definitions of these segments). The effect of brand equity on ESC purchase likelihood is somewhat smaller in the Heckit model than in the other models. This is partly due to the fact that this variable also has a strong effect on whether people fall into the *potential ESC buyer vs. decliner* groups, as demonstrated by the significant positive effect of brand equity in the selection sub-model. The effect of ESC purchase ratio is noticeably large in the Heckit selection sub-model. This is due to the fact that classification of households into potential ESC buyers and decliners is determined by their past ESC purchases. Results from the Heckit model show that the brand equity effect on ESC purchase decisions within the potential ESC buyer segment is significant and positive.

Comparing the effect of brand equity in either of the two GEE models with their counterpart random intercept model also shows that the effect size is relatively smaller at the population level vis-à-vis the individual level. This is to be expected as a sizeable segment of households decline extended warranty offers.

The above findings confirms the dominance of the value dimension of brand equity over its reliability/quality dimension in affecting extended warranty purchases, and provides evidence in support of our main hypothesis (H1).

The results across all models also confirm our second hypothesis (H2) that predicts a positive effect of store ESC selling power on an individual's ESC purchase likelihood. The odds ratio of buying an ESC for a product within a focal category is significantly affected by a store's overall ability to sell ESCs in non-focal categories. This result suggests that a stronger marketing or sales push at some stores is having an overall effect on ESC sales across all categories. This result holds at both the individual and the population level as confirmed by the GEE model.

The results also confirm our hypothesis regarding online ESC purchases (H3). Online purchases are less likely to lead to ESC purchases. This finding could be partly due to the lack of store push strategies and sales tactics in an online shopping environment. It could also be due to a self-selection effect that people who buy online might belong to the less risk averse segment of the population.

In addition, the effect of the online transaction in the Heckman selection model is positive. This result seemingly means that online transactions are more likely to lead to a classification of 'potential ESC buyer' as opposed to 'ESC decliner'. However, this may not be the case due to the way we classified buyers. In our dataset, classification into the potential ESC buyer vs. decliner segments is based on both online and offline ESC purchases. It could be that people who

have been classified as 'potential ESC buyers' because of their offline ESC purchases, also have online purchases, and the observed positive association between online transactions and membership in the ESC buyer segment is indeed coming from these buyers' offline ESC purchases.

Our fourth hypothesis (H4) on the effect of product price on ESC purchase likelihood is also confirmed across all models. As far as product value goes, monetary value most often comes first. Our findings confirm that a product's price is a major determinant of ESC purchases.

Similar to findings in the insurance literature, we find that people are more likely to buy ESCs for higher-priced products. A product's monetary value comprises an important source of value that needs to be insured and people are more likely to purchase an ESC for products with higher prices. This effect is also directly related to a product's replacement cost, as products with higher prices have higher replacement costs as well. Our result does not contradict the finding in Chen et al. (2009) regarding the negative effect of relative product prices on the perceived probability of failure. These researchers defined and used relative price in their formulation as the price of a product "relative to the average price of all products within its category". In their formulation, relative prices (or price premiums) signal product reliability and can have a negative effect on ESC purchase likelihood.

We now turn our attention to discussing the effects of other included covariates on ESC purchase likelihood. The effect of past ESC purchases, as captured by *ESC purchase ratio*, on subsequent ESC purchases is confirmed across all models, except the random intercept models and we will discuss this exception shortly. Nevertheless, Past ESC purchases seem to have a substantial effect on ESC purchases. Past ESC purchases are an indicator of a person's *type* which persists across product purchases (i.e. high- vs. low- risk aversion). People who have

purchased ESCs in the past can be categorized as strong potential candidates for future ESC purposes. It is noteworthy that this effect loses its significance in our random intercept models. Interestingly, in the random intercept model the effect of past ESC purchases, or a person's *type* seem to be explained out by the individual-specific random intercepts. This means that controlling for unobserved individual differences, this factor does not affect ESC purchase decisions which is not surprising.

The significant negative effect size for the quadratic term of product price indicates that the effect of product price on ESC purchase likelihood slightly diminishes as price increases. We also find a significant negative effect of ESC prices on ESC purchase likelihood which is evidently expected.

The hedonic category score variable, which was conceptually borrowed from (Chen et al. 2009), has the expected positive effect. Despite controlling for product category effects through subcategory dummies in the model, the result for this variable shows that people are more likely to buy warranties for the hedonic product categories. Interestingly, this effect loses its significance in the Heckit selection sub-model. This is an acceptable finding as the characteristics of the product categories are not necessarily expected to affect whether people can be categorized as an ESC buyer or a decliner. We also tested for an interaction effect between the brand equity and the hedonic score variables to see if the effect of brand equity changed based on the hedonic-ness of a product category. This interaction term was insignificant across all models and was excluded in subsequent analyses.

We also find a positive effect for quarterly brand sales on ESC purchase likelihood. Product brands that sell more are more likely to have more extended warranties sold. Past purchase dollar sum also has a negative association with ESC purchase likelihood. As conceptualized, this could

mean that people who have more experience with electronic products as demonstrated by their past spending in this category, are less likely to buy extended warranties. We do not find any effect for product discounts and this factor is insignificant across all models. This is perhaps a weakness in our dataset that includes very few discounted sales.

We also find a very small yet positive effect for age and a negative effect for sex (male=1) as expected. All models indicate that going from female to male decreases the odds of purchasing an ESC. As described previously, this effect could be due to higher levels of risk aversion among female buyers. This effect could also be partly attributed to the differential impact of persuasive sales tactics on female versus male buyers. Nevertheless, the observed effect for sex should be received with caution as many purchase decisions may be made as a family or by the female member of a family, and only recorded as male in our dataset because the male member made the payment. In such cases, we might be assigning a lower ESC non-purchase incidence to females which causes a bias in our estimate of the parameter for sex.

Income has been included as a categorical variable in the model and higher income levels have a significant negative effect on ESC purchases as compared to the lowest income level. Higher income people might be less risk averse, or the potential losses incurred in case of product failure might have a less significant financial impact on them. Including income as an interval-scaled variable instead of a categorical variable produces a significant negative effect as well. These results replicates prior findings on the negative effect of income on ESC purchase likelihood.

In sum, results from analyzing the scanner data support our four hypotheses. Moreover, the effects of included covariates are in line with our expectations and replicate prior research findings. To further test our main hypothesis, we conduct an additional study in which we

directly measure brand equity. In the next sections, we will provide the details of this study and its results.

2.9 Market simulation study

In our scanner data analysis, we were not able to directly observe brand equity levels. To address this issue, we conducted a simple online stated choice survey in which we measured brand equity directly and assessed its impact on extended warranty purchases. To directly measure brand equity, we used the 10-item consumer based brand equity scale developed by Yoo and Donthu (2001). A Screenshot of the implementation of this scale in the survey can be found in Appendix 2-3. The following sections provide the details and results of this study.

2.9.1 Procedures and design

In this study, we mimic a simple online electronics market for two product categories: Television sets, and cameras. Data collection was conducted on Amazon MTurk. Adult respondents from the US were allowed to participate in the study.

Participants are asked to choose and buy one product from each of the two categories. To mitigate potential order effects, the presentation order of the two categories is counter-balanced so that half of the participants see the television choice task first and the remaining half see the camera choice task first. A list of products from each category is provided to participants (35 Televisions from 7 brands, and 33 cameras from 7 brands)[1]. The Television sets vary on the four

[1] The TV brands were: LG, HiSense, Philips, Samsung, Sony, Viewsonic, Vizio, and the camera brands were: Canon, Nikon, FujiFilm, Olympus, Panasonic, Vivitar, and Sony.

dimensions of brand, price, screen size, and resolution. The cameras vary on five dimensions: brand, price, resolution, optical zoom, movie quality, and built-in wifi. The chosen attributes are similar to the same summary product attributes offered on www.bestbuy.com. The brands and price points were also chosen to mimic the offerings on this website. Respondents are also able to sort the table of products by clicking each product attribute name in the table and find the product that best matches their needs or wants.

After choosing their first product, the participant goes to the next screen where they see the product they have chosen. On this page, they are informed of the existence of a three-year extended warranty for the purchased product for a given price, and the warranty is offered to them. The respondents can choose yes or no, and are directed to a choice task from the second product category that is also followed by an extended warranty offer. Upon completion of these two product and extended warranty choice tasks, participants are asked to take a survey. Part of this survey includes a 10-item scale that measures consumer-based brand equity for the brands that they have chosen in their television and camera purchases.

Since brand equity cannot be directly manipulated in our simulated market, we rely on existing random variations of perceived brand equity among respondents.

For product price points, we chose price points that correspond to the prices of similar products on bestbuy.com, but slightly varied them for each respondent to allow a wider range of prices within each brand of products across respondents. In addition, we jittered prices that are displayeed to each respondent randomly above the initial price points: For the TV sets, a randomly chosen number from (0,1,2,3) multiplied by $50, was added to all product prices of the same brand. For the cameras, a randomly chosen number from (0,1,2,3) multiplied by ($10, $15, or $20 depending on the brand) was added to the base price for each brand. The smaller

multiples are applied to the less expensive brands of cameras to jitter prices without significantly disturbing the observed relative market prices across brands.

For each respondent, we allowed the price of extended warranties to be randomly determined by multiplying the chosen product's price by a random percentage from the (0.11,0.175) range. Since a sizeable segment of buyers in the market decline extended warranty offerings, we allowed lower extended warranty prices than seen in the market to encourage more warranty purchases. A summary of the resulting data is presented in the next section. Appendix 2-2 includes sample screenshots of the TV and camera choice screens.

2.10 Dataset II: Stated choice data

A total of 512 people participated in this study. Observations for 30 respondents were dropped due to low quality concerns.[1] The data for 482 participants was eventually used in analysis.

Analyses of the data in each product category separately showed that non-price product attributes did not have a significant effect on ESC purchase likelihood. Hence, we combined the data from the two categories into a single dataset that we call dataset II, and added a dummy variable called TV, to distinguish TV purchases from camera purchases. Table 2-8 includes summary statistic for this dataset.

[1] Of these, thirteen people had done the task very quickly (in less than three minutes), and the remaining had provided unrealistic answers to two survey questions. Our results are not sensitive to these exclusions.

Table 2-8 Summary statistics for non-categorical variables in dataset II

Variable	Mean	Std. Dev.	Min.	Max.
Consumer-based brand equity[1]	3.45	0.61	1.23	4.77
Product price	602.19	493.63	30	1850
Extended warranty price	86.18	72.50	4	324
Reference warranty price[2]	115.96	68.74	20	600
Do-it-yourselfer[3]	3.65	1.14	1	5

Table 2-9 Summary statistics for categorical variables in dataset II

Variable	No. of levels	0	1
ESC purchased (DV)	2	560	404
Past warranty purchase dummy	2	390	574
Buyer's sex dummy (male=1)	2	480	484
TV	2	482	482
Participants	482	–	–
Brands	13	–	–
Age	5	–	–
Income	4	–	–

2.11 Results from stated choice data

Following the methods used in our analysis of dataset I, we used simple and random intercept Logit as well as a GEE model with a Logit link function to analyze this dataset. We used *ESC purchased* as our dependent variable, which equals one if an ESC was purchased for a product and equals zero otherwise. The results are presented in Table 2-10.

[1] Measured on a 5-point Likert scale

[2] Respondents were asked to tell how much they thought local electronic stores might charge for a three-year extended warranty for a $1000 product.

[3] 5-point Likert scale; Agreement/Disagreement with the statement "When an electronic device stops working, I first attempt to fix it myself."

Table 2-10 Estimation results of dataset II

Explanatory variables	Standard Logit (S.E.)	Random Intercept Logit (Robust S.E.)	GEE with Logit link (Robust S.E.)
Extended warranty price	-1.62**	-2.37**	-1.49**
	(0.56)	(0.83)	(0.53)
Product price (1000 dollars)	1.17**	1.59 *	1.00*
	(0.57)	(0.85)	(0.54)
Consumer-based brand equity (CBE)	0.35**	0.47**	0.31**
	(0.14)	(0.22)	(0.14)
Past warranty purchase	1.66***	2.63***	1.66***
	(0.16)	(0.35)	(0.19)
Reference price	0.001	0.001	0.001
	(0.001)	(0.002)	(0.001)
Do-it-yourselfer	-0.14**	-0.23*	-0.14*
	(0.07)	(0.13)	(0.08)
TV	-0.17	-0.20	-0.13
	(0.22)	(0.33)	(0.21)
Sex(male=1)	-0.55***	-0.82***	-0.54***
	(0.15)	(0.29)	(0.18)
Income (reference: $0 - $19,999)			
$20,000 - $39,999	0.60***	1.03**	0.64**
	(0.23)	(0.44)	(0.26)
$40,000 - $59,999	-0.001	0.07	0.02
	(0.25)	(0.46)	(0.28)
$60,000 or more	-0.23	-0.25	-0.19
	(0.23)	(0.43)	(0.27)
Age (reference: 18-25)			
26 - 34	-0.74***	-1.17***	-0.73***
	(0.21)	(0.39)	(0.23)
35 - 54	-1.46***	-2.32***	-1.46***
	(0.21)	(0.42)	(0.24)
55 - 64	-1.4***	-2.2***	-1.38***
	(0.31)	(0.59)	(0.35)
65 or over	-1.07**	-1.74*	-1.04*
	(0.52)	(1.01)	(0.6)
Intercept	-1.1*	-1.56	-1.03
	(0.66)	(1.1)	(0.69)
Model parameters / statistics			
Intra-class correlation (ICC)	-	0.55** (0.07)	-
σ^2(Variance of random intercepts)	-	2.01*** (0.27)	-
α (within-subject corr.)	-	-	0.32***

			(0.06)
Log likelihood	-532.99	-505.72	-533.2
AIC	1097	1045	1105[+]
BIC	1175	1128	-
McFadden's R^2 (Adjusted)	0.187 (0.162)		-
Overall model fit	LR Chi2(15)=245 p-value =.000	Wald Chi2(15)= 89.6 p-value=.000	Wald Chi2(123)= 5383 p-value=.000

Significance codes: <0.01 '***'; <0.05 '**'; <0.1 '*'

[+] Quasi-AIC (QIC: For GEE models, there is no log likelihood function, hence no AIC or BIC).

2.11.1 Model fit and comparison

The Hosmer-Lemeshow Goodness of Fit test confirms that the standard Logit model fits the data well (H-L $Chi^2(8) = 11.01$, p-value = 0.20). This test is a reliable Goodness-of-Fit measure for this dataset with a small number of observations. The random intercept model improves upon this fit. Comparison of information criteria show significant improvement in both AIC and BIC values when we use a random intercept Logit model. The interclass correlation for the random intercept Logit model, and the variance of random intercepts are both significant. Hence, the random intercept model describes the data better than the standard Logit model. The GEE model also follows the pattern of results in the other two models and shows that the observed effects hold at a population effect after averaging out individual effects. We will discuss the results of these models in the next section.

2.11.2 Discussion of results

The results from all three models re-confirm our first hypothesis (H1). Consumer-based brand equity has a significant positive effect on whether respondents bought extended warranties for their chosen products. The results do not show any difference in warranty purchasing behavior between the TV and camera categories, as the effect for the dummy variable *TV* is not significant. We also find a strong positive effect of product prices on ESC purchases. We also don't find a significant result for the effect of extended warranty reference prices. This result might be a limitation in our data rather than any evidence for the insignificance of this effect in the actual market. All other predicted effects are in line with expectations and confirm the findings from analyzing the scanner data. We also observe a very strong effect for past ESC purchases on ESC purchase likelihood. This provides more evidence for our conjecture that people who are risk averse identify their type with ESC purchases. In the next section, we study the relationship between the consumer-based brand equity measure measured in this study and the residual-based brand equity measure calculated from scanner data.

2.12 Validation check

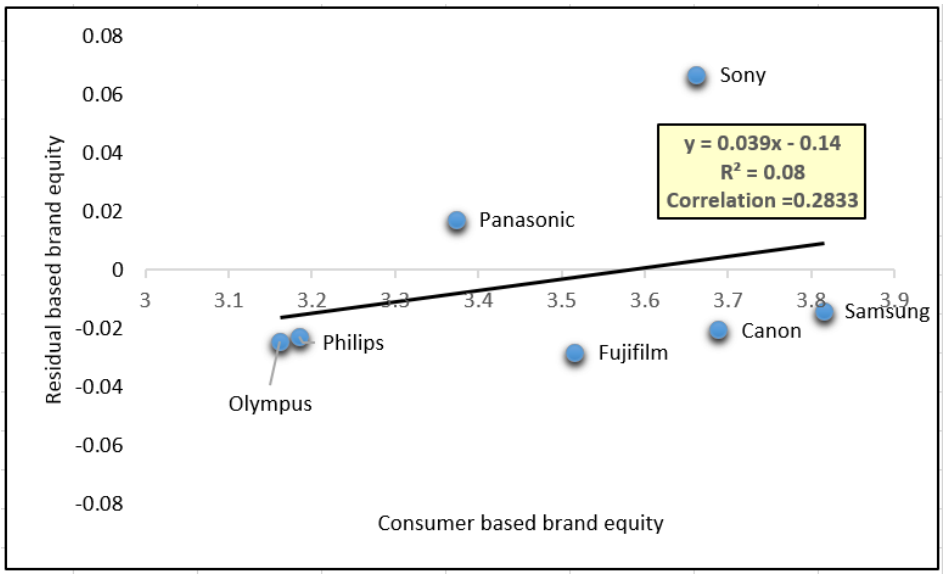
One way to validate our brand equity measures is to check their convergent validity by checking the correlation between these variables. The existence of a positive correlation between these measures would provide evidence in support of the notion that they are measuring the same underlying variable.

We have respectively 74 and 13 brands in the scanner and choice survey data sets. Of these, seven brands are present in both data sets. In the scanner data set, the brand equity is calculated

on a quarterly basis; here, we calculate the mean value of these quarterly brand equity scores for each brand to come up with our residual-based brand equity scores. In the survey data set, we have individual-specific consumer based brand equity scores calculated from a 10-item scale; here, we calculate the mean value of these scores across individuals for each brand to produce consumer based brand equity scores. The scores for the seven brands that are observed in both data sets have been plotted in Figure 2-5 and the correlation of these variables along with a simple regression output are also shown in this figure.

This figure shows an overall linear relationship between our two measures for these seven brands, with a correlation of 0.28. In addition, two highly linear patterns of relationship are also discernible. Both these patterns exhibit very high correlations (r= 0.998 for the upper-left four points, and r=0.999 for the lower right three points).

Figure 2-5 Relationship between the two brand equity measures

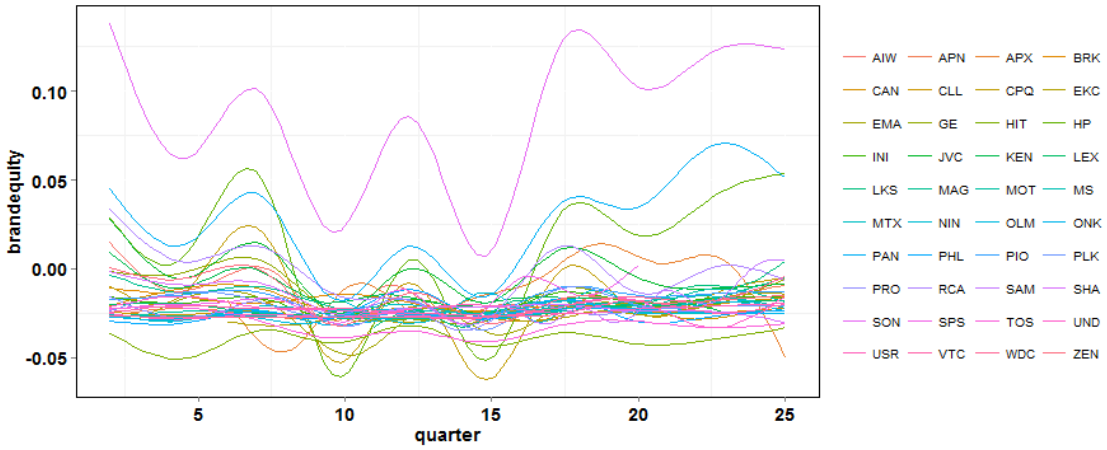


The observed correlation which is calculated for a small subset of brands from the scanner data set cannot single-handedly provide validation for our two equity measures. However, the overall correlation of 0.28 provides some evidence in support of the notion that these two measures might be positively correlated for the larger data set as well. In addition, the nearly-linear sub-patterns observed in the above figure suggests that for subsets of brands in our data sets, the residual based measure is perfectly correlated with the consumer based brand equity measure. Unfortunately, brand names in the scanner data set are only stored with three-letter designations (e.g. CAN for Canon and FUJ for Fujifilm), which makes it hard to identify most of the brands this data set. As a result of this limitation, we are not able to collect additional consumer-based brand equity scores for all brands in the scanner data set and explore this relationship for all the brands within this data set. We conclude this essay in the next section by discussing our overall findings and their implications for marketing theory and practice.

2.13 Robustness checks

In this section, we take a closer look at the residual-based brand equity variable. Figure 2-6 indicates this variable for 40 brands that have the highest number of observations in our scanner panel data set. This figure shows that the brand equity variable undergoes two major shocks in quarters 10, and 14.

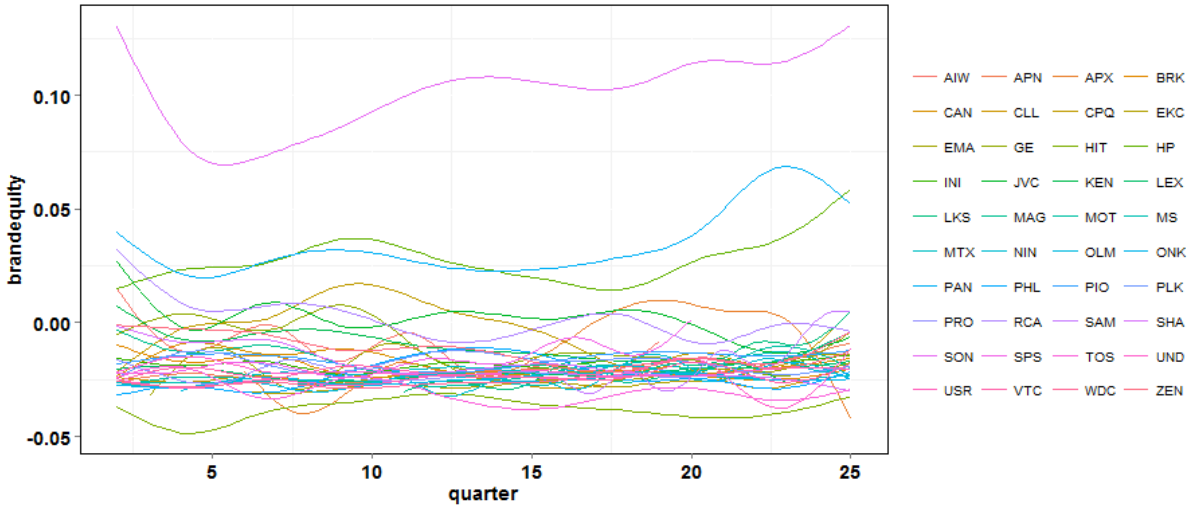
Figure 2-6 Residual-based brand equity for the top 40 brands



An examination of the data set reveals that there is a disproportionate number of observations for these two periods. While the average number of observations for the other periods is 1745 (Minimum=856, Maximum=3022), there are respectively 7897 and 8076 observations in these two periods, which drives relative market shares down. It is not clear why we observe higher number of observations in quarters 10, and 14 that correspond to the first three months of years 2001, and 2002.

As a robustness check, we also analyze our scanner panel data after excluding data from periods 10, and 14. Our previous results are replicated under these conditions and are robust to these exclusions. We do observe slight changes in parameter values, but the overall effect and significance levels reported in Section 2.8 remain unchanged. Figure 2-7 shows the residual-based brand equity measure after dropping data from quarters 10, and 14.

Figure 2-7 Residual-based brand equity for the top 40 brands after dropping quarters 10, and 14



We also notice that the Sony brand represented with a pink line on the upper part of this figure seems to have the highest brand equity value over all time periods and might be an outlier that could affect our results. Exclusion of this brand from the analyses, regardless of whether data from periods 10, and 14 are excluded does not affect our findings. Several other analyses, e.g. limiting the analyses to periods 5-20 show that our results are robust to exclusion of data from periods that the brand equity measure behaves in unexpected ways.

2.14 Conclusions and limitations

In this essay, our main purpose was to study the role that brands and specifically brand equity plays in consumers' purchases of extended warranties for electronic products. Within this research agenda, we were also able to study the effects of several other factors on extended warranty purchases.

For the role of brand equity, we theorized two potential effects. We argued that brands could potentially play a positive or a negative effect on extended warranty purchases for the products.

According to one argument, products that carry brands with higher equity could be perceived as having a higher reliability or build quality, and hence be perceived as less likely to fail. We called this the "reliability effect" and expect it to cause a negative effect of brand equity on extended warranty purchases. Based on a second argument, brands constitute a source of value in addition to the product's monetary or utilitarian values. We called this the "value effect" and expect it to have positive effect on extended warranty purchases, as higher values are associated with higher insurance purchase likelihood. These two effects have a one-on-one correspondents with two major drivers of demand for insurance products, namely the probability of loss, and the extent of loss. We use this correspondence to form arguments that favor the dominance of the value effect over the reliability effect, and predict brand equity to have an overall positive effect on extended warranty purchase likelihood.

We test the above prediction using the ISMS Durable Goods Dataset 1, and a market simulation study. Both studies provide evidence in support of our prediction. Our models show that at both the individual and population levels, and also within potential ESC buyers as well as within the entire sample of buyers, brand equity plays a significant positive role in extended warranty purchases for electronic products.

Although it is theoretically justifiable to expect to observe a negative reliability effect for brand equity in at least some product categories, it is not hard to see why this effect could be statistically dominated by the value effect of brands in practice. According to the reliability effect argument, people are less likely to buy extended warranties for higher-brand-equity products due to the higher perceived quality and reliability of these products. However, product failure or break-down is relatively a rare event for most brands that are strong enough to stay in the market. Hence, regardless of differential failure rates across brands, failure inevitably

happens for all brands. Even, within the products of a single brand, failure rates could vary by product model, or production batch. Furthermore, failure rate variations across brands are small. For example, Wang et al. (2012) calculate quarterly failure rates for 12 TV brands from the ISMS 1 data set based on Consumer Reports surveys. These failure rates range from 0.328% to 0.638% (Mean=0.457%, SD=0.10). The relatively low product failure rates across all brands, and people's disability to accurately account for such probabilities, lends credence to the prediction that the brand reliability effect may not be as strong as the value effect. In a sense, people seem to be following Murphy's Law, that "if something can go wrong, it will'; Given that there's a slight chance of product failure, people are more likely to insure purchases from better brands. As a result, a brand's value information takes the front-seat and drives extended warranty purchase decisions rather than its reliability information.

We further study the role that retail stores might play in ESC sales and find evidence for their significant impact on driving ESC sales. Our results indicate that ESC selling power in non-focal product categories spills over to focal product categories and that stores who are good at selling ESCs in general, have a significant positive impact on an individual's propensity to purchase ESCs. The significant effect of store-level factors in driving sales as well as the negative association between online purchases and ESC sales suggest that retailers should devise specific strategies to drive ESC sales on their online platforms.

In addition we confirm previous findings on the negative role of income, and the positive roles of product price and hedonic-ness of product categories on ESC purchases. We also find that male buyers are slightly less likely to purchase ESCs.

Our results also indicate that potential ESC buyers can be readily targeted by considering buyers' past ESC purchases. This could guide sales efforts as consumers who have purchased

ESC in the past are more likely to belong to the risk averse segment of the market who derive more benefits from ESC purchases by virtue of their type.

Our findings shed light on how brands might affect ESC purchase decisions and provide marketing theorists and practitioners with another piece of evidence on the importance of brand equity in consumer markets. Consumers continue to see brands as a valuable asset that is even worthy of protection with insurance.

One of the limitations in this essay has to do with our use of data from a single retailer. Finding a similar pattern of results from other retailers or in a study across retailers could further strengthen our findings in this essay. In addition, our data did not allow us to explicitly account for manufacturer warranty lengths in the models. Findings on the effect of warranty lengths on purchase decisions are mixed. In a competitive market, signaling could lead to a situation where products with lower reliability might end up offering longer warranties (Balachander 2001). Nevertheless, the intuitive expectation is to observe a negative effect of manufacturer warranty lengths on ESC purchase likelihood. Our results on the effect of brand equity on ESC purchase likelihood in the scanner panel data could be overestimated if higher brand equity is associated with lower warranty lengths. Understanding the dynamics between manufacturer warranties and extended warranty purchases provides an interesting area of future ESC research.

This essay contributes to the burgeoning marketing literature on extended service contracts by studying the effect of brand equity on the ESC purchase likelihood. Our analyses provide evidence for an overall positive effect of brand equity on ESC purchases and highlight the important role of several factors in driving extended warranty purchase decisions. In the next section, we will discuss the implications of our findings for retailers.

2.14.1 Substantive implications for retailers

Our findings have direct implications for retailers' product assortment decisions as they could benefit doubly from having a larger portion of their assortment devoted to high equity brands. The overall positive effect of brand equity on ESC sales suggests that carrying higher brand equity products may not only affect product purchases, but it can also significantly affect ESC sales for these products. This finding is congruent with Wal-Mart's move towards offering more high-end brands as it started offering extended warranties in 2005 (Business Week 2005). Our result suggests that offering a larger assortment of high brand equity products could be a more profitable strategy for retailers who also sell extended warranties.

Another important substantive implication of our findings is that ESC sales for products with higher brand equity can benefit from persuasive arguments that focus on brand value in addition to arguments based merely on product value. Consumers have positive associations with brands of the products that they purchase and they are more likely to protect the products with an ESC purchase when they consider these associations.

Our findings also show that potential ESC buyers can be more easily targeted considering their past ESC purchases. In addition, given the positive impact of store-level factors as demonstrated by the effect of our ESC selling power variable, and the negative association between online purchases and extended warranty sales, retailers would be well-advised to devise online ESC sales strategies that address the deficiencies in an online shopping experience (e.g. virtual salespeople could be used to encourage ESC purchases).

With the increase of service offering by retailers, and the interconnections between product attribute (e.g. brands) and extended service contract purchase decisions, our results also highlight

the notion that a product assortment optimization strategy that does not take product-service purchase interdependencies might be sub-optimal.

In conclusion, extended service contracts do offer benefits to some segments of the consumer market and both consumers and retailers could benefit from advances in understanding this complex decision.

Chapter 3 Essay 2: An empirical investigation of the impact of ESC information availability strategies on product and ESC purchase decisions

3.1 Abstract

Extended service contracts (ESCs) provide insurance against durable product failures to people who buy them. ESC attribute information, mainly price, is generally offered to buyers subsequent to their product purchase decision during the checkout. However, ESC information can also be made available alongside product attribute information. In this essay, we ask whether and how the mere availability of ESC information during the product choice phase might affect consumers' product and ESC purchase decisions. To answer this question, we pit the simultaneous vs. delayed ESC information availability strategies against one another in a choice experiment and compare their effect on how buyers weigh major product and warranty attribute information in their choices. We propose that the simultaneous availability of ESC information can influence the risk reduction strategies adopted by consumers due to potentially heightened perceptions of risk, loss, or need for insurance. Our findings show that changes in risk reduction strategies do occur in this condition. We find that in the simultaneous ESC information availability scenario, buyers exhibit less sensitivity to both product and ESC prices. In this scenario, we observe a combination of effects that could be attributed to two distinctive response patterns. On the one hand, we observe lower sensitivity to ESC prices combined with buying ESCs for higher quality products (i.e. a reparative ESC-focused risk reduction strategy), while on the other hand, we observe a lower ESC purchase likelihood along with lower sensitivity to product prices (i.e. a preventative product-focused risk reduction strategy). These effects are consistent with expected patterns of behavior for consumers with high vs. low levels

of risk or loss aversion. These patterns suggest that people might respond to a heightened need for insurance by undergoing a reparative ESC-focused vs. a preventative product-focused mind-set or a combination of both mindsets in the simultaneous ESC information availability condition. Although we do not find any changes in stated perceptions of product failure likelihood across the two scenarios, the observed pattern of results implies that buyers tend to experience, albeit unconsciously, a heightened need for insurance in the simultaneous ESC information availability scenario.[1]

3.2 Introduction

Today, most retailers of durable products offer extended warranties to consumers who have decided to purchase a product as they prepare to pay for it during the checkout. Buyers who have already made a product purchase decision are faced with new information on a service contract that can insure their purchase against future failure or break-down. Offering ESC information during checkout might be, at least in part, rooted in its seemingly irrelevancy to the product purchase decision and the unnecessary complexity or distraction it might add to the more primary product purchase task. Another reason why ESC information is not offered alongside

[1] ESC information, specifically ESC price, can potentially carry a product quality signal if its ratio over product price (which we call ESC ratio), varies based on product failure rates for different products or brands. This could lead to a situation where products with higher ESC ratios are perceived to be of lower quality or higher failure likelihood. We do not investigate this scenario in this essay, as the impact of such changes on consumer behavior is rather self-evident. Instead, we restrict our analysis to a situation where the ESC information does not carry a quality signal and ESC prices are merely a function of product price rather than product failure likelihood or product brands. As a result, we only study the *mere availability* of ESC information rather than the ESC information's *signaling content*, and our study design ensures that ESC prices contain no signaling content by keeping ESC ratios constant within a given choice set.

product information might have to do with the fact that earlier exposure to this information can make deliberation on ESC purchase more likely. Deliberation can lead to a stronger preference for or against a purchase (Kahneman et al. 1982; Tversky and Kahneman 1974b), which can in turn make ESC sales tactics such as price or coverage negotiations less effective during checkout. Nevertheless, offering ESC information alongside product information may not be as irrelevant as it seems, especially if the mere presence of this information might affect ESC and/or product purchase decisions. Employing a simultaneous ESC information availability strategy, that allows buyers to see ESC information alongside product information on product tags, might have positive implications for both consumers and retailers. This strategy would give consumers more time to contemplate on purchasing an ESC, leading to eventually more informed purchase decisions that could reduce potential ESC returns. It might also benefit retailers by influencing the combined product and ESC purchasing behaviors in a more profitable direction.

The ESC literature in marketing is silent about the implications of information availability strategies on consumer decisions and it is not clear how consumer decisions might be affected under the simultaneous vs. delayed information availability scenarios. The status quo seems to favor the delayed information availability strategy, perhaps due to some immediate benefits it might offer. But how would the alternative simultaneous ESC information availability strategy affect purchase decisions? How would an average buyer modify her risk reduction strategies in this context? Earlier access to information could potentially lead to more informed decisions on the consumers' part, but would this effect translate into shifts in the risk reduction strategies used by buyers, and would it lead to fewer or more ESC sales for the retailer? We will attempt to answer the above questions in this essay.

While it is conceivable that the delayed information availability scenario might make buyers more prone to push strategies during checkout with an ensuing positive impact on ESC sales, this view might be myopic as it ignores any potential effects that this strategy could have on the combined product and ESC purchase decisions.

We argue that the simultaneous information availability strategy can cause shifts in buyers' perceptions of risk and also affect how people adapt to perceived risks of product failure. We propose two potential mechanisms that could lead to this effect. First, the mere abundance of warranty information can highlight the need for insurance through the availability heuristic or by influencing construal levels through reducing the psychological distance of product failure. The availability and frequency of extended warranty information in the simultaneous information availability scenario can reduce the psychological distance between the buyer on the one hand, and potential warranty usage on the other hand. This reduced psychological distance could lead to buyers perceiving warranty usage more common than it is, which could in turn imply a higher perceived product risk and/or a higher need for extended warranty. Second, the salience of ESC information during the product information acquisition stage can also prime buyers about the possibility of product failure which can again affect risk perceptions and buyers' risk-handling strategies.

The above mentioned mechanisms can consciously or unconsciously lead to a higher perceived need for insurance. If such mechanisms are activated in the simultaneous information availability scenario, it would also be very likely that people might weigh product and ESC attributes differently than they did in the delayed information availability scenario. These potential changes in product or extended warranty attribute weights would allow us to detect whether and how, buyers' risk-handling strategies change across our two conditions.

We first conduct a pilot study that provides evidence in support of the notion that a shift in behavioral response occurs in the simultaneous information availability scenario as compared to the delayed information availability scenario. We then follow this study with a choice experiment that allows us to compare the impact of the simultaneous ESC information availability on consumers' purchase decisions for both products and extended warranties. Findings from this study suggest that our manipulation might change how people weigh major product and ESC attributes in their choice decisions. The pattern of results indicate that people may adopt additional risk reduction mechanisms in the simultaneous ESC information availability scenario, in what may be described as a situation with heightened perceptions of risk or need for insurance.

In the following section, we lay out the background, and the theoretical framework to discuss mechanisms through which, simultaneous vs. delayed ESC information availability might affect behavior. We will later derive the implications of these mechanisms for product and extended warranty decisions in the form of testable hypotheses.

3.3 Background

Extended service contracts (ESCs), or extended warranties have been offered alongside durable products for several years now. While ESCs can be classified as a group of insurance products, their availability as add-on services to various classes of durable products in retail contexts affords them unique characteristics that differentiate them from mere insurance products. For example, a consumer's decision to purchase an ESC can be significantly affected by product attributes and the retail context (Chen et al. 2009). Despite the major contributions of ESC sales to retail bottom lines (Business Week 2004; Business Week 2005), marketing

researchers have only recently started to pay attention to how consumers make their purchase decisions in this category.

Human decision making processes rely heavily on external information. Several research streams in marketing have studied different dimensions of the role of information in human decision making. For example, researchers have studied the role of information content (Kim et al. 2012; Tybout et al. 2005), information valence (Ahluwalia et al. 2000), and information timing (Ge et al. 2012; Ha et al. 2013) on consumer decisions. Findings from these diverging lines of research unanimously suggest that managing the *content* and *flow* of information can influence how the information is *processed* and *used* for decision making purposes.

Curiously, in the case of ESCs, the availability of ESC information in retail contexts is rather limited, and the flow of information is tightly controlled. Most retailers provide ESC information to customers during the checkout when they have made their product decision and are about to pay for their chosen product. As a result, customers have to make their ESC purchase decisions within a short amount of time. We call this a *delayed* ESC information availability strategy as the ESC information is provided following the product purchase decision with a time delay between the two decisions. While the rationale behind this strategy is unstated, a few explanations come to mind. First, ESC information might be considered as irrelevant to the product purchase decision, which makes this information redundant to buyers at the product purchase stage. While the underlying premise for this reason is questionable, buyers might benefit with the resulting reduction in choice complexity as they have to process less information. A second potential rationale for adopting a delayed information availability strategy might have to do with buyers' higher susceptibility to sales tactics such as ESC price and coverage negotiations in this scenario, as they have less time to deliberate on the purchase. According to Kahneman et al. (1982),

deliberation can lead to a stronger preference for or against a purchase. Having a weaker preference for or against an ESC purchase makes buyers more likely to be swayed by point-of-sales tactics to push ESC sales.

Despite these potential rationales for the delayed information availability scenario, it is not clear whether delaying the provision of ESC information will have a positive or negative overall effect on ESC and/or product purchases. If ESCs offer value to the more risk averse segments of the market, it is conceivable that earlier access to ESC information might be desirable from buyers' point of view as it might lead to more informed purchase decisions for them. This could be achieved by offering ESC information alongside product attribute information on product tags, a scenario which we call a *simultaneous* ESC information availability strategy, which gives buyers simultaneous access to both product and ESC information.

The simultaneous availability of ESC information alongside product information might potentially benefit both consumers and retailers. Consumers have more time to consider this information in their decisions, and retailers might benefit from lower ESC returns as a result of consumers' more informed decision for their ESC purchase. However, this strategy might also affect consumers' decision for both ESC and product purchases. In this essay, we ask whether the simultaneous ESC information availability affects ESC and product purchase decisions. In order to answer this question, we first provide an overview of relevant streams of literature that seem to be relevant to the context of our problem.

3.3.1 Joint vs. separate evaluation, and complementary goods

In the delayed ESC information availability scenario, the product and ESC purchase decisions are temporally separate. As a result, buyers evaluate the ESC separately from the product, but

they do condition this evaluation on the product attributes as product information is available at the second stage. In the simultaneous ESC availability scenario, both product and ESC information are available, so decisions for one might be affected by the decisions for the other, and people might engage in joint evaluation of the two sets of information. Still, each of our two ESC information availability scenarios involve joint evaluation of products, but they also have the added component of a second decision, i.e. the ESC purchase decision, that might be contemplated jointly with or separate from the product purchase decision. We will now review the literature on joint vs. separate evaluation of alternatives in search of insights that might inform our study.

The issue of separate vs. joint evaluation of products has received some attention in marketing (Bazerman et al. 1992; Hsee 1996; Hsee and Leclerc 1998; Hsee et al. 1999). However, these studies have been mainly focused on evaluations within the same product category. For example, Hsee (1996) studies preference reversals in joint vs. separate evaluation of two-attribute products. For example, to demonstrate such preference reversals, this researcher shows that when two given dictionaries (A, and B) with specifications that mainly vary on the number of words (10,000, and 20,000) and state (new vs. used with torn cover), are evaluated jointly, average willingness to pay for the dictionaries is respectively $19, and $27, whereas in separate evaluations, average willingness to pay is $24, and $20. The author proposes the evaluability hypothesis to explain this phenomenon. According to this hypothesis, such reversals occur because one of the attributes involved in the decision is easy to evaluate independently, while another attribute is hard to evaluate independently. Sher and McKenzie (2014) extend this work to multiple-product evaluations, and provide a normative framework to explain why the evaluability hypothesis works and identify its boundary conditions. In another work, Hsee and

Leclerc (1998) find that joint evaluation of attractive alternatives leads to lower perceived attractiveness than if each of the alternatives were presented separately, and joint evaluation of unattractive alternative makes them look more attractive.

Another slightly related work is that of Simonson (1990) where he compares simultaneous product purchases for sequential consumption, with a sequential product purchase in which the customer buys one item at a time just before each sequential consumption. The findings show that people seek more variety seeking in the simultaneous choice scenario but stick with their favorite option and avoid variety seeking in the sequential choice scenario.

The common thread that runs through most of the work on joint vs. separate evaluations is the fact that joint evaluation provides additional information, or as Sher and McKenzie (2014) put it, *options* can be considered as information, and the mode of evaluation (i.e. joint vs. separate) can change how people weigh different attributes in their decisions.

Another body of literature more closely related to the circumstances of our study is the stream of research on complementary products, as products and ESCs are asymmetric complements, where one of the duo is more dependent on the other and consumers experience a higher utility if they consume both (Lee et al. 2013).

Complementary goods have received considerable research attention and have been studied from several aspects, including, demand modeling to estimate their cross-price elasticities (Lee et al. 2013), complementary goods pricing (Cheng and Nahm 2010), competition between complements (Casadesus-Masanell et al. 2007; Chen and Nalebuff 2006), category-based screening when choosing complement products (Aribarg and Foutz 2009), and brand choice dependencies across complementary product categories (Ma et al. 2012).

To the best of our knowledge, the existing research on complementary goods does not study the implications of the availability of complementary goods information on choice decisions for either of the goods, especially in a situation where perceptions of risk might be affected by the mere availability of information. Our context comprises a unique complementary goods case that has not received much research attention.

Despite their relevance and commonalities with the context of our study, the areas of research on joint vs. separate evaluation of alternatives and complementary goods provide little insight into our analysis of the impact of ESC information availability scenarios on consumers' purchase decisions. As a result, we explored the more general marketing literature to find insights that could inform our inquiry.

3.4 Conceptual development

According to prospect theory, people's tendency to avoid losses is stronger than their tendency to acquire gains (Kahneman and Tversky 1979). In addition to drivers of demand for ESCs, such as the extent of loss, the probability of loss, and people's intrinsic risk aversion levels (Zweifel and Eisen 2012), the tendency to avoid losses, i.e. loss aversion, is another factor that drives the more risk averse people in the market to purchase ESCs (Jindal 2013). Purchasing ESCs allows this segment to avoid higher uncertain losses in the future by undergoing a smaller certain loss in the form of ESC purchase cost. Due to this connection, the same factors that could affect perceptions of loss, risk, or need for insurance in the simultaneous ESC information availability scenario could lead to changes in consumer behavior in this condition.

In this section, we will identify and discuss mechanisms and theories from the marketing literature that can help us understand how the simultaneous availability of ESC information

alongside product information might affect product and ESC decisions. We specifically identify three mechanisms that can help us predict potential changes in consumer behavior in the simultaneous ESC information availability scenario.

3.4.1 The Availability heuristic

Availability refers to the "ease with which one can bring to mind exemplars of an event" (Folkes 1988b). In their seminal paper on the availability heuristic, Tversky and Kahneman (1973) introduced it as a shortcut to judge probabilities or frequencies. According to this heuristic, instances of large classes are easier and faster to recall and events that are easier to imagine are considered to be more likely to occur. Tversky and Kahneman (1973) posited and showed that people can estimate the likelihood of an event by "assessing the ease with which the relevant mental operation of retrieval, construction, or association can be carried out". Further experiments have confirmed that ease of recall is positively associated with perceived future probability of similar events (MacLeod and Campbell 1992). The availability heuristic has also been linked to perceptions of risk. For example, (Folkes 1988a) shows that judgments of product failure likelihood are affected by the availability heuristic. For example, when product failure scenarios are more available than product success scenarios, respondents overestimate product failure.

One of the main differences between the simultaneous and delayed ESC information strategy scenarios is the availability of ESC information in the simultaneous scenario long before a decision can be made regarding its purchase. In the simultaneous information availability scenario, a person observes that an optional warranty is available for every product whose description tag they read. Based on the availability heuristic, this higher exposure to ESC

information with higher frequency can enhance a person's perceptions of the prevalence of extended warranties, or conceivably their usage. This heightened perception of warranty prevalence can increase the perceived probability that an ESC is generally purchased, needed, or eventually used by consumers to offset product failure costs. This situation might also change perceptions of product failure likelihood or purchase risk. Perceptions of risk are higher in service purchases than in product purchases (Mitchell and Greatorex 1993) and may be more easily affected by these influences. Hence, the mere simultaneous availability of ESC information in the product choice stage, regardless of its informational content, might potentially affect product and ESC purchase decisions.

The availability heuristic provides an avenue through which simultaneous availability of ESC information can affect perceptions of product risk or failure, which could lead to behavioral responses or adaptations of behavior to reduce risk. However, construal level theory might be able to explain what underlying mechanism could drive such impacts. In the next section, we describe how this theory might offer insights that will allow us to form expectations of observing behavioral changes in the simultaneous ESC information availability scenario.

3.4.2 Construal level theory (CLT)

Construal level theory posits that psychological distance from events affects how those events are represented in people's minds. According to this theory, the farther an event is from direct experience, people form higher-level construals, i.e. more abstract representations, of that event whereas proximity to direct experience leads to the formation of lower-level construals which are more concrete, specific, or detailed (Trope and Liberman 2010; Trope and Liberman 2003). This basic premise of the construal theory applies to several forms of psychological distance including

spatial distance (Fujita et al. 2006a), temporal distance (Eyal et al. 2008; Trope and Liberman 2003), probability/hypotheticality distance, i.e. likely vs. hypothetical events (Todorov et al. 2007) or social distance, i.e. from an individual's perspective vs. from an observer's perspective (Eyal et al. 2008).

Construal level theory deals with how information is represented in people's minds; hence, it is no surprise that several streams of research have adopted it to study different aspects of consumer behavior under its tenets. For example, construal levels have been shown to affect as diverse issues as price-quality inferences[1] (Yan and Sengupta 2011), impulsive consumption (Zhang and Shrum 2009), persuasion (Agrawal and Maheswaran 2005), consumer confidence (Tsai and McGill 2011) and self-control (Fujita et al. 2006b). Construal levels also affect risk taking behavior. The implications of construal level theory for consumer behavior still attract researchers (e.g. See Dhar and Kim (2007) for a discussion of CLT's implications for consumer choices).

Construal level theory is especially relevant to ESC purchase decisions as the availability of information in the simultaneous availability scenario can potentially affect construal levels. In an ESC purchase scenario, consumers decide whether to buy a service contract for "*probable future"* consumption. This decision making domain exhibits two types of psychological distance, namely the temporal (Trope and Liberman 2003) and probability distance (Bar-Anan et al. 2006; Wakslak and Trope 2009). Using a purchased ESC is generally considered to be an *unlikely* event in the *future* making it *psychologically distant on two dimensions*. Researchers on

[1] Consumers' reliance on price for making quality inferences is higher for psychologically distant judgments.

construal level theory have found that greater temporal distance of an event makes it more likely to be represented with high-level construals in people's mind (Trope and Liberman 2003). In addition, improbable events are represented in an abstract high-level construal whereas events that are more likely are construed as more detailed and concrete (Wakslak et al. 2006). These findings suggest that ESCs and ESC usage might also be mentally represented in an abstract level with high-level construals, since they entail two types of psychological distance, namely the temporal and probability distances. As a result, in an ESC purchase occasion, when the probability of product failure or ESC usage is perceived to be low and such events seem to be temporally distant, the consumer would, relatively-speaking, be in a higher-level-construal mind-set. When people are in a high-level construal mindset, their assessment of subjective probability is also lower (Wakslak and Trope 2009), which could possibly contribute to an even lower perceived probability of product failure.

However, it is conceivable that contextual factors such as the simultaneous ESC information availability strategy can potentially shift the psychological distance of ESC usage due to the availability heuristic and the abundance of ESC information in this scenario. Findings by Tversky and Kahneman (1973) on the influence of information availability on people's perceptions of the likelihood of an event suggest that this situation may cause ESC usage to be perceived as a *more likely* and *closer* event, and reduce buyers' psychological distance from ESC usage and even put them in a lower-construal-level mindset. This mindset is associated with more concrete, more tangible, and closer representation of decision-relevant information. Buyers in this mindset are likely to perceive product failure and ESC usage as more probable and less distant events which could affect their purchase decisions and the strategies they employ to handle or mitigate product purchase risks.

People tend to make more conservative decisions for more immediate consequences and become more risk taking for outcomes further into the future (Eyal et al. 2009). Chandran and Menon (2004) demonstrate that temporal framing of risky information (e.g., "every *day/year* a significant number of people succumb to heart disease") can also affect perceptions of risk. According to their findings, time frames that are psychologically closer are represented with low-level construals and lead to higher levels of perceived risk. If a low-level construal is activated in the simultaneous ESC availability scenario, it is conceivable that in light of the above finding, purchase risks or product failure likelihood might also be perceived as higher when psychological distance is reduced.

In sum, construal level theory offers a mechanism through which simultaneous ESC information availability could influence consumer decisions. Changes in buyers' perceived psychological distance from ESC usage (or product failure) in the simultaneous availability scenario could lead to a heightened need for insurance, and consumers with different risk aversion levels might respond differently to this heightened need through their ESC and product decisions.

Next, we will briefly mention one other mechanism that could play a similar role or enhance the influences suggested by construal level theory.

3.4.3 Concept priming

It is worthy to note that the simultaneous availability of ESC information could also act as a situational cue and induce a *concept priming* effect (Bargh 2002; Bargh and Chartrand 1999; Sela and Shiv 2009). Situational cues can unconsciously prime people to behave in a way that is consistent with those cues. As a result, the observation of the availability of warranties for every

product could also unconsciously prime buyers of concepts like product failure, the need for ESCs, or prevalence of ESC purchase. This priming effect could also affect perceptions of risk or the psychological distance to ESC usage or product failure. This effect would in turn influence product purchase decisions and also spill over into the ESC purchase decision as well.

3.4.4 The role of the described accounts

As described in the previous sections and depicted in Figure 3-1, the simultaneous availability of ESC information can potentially activate mechanisms that might influence changes in consumer behavior. These mechanisms might directly affect behavior or cause changes in behavior by affecting consumers' perceptions.

Although, we do not derive our hypotheses directly from the three accounts discussed in the three preceding sections, they do form the basis and foundation for all of our hypotheses on how consumer behavior might be influenced in the simultaneous ESC availability condition. These accounts basically describe why people might be inclined to seek risk-handling strategies in the simultaneous condition, but do not directly inform the question of what risk-handling strategies might be adopted.

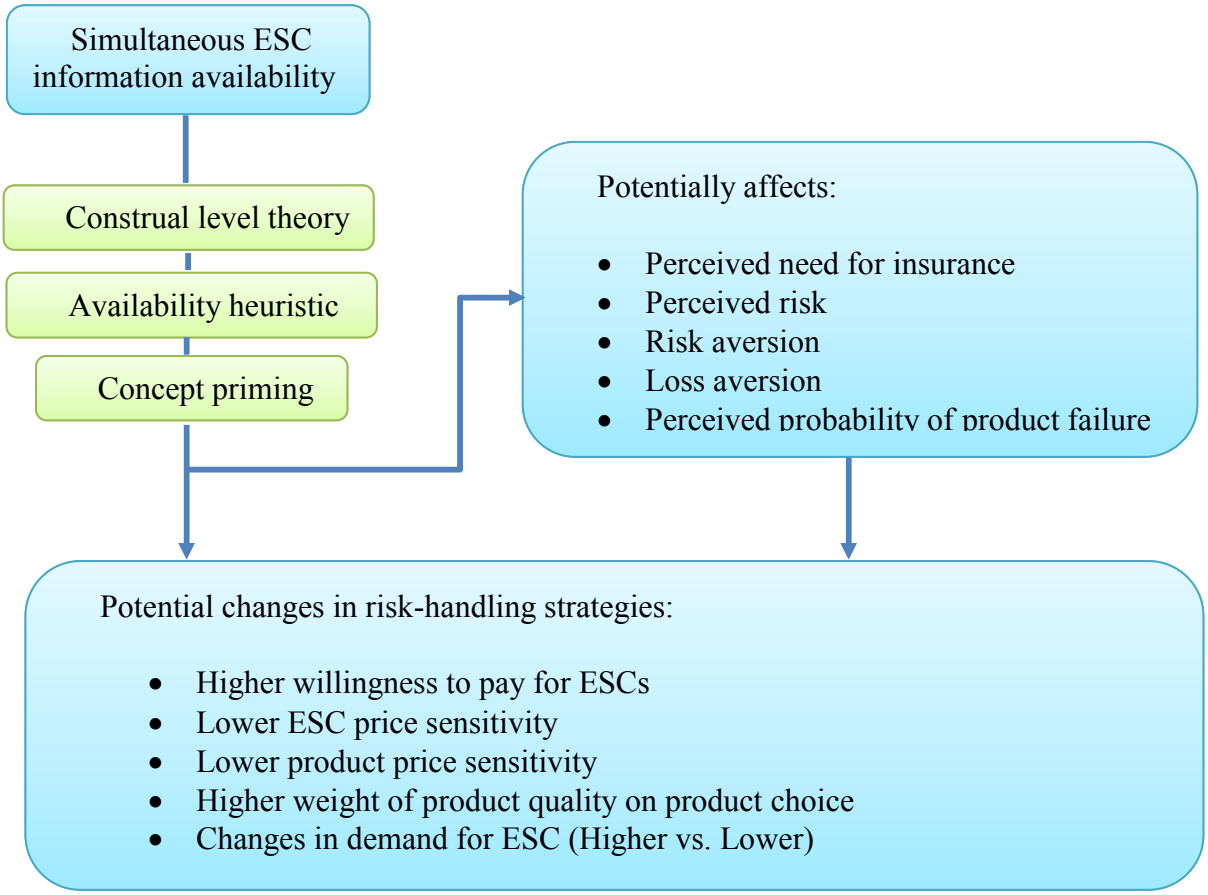
In the next section, we will explore how the potential influences of the availability heuristic, construal level theory, and concept priming might affect consumers' product and ESC purchase decisions and the risk-handling strategies they might adopt.

3.4.5 Risk-handling strategies adopted by consumers

All of the three discussed accounts, namely, the availability heuristic, construal level theory, and concept priming seem to lend credence to the notion that perceptions of need for insurance

could be potentially affected by the simultaneous availability of the ESC information during the product choice phase.

Figure 3-1 The potential effects of the simultaneous availability condition on buyers' risk-handling strategies



While it may not be easy to uniquely identify the exact underlying mechanism, as all three mechansims seem to act in the same direction, it is of more practical interest to identify how, if at all, consumer behavior is affected in the simultaneous ESC information availability scenario as a result of the above-mentioned influences. If any of these mechanisms are affecting perceptions of need for insurance, people are likely to exhibit different risk-handling strategies in the simultaneous vs. the delayed ESC information availability scenario. Such strategies are likely to

influence both product and ESC purchase decisions as both decisions could be modified to handle or mitigate heightened product purchase risk.

Marketers can use several risk reduction methods or risk relievers to decrease buyers' perceived risk. Some risk relievers include product endorsements, brand image, store image, free samples, money-back guarantees, and word-of-mouth (Roselius 1971). Advertising has also been shown to play a role in reducing purchase risk and uncertainty (Byzalov and Shachar 2004), as the informative content of advertising reduces the uncertainty associated with a purchase. Cases (2002) studies risk relievers in the context of internet shopping and finds no difference between risk relievers in online vs. offline shopping except for payment security which is specific to online shopping.

Consumers adopt risk-handling activities to avoid potential financial and non-financial losses (e.g. loss of time, embarrassment), and their intention to use risk-handling activities increases as the perceived levels of risk increase (Dowling and Staelin 1994). Consumers may reduce product purchase risks by reducing their uncertainty about the purchase (e.g. collecting additional information), or by reducing the potentially negative consequences of the decision that involves risk (Cunningham 1966). As an example for the latter case, people might resort to buying quantities smaller than those normally purchased, in order to mitigate the risks associated with purchasing a new product (Shoemaker and Shoaf 1975).

If perceptions of risk or product failure are affected in the simultaneous ESC information availability scenario, we may be able to detect changes in both product and ESC purchase decisions as well as changes in demand for ESCs under this scenario.

We will now formalize our predictions on the potential risk-handling strategies that consumers may adopt as a result of our manipulation of ESC information availability.

3.4.5.1 Impact on ESC purchase decisions

There is a segment in the market that derives value from purchasing ESCs. Not everyone falls into this segment, but those who do, are characterized by higher levels of risk aversion or loss aversion (Jindal 2013). Consumers with higher levels of risk aversion, who comprise the main target market for extended service contracts, may not be easily swayed away from purchasing ESCs to product-focused strategies, e.g. buying a more reliable product in response to situational factors such as a heightened perceived risk due to the simultaneous ESC information availability. These consumers may keep their existing risk-handling strategy while adopting additional risk reduction strategies.

Price sensitivity is known to be influenced by situational factors. For example, Wakefield and Inman (2003) find that people become less price sensitive in hedonic purchases or social consumption situations. Erdem et al. (2002) also show that higher brand credibility reduces price sensitivity in choice of brands. Popkowski Leszczyc and Rao (1990) find that local advertising increases price sensitivity while national advertising decreases it. Kaul and Wittink (1995) later generalize previous findings to conclude that non-price advertising reduces consumer price sensitivity while price advertising makes consumers more sensitive to prices.

In our context, too, price sensitivity is likely to be affected in the simultaneous availability condition. According to Erdem et al. (2002) and Tellis and Gaeth (1990), factors that decrease consumer uncertainty and their associated perceived risks can also make them less price sensitive. In our study, participants in general, and those with higher levels of risk or loss aversion in particular, might become less sensitive to ESC prices *if* ESCs reduce uncertainty about their future consumption outcome. Evidently, ESCs do reduce uncertainty about future

usage of the product as they insure it against failure, and we can expect to observe lower sensitivity to ESC prices in this condition. If perceptions of need for insurance are higher in the simultaneous condition than in the delayed condition, the uncertainty associated with consumption of the product also increases in this condition, and in order to mitigate this uncertainty, buyers' sensitivity to prices could decrease in this condition. This effect could be manifested in lower ESC price sensitivities in our choice model or higher self- declared willingness to pay for ESCs. Our next hypotheses address these predictions:

H1: ***Normalized willingness to pay for ESCs (WTP ratio) is higher in the simultaneous ESC information availability scenario than in the delayed availability scenario.***

H2: ***People are less sensitive to ESC prices in the simultaneous ESC information availability scenario than in the delayed availability scenario***.

Both of the above hypotheses pertain to the same phenomenon of becoming less sensitive to ESC prices. However, with the first hypothesis, we are testing the effect through the self-declared willingness to pay levels, while in the second hypothesis we are testing the effect by analyzing actual choices made by participants. Testing these hypotheses will allow us to assess the impact of the simultaneous ESC information availability scenario on ESC purchase decisions.

3.4.5.2 Impact on product purchase decisions

Consumers may also handle product purchase risks through modifying their product purchase decision. This may be proactively achieved by collecting information on product reliability or product failure rates. However, at the product choice stage, people might have to infer these characteristics from brands, as some consumers reduce purchase risks by buying more well-known brands (Erdem 1998). People might also infer these characteristics from product price or explicit quality ratings or user ratings.

The relationship between price and perceived quality has been extensively studied with overwhelming support for the existence of a positive correlation between the two (See Gneezy et al. (2013) for a recent examination of this relationship). Although the effect size has decreased over the past decades (Völckner and Hofmann 2007), and the strength of the relationship varies across different product categories (Gerstner 1985), there is a "moderately strong and highly significant" relationship between price and quality (Völckner and Hofmann 2007).

Many people infer product quality from price. In a very interesting finding, Shiv et al. (2005) demonstrated that a reduced-price product can even reduce its objective performance for buyers. In one study, subjects who had paid lower prices for an energy drink performed worse in a puzzle-solving task than subjects who had paid full price for the same physical product. The authors attribute this effect to the participants' lowered expectancies regarding product quality in the reduced-price condition.

If consumers associate higher prices with higher quality levels, and they perceive a higher need for insurance in the simultaneous case, they might not only resort to buying higher quality products, but they might also become less sensitive to product prices, as higher prices translate

into higher quality levels for them. In other words, the negative effect of price on product choice might become less negative in the simultaneous condition as people seek product quality and reliability in higher-priced products.

In addition, in the presence of explicit product quality information, e.g., through consumer ratings or reviews, people might also resort to choosing products with higher quality ratings in the simultaneous ESC information availability scenario to counteract a potentially heightened perceived need for insurance. This discussion brings us to our next two hypotheses:

> **H3:** ***People are less sensitive to product price in the simultaneous ESC information availability scenario than in the delayed availability scenario.***

> **H4:** ***Product quality has a stronger influence on product choice in the simultaneous ESC information availability scenario than in the delayed availability scenario.***

The above hypotheses formalize two product-focused risk-handling strategies that people might adopt in the simultaneous ESC information availability scenario.

3.4.5.3 Impact on demand for ESCs

It is not readily clear whether the simultaneous availability of ESC information leads to higher or lower ESC purchase likelihood. On the one hand, a mental accounting argument (Thaler 1985) suggests that the earlier availability of information might affect how people allocate funds

between the product and ESC purchases. If the product and its ESC belong in the same mental account as suggested in Chen et al. (2009), contemplating an ESC purchase at the product choice stage might impact the funds allocated to the purchase of the product. In this case, people might be inclined to spend less for the product to accommodate an ESC purchase, which could make ESC purchase more likely in the simultaneous information availability condition.

On the other hand, the earlier access to ESC information can allow people to anticipate the ESC purchase decision and mitigate the risk of product failure by allocating more funds to the product purchase. This strategy could ensure higher product quality and reliability that in turn counterbalances heightened levels of perceived risk in the simultaneous scenario. In doing so, these consumers follow the adage that 'prevention is better than cure'. According to this argument, buyers might be inclined to take a preventative measure through higher spending for the product purchase, and this could lead to a lower ESC purchase likelihood in the simultaneous condition. Theoretically speaking, both of the above accounts might be manifested in the market.

In addition to the above two accounts, any change in demand for ESCs in the simultaneous availability condition might also depend on whether people belong to segments of the market with high vs. low risk aversion. Segments with higher risk aversion levels might be inclined to seek additional insurance and be more likely to buy ESCs in the simultaneous condition, while segments with lower risk aversion levels, might ensure they buy a more reliable product.

Despite the fact that demand for ESCs might change asymmetrically for different segments of the market, we know that a higher percentage of consumers fall into the "ESC decliner" segment. Buyers in this segment of the market do not consider purchasing an ESC in their durable product shopping basket, and are more likely to adopt a preventative product-focused risk-handling strategy in the simultaneous condition. If a higher percentage of people decline ESCs, then a

higher percentage of people are also likely to invest in the product purchase in response to a heightened perceived risk. Consequently, people would on average be less likely to purchase ESCs in the simultaneous ESC information availability scenario, which brings us to our last hypothesis:

> **H5:** ***People are less likely to purchase ESCs in the simultaneous ESC information availability scenario than in the delayed availability scenario.***

Taken together, the above hypotheses address how both ESC and product purchase decisions might be affected by the simultaneous vs. delayed ESC information availability scenarios. In the next section, we describe a pilot study designed to detect potential changes in ESC purchase decisions in response to the manipulation of ESC information availability. The pilot study will be followed by a more extensive choice experiment to test the hypotheses developed in this section.

3.5 Pilot study

We conducted an exploratory pilot study with the intent to test whether a very simple choice experiment would reveal any observable changes in ESC purchase behavior when ESC information was presented alongside product information (i.e. simultaneous availability condition vs. the delayed availability). To this end, we tested to see if willingness to pay (WTP) for ESCs would change if we manipulated ESC information availability.

As noted earlier, concept priming can also affect perceptions of risk or product failure. In fact, it might be one channel through which the simultaneous availability of ESC information may also affect product or ESC purchase decisions. Therefore, we also intended to test whether

concept priming alone would be able to produce results similar to the simultaneous availability of ESC information. To this end, we added a condition to our study to test for the effect of concept priming in the delayed availability condition.

We used a single-factor between-subjects design. We randomly assigned 114 adult participants to three information availability conditions. The participants were recruited from Amazon Mechanical Turk's US participant pool which provides easy access to a large, stable and diverse subject pool (Mason and Suri 2012). Despite some caveats regarding the use of the MTurk subject pool for behavioral research in some domains, MTurk participants are very similar to community and student samples and produce reliable results consistent with standard decision making biases (Goodman et al. 2013; Mason and Suri 2012).

Our single factor of interest in this study was "ESC information availability strategy" with three levels as shown in Table 3-1.

Table 3-1 The levels of the single factor studied in Study 1 of Chapter 5

Information availability strategy	Number of subjects
Delayed availability of ESC information	38
Primed delayed availability of ESC information	37
Simultaneous availability of ESC information with product information	39

We will refer to our three experimental conditions as a) delayed availability, b) primed delayed availability and c) simultaneous availability scenarios. In all scenarios, participants observed the same cover story that asked them to consider purchasing a smart watch. The smart watch category was chosen as a product category in which most consumers may not have any previous product performance or quality knowledge, which could potentially contaminate our analysis.

All participants were asked to choose one of four smart watch options based on their prices from a product choice menu. The order of the presentation of the four options was randomized in all three conditions. In the absence of any product/attribute information other than price, which could contaminate our results if present, participants were told that they had to choose from four brands that were made by different companies and had different quality levels. The products would be similar in terms of features and attributes, but no attribute other than price was provided. No brand name was provided to prevent differential willingness to pay due to brand knowledge. Hence, the products could be merely differentiated by their price differences. The duration of all ESCs for all three conditions was held constant at two years.

Participants in the *simultaneous availability condition* were able to observe ESC prices alongside product price while they were choosing a product from a four-option product choice menu. In addition, after making their product choice, they would see the price of the chosen product and its warranty information in the following screen.

Participants in the *delayed availability condition* observed no extended warranty information when choosing their product from the product choice menu. After they chose their products, they would see both price and warranty information for the chosen product in the next screen.

Participants in the *primed delayed condition* were presented with a priming manipulation before observing the product choice menu. They were asked to complete a sentence-unscrambling task[1] that intended to prime the "product failure" concept. Product categories unrelated to the study, (i.e. cars and lawn mowers) were chosen for priming this concept. After

[1] Sentence 1: has / a / John / working / lawn mower / could / I / borrow;
Sentence 2: the car / has / sounds / engine / started / strange / making.

the priming screen, participants in this condition would go through the exact same screens as the delayed condition.[1]

As noted earlier, after making their product choice, all participants were informed of the price of a two-year extended warranty for their chosen product in addition to being reminded of the price of the product they chose. Then, they were asked to provide their maximum willingness to pay (WTP) for an extended warranty for this product. After indicating their WTP for an ESC, all participants responded to a short survey to measure a number of covariates.

One of the important variables to measure and account for in our analysis is participants' reference prices. Willingness to pay is expected to be significantly affected by reference price levels. Hence, we used a self-reporting method of reference price elicitation used in prior research: We told participants that a few other stores also offer extended warranties for smart watches in their area and asked them to indicate how much they thought these other stores might charge on average for a two-year extended warranty of a $200 smart watch.

In addition, we collected data on a number of covariates. These variables were measured using single 5- or 7-point Likert scales.[2] Data on age, sex, and income levels were also recorded.

The main difference between the simultaneous and delayed scenarios is the fact that in the simultaneous scenario, subjects observe ESC information alongside product attribute information for all four alternatives in the choice set. In the delayed scenario, they only observe ESC information subsequent to their product choice, i.e. after they choose a product from the same group of four alternatives. The primed delayed scenario is similar to the delayed scenario with

[1] See Appendices 3-1 to 3-4 for sample screens of the three conditions and the cover story.
[2] See Appendix 3-5 for exact wording of these questions.

one small difference. Subjects in this scenario are asked to do a sentence unscrambling task which primes them the concept of "product failure". This condition was added to see whether any observed effect in the simultaneous scenario could have been reproduced with mere concept priming in the delayed scenario.

3.5.1 Pilot study results

In this section, we present the results of the pilot study. Since WTP values depend on product prices as well, we divided the WTP values by the chosen product's price to come up with a normalized WTP value which we call *WTP ratio*. Hence, WTP ratio is defined as the ratio of product price that a person in willing to pay for an ESC to insure it. The WTP values in our data had a range of \$1-\$60 (Mean = \$21.29, SD=12.83). The WTP ratios had a range of 0.007-0.34 (Mean = 0.12, SD= 0.07). Figure 3-2 illustrates the mean WTP ratios for our three conditions. We conducted an ANOVA analysis to compare the effect of information availability scenarios on buyers' willingness to pay for an ESC for their chosen product. ANOVA results confirmed a significant effect of information availability strategy on WTP ratios ($F(2,107) = 4.10$, P-value = 0.02).

To statistically compare WTP ratios across conditions, a pairwise comparison test was conducted. The results show a significant difference between the WTP ratio of the simultaneous condition and the delayed condition (t-stat = 3.54, p-value = 0.002) and a significant difference between the WTP ratios of the simultaneous condition with the primed delayed condition (t-stat = 3.09, p-value = 0.007). The difference in mean WTP ratios between the delayed and the primed delayed conditions was not significant (t-stat = 0.39, p-value = 0.92).

Figure 3-2 Mean WTP ratios by group

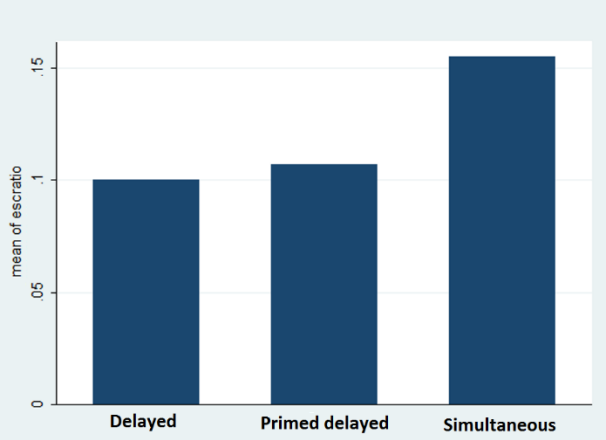


Table 3-2 Regression results: DV= WTP ratio

DV: WTP ratio[++]	Coefficient	Robust Std. Err.	t-statistic	P-value	Sig.
Condition[+]					
Primed delayed	0.008	0.02	0.51	0.61	
Simultaneous	**0.041**	**0.01**	**2.79**	**0.006**	***
Reference Price[+++]	**0.002**	**0.0006**	**2.31**	**0.023**	**
Sex (Female)	0.001	0.022	0.670	0.50	
Age	0.008	0.006	0.88	0.38	
Income	-0.0003	0.002	-1.30	0.22	
Financial Risk taking	-0.005	0.006	-0.16	0.87	
Tech savviness	0.009	0.009	1.12	0.27	
Quality Importance	0.001	0.004	0.40	0.69	
Buy Reliable	**-0.034**	**0.012**	**-2.85**	**0.005**	***
Buy Reliable x Condition					
Primed delayed	**0.089**	**0.032**	**2.77**	**0.007**	***
Simultaneous	**0.073**	**0.023**	**3.16**	**0.002**	***
Intercept	0.101	0.010	8.89	0.000	***

$F(12,101) = 4.66$, $R^2=0.30$, Adjusted $R^2=0.22$, Significance codes: 0.01 '***'; 0.05 ' **'; 0.1 ' * ' ;

[+] Base level for the condition variable: Delayed

[++] See Appendix 3-5 for survey questions pertaining to each variable and see Appendix 3-6 for a full model that includes all the interactions between condition and the rest of the covariates. The insignificant interactions were excluded here for parsimony.

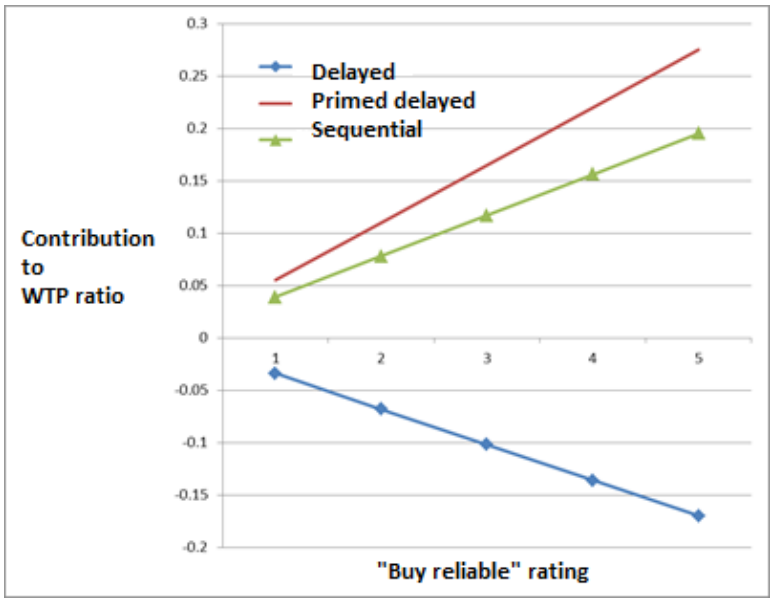
[+++] We do not find a significant change across the conditions for this variable, as demonstrated by insignificant interaction terms shown in the full model provided in Appendix 3-6.

In order to shed more light on the relationship between WTP ratios and our measured variables, we ran a regression model with robust standard errors. The overall regression model was highly significant (F(12,101) = 4.66, Adjusted R2=0.22).

Table 3-2 summarizes the regression results.

According to the regression model results, reference prices had a significant positive effect on WTP ratios which is to be expected. In addition, the results show that both the main effect and the interaction term for the "Buy reliable" [1] variable are significant. The effect of this variable on WTP ratios has been plotted in Figure 3-3.

Figure 3-3 The differential effect of "Buy reliable" on WTP ratios across conditions



[1] "Buy reliable" measures the extent of agreement with this statement: "I usually try to make sure I'm buying a reliable electronic product that is not likely to break down." A 5-point Likert scale was used for this question (1=Strongly Disagree..., 5=Strongly Agree).

As this figure illustrates, participants in the delayed condition who tend to buy reliable products pay lower WTP ratios. This finding makes intuitive sense as people who tend to buy more reliable products are expected to depend less on ESCs and their willingness to pay for ESCs is expected to be lower. However, this effect reverses for participants in the simultaneous and the primed delayed scenarios. This finding shows that both *priming* and the *simultaneous availability of ESC information* increased WTP ratios for people who scored higher on the "Buy reliable" variable. Interestingly, for participants in these two conditions, the propensity to buy reliable products loses its inhibitive effect on WTP ratios. In other words, buying reliable products may not sufficiently reduce their perceptions of risk and, as a result, does not reduce their willingness to pay for ESCs.

The similarity of response patterns for the simultaneous and the primed sequential conditions suggests that participants in the simultaneous scenario might also experience a *priming* effect. In addition, the unexpected positive relationship between the "Buy reliable" scores and ESC ratio for the primed sequential scenario points to the success of our priming manipulation.

It is interesting to note that being in the primed delayed condition, led to higher WTP ratios for people with higher "buy reliable" levels in this group, whereas being in the simultaneous condition, not only led to higher WTP ratios for those with higher "buy reliable" levels, but also caused an overall higher WTP ratio level as demonstrated by the effect of the Simultaneous condition in

Table 3-2. This observation suggests that the simultaneous scenario might entail more influence than a simple priming scenario and the other identified mechanisms, namely availability and construal level theory, might be playing a role in the simultaneous scenario as well.

The above results provide support for a positive effect of the simultaneous information availability scenario on WTP ratios for ESCs, and suggest that priming alone may not be sufficient to reproduce the effect observed for the simultaneous availability condition. These initial findings motivated a deeper analysis of the impact of our proposed information availability scenarios on both product and ESC purchase decisions. To this end, we conducted a choice experiment to further explore and scrutinize the impact of information availability on purchase decisions.

3.6 Choice experiment design

Our pilot study showed that people might be willing to pay significantly higher prices for ESCs in the simultaneous information availability scenario. This study provides evidence for our initial prediction that simultaneous availability of ESC information alongside product prices might indeed affect consumers' risk reduction strategies. However, the study had a simple design and was only meant to be exploratory. To examine consumer choice behavior under the two ESC information availability scenarios more closely, we designed a second study involving a choice experiment that allowed us to test the hypotheses developed in the earlier sections. For each choice set in our study, participants would go through a product choice task followed by a simple filler game. After this filler task, participants saw a screen that offers them an extended warranty for their chosen product. Subjects would be randomly assigned to one of two experimental conditions, namely, the simultaneous vs. delayed ESC information availability conditions. The only difference between the two conditions is that participants will also observe the information for an optional extended warranty for each of the products displayed in the product choice task in the simultaneous condition. This set-up basically requires us to design a choice experiment for

the product choice task as the details of the ESC choice task would depend on the chosen product.

Huber and Zwerina (1996) identifies four principles, namely, utility balance, orthogonality, level balance, and minimal overlap to guide the design of efficient choice experiments. Satisfying these elements would maximize the design's D-efficiency.

D-efficiency, defined as the inverse of D-errors, needs to be maximized for an efficient design. Common efficiency measures for a design matrix X in linear models are based on the matrix X'X, since the variance-covariance matrix of the parameter estimates β is proportional to the inverse of this matrix. A design with a "small" variance-covariance matrix is considered to be efficient, and D-error is defined as a function of the geometric mean of the eigenvalues of this matrix, which should be minimized for an efficient design (Kuhfeld 2005b).

Kuhfeld (2005b) states that it is impossible to find a design that satisfies all four principles discussed by Huber and Zwerina (1996). Instead, Zwerina et al. (1996) show that a computerized search strategy can be used to find efficient choice designs that is able to directly minimize D-error despite only approximately satisfying the above principles. Relative D-efficiency, which is the ratio of D-efficiency to the D-efficiency for a possibly hypothetical optimal design is used for comparison of designs, and ranges from 0 to 100 (Kuhfeld 2005a).

For this choice experiment, we followed the above design paradigm, and conducted an algorithmic search for a choice design that maximizes D-efficiency given the number of levels we specified for each design factor. This search produced a design with a relative D-efficiency of 76 while avoiding dominant alternatives in each choice set. Most published work in the literature use designs with relative D-efficiencies smaller than 50 (Kuhfeld 2005a).

3.6.1 Experiment design parameters

We chose a generic choice design over a labeled design for the product choice stage. In a generic choice design, there are no identifying product labels, such as brand names. This decision allowed us to prevent study participants from inferring unobservable product attributes such as product quality or reliability from brand names. Instead, we were able to use product quality as a design attribute, and directly manipulate quality levels in our design.

In addition, we used a forced-choice format as we were not interested in developing a predictive demand or market share model which could be negatively impacted by this decision. This format helped us reduce sparseness in ESC choice data and ensure participants had an opportunity to buy an ESC in all product purchase occasions, as a choice in the ESC category is contingent upon having chosen a product. Nevertheless, we note that in the absence of a no-choice or a choice-deferral option, we will be estimating a conditional demand model; i.e. conditional on people *choosing* among the existing alternatives, we estimate the probability of choice for each alternative (Hensher et al. 2005).

The decision of how many alternatives to include in each choice set was determined mainly by design efficiency concerns in addition to practical considerations. We created designs with 2, 3, 4, 5, and 6 alternatives in each choice set and chose the one that provided the maximum D-efficiency value while keeping user workload in check. This process led to our decision to include four alternatives in each of 16 choice sets per participant.

Respondents were asked to choose among television sets. The television sets varied over five attributes, namely, price: 4 levels ($399.85, $599.85, $799.85, $998.85), quality score: 4 levels (3 stars, 3.5 stars, 4 stars, 4.5 stars), Screen size: 3 levels (40”, 46”, 52”), Screen resolution: 2

levels (1080p HD, and 720p HD), Pedestal style: 2 levels (Single central pedestal, Two side pedestals). More levels for price, quality, and screen levels were used in the design to add more realism to the choice sets. Price values were jittered within ±3% of the values of main levels. Quality scores were depicted with yellow stars similar to Amazon's ratings, and pedestal types were shown in the TV images. In addition, product images were sized proportionate to their respective screen sizes in the choice set. Each product attribute was defined in the instructions that participants saw before starting the task. These definitions along with choice set images are provided in Appendix 3-7.

Following choice of each product, participants would play a simple clicking game as a filler task. This task was included to temporally separate the product and ESC purchase decisions similar to most retail contexts, where buyer make their product decision first, and are only asked about the extended warranty after communicating their product choice to the salesperson.

After doing this filler task, they would observe their chosen product in the next screen and were asked whether they would buy an ESC for this product at a given price. This ESC price was calculated as a percentage of the product's price. This percentage, which we call ESC price ratio, or ESC ratio, was kept constant within the same choice set, but varied from 8% to 18% across choice sets. This setup allowed us to prevent respondents from making inferences about product reliability from ESC ratio variations within the same choice set. A small jittering was applied to the actual ESC prices shown to respondents, but the jittered prices were constant for all participants.

In the next section, we will specify a model that will allow us to test our proposed hypotheses using data from the above choice experiment.

3.7 Model Specification

In our choice experiment, respondents are randomly assigned to one of simultaneous vs. delayed ESC information availability conditions. The only difference between these two conditions is that respondents observe optional extended warranty prices along with other product attributes in the simultaneous condition, whereas this information is missing in the delayed condition. Both groups are offered an extended warranty for their chosen product following a filler task, and are also able to view their chosen product in the ESC choice screen. We will use the random utility framework to specify three models for these related decisions. In our first specification, we assume that purchase decisions in the ESC category are made subsequent to the product purchase decisions and are temporally separated from them. In our second specification, we assume that despite some temporal separation, ESC purchase decisions are made in the product choice stage in at least the simultaneous ESC information availability scenario. Although, each of these model specifications may not individually capture the reality of how the two inter-related decisions are made, they do allow us to test our hypotheses from different angles under the implied assumptions of each model. Since, the two decisions are actually temporally forced to be separated in our choice experiment design, we consider our main model specification below to be more in line with the reality of the situation, while the next model is meant to provide a validation check.

3.7.1 Main model specification: subsequent purchase decisions

In this specification, we recognize that respondents make their ESC purchase decisions subsequent to product purchase decisions identical to the way our choice experiment was set up.

The two decisions are temporally separated by a short clicking game task. Respondents in both of our ESC data availability conditions have to complete this task before going to the screen where they are offered with an ESC for their chosen product.

Consumers derive a utility from their choices in each of the two categories. For each offering category, this utility consists of a deterministic component determined by observable attributes and a stochastic component that represents the analyst's lack of information about the decision-makers' full preferences.

Let ${U_{ijt}}^{p}$ be the overall utility that individual *i* receives from alternative *j* in the product choice set *t*, and let ${U_{ijt}}^{w}$ be the utility she receives from purchasing an extended warranty for product *j* in the same choice occasion. The overall utility can be decomposed into a deterministic and a stochastic component such that

$${U_{ijt}}^{p} = {V_{ijt}}^{p} + {\epsilon_{ijt}}^{p}, \quad and \quad {V_{ijt}}^{p} = {X_{ijt}}^{p}\beta^{p} \qquad \text{Equation 3.1}$$

$${U_{ijt}}^{w} = {V_{ijt}}^{w} + {\epsilon_{ijt}}^{w}, \quad and \quad {V_{ijt}}^{w} = {X_{ijt}}^{w}\beta^{w} \qquad \text{Equation 3.2}$$

Where the superscript p denotes the product and w denotes the extended warranty. The deterministic components (V) are a linear-in-parameters function of observed product or warranty attributes ($X^{p}$and X^{w}) that affect each purchase decision and the stochastic components of utility (ϵ) have i.i.d. type 1 extreme value distributions. The main variables that comprise the deterministic component of each decision ($X^{p}$and X^{w}) are the choice attributes explained in Section 3.6.1. We also included additional interaction terms that will be discussed in Section 3.10 on estimation results. The $\beta's$ represent consumers' taste parameters in each of the two choice categories.

The probability that individual *i* chooses product *j* in choice set *t* is given by the multinomial Logit model as:

$$\Pr\{{d_{ijt}}^{p} = 1\} = \frac{e^{{V_{ijt}}^{p}}}{\sum_{ijt} e^{{V_{ijt}}^{p}}} \quad \text{Equation 3.3}$$

Where ${d_{ijt}}^{p}$ equals one if person *i* chooses product *j* in choice set *t*, and ${d_{ijt}}^{w}$ equals one if the same person also buys an ESC for that product.

The probability that this individual chooses to buy an extended warranty for the product chosen in choice set t is given by the binary Logit model as

$$\Pr\{{d_{ijt}}^{w} = 1 \mid {d_{ijt}}^{p} = 1\} = \frac{e^{{V_{ijt}}^{w}}}{1+e^{{V_{ijt}}^{w}}} \quad \text{Equation 3.4}$$

The unconditional choice probability of buying a product with a warranty is given by:

$$\begin{aligned}\Pr\{{d_{ijt}}^{p} = 1, {d_{ijt}}^{w} = 1\} &= \Pr\{{d_{ijt}}^{w} = 1 \mid {d_{ijt}}^{p} = 1\} \times \Pr\{{d_{ijt}}^{p} = 1\} \\ &= \frac{e^{{V_{ijt}}^{p}}}{\sum_{ijt} e^{{V_{ijt}}^{p}}} \times \frac{e^{{V_{ijt}}^{w}}}{1+e^{{V_{ijt}}^{w}}} \quad \text{Equation 3.5}\end{aligned}$$

$$\text{Likelihood} = \prod_{i=1}^{N}\prod_{t=1}^{T}\prod_{j=1}^{J}\left(\frac{e^{{V_{ijt}}^{p}}}{\sum_{ij} e^{{V_{ijt}}^{p}}}\right)^{{d_{ijt}}^{p}}\left(\frac{e^{{V_{ijt}}^{w}}}{1+e^{{V_{ijt}}^{w}}}\right)^{{d_{ijt}}^{w}}\left(1-\frac{e^{{V_{ijt}}^{w}}}{1+e^{{V_{ijt}}^{w}}}\right)^{1-{d_{ijt}}^{w}} \quad \text{Eq. 3.6}$$

The above specification assumes independent error terms across the two choice models while imposing similar scales for the two models. Maximum likelihood estimation was employed to estimate the parameters in the above choice probabilities. The above formulation provides point estimates for model parameters, and suffers from the same limitations as the Multinomial Logit model, where the IIA property could be violated, unobserved factors are independent across alternatives, and have the same variance across alternatives (Louviere et al. 2000; Train 2009).

Hence, we also used a mixed Logit formulation that allows the unobserved factors to be correlated over alternatives. The mixed Logit model enables us to estimate a distribution for the parameters of interest, which also makes it possible to account for unobserved heterogeneity (Train 2009). To estimate the mixed Logit formulation of the above model, we used maximum simulated likelihood estimation. In this estimation method, choice probabilities are estimated by averaging R simulated probabilities that are themselves computed using parameter values that are randomly drawn from the specified distribution for each parameter. The simulated likelihood (S.L.) function for *N* participants who observe *T* choice sets each, comprised of *J* alternatives, using *R* number of simulation draws is depicted below:

$$\text{S. L.} = \prod_{i=1}^{N} \frac{1}{R} \sum_{r=1}^{R} \prod_{t=1}^{T} \prod_{j=1}^{J} \left(\frac{e^{V_{ijt}{}^{p}}}{\sum_{ijt} e^{V_{ijt}{}^{p}}} \right)^{d_{ijt}{}^{p}} \left(\frac{e^{V_{ijt}{}^{w}}}{1 + e^{V_{ijt}{}^{w}}} \right)^{d_{ijt}{}^{w}} \left(1 - \frac{e^{V_{ijt}{}^{w}}}{1 + e^{V_{ijt}{}^{w}}} \right)^{1 - d_{ijt}{}^{w}} \quad \text{Eq. 3.7}$$

We allowed model parameters to have a normal distribution and used Halton sequences (Halton 1964) based on prime numbers, to draw from normal distributions for our simulation.

The interdependency between the product choice and ESC choice decisions were accommodated by using relevant product/ESC attributes in the choice sub-models for each decision.

3.7.2 Second model specification: Simultaneous decisions

In our choice experiment, people who are in the simultaneous ESC information availability scenario observe both product and ESC information at the same time. However, the experiment

is designed such that they first make their product choice, do a filler task in a second screen, are offered to buy an ESC in a third screen. . Our experiment was set up in this way to add realism to the process. In retail settings, ESC offers are always made at the checkout after people have made their product purchase decisions regardless of whether ESC information is available at the product choice stage or not. Similar to participants in the delayed condition, those who are in the simultaneous condition literally communicate their ESC purchase decision in the third screen by design, despite the possibility that they might have made their ESC purchase decision at the product choice stage because of their access to ESC price at that stage.

It is possible that at least some people who are in the simultaneous ESC availability scenario, and potentially also those who are in the delayed availability scenario make both product and ESC purchase decisions simultaneously. To allow for this possibility, we also estimate a model specification assuming that people make their choices from a hypothetical choice set that includes the initial four product alternatives as well as the same four products bundled with ESCs. In doing so, we assume that instead of choosing from among *four products* A, B, C, and D in each choice set, people are choosing among *eight alternatives*: product A, product B, product C, product D, product A & its ESC, product B & its ESC, product C & its ESC, and product D & its ESC. We reshape our collected choice data set to reflect this setup and add ESC to each product as a dummy attribute. We call this new variable withESC. For alternatives that are considered to be a bundle of a product and its ESC, the *withESC* variable takes the value of one, and it is zero for pure products in this hypothetical choice set. While people in the delayed ESC information availability do not observe ESC data in a specific product choice screen, they are also susceptible to simultaneous decision making for both categories based on their predispositions about buying an ESC and their formed/updated expectations about ESC prices

after going through the first choice set. We will estimate this simultaneous-decisions model using standard multinomial Logit and mixed Logit models. In the next section, we describe the data collection process and provide summary statistics of the choice data set.

3.8 Data collection

Data collection was conducted on Amazon MTurk. A total of 879 MTurk participants took part in our choice study. Each respondent went through 16 television choice sets. Following each television choice task, respondents played a short game (about 5 seconds) where they observed a set of randomly-dispersed colored dots and were randomly asked to click all dots of a randomly-determined color. Clicking the correct dots made *the next* button visible, and participants were able to go to the next screen when they clicked it. In this screen, their chosen TV set and its attributes were displayed and participants were asked if they would like to purchase a three-year extended warranty for this product at a price proportionate the product price (i.e., ESC price = ESC ratio × Product price). Regardless of their response to the ESC offering, participants were also asked to specify the maximum amount they were willing to pay for an extended warranty for their chosen product. All participants took a short survey after going through the choice experiment that included questions for measuring some covariates of interest, e.g., risk aversion, perceived product failure likelihood.

3.9 Data summary

We collected data from 879 respondents who participated in our study for a small monetary compensation. Of these, 437 people were randomly assigned to the delayed ESC information

availability scenario and 442 people were assigned to the simultaneous availability scenario. Data for some of the main variables have been summarized in Table 3-3 and Table 3-4.

Table 3-3 Data summary for main continuous variables

Variable	Mean	Std. Dev.	Min.	Max.
Product quality	3.7	0.57	3	4.5
Product price	695.2	228.5	374	1004
ESC price[1]	89.9	33.9	29.9	180.8
ESC ratio	0.13	0.02	0.08	0.18
WTP ratio	0.08	0.06	0	0.77
Perceived failure probability	27.36	20.54	0	100
Risk aversion	1.87	1.38	1	7

Table 3-4 Main categorical variables

Variable	No. of levels
Resolution (1080p HD =1, 720p HD =0)	2
Single-leg pedestal dummy	2
Screen size	
52”	2
46”	2
40”	2
Sex dummy (male=1)	2
Age	5

Our models included several interaction terms. For estimation purposes, we mean-centered the continuous variables before creating their interactions, and used their mean-centered versions in the models.

[1] This variable will not be directly used in our models due to its high correlation with product price. Instead, we will use ESC ratio to represent it, as ESC price is determined by ESC ratio × Product price.

3.10 Estimation results and discussion

In this section, we will provide a few statistical comparisons of the two experimental conditions, before moving on to provide model-based estimation results.

3.10.1 Comparison of willingness to pay

As mentioned earlier, regardless of a person's decision to buy or decline an extended warranty, we asked respondents in both conditions to specify the maximum amount they were willing to pay for an extended warranty for their chosen products. To compare the effect of our experimental condition on this variable, we first normalized WTP values through dividing them by their respective product prices to create what we call WTP ratios. We then conducted t-tests for differences in mean WTP ratios across our two experimental conditions under two scenarios. The summary for this variable is provided in Table 3-3.

In one scenario, we compared mean WTP ratios for all participants, whereas in a second scenario, we excluded ESC decliners from our analysis and conducted t-tests on the remaining observations. ESC decliners are defined as respondents who did not buy a single ESC in any of the 16 choice sets. As shown in Table 3-5, the results indicate a very small increase in WTP ratio in the simultaneous scenario in both scenarios, but the differences in the second scenario are slightly higher and more significant.

In our first hypothesis (H1), we posited that normalized willingness to pay for ESCs (i.e. WTP ratios) are higher in the simultaneous ESC information availability. Although, the above results provide evidence in support of this hypothesis, the observed effect is small in comparison to the results from the pilot study. Interestingly though, this effect is stronger if we exclude ESC

decliners and limit our attention to ESC buyers who are the main target market for ESCs. Under the simultaneous condition, potential ESC buyers are on average willing to pay five dollars more for the extended warranty of a product priced at $1000 than potential ESC buyers in the delayed condition.

Table 3-5 Two-sample t-test for WTP ratios

What is compared?	Delayed condition	Simultaneous condition	t-test result
All WTP ratios	0.082	0.085	t-stat(14062)=-1.95 p-value = 0.05
WTP ratios after excluding ESC decliners	0.108	0.113	t-stat(8942)=-3.67 p-value = 0.0002

In the short survey following the choice study, we also asked respondents to provide us with their preference for two gambles of the same expected value that involved a high vs. low riskiness. This question was meant to provide a measure of risk aversion. In addition, we asked respondents to provide us with their perceived probability of a TV set breaking down in the first three years of usage. These variables are summarized in Table 3-3. We did not find any significant difference in responses for these two variables across the two experimental conditions. This result could be due to the inadequacy of our measurement or it might mean that risk aversion levels or perceived product failure likelihood do not change across our two conditions. The latter scenario might be more likely as the observed pattern of responses suggest a heightened perceived need for insurance must have occurred in the simultaneous condition. Recently, Jindal (2013) showed that ESC purchase decisions are mainly driven by loss aversion rather than risk aversion. Unfortunately, we did not have a measure for loss aversion levels to see if they underwent any change across our two conditions.

3.10.2 Comparison of results from both models

Comparing the information criteria (AIC, and BIC) across the two models explained above seems to suggest a better fit of data to the simultaneous decision model. However, the two model structures are not nested to allow a direct comparison of information criteria across these two models as they use the data differently do to the different structures they impose on the data. As a result, the log-likelihood values from these models are based on different normalization constants. Since AIC and BIC are derived from log-likelihood values, we cannot directly compare the two models. Evidently, the simultaneous-decisions model uses the data more parsimoniously and has a better AIC and BIC.

The effect sizes in the simultaneous-decisions model are larger in absolute value. This is mainly due to difference in scales across the two models. In addition, the fact that the models use the data in different ways causes additional differences in effect sizes, such that slight variations in the ratio of effect sizes across the two models exist. Despite these differences, observed effects are theoretically consistent across both model.

3.10.3 Results for the main model specification: subsequent purchase decisions

Model fit parameters indicate a better fit of the mixed Logit over the standard Logit specification, as demonstrated by lower AIC and BIC values. All observed main effects are in the expected directions. We observe significant effects and preferences for lower prices, higher quality, higher screen resolutions, larger screen sizes, and the single-leg-pedestal TV set style.

In addition, the results from our sequential-decisions model uncover interesting patterns of choice behavior in the simultaneous condition. This model allows us to see how taste parameters might change under the simultaneous ESC information availability scenario.

To better understand risk handling activities adopted by buyers, we are mainly interested to see how choice parameters for price and quality change in both product and ESC purchase decisions. The interaction between product price and the simultaneous condition dummy variable shows how the weight of the product price attribute changes for buyers who are in the simultaneous condition. The significant positive effect of this interaction term indicates that price has a less negative effect on the product purchase decision in the simultaneous condition.[1] In other words, buyers in this condition tend to be less sensitive to product prices. This finding provides evidence in support of our third hypothesis (H3).

We are also interested to see how the effect of product quality might change in the product purchase decision for buyers in the simultaneous condition. The effect of the interaction term between product quality and the simultaneous condition dummy variable is significant and negative. Contrary to our expectation, quality seems to play a less positive effect in the product purchase in the simultaneous condition. Hence, our fourth hypothesis (H4) on the stronger influence of quality on product purchase decisions in the simultaneous condition finds no direct support. To better understand why we might be observing this unexpected effect, let us take a look at the effect of quality in the ESC choice sub-model.

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[1] All significance levels are reported at the common 5% level.

The main effect of quality in the ESC choice model is insignificant and negligible. One might expect that if quality provides a valid signal about product failure, the effect of quality on ESC purchase decisions must be negative. The lack of a significant effect for the main effect of quality suggests that, at least in our study, product quality is not affecting ESC purchase decisions in general. Interestingly however, we also observe that the interaction term between product quality and the simultaneous condition dummy in the ESC choice model is significant and positive. This shows that people are more likely to buy an extended warranty for higher quality products in the simultaneous condition. This result suggests that people who tend to buy ESCs, are buying them for higher quality products in the simultaneous condition, which could be conceived as a dual risk reduction strategy. This could also mean that people with higher risk aversion, i.e. those who buy ESCs, are also buying higher quality products in the simultaneous condition. If that is indeed the case, why are we observing that quality has a weaker effect in the product choice decision in the simultaneous scenario?

One possible explanation for this result may be that, in our experimental setup, product price is perceived to be more informative about product failure likelihood and product quality than the provided owner ratings on quality. As a result, people are inferring quality from price, which steals away from the effect of quality in the simultaneous condition. Such inferences are not unprecedented in past research. This situation is exactly what Tellis and Gaeth (1990) refer to as a *price-seeking* choice, where buyers "systematically ignore or misrepresent the uncertain information on quality and make a price-seeking choice", by choosing a product that has a higher price despite having a lower quality or probability of breakdown (Tellis and Gaeth 1990).

It is not difficult to speculate on where uncertainties about quality can come from in our own study. In our instructions for the choice experiment, we defined quality ratings as 'average owner

quality ratings collected by an online retailer.' Quality ratings from unknown users only become informative when a sizeable number of users provide those ratings. Otherwise a product might get a high quality rating simply because it has fewer but more positive reviews. Our definition of quality scores does not specify the number of ratings that were used to calculate average ratings displayed. This adds an element of uncertainty to these quality ratings, whereas price provides a stronger signal of quality as it is directly related to investments in production costs. It is likely that the less risk averse buyers in our study, relied more heavily on product prices, became less price sensitive, and in doing so, discounted the effect of product quality attribute in their decisions. Despite the above speculation, our study does not provide any evidence in support of the fourth hypothesis (H4), which may be an artifact of our study design.

It is also worthy to mention the effect of the interaction between product price and quality, which is negative and statistically significant. That is, for higher price levels the positive effect of quality on product choices is smaller. This result makes sense if higher price levels act as a substitute for quality. It could also be interpreted to mean that for higher quality levels, price tends to have a more negative impact on product purchase decisions and people become more price sensitive at higher quality levels. While both interpretations might be valid, the former is more consistent with the literature on the price-quality relationship. It is to be noted that product quality ratings and product prices were uncorrelated in our choice study by design.

Since product prices in our study were highly correlated with ESC prices, we did not directly investigate the effect of the ESC information availability scenarios on ESC prices. Instead, we investigated their effect on ESC ratios, that is, the ratio of ESC price to product price for a given alternative. ESC ratios are uncorrelated with product price by design, and correlated with ESC prices.

Table 3-6 Results for the main model specification: subsequent purchase decisions

Models	Explanatory variables (Hypothesis #)	Standard Logit (S.E.)	Mixed Logit (S.E.)
Product Choice Model	1080p HD resolution dummy (vs. 720p HD)	1.06 (0.02) ***	1.66 (0.09) ***
	Single-leg pedestal dummy	0.17 (0.02) ***	0.26 (0.03) ***
	Product price (in 1000 dollars)	-3.98 (0.08) ***	-5.81 (0.29) ***
	Product quality	0.84 (0.03) ***	1.27 (0.07) ***
	46" screen size (Reference level: 42")	0.23 (0.03) ***	0.4 (0.05) ***
	52" screen size (Reference level: 42")	0.72 (0.03) ***	1.15 (0.07) ***
	Product price × Simultaneous availability dummy **(H3)**	0.42 (0.1) ***	0.56 (0.14) ***
	Product quality × Simultaneous availability dummy **(H4)**	-0.13 (0.04) ***	-0.18 (0.05) ***
	Product Price × Quality	-0.42 (0.08) ***	-0.58 (0.12) ***
Warranty Choice Model	Product quality	-0.03 (0.05)	-0.01 (0.05)
	ESC price ratio	-22.77 (1.26) ***	-34.36 (4.65) ***
	Simultaneous availability dummy **(H5)**	-0.70 (0.03) ***	-0.79 (0.05) ***
	Product quality × Simultaneous availability dummy	0.3 (0.07) ***	0.34 (0.08) ***
	ESC price ratio × Simultaneous availability dummy **(H2)**	4.33 (1.78) **	7.67 (2.89) ***
	1080p HD resolution SD	–	1.71 (0.15) ***

Standard Deviations[1]	Single-Leg Pedestal dummy SD	_	0.01 (0.06)
	Product Price SD	_	2.31 (0.34) ***
	Product quality SD	_	0.92 (0.13) ***
	46" screen SD	_	1.27 (0.16) ***
	52" screen SD	_	0.72 (0.2) ***
	product quality SD	_	1.05 (0.4) ***
	ESC price ratio SD	_	37.64 (9.73) ***
	Simultaneous availability dummy SD	_	0.01 (0.04)
	Model parameters / statistics		
	Log likelihood Value	-25598.53	-25518.41
	AIC	51225.05	51082.82
	BIC	51330.77	51256.5

We find the expected negative effect for the main effect of ESC ratio on ESC purchase likelihood, i.e., people are less likely to buy an extended warranty for higher ESC ratios. We also observe that buyers in the simultaneous ESC information availability condition, are less sensitive to ESC ratio values in their ESC purchase decisions as indicated by the ESC price ratio × Simultaneous availability dummy interaction term. This result shows that people are less sensitive

[1] Parameters for interaction terms were not given a random distribution for parsimony. Nevertheless, the results are robust.

to ESC prices in the simultaneous condition and provides support for our second hypothesis (H2).

The last hypothesized effect to discuss for our main model specification is the effect of the simultaneous condition on extended warranty purchase likelihood. We measured this effect by using a simultaneous condition dummy variable in the ESC choice sub-model. This effect is significant and negative. People tend to be less likely to purchase ESCs in the simultaneous ESC information availability condition. This result provides evidence in support of our fifth hypothesis (H5). We will further scrutinize this result and its meaning in our discussion of the next model specifications.

As described earlier, we kept ESC ratios constant within each choice set by design and only allowed them to vary across choice sets. As a result of this design decision, ESC ratio differences are not expected to affect what product a person buys within each choice set in the simultaneous condition, where ESC prices are displayed in the product choice stage. However, it could be argued that the overall level of the ESC ratio in a given choice set (e.g. 10% vs. 50%) might allow buyers to anticipate their ESC choice decision and this could affect their taste parameters for product price and quality in the product purchase decision. They might modify their product choices to buy higher quality or higher priced products as they modify their risk reduction strategy conditional on their anticipated ESC purchase decision. We tested this possibility by adding two interaction terms to the mixed Logit model displayed in Table 3-6. The results have been shown in the table provided in Appendix 3-8. The added variables are two three-way interactions, 1) the interaction of ESC ratio with product price and the simultaneous condition dummy, and 2) the interaction of ESC ratio with product quality and the simultaneous condition dummy. The results show that these two effects are not significant in our model. Although, the

proposed effect of ESC ratio levels on price and quality parameters in the product choice model are plausible to exist, our data does not seem to be rich enough to capture this subtlety.

3.10.4 Results for the second model specification: simultaneous purchase decisions

As discussed in section 3.7.2, we also modeled our choice data with the assumption that respondents make their product and ESC purchase decision simultaneously. In this model, we have eight alternatives in each choice set instead of four. The four extra alternatives are created by bundling the initial four products with their respective ESCs. As a result, instead of assuming that people make their product purchase decision first and then decide whether to buy an ESC or not, we assume that people are simultaneously making both decisions by deciding to choose from products or products that are bundled with ESCs. The results for the simultaneous decision model, specified in Sections 3.7.2, are provided in Table 3-7.

The interaction terms between the product price and quality and the simultaneous condition dummy follow the pattern of results from the previous models and provide evidence in support of the third hypothesis (H3), but not the fourth hypothesis (H4).

The choice alternatives in our second model specification have an extra attribute, called *withESC,* which equals one if the choice alternative is bundled with an ESC. We create interaction terms between the withESC variable and other important variables to enable our simultaneous model to capture differences in tastes across the two experimental conditions.

Most people tend to decline ESC offerings, which implies that they are less likely to buy product-ESC bundles. As a result, we expect the effect of this variable to be negative, which is indeed the case, and withESC variable has a negative effect on consumer choices. In addition,

there are four variables in this model that capture the differential impact of simultaneous vs. delayed information availability scenarios on ESC purchase decisions and are printed in bold italicized font in Table 3-7.

Table 3-7 Results for the second model specification: simultaneous purchase decisions

Model	Explanatory variables (Hypothesis #)	Mixed Logit (S.E.)
Model of choice from 8 alternatives	1080p HD resolution dummy (vs. 720p HD)	1.93 (0.08) ***
	Single-leg pedestal dummy	0.23 (0.03) ***
	Product price (in 1000 dollars)	-7.48 (0.06) ***
	Product quality	1.53 (0.09) ***
	46" screen size (Reference level: 42")	0.61 (0.04) ***
	52" screen size (Reference level: 42")	1.38 (0.06) ***
	Product price × Simultaneous availability dummy **(H3)**	0.91 (0.4) **
	Product quality × Simultaneous availability dummy **(H4)**	-0.27 (0.13) **
	Price × Quality	-0.91 (0.09) ***
	withESC	-1.52 (0.18) ***
	withESC × ESC ratio	-51.72 (0.07) ***
	withESC × ESC ratio × Simultaneous availability dummy (H2)	7.63 (0.35) ***
	withESC × Simultaneous availability dummy (H5)	-0.71 (0.21) ***

Standard Deviations	withESC SD	3.92 (0.12) ***
	46" screen size SD	0.01 (0.01)
	52" screen size SD	-1.02 (0.05) ***
	1080p HD resolution dummy SD	-2.11 (0.08) ***
	Single-leg pedestal dummy SD	0.01 (0.02)
	Product price (in 1000 dollars) SD	-5.6 (0.26) ***
	Product quality SD	1.69 (0.07) ***
	Model parameters / statistics	
	Log likelihood Value	-17286.7
	AIC	34599.38
	BIC	34697.54

As discussed in the previous section and as demonstrated in Appendix 3-6, ESC ratios do not affect *product* purchase decisions, at least in our data set. Hence, they are only relevant to the extended warranty purchase decision. The interaction term *withESC × ESC ratio* shows the effect of ESC ratio on *extended warranty* purchase decisions. This interaction term compares the effect of ESC ratio between the alternatives that are bundled with ESCs and those that are not. The significant negative effect for this interaction term indicates that ESC ratio has a negative effect on ESC purchase decisions which is to be expected.

The three-way interaction term, *withESC × ESC ratio × Simultaneous availability dummy*, compares the effect of *withESC × ESC ratio* across our two experimental conditions. In other words, it shows us how the effect of ESC ratio on extended warranty purchases varies across the two conditions.

The positive significant effect for this interaction term re-confirms our second hypothesis (H2) that people become less sensitive to ESC ratio levels, and equivalently less sensitive to ESC prices in the simultaneous condition.

The interaction between *withESC* and the simultaneous availability condition mirrors the effect of the simultaneous availability condition dummy in the ESC choice sub-model of Table 3-6, and has the expected negative effect, re-confirming our fifth hypothesis (H5): People in the simultaneous ESC information availability condition are less likely to buy ESCs. Despite this finding, we will delve deeper into why our choice data shows this outcome.

Breaking down ESC purchases and identifying their source provides additional insights in how our two conditions affected ESC purchase likelihood. Descriptive statistics show that 167 people from the simultaneous condition, and 153 people from the delayed condition purchased zero extended warranties across all choices.

The remaining 559 participants were divided into 275 people from the simultaneous scenario and 284 people in the delayed scenario. These two sub-groups, respectively purchased 2412, and 2306 ESCs. We can see that despite having fewer members, the subgroup in the simultaneous condition purchased more ESCs than the subgroup in the delayed condition. This shows despite the fact that our models indicate less ESC purchase likelihood in the simultaneous ESC information availability scenario, this net effect is the result of two opposing influences: One group, presumably the more risk averse segment, seems to become more likely to *buy* ESCs in the simultaneous condition, while another group, presumably those with lower risk aversion levels, seems to become more likely to *avoid* ESCs. This latter group might entirely counterbalance their potentially heightened perceptions of risk by becoming less sensitive to product prices and buying better products while ignoring the ESCs altogether. As a result, we

should not read too much into the finding that the net effect of our experimental manipulation on ESC purchase likelihood is negative. The response patterns seem to suggest differences across groups, potentially based on their risk or loss aversion levels, in whether they buy fewer or more ESCs in the simultaneous ESC information availability scenario.

Some people might argue that the observed variations in parameter tastes across our two conditions might be partly due to changes in scales rather than tastes as they are confounded. We address this concern by estimating a Generalized Multinomial Logit model (GMNL) (Fiebig et al. 2010) that allows us to control for differences in scale across buyers. The results from this model indicate that our findings remain unchanged under this specification. This GMNL model and its estimation results are presented in Appendix 3-9.

3.11 Conclusions and limitations

In this essay, we propose that the *mere availability* of ESC information, namely ESC price, alongside product attributes might affect how consumers respond to a potentially heightened level of perceived risk, product failure likelihood, or need for insurance. We use the availability heuristic and construal level theory to conceptualize potential pathways through which such perceptions might be affected.

Our results from a pilot study and a choice experiment indicate that the simultaneous availability of ESC information alongside product information might induce changes in consumer behavior that are consistent with a heightened perceived need for insurance. We observe that participants in our choice experiment adopt preventative product-focused and reparative ESC-focused risk reduction strategies in the simultaneous information availability scenario, which suggests that people with different levels of risk or loss aversion might adopt

different risk reduction mechanisms or a combination of them, when they are provided with ESC information at the product choice stage as opposed to receiving this information during the checkout.

We develop and test several hypotheses to study how consumer decisions might be affected as a result of the simultaneous availability of ESC information in the product choice stage.

We find that in the simultaneous condition, study participants not only become less sensitive to ESC prices, but also buy ESCs for higher quality products. This pattern of behavior suggests that at least some participants, presumably those with higher levels of risk or loss aversion, are adopting dual risk reduction strategies in the simultaneous ESC information availability condition. This pattern is indicative of an ESC-focused risk reduction strategy where buyers are in a reparative mind-set and have a propensity to become prepared for potential product repair in the future if the product breaks down or fails.

Buying ESCs for higher quality products is also consistent with prior research that find associations between higher quality levels and higher value for consumers Dodds et al. (1991); Sweeney et al. (1999), as the more valuable a product is, the more likely it is for people to insure it against failure.

A second pattern observed in our results shows that some participants become less likely to purchase ESCs in the simultaneous ESC information availability condition, and also become less sensitive to product prices. This pattern is indicative of a product-focused risk reduction strategy where buyers are in a preventative mind-set and have a propensity to prevent potential product break-down by investing more heavily in the product purchase.

Despite observing the two distinct patterns of product-focused preventative vs. the ESC-focused reparative risk reduction strategies in our results, it is very likely that buyers might adopt

either of these two strategies or some combination of both. Some people might focus on buying a better product while avoiding ESC, yet another group might invest more in insuring the product through an ESC purchase, while another segment might attempt to buy a better product and also make sure they insure it.

We also find that willingness to pay for extended warranties is slightly more in the simultaneous ESC information availability scenario, despite the fact that we don't find evidence for changes in perceptions of risk or product failure likelihood.

We tested our hypotheses under two mutually exclusive decision formation scenarios. Buyers are likely to engage in simultaneous decision making for both the product and its ESC, or make these decisions subsequent to one another. We specified two models that allow for these two possibilities and find that the same patterns of behavior are observed under these formulations.

The overall pattern of observed results indicate that retailers might benefit from offering extended warranty information alongside product information, as people might become less sensitive to both product and ESC prices in this condition. However, a field experiment is needed to see whether these gains could be counterbalanced by a slightly lower propensity to buy ESCs by the less risk-averse segment of the market under this ESC information availability scenario. In an actual implementation of this scenario in a retail context, the retailer also has to decide whether it wants to convey product failure rate signals by allowing ESC prices to vary based on product reliability. Nevertheless, earlier access to ESC information through the simultaneous availability of both product and ESC information might benefit consumers by allowing them to contemplate on ESC purchase decisions. More contemplation on this decision could result in more informed decision, lower return rates and higher customer satisfaction, which would benefit the retailer as well in the long run.

A limitation of our work is that our setup does not allow for the full spectrum of risk reduction strategies that people might adopt in the simultaneous scenario. For example, some people might delay product purchase when purchase risks are perceived to be higher. Our choice experiment does not have a no-choice alternative for reasons stated earlier and is not able to capture this risk reduction strategy. In addition, we tell participants that products are similar on attributes not explicitly shown in choice sets including manufacturer warranty lengths. Keeping manufacturer warranty lengths constant prevents us from capturing another potential risk reduction strategy in which buyers could adopt products with lengthier manufacturer warranties in response to higher perceived risk. It is likely that inclusion of opportunities to pursue these additional risk reduction strategies would cause changes in product and ESC product purchase likelihood and change our parameter sizes. However, all these risk reduction strategies could co-exist simultaneously and be tested in an adequately large sample. These limitations offer further avenues to extend and improve this line of research. The general limitations of lab experiments also apply in our case and a field experiment could provide a stronger test of our hypotheses.

In sum, this essay provides new evidence on how the control of the flow of information in retail environments might affect complex consumer decisions in complementary product and service categories. Our findings suggest that both retailers and consumers might benefit from the simultaneous availability of product and ESC information in the marketplace. We also contribute to the small but growing literature on extended service contracts and show how their interdependency with product decisions can shape decision outcomes in both the product and ESC categories. Our findings highlight the need to account for these interdependencies in the joint management of both product and ESC offerings.

Chapter 4 Conclusion

In this dissertation, we contribute to the burgeoning stream of research on extended service contracts (ESCs) in marketing. We asked two main research questions regarding consumers' ESC purchase decisions and attempted to answer them: 1) How do product brands affect consumers' decision to purchase an extended warranty for a product?, and 2) How do ESC information availability strategies (i.e., simultaneously available with product information vs. delayed availability only during checkout) affect consumers' product and ESC purchase decisions?

To answer the first question in Essay 1, we explored the effect of brand equity on ESC purchase decisions by analyzing a scanner panel data set from an electronics retailer and a stated choice data set that we specifically collected for this purpose. We developed and used a market-share residual-based measure of brand equity for the scanner panel data set and used a consumer-based brand equity measure in the stated choice data to test our main hypothesis on the relationship between brand equity and ESC purchase likelihood. We explored two mechanisms through which brand equity might affect consumers' ESC purchase decision.

We proposed that higher brand equity can have a positive effect on ESC purchase likelihood because of their higher value to the consumers (value effect). In addition, higher brand equity could be perceived as higher product reliability which can lead to a negative effect of brand equity on ESC purchase likelihood (reliability effect). We borrowed from findings in the literature to predict that the positive effect might dominate the negative effect, favoring an overall positive effect of brand equity on ESC purchase decisions. Our results from analyzing

two data sets provide evidence in support of the hypothesis that higher brand equity has an overall positive effect on ESC purchase likelihood.

The scanner panel data set in Essay 1 also allowed us to investigate the impact of push strategies at the store level on individuals' propensity to purchase extended warranties. We found that stores have a significant positive effect on these decisions and a store's ability to sell ESCs in non-focal categories can explain buyers' ESC purchase likelihood in a focal category.

We also tested the effect of several other factors on ESC purchase likelihood. Our analyses replicated prior findings on the effect of important variables on ESC purchase decisions, including the positive effects of product price and the hedonic-ness of a product category on ESC purchase likelihood.

Our main finding on the positive effect of brand equity on ESC purchase decisions provides one reason why Walmart might have extended its electronics product line to include more prominent brands in 2004 shortly after starting to offer extended warranties.

In sum, Essay 1 provided insights on how product brands and ESC purchase decisions might be related. Understanding this interdependency between a major product attribute and ESC purchase decisions can help retailers optimize their marketing mix decisions across both the product and ESC categories.

In Essay 2, we aimed to answer a second question that has not been addressed in the literature regarding the effect of retailers' ESC information provision strategies on product and ESC purchase decisions. Most retailers delay the availability of ESC information to the point when customers have made their product purchase decisions and are at the checkout to pay for their chosen products. In Essay 2, we studied the effect of ESC information availability strategies on both product and ESC purchase decisions. In particular, we tested how the simultaneous

availability of ESC information alongside product information might affect both product and ESC purchase decisions in comparison with the delayed ESC information availability condition.

Our findings from a choice experiment show that people in the simultaneous ESC information availability condition exhibit changes in their taste parameters that are indicative of risk handling activities they may be adopting. Specifically, we find effects that can be categorized into two distinct risk handling strategies. In one group of effects, we observe that participants in our choice experiment become less sensitive to ESC prices and buy ESCs for higher quality products. These changes suggest that these participants are adopting a reparative ESC-focused mindset where they become prepared to deal with potential product failure if and when it happens. In another group of effects, we observe that study participants become less sensitive to ESC prices and are also less likely to purchase ESCs in the simultaneous condition. These changes suggest that some participants are adopting a product-focused preventative mindset where they invest more heavily in the product to counterbalance a potentially heightened perceived need for insurance. Although, we are able to categorize the observed effects into the two above-mentioned patterns of preventative vs. reparative measures, some people are likely to adopt both of these measures or a combination of them.

In a stylized game-theoretical setting that a retailer competes with a manufacturer that offers base warranties, Heese (2012) finds that retailers benefit from inducing consumers to make simultaneous purchase decisions for both extended warranties and products by posting ESC information alongside product information. Our results also suggest that retailers might benefit from making ESC information available alongside product information as customers become less sensitive to both ESC and product prices in this situation. However, we also observe a lower ESC purchase likelihood by what can be inferred to be as the less risk averse segment of the

market. To assess the effect of the simultaneous availability condition on retailer profits, both of these effects should be evaluated in the field.

Consumers might find earlier access to ESC information beneficial in their decisions, which could in turn benefit retailers through higher customer satisfaction and retention rates. This latter effect benefits consumers and marketers alike, as more informed decision making and higher levels of customer satisfaction might also reduce the number of ESC returns and help marketers cultivate ongoing relationships with their customers that motivates repeat purchases and positive word of mouth (Fournier 1998).

Taken together, the two essays in this dissertation shed light on consumer behavior in the domain of consumer decision making for products and their extended service contracts, by studying two important interdependencies between decisions in these categories. In the first essay, we studied how an important product attribute, namely brand, affects ESC purchase decisions, and in the second essay, we studied how the simultaneous availability of ESC attribute information might affect both product and ESC decisions.

The strategic shift in the durable product retail industry from a product-dominant focus to a focus on both products and service delivery motivates further research on the factors that shape consumer behavior in these categories in order to improve our understanding of their interdependencies. This knowledge can help retailers better manage their marketing decisions in these two distinct categories, and avoid strategies that may be suboptimal due to ignoring such important linkages.

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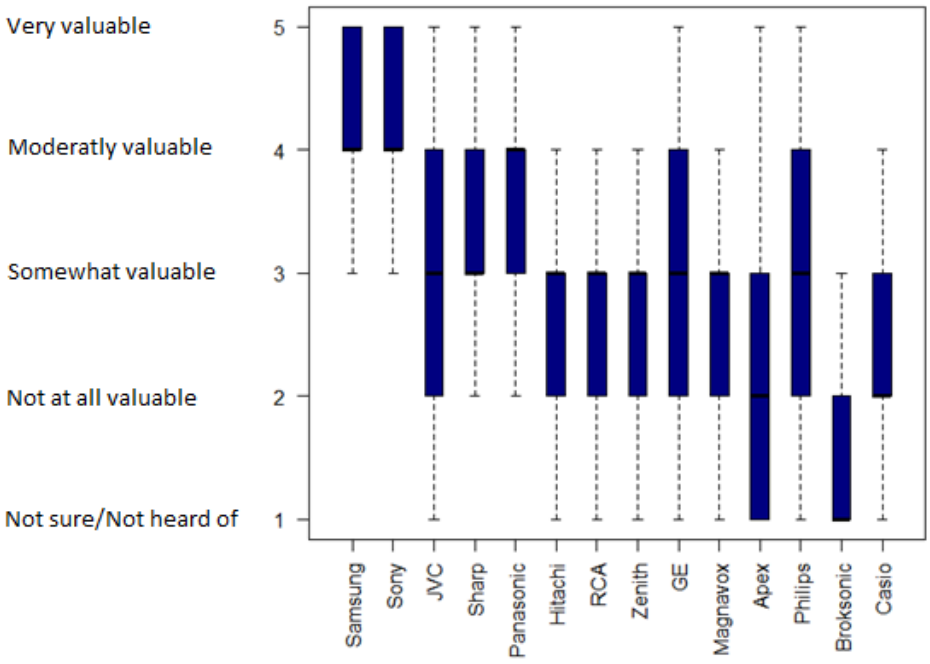
Appendices

Appendix 2-1: Box-plot of brand valuations for TV brands in the ISMS 1 dataset

As part of the survey conducted in the stated choice data collection for essay 1, 202 respondents answered the following question on a 5-point Likert scale for the shown brands: *"For each of the following brands, please indicate the level a TV set carrying this brand might be valuable to you."*



Appendix 2-2: Screenshots of the product choice screen in the market simulation study

You can sort the table by clicking the table headings.
After making your decision, please indicate the "Item number" of your chosen camera at the bottom of the page.

	Brand	Price	Resolution (Megapixels)	Optical Zoom	Movie quality	Built-in Wi-Fi	Item number
	Fujifilm	$249.99	12	6x	1080p	Yes	1
	Fujifilm	$59.99	8	4x	720p	-	2
	Fujifilm	$129.99	14	4x	720p	-	3
	Fujifilm	$79.99	8	6x	720p	-	4
	Vivitar	$69.99	12	6x	720p	-	5

You can sort the table by clicking the table headings.
After making your decision, please indicate the "Item number" of your chosen TV set at the bottom of the page

	Brand	Price	Screen size	Resolution	Item number
	LG	$1499.99	55"	Ultra HD 2160p	1
	LG	$1199.99	55"	Full HD 1080p	2
	LG	$899.99	50"	Full HD 1080p	3
	LG	$699.99	47"	Full HD 1080p	4
	LG	$499.99	42"	Full HD 1080p	5

Appendix 2-3: Screenshot of the consumer-based brand equity scale used in the market simulation study

To what extent, do you agree or disagree with the following statements about **the Sony brand**?

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
The likelihood that **the Sony brand** would be functional is very high.	○	○	○	○	○
The likely quality of **the Sony brand** is extremely high.	○	○	○	○	○
I am aware of **the Sony brand**.	○	○	○	○	○
I will not buy other brands if **the Sony brand** is available at the store.	○	○	○	○	○
Some characteristics of **the Sony brand** come to my mind quickly.	○	○	○	○	○
I can quickly recall the symbol or logo of **the Sony brand**.	○	○	○	○	○
I have difficulty in imagining **the Sony brand** in my mind.	○	○	○	○	○
I can recognize **the Sony brand** among other competing brands.	○	○	○	○	○
The Sony brand would be my first choice.	○	○	○	○	○
I consider myself to be loyal to **the Sony brand**.	○	○	○	○	○

Appendix 2-4: Full model results for the results provided in Table 2-7

The Dependent Variable in all following models is the *ESC purchased* dummy that equals one if an extended warranty was purchased for a product.

Standard Logit				
Explanatory variables	**Coefficient**	**Std. Err.**	**Z**	**Significance**
Intercept	-6.68	0.34	-19.7	***
Hedonic score	0.423	0.059	7.18	***
Log of Extended warranty price (1000 dollars)	-1.74	0.04	-42.37	***
Product price (1000 dollars) (H4)	1.41	0.06	23.47	***
Squared product price (1000 dollars)	-0.27	0.01	-32.01	***
Quarterly brand sales	0.05	0.02	3.38	***
Brand equity (H1)	1.82	0.39	4.66	***
Store ESC selling power (H2)	2.00	0.18	10.99	***
Past purchase dollar sum (1000 dollars)	-0.07	0.01	-7.84	***
Online transaction (H3)	-1.58	0.26	-6.13	***
ESC purchase ratio	1.45	0.04	39.89	***
Discounted product	-0.04	0.14	-0.25	
Sex(male=1)	-0.16	0.02	-6.68	***
Age	0.004	0.001	4.93	***
income				
2	-0.07	0.08	-0.89	
3	-0.11	0.06	-1.88	*
4	-0.11	0.06	-1.91	*
5	-0.12	0.06	-2.04	**
6	-0.19	0.05	-3.91	***
7	-0.29	0.05	-5.65	***
8	-0.31	0.06	-5.26	***
9	-0.37	0.05	-7.15	***
quarter				
3	-0.15	0.11	-1.37	
4	0.02	0.11	0.22	
5	-0.25	0.10	-2.55	**
6	0.02	0.10	0.16	
7	-0.13	0.11	-1.26	
8	-0.10	0.10	-1.01	

9	-0.28	0.10	-2.89	***
10	-0.11	0.09	-1.19	
11	-0.12	0.10	-1.13	
12	-0.06	0.10	-0.56	
13	0.00	0.09	-0.01	
14	0.16	0.09	1.68	*
15	0.20	0.10	2.09	**
16	0.24	0.10	2.51	**
17	-0.18	0.10	-1.9	*
18	-0.14	0.10	-1.37	
19	0.17	0.10	1.67	*
20	0.15	0.10	1.4	
21	-0.12	0.10	-1.17	
22	0.10	0.11	0.98	
23	0.31	0.11	2.93	***
24	0.26	0.11	2.36	**
25	0.11	0.12	0.89	
Subcategories				
25----UP-TV-VCR-COMBI	0.98	0.25	3.86	***
25--TELEVISION	0.83	0.13	6.34	***
27--TELEVISIONS	0.97	0.10	9.47	***
30--AND-LARGER-TV-S	0.96	0.14	6.8	***
9-16--COLOR-TV	-0.12	0.16	-0.77	
ADVANCED-TECHNOLOGY-TV	1.24	0.64	1.95	*
ANALOG-COMPONENTS	-0.15	0.21	-0.7	
AUDIO-FOR-VIDEO	1.06	0.13	8.07	***
AUTOMOTIVE-SECURITY	0.51	0.36	1.44	
CALCULATORS	1.06	0.87	1.22	
CAMCORDER	1.26	0.10	12.51	***
CAMERAS	1.27	0.17	7.48	***
CASSETTES-AND-CHANGERS	1.19	0.20	6.03	***
CD-BOOMBOXES	-0.33	0.15	-2.17	**
CD-PLAYER--AUTO	0.27	0.09	2.93	***
CLOCK-TABLE-RADIO	0.10	0.32	0.3	
COMPACT-DISC-PLAYER	-0.28	0.14	-2.05	**
COMPUTER-INPUT-DEVICES	-0.64	0.47	-1.37	
COMPUTER-MONITOR	0.74	0.21	3.53	***
COMPUTER-PRINTERS	1.85	0.29	6.41	***
DESKTOP-COMPUTERS	3.30	0.19	17.81	***

DIGITAL-AUDIO-RECORDING	0.70	0.20	3.49	***
DIGITAL-CAMERAS---SOHO	1.10	0.11	9.7	***
DIGITAL-VIDEO	0.01	0.09	0.11	
DIGITAL-VIDEO-RECORDERS	0.53	0.38	1.38	
DIRECTV-SYSTEMS	-0.85	0.11	-8.08	***
DISHWASHERS	0.32	0.33	0.95	
DISNEY-ELECTRONICS	-2.55	0.56	-4.55	***
DIVX--DVD	0.36	0.47	0.76	
DRYERS---ELECTRIC	0.35	0.29	1.19	
DRYERS---GAS	0.22	0.39	0.55	
ELECTRONIC-GAMES	-2.01	0.18	-10.94	***
FACSIMILES	1.13	0.26	4.29	***
FREEZERS	1.64	0.32	5.13	***
FRS-RADIOS	-0.18	0.33	-0.53	
HEADPHONES	-1.39	0.28	-5.06	***
IN-WALL-LOUD-SPEAKERS	-1.29	0.75	-1.72	*
INTERNET-HARDWARE	0.47	0.27	1.74	*
LOADED-ENCLOSURES	0.79	0.25	3.11	***
MICROWAVE-OVENS	1.34	0.36	3.72	***
MINI-COMPONENT-SYSTEMS	0.14	0.14	1	
MOBILE-VIDEO	1.51	0.23	6.54	***
NETWORKING	-0.18	0.22	-0.84	
NOTEBOOK-COMPUTERS	2.88	0.19	15.56	***
OPTICAL-DRIVES	0.06	0.50	0.13	
PDA-S	1.78	0.17	10.28	***
PERIPHERALS	-1.36	0.25	-5.52	***
PERSONAL-PORTABLES	0.84	0.19	4.54	***
PHONE-ANSWERING-DEVICES	1.77	0.35	5.02	***
PHONES---CORDLESS	0.86	0.20	4.37	***
PHONES---STD	1.22	0.30	4.01	***
PORT--COMPACT-DISC	-0.16	0.11	-1.41	
PORTABLE-DIG-AUDIO-PLAYER	-1.21	0.20	-6.01	***
PORTABLE-MINI-DISCS	0.21	0.36	0.6	
POWER-AMP---AUTO	1.33	0.17	7.61	***
POWERED-SUBWOOFERS	-2.54	0.37	-6.8	***
RADIOS	1.11	0.59	1.89	*
RANGES---ELECTRIC	0.86	0.36	2.38	**
RANGES---GAS	2.10	0.37	5.61	***
RECEIVER	0.90	0.14	6.45	***
RECORDERS	0.79	0.24	3.3	***

REFRIGERATOR-SIDE-BY-SIDE	1.93	0.25	7.64	***
REFRIGERATORS---TOP-MOUNT	1.53	0.30	5.19	***
SATELLITE-DISHES	-0.64	0.26	-2.49	**
SATELLITE-RADIO	0.03	0.19	0.15	
SCANNERS	1.38	0.26	5.34	***
SET-TOP-DECODERS	-0.69	0.36	-1.94	*
SPEAKER	-1.06	0.15	-7.25	***
SPEAKER---AUTO	0.70	0.11	6.3	***
SPECIALTY-TELECOM	-1.11	0.31	-3.62	***
SPECIALTY-TV	-0.64	0.30	-2.13	**
TELECORDER	1.45	0.22	6.74	***
TELEVISION	0.70	0.33	2.12	**
TV-PROJECTION	1.31	0.17	7.56	***
UNIVERSAL-REMOTE-CONTROLS	-0.61	0.36	-1.7	*
VCR-HOME	0.01	0.10	0.1	
WASHERS	0.52	0.25	2.13	**
WIRELESS-HANDSETS	1.74	0.20	8.57	***
WIRELESS-PHONE	0.73	0.28	2.65	***

Random Intercept Logit				
Explanatory variables	**Coefficient**	**Std. Err.**	**Z**	**Significance**
Intercept	-7.334	0.408	-17.96	***
Hedonic score	0.619	0.076	8.11	***
Log of Extended warranty price (1000 dollars)	-2.048	0.051	-40.26	***
Product price (1000 dollars) (H4)	1.784	0.077	23.07	***
Squared product price (1000 dollars)	-0.334	0.011	-31.25	***
Quarterly brand sales	0.051	0.018	2.79	***
Brand equity (H1)	2.222	0.488	4.55	***
Store ESC selling power (H2)	1.147	0.274	4.18	***
Past purchase dollar sum (1000 dollars)	-0.064	0.014	-4.58	***
Online transaction (H3)	-2.176	0.296	-7.34	***
ESC purchase ratio	0.087	0.072	1.21	
Discounted product	-0.046	0.176	-0.26	
Sex(male=1)	-0.234	0.039	-5.94	***
Age	0.006	0.001	4.5	***
income				

2	-0.088	0.116	-0.76	
3	-0.147	0.091	-1.61	
4	-0.148	0.088	-1.68	*
5	-0.165	0.089	-1.86	*
6	-0.304	0.076	-4	***
7	-0.453	0.081	-5.62	***
8	-0.418	0.09	-4.65	***
9	-0.572	0.081	-7.04	***
quarter				
3	-0.187	0.138	-1.35	
4	-0.01	0.134	-0.07	
5	-0.348	0.125	-2.79	***
6	0.048	0.129	0.37	
7	-0.182	0.134	-1.36	
8	-0.101	0.132	-0.77	
9	-0.332	0.124	-2.67	***
10	-0.103	0.12	-0.86	
11	-0.031	0.131	-0.24	
12	-0.01	0.128	-0.08	
13	0.079	0.119	0.66	
14	0.203	0.12	1.7	*
15	0.362	0.123	2.94	***
16	0.465	0.123	3.78	***
17	-0.114	0.121	-0.94	
18	-0.024	0.131	-0.18	
19	0.35	0.132	2.64	***
20	0.276	0.134	2.07	**
21	-0.052	0.127	-0.41	
22	0.193	0.136	1.42	
23	0.518	0.137	3.78	***
24	0.418	0.141	2.97	***
25	0.132	0.156	0.85	
Subcategories				
25----UP-TV-VCR-COMBI	1.195	0.313	3.82	***
25--TELEVISION	0.932	0.163	5.71	***
27--TELEVISIONS	1.152	0.125	9.21	***
30--AND-LARGER-TV-S	0.807	0.182	4.43	***
9-16--COLOR-TV	-0.22	0.191	-1.15	

ADVANCED-TECHNOLOGY-TV	1.414	0.746	1.9	*
ANALOG-COMPONENTS	0.064	0.258	0.25	
AUDIO-FOR-VIDEO	1.352	0.16	8.44	***
AUTOMOTIVE-SECURITY	1.122	0.436	2.57	**
CALCULATORS	1.083	0.993	1.09	
CAMCORDER	1.53	0.124	12.34	***
CAMERAS	1.5	0.213	7.05	***
CASSETTES-AND-CHANGERS	1.499	0.248	6.05	***
CD-BOOMBOXES	-0.674	0.199	-3.39	***
CD-PLAYER--AUTO	0.265	0.119	2.24	**
CLOCK-TABLE-RADIO	0.381	0.384	0.99	
COMPACT-DISC-PLAYER	-0.313	0.169	-1.85	*
COMPUTER-INPUT-DEVICES	-0.161	0.528	-0.3	
COMPUTER-MONITOR	1.37	0.261	5.25	***
COMPUTER-PRINTERS	2.713	0.364	7.45	***
DESKTOP-COMPUTERS	4.074	0.233	17.49	***
DIGITAL-AUDIO-RECORDING	0.915	0.244	3.75	***
DIGITAL-CAMERAS---SOHO	1.41	0.139	10.11	***
DIGITAL-VIDEO	0.118	0.111	1.07	
DIGITAL-VIDEO-RECORDERS	1.167	0.48	2.43	**
DIRECTV-SYSTEMS	-0.965	0.135	-7.16	***
DISHWASHERS	0.453	0.396	1.14	
DISNEY-ELECTRONICS	-3.482	0.682	-5.11	***
DIVX--DVD	0.396	0.546	0.72	
DRYERS---ELECTRIC	0.482	0.345	1.39	
DRYERS---GAS	0.382	0.47	0.81	
ELECTRONIC-GAMES	-2.703	0.24	-11.25	***
FACSIMILES	1.659	0.326	5.08	***
FREEZERS	2.131	0.397	5.37	***
FRS-RADIOS	0.296	0.395	0.75	
HEADPHONES	-1.451	0.318	-4.56	***
IN-WALL-LOUD-SPEAKERS	-1.066	0.84	-1.27	
INTERNET-HARDWARE	0.921	0.33	2.8	***
LOADED-ENCLOSURES	1.437	0.306	4.7	***
MICROWAVE-OVENS	2.037	0.435	4.68	***
MINI-COMPONENT-SYSTEMS	0.341	0.173	1.97	**
MOBILE-VIDEO	1.853	0.286	6.49	***
NETWORKING	0.123	0.267	0.46	
NOTEBOOK-COMPUTERS	3.565	0.233	15.32	***
OPTICAL-DRIVES	0.288	0.626	0.46	

PDA-S	2.271	0.216	10.53	***
PERIPHERALS	-1.399	0.281	-4.98	***
PERSONAL-PORTABLES	0.933	0.238	3.92	***
PHONE-ANSWERING-DEVICES	2.514	0.44	5.71	***
PHONES---CORDLESS	1.338	0.246	5.45	***
PHONES---STD	1.814	0.373	4.87	***
PORT--COMPACT-DISC	-0.373	0.145	-2.57	**
PORTABLE-DIG-AUDIO-PLAYER	-1.536	0.239	-6.43	***
PORTABLE-MINI-DISCS	0.292	0.446	0.66	
POWER-AMP---AUTO	1.866	0.22	8.48	***
POWERED-SUBWOOFERS	-3.09	0.423	-7.3	***
RADIOS	1.002	0.711	1.41	
RANGES---ELECTRIC	1.08	0.438	2.47	**
RANGES---GAS	2.732	0.472	5.79	***
RECEIVER	1.299	0.174	7.46	***
RECORDERS	1.201	0.295	4.07	***
REFRIGERATOR-SIDE-BY-SIDE	2.451	0.318	7.71	***
REFRIGERATORS---TOP-MOUNT	1.916	0.375	5.11	***
SATELLITE-DISHES	-0.586	0.312	-1.88	*
SATELLITE-RADIO	0.31	0.233	1.33	
SCANNERS	1.918	0.322	5.96	***
SET-TOP-DECODERS	-0.647	0.417	-1.55	
SPEAKER	-0.998	0.174	-5.73	***
SPEAKER---AUTO	1.096	0.139	7.9	***
SPECIALTY-TELECOM	-1.211	0.376	-3.22	***
SPECIALTY-TV	-0.633	0.375	-1.69	*
TELECORDER	1.927	0.268	7.19	***
TELEVISION	1.018	0.385	2.65	***
TV-PROJECTION	1.251	0.221	5.65	***
UNIVERSAL-REMOTE-CONTROLS	-0.133	0.408	-0.33	
VCR-HOME	0.045	0.125	0.36	
WASHERS	0.779	0.287	2.72	***
WIRELESS-HANDSETS	2.223	0.255	8.7	***
WIRELESS-PHONE	0.96	0.338	2.84	***

GEE with Logit Link				
Explanatory variables	**Coefficient**	**Std. Err.**	**Z**	**Significance**
Intercept	-5.966	0.334	-17.84	***
Hedonic score	0.481	0.06	8.07	***
Log of Extended warranty price (1000 dollars)	-1.661	0.04	-41.64	***
Product price (1000 dollars) (H4)	1.33	0.058	23.12	***
Squared product price (1000 dollars)	-0.261	0.008	-31.67	***
Quarterly brand sales	0.048	0.014	3.37	***
Brand equity (H1)	1.734	0.379	4.58	***
Store ESC selling power (H2)	1.135	0.205	5.55	***
Past purchase dollar sum (1000 dollars)	-0.075	0.011	-6.55	***
Online transaction (H3)	-1.724	0.252	-6.85	***
ESC purchase ratio	0.319	0.041	7.87	***
Discounted product	-0.019	0.135	-0.14	
Sex(male=1)	-0.178	0.029	-6.16	***
Age	0.004	0.001	4.31	***
income				
2	-0.032	0.086	-0.38	
3	-0.099	0.067	-1.47	
4	-0.102	0.065	-1.57	
5	-0.108	0.065	-1.65	*
6	-0.206	0.056	-3.69	***
7	-0.32	0.059	-5.4	***
8	-0.307	0.066	-4.63	***
9	-0.428	0.06	-7.13	***
quarter				
3	-0.14	0.107	-1.31	
4	0	0.105	0	
5	-0.274	0.098	-2.79	***
6	0.041	0.101	0.41	
7	-0.132	0.105	-1.26	
8	-0.089	0.104	-0.86	
9	-0.257	0.097	-2.65	***
10	-0.077	0.093	-0.83	
11	-0.024	0.101	-0.24	
12	0	0.1	0	
13	0.065	0.092	0.71	
14	0.173	0.093	1.87	*

15	0.285	0.095	3.01	***
16	0.37	0.094	3.91	***
17	-0.074	0.094	-0.79	
18	-0.007	0.102	-0.07	
19	0.287	0.102	2.8	***
20	0.24	0.104	2.31	**
21	-0.02	0.099	-0.21	
22	0.18	0.106	1.7	*
23	0.415	0.106	3.9	***
24	0.344	0.109	3.15	***
25	0.142	0.123	1.16	
Subcategories				
25----UP-TV-VCR-COMBI	0.96	0.243	3.94	***
25--TELEVISION	0.77	0.127	6.06	***
27--TELEVISIONS	0.932	0.098	9.51	***
30--AND-LARGER-TV-S	0.761	0.142	5.35	***
9-16--COLOR-TV	-0.156	0.155	-1.01	
ADVANCED-TECHNOLOGY-TV	1.332	0.592	2.25	**
ANALOG-COMPONENTS	-0.018	0.201	-0.09	
AUDIO-FOR-VIDEO	1.075	0.126	8.5	***
AUTOMOTIVE-SECURITY	0.745	0.357	2.09	**
CALCULATORS	0.81	0.893	0.91	
CAMCORDER	1.215	0.097	12.52	***
CAMERAS	1.253	0.162	7.74	***
CASSETTES-AND-CHANGERS	1.168	0.193	6.06	***
CD-BOOMBOXES	-0.51	0.153	-3.33	***
CD-PLAYER--AUTO	0.18	0.092	1.95	*
CLOCK-TABLE-RADIO	0.265	0.311	0.85	
COMPACT-DISC-PLAYER	-0.296	0.133	-2.22	**
COMPUTER-INPUT-DEVICES	-0.517	0.481	-1.08	
COMPUTER-MONITOR	1.101	0.206	5.34	***
COMPUTER-PRINTERS	2.132	0.287	7.44	***
DESKTOP-COMPUTERS	3.313	0.182	18.19	***
DIGITAL-AUDIO-RECORDING	0.677	0.196	3.45	***
DIGITAL-CAMERAS---SOHO	1.129	0.11	10.29	***
DIGITAL-VIDEO	0.048	0.088	0.54	
DIGITAL-VIDEO-RECORDERS	0.733	0.355	2.07	**
DIRECTV-SYSTEMS	-0.797	0.105	-7.59	***
DISHWASHERS	0.413	0.315	1.31	

DISNEY-ELECTRONICS	-2.752	0.574	-4.8	***
DIVX--DVD	0.263	0.468	0.56	
DRYERS---ELECTRIC	0.417	0.276	1.51	
DRYERS---GAS	0.345	0.364	0.95	
ELECTRONIC-GAMES	-2.159	0.187	-11.52	***
FACSIMILES	1.265	0.257	4.92	***
FREEZERS	1.716	0.302	5.68	***
FRS-RADIOS	0.095	0.313	0.3	
HEADPHONES	-1.379	0.28	-4.92	***
IN-WALL-LOUD-SPEAKERS	-1.06	0.697	-1.52	
INTERNET-HARDWARE	0.672	0.264	2.55	**
LOADED-ENCLOSURES	1.033	0.24	4.3	***
MICROWAVE-OVENS	1.575	0.353	4.46	***
MINI-COMPONENT-SYSTEMS	0.197	0.139	1.42	
MOBILE-VIDEO	1.489	0.223	6.67	***
NETWORKING	0.003	0.214	0.01	
NOTEBOOK-COMPUTERS	2.919	0.181	16.12	***
OPTICAL-DRIVES	0.174	0.486	0.36	
PDA-S	1.81	0.168	10.75	***
PERIPHERALS	-1.226	0.236	-5.19	***
PERSONAL-PORTABLES	0.724	0.182	3.97	***
PHONE-ANSWERING-DEVICES	1.921	0.349	5.5	***
PHONES---CORDLESS	0.98	0.194	5.05	***
PHONES---STD	1.316	0.3	4.38	***
PORT--COMPACT-DISC	-0.287	0.114	-2.52	**
PORTABLE-DIG-AUDIO-PLAYER	-1.29	0.199	-6.47	***
PORTABLE-MINI-DISCS	0.219	0.352	0.62	
POWER-AMP---AUTO	1.467	0.171	8.57	***
POWERED-SUBWOOFERS	-2.566	0.362	-7.1	***
RADIOS	0.838	0.635	1.32	
RANGES---ELECTRIC	0.888	0.348	2.55	**
RANGES---GAS	2.137	0.358	5.97	***
RECEIVER	0.963	0.136	7.11	***
RECORDERS	0.873	0.229	3.81	***
REFRIGERATOR-SIDE-BY-SIDE	1.936	0.242	7.99	***
REFRIGERATORS---TOP-MOUNT	1.585	0.281	5.65	***
SATELLITE-DISHES	-0.549	0.247	-2.22	**
SATELLITE-RADIO	0.142	0.188	0.76	
SCANNERS	1.501	0.256	5.85	***
SET-TOP-DECODERS	-0.612	0.355	-1.72	*

SPEAKER	-0.895	0.142	-6.32	***
SPEAKER---AUTO	0.831	0.108	7.66	***
SPECIALTY-TELECOM	-1.007	0.32	-3.14	***
SPECIALTY-TV	-0.446	0.287	-1.55	
TELECORDER	1.544	0.211	7.31	***
TELEVISION	0.786	0.314	2.5	**
TV-PROJECTION	1.126	0.172	6.54	***
UNIVERSAL-REMOTE-CONTROLS	-0.351	0.343	-1.02	
VCR-HOME	0.025	0.1	0.25	
WASHERS	0.641	0.228	2.81	***
WIRELESS-HANDSETS	1.773	0.202	8.8	***
WIRELESS-PHONE	0.769	0.279	2.76	***

Random Intercept Probit				
Explanatory variables	**Coefficient**	**Std. Err.**	**Z**	**Significance**
Intercept	-4.096	0.218	-18.78	***
Hedonic score	0.348	0.043	8.06	***
Log of Extended warranty price (1000 dollars)	-1.129	0.028	-40.65	***
Product price (1000 dollars) (H4)	1.009	0.043	23.53	***
Squared product price (1000 dollars)	-0.189	0.006	-31.93	***
Quarterly brand sales	0.025	0.01	2.46	**
Brand equity (H1)	1.22	0.276	4.42	***
Store ESC selling power (H2)	0.645	0.154	4.18	***
Past purchase dollar sum (1000 dollars)	-0.036	0.008	-4.62	***
Online transaction (H3)	-1.177	0.153	-7.68	***
ESC purchase ratio	0.064	0.041	1.55	
Discounted product	-0.027	0.1	-0.27	
Sex(male=1)	-0.131	0.022	-5.94	***
Age	0.004	0.001	4.53	***
Intercept				
Hedonic score				
2	-0.052	0.066	-0.79	
3	-0.081	0.052	-1.58	
4	-0.083	0.05	-1.66	*
5	-0.092	0.05	-1.84	*
6	-0.171	0.043	-3.98	***
7	-0.254	0.045	-5.59	***

8	-0.234	0.051	-4.63	***
9	-0.32	0.046	-7	***
quarter				
3	-0.113	0.077	-1.47	
4	-0.01	0.075	-0.13	
5	-0.199	0.069	-2.86	***
6	0.024	0.072	0.33	
7	-0.105	0.075	-1.4	
8	-0.057	0.074	-0.78	
9	-0.192	0.069	-2.78	***
10	-0.062	0.067	-0.92	
11	-0.028	0.073	-0.38	
12	-0.009	0.072	-0.13	
13	0.039	0.066	0.59	
14	0.111	0.067	1.66	*
15	0.193	0.069	2.78	***
16	0.255	0.069	3.69	***
17	-0.078	0.068	-1.15	
18	-0.018	0.073	-0.24	
19	0.18	0.074	2.42	**
20	0.146	0.075	1.94	*
21	-0.038	0.071	-0.53	
22	0.101	0.076	1.32	
23	0.283	0.077	3.67	***
24	0.225	0.079	2.84	***
25	0.07	0.087	0.8	
Subcategories				
25----UP-TV-VCR-COMBI	0.675	0.174	3.87	***
25--TELEVISION	0.514	0.092	5.57	***
27--TELEVISIONS	0.635	0.07	9.05	***
30--AND-LARGER-TV-S	0.416	0.103	4.03	***
9-16--COLOR-TV	-0.12	0.105	-1.14	
ADVANCED-TECHNOLOGY-TV	0.73	0.404	1.81	*
ANALOG-COMPONENTS	0.045	0.146	0.31	
AUDIO-FOR-VIDEO	0.748	0.09	8.28	***
AUTOMOTIVE-SECURITY	0.7	0.238	2.94	***
CALCULATORS	0.631	0.565	1.12	
CAMCORDER	0.857	0.07	12.31	***

CAMERAS	0.827	0.121	6.83	***
CASSETTES-AND-CHANGERS	0.854	0.14	6.09	***
CD-BOOMBOXES	-0.364	0.114	-3.21	***
CD-PLAYER--AUTO	0.163	0.068	2.4	**
CLOCK-TABLE-RADIO	0.267	0.213	1.26	
COMPACT-DISC-PLAYER	-0.17	0.096	-1.78	*
COMPUTER-INPUT-DEVICES	0.061	0.267	0.23	
COMPUTER-MONITOR	0.741	0.146	5.06	***
COMPUTER-PRINTERS	1.506	0.205	7.36	***
DESKTOP-COMPUTERS	2.25	0.13	17.24	***
DIGITAL-AUDIO-RECORDING	0.527	0.137	3.85	***
DIGITAL-CAMERAS---SOHO	0.776	0.078	9.93	***
DIGITAL-VIDEO	0.079	0.062	1.28	
DIGITAL-VIDEO-RECORDERS	0.68	0.27	2.52	**
DIRECTV-SYSTEMS	-0.53	0.076	-7	***
DISHWASHERS	0.201	0.224	0.89	
DISNEY-ELECTRONICS	-1.94	0.373	-5.2	***
DIVX--DVD	0.233	0.307	0.76	
DRYERS---ELECTRIC	0.244	0.193	1.26	
DRYERS---GAS	0.162	0.266	0.61	
ELECTRONIC-GAMES	-1.5	0.136	-11.02	***
FACSIMILES	0.951	0.184	5.17	***
FREEZERS	1.171	0.228	5.13	***
FRS-RADIOS	0.203	0.215	0.94	
HEADPHONES	-0.704	0.167	-4.22	***
IN-WALL-LOUD-SPEAKERS	-0.547	0.431	-1.27	
INTERNET-HARDWARE	0.549	0.181	3.04	***
LOADED-ENCLOSURES	0.814	0.173	4.72	***
MICROWAVE-OVENS	1.13	0.242	4.67	***
MINI-COMPONENT-SYSTEMS	0.225	0.096	2.34	**
MOBILE-VIDEO	1.033	0.16	6.45	***
NETWORKING	0.1	0.148	0.68	
NOTEBOOK-COMPUTERS	1.959	0.13	15.01	***
OPTICAL-DRIVES	0.142	0.356	0.4	
PDA-S	1.256	0.122	10.34	***
PERIPHERALS	-0.728	0.145	-5.03	***
PERSONAL-PORTABLES	0.544	0.136	3.99	***
PHONE-ANSWERING-DEVICES	1.419	0.248	5.73	***
PHONES---CORDLESS	0.777	0.138	5.65	***
PHONES---STD	1.038	0.209	4.98	***

PORT--COMPACT-DISC	-0.195	0.082	-2.37	**
PORTABLE-DIG-AUDIO-PLAYER	-0.809	0.129	-6.26	***
PORTABLE-MINI-DISCS	0.183	0.252	0.73	
POWER-AMP---AUTO	1.035	0.125	8.26	***
POWERED-SUBWOOFERS	-1.638	0.219	-7.48	***
RADIOS	0.592	0.407	1.46	
RANGES---ELECTRIC	0.572	0.252	2.27	**
RANGES---GAS	1.533	0.272	5.63	***
RECEIVER	0.739	0.098	7.54	***
RECORDERS	0.689	0.168	4.11	***
REFRIGERATOR-SIDE-BY-SIDE	1.342	0.182	7.38	***
REFRIGERATORS---TOP-MOUNT	1.033	0.214	4.82	***
SATELLITE-DISHES	-0.318	0.18	-1.76	*
SATELLITE-RADIO	0.194	0.13	1.49	
SCANNERS	1.083	0.18	6.01	***
SET-TOP-DECODERS	-0.328	0.223	-1.47	
SPEAKER	-0.518	0.094	-5.52	***
SPEAKER---AUTO	0.611	0.078	7.82	***
SPECIALTY-TELECOM	-0.667	0.204	-3.27	***
SPECIALTY-TV	-0.353	0.208	-1.7	*
TELECORDER	1.07	0.151	7.1	***
TELEVISION	0.573	0.21	2.74	***
TV-PROJECTION	0.658	0.125	5.25	***
UNIVERSAL-REMOTE-CONTROLS	0.001	0.218	0	
VCR-HOME	0.027	0.069	0.39	
WASHERS	0.435	0.156	2.79	***
WIRELESS-HANDSETS	1.226	0.143	8.55	***
WIRELESS-PHONE	0.566	0.181	3.12	***

GEE with Probit Link				
Explanatory variables	**Coefficient**	**Std. Err.**	**Z**	**Significance**
Intercept	-3.338	0.173	-19.29	***
Hedonic score	0.273	0.034	8.02	***
Log of Extended warranty price (1000 dollars)	-0.902	0.023	-39.97	***
Product price (1000 dollars) (H4)	0.789	0.034	23.08	***
Squared product price (1000 dollars)	-0.151	0.005	-33.43	***
Quarterly brand sales	0.022	0.008	2.66	***

Brand equity (H1)	0.961	0.218	4.4	***
Store ESC selling power (H2)	0.65	0.118	5.5	***
Past purchase dollar sum (1000 dollars)	-0.04	0.006	-6.13	***
Online transaction (H3)	-0.895	0.12	-7.47	***
ESC purchase ratio	0.181	0.024	7.67	***
Discounted product	-0.004	0.079	-0.05	
Sex(male=1)	-0.103	0.017	-6.19	***
Age	0.003	0.001	4.46	***
income				
2	-0.032	0.05	-0.65	
3	-0.065	0.039	-1.65	*
4	-0.066	0.038	-1.74	*
5	-0.071	0.038	-1.88	*
6	-0.13	0.033	-4	***
7	-0.198	0.034	-5.75	***
8	-0.184	0.038	-4.79	***
9	-0.253	0.035	-7.28	***
quarter				
3	-0.09	0.061	-1.47	
4	-0.009	0.06	-0.15	
5	-0.159	0.055	-2.86	***
6	0.014	0.058	0.25	
7	-0.083	0.06	-1.4	
8	-0.051	0.059	-0.87	
9	-0.156	0.055	-2.84	***
10	-0.048	0.053	-0.92	
11	-0.032	0.058	-0.55	
12	-0.011	0.057	-0.18	
13	0.033	0.053	0.62	
14	0.095	0.053	1.79	*
15	0.153	0.055	2.8	***
16	0.203	0.054	3.74	***
17	-0.057	0.054	-1.06	
18	-0.013	0.058	-0.23	
19	0.144	0.059	2.45	**
20	0.121	0.059	2.03	**
21	-0.021	0.056	-0.37	
22	0.088	0.061	1.45	

23	0.226	0.061	3.69	***
24	0.186	0.063	2.96	***
25	0.067	0.07	0.95	
Subcategories				
25----UP-TV-VCR-COMBI	0.559	0.139	4.01	***
25--TELEVISION	0.405	0.073	5.56	***
27--TELEVISIONS	0.502	0.056	9.04	***
30--AND-LARGER-TV-S	0.34	0.083	4.11	***
9-16--COLOR-TV	-0.075	0.082	-0.91	
ADVANCED-TECHNOLOGY-TV	0.483	0.354	1.37	
ANALOG-COMPONENTS	0.023	0.115	0.2	
AUDIO-FOR-VIDEO	0.597	0.072	8.26	***
AUTOMOTIVE-SECURITY	0.515	0.192	2.68	***
CALCULATORS	0.485	0.498	0.97	
CAMCORDER	0.677	0.055	12.29	***
CAMERAS	0.669	0.092	7.29	***
CASSETTES-AND-CHANGERS	0.677	0.111	6.1	***
CD-BOOMBOXES	-0.273	0.089	-3.07	***
CD-PLAYER--AUTO	0.127	0.054	2.36	**
CLOCK-TABLE-RADIO	0.223	0.169	1.32	
COMPACT-DISC-PLAYER	-0.15	0.077	-1.95	*
COMPUTER-INPUT-DEVICES	-0.007	0.221	-0.03	
COMPUTER-MONITOR	0.581	0.115	5.04	***
COMPUTER-PRINTERS	1.194	0.161	7.4	***
DESKTOP-COMPUTERS	1.791	0.103	17.42	***
DIGITAL-AUDIO-RECORDING	0.427	0.114	3.76	***
DIGITAL-CAMERAS---SOHO	0.601	0.062	9.73	***
DIGITAL-VIDEO	0.051	0.049	1.04	
DIGITAL-VIDEO-RECORDERS	0.458	0.216	2.12	**
DIRECTV-SYSTEMS	-0.442	0.06	-7.38	***
DISHWASHERS	0.185	0.171	1.08	
DISNEY-ELECTRONICS	-1.521	0.296	-5.13	***
DIVX--DVD	0.162	0.263	0.62	
DRYERS---ELECTRIC	0.2	0.15	1.33	
DRYERS---GAS	0.141	0.202	0.7	
ELECTRONIC-GAMES	-1.203	0.108	-11.15	***
FACSIMILES	0.761	0.147	5.18	***
FREEZERS	0.922	0.178	5.18	***
FRS-RADIOS	0.151	0.169	0.9	

HEADPHONES	-0.598	0.14	-4.28	***
IN-WALL-LOUD-SPEAKERS	-0.51	0.342	-1.49	
INTERNET-HARDWARE	0.42	0.143	2.94	***
LOADED-ENCLOSURES	0.617	0.142	4.36	***
MICROWAVE-OVENS	0.895	0.192	4.67	***
MINI-COMPONENT-SYSTEMS	0.179	0.077	2.34	**
MOBILE-VIDEO	0.802	0.129	6.21	***
NETWORKING	0.058	0.118	0.49	
NOTEBOOK-COMPUTERS	1.561	0.104	15.08	***
OPTICAL-DRIVES	0.084	0.282	0.3	
PDA-S	0.991	0.095	10.38	***
PERIPHERALS	-0.563	0.113	-4.99	***
PERSONAL-PORTABLES	0.44	0.105	4.21	***
PHONE-ANSWERING-DEVICES	1.123	0.196	5.74	***
PHONES---CORDLESS	0.61	0.109	5.6	***
PHONES---STD	0.82	0.166	4.94	***
PORT--COMPACT-DISC	-0.148	0.065	-2.27	**
PORTABLE-DIG-AUDIO-PLAYER	-0.664	0.106	-6.25	***
PORTABLE-MINI-DISCS	0.151	0.204	0.74	
POWER-AMP---AUTO	0.821	0.099	8.29	***
POWERED-SUBWOOFERS	-1.31	0.177	-7.4	***
RADIOS	0.507	0.342	1.48	
RANGES---ELECTRIC	0.467	0.201	2.33	**
RANGES---GAS	1.213	0.219	5.53	***
RECEIVER	0.563	0.077	7.3	***
RECORDERS	0.535	0.131	4.08	***
REFRIGERATOR-SIDE-BY-SIDE	1.044	0.146	7.15	***
REFRIGERATORS---TOP-MOUNT	0.829	0.166	4.98	***
SATELLITE-DISHES	-0.255	0.143	-1.78	*
SATELLITE-RADIO	0.119	0.105	1.13	
SCANNERS	0.867	0.143	6.07	***
SET-TOP-DECODERS	-0.309	0.185	-1.67	*
SPEAKER	-0.432	0.075	-5.76	***
SPEAKER---AUTO	0.478	0.061	7.79	***
SPECIALTY-TELECOM	-0.51	0.159	-3.21	***
SPECIALTY-TV	-0.249	0.157	-1.59	
TELECORDER	0.853	0.119	7.19	***
TELEVISION	0.453	0.177	2.56	**
TV-PROJECTION	0.535	0.102	5.27	***
UNIVERSAL-REMOTE-CONTROLS	-0.027	0.176	-0.15	

VCR-HOME	0.024	0.055	0.44	
WASHERS	0.322	0.124	2.59	**
WIRELESS-HANDSETS	0.968	0.113	8.56	***
WIRELESS-PHONE	0.43	0.147	2.93	***

Heckit Outcome Sub-model				
Explanatory variables	**Coefficient**	**Std. Err.**	**Z**	**Significance**
Intercept	-3.516	0.204	-17.25	***
Hedonic score	0.244	0.036	6.8	***
Log of Extended warranty price (1000 dollars)	-0.968	0.03	-32.36	***
Product price (1000 dollars) (H4)	0.944	0.051	18.36	***
Squared product price (1000 dollars)	-0.161	0.005	-32.66	***
Quarterly brand sales	0.02	0.009	2.16	**
Brand equity (H1)	1.104	0.261	4.23	***
Store ESC selling power (H2)	1.024	0.128	7.98	***
Past purchase dollar sum (1000 dollars)	-0.046	0.009	-5.29	***
Online transaction (H3)	-0.963	0.145	-6.66	***
ESC purchase ratio	0.617	0.036	17.01	***
Discounted product	-0.027	0.1	-0.27	
Income				
2	-0.043	0.052	-0.82	
3	-0.082	0.041	-1.97	**
4	-0.094	0.042	-2.25	**
5	-0.099	0.04	-2.45	**
6	-0.14	0.035	-3.94	***
7	-0.2	0.038	-5.27	***
8	-0.188	0.042	-4.43	***
9	-0.232	0.038	-6.14	***
quarter				
3	-0.093	0.069	-1.35	
4	-0.012	0.067	-0.18	
5	-0.175	0.063	-2.75	***
6	-0.005	0.066	-0.08	

7	-0.088	0.069	-1.29	
8	-0.044	0.069	-0.64	
9	-0.179	0.063	-2.85	***
10	-0.071	0.06	-1.19	
11	-0.055	0.066	-0.84	
12	-0.044	0.065	-0.67	
13	0.051	0.061	0.84	
14	0.09	0.06	1.52	
15	0.168	0.064	2.63	***
16	0.205	0.063	3.24	***
17	-0.08	0.062	-1.28	
18	0.009	0.071	0.13	
19	0.156	0.069	2.26	**
20	0.14	0.072	1.94	*
21	0.02	0.067	0.3	
22	0.129	0.071	1.82	*
23	0.277	0.074	3.73	***
24	0.26	0.079	3.3	***
25	0.148	0.087	1.71	*
Subcategories				
25----UP-TV-VCR-COMBI	0.602	0.189	3.18	***
25--TELEVISION	0.414	0.08	5.2	***
27--TELEVISIONS	0.513	0.065	7.91	***
30--AND-LARGER-TV-S	0.407	0.09	4.53	***
9-16--COLOR-TV	-0.041	0.096	-0.43	
ADVANCED-TECHNOLOGY-TV	0.742	0.424	1.75	*
ANALOG-COMPONENTS	-0.036	0.133	-0.27	
AUDIO-FOR-VIDEO	0.595	0.087	6.8	***
AUTOMOTIVE-SECURITY	0.353	0.217	1.63	
CALCULATORS	0.834	0.377	2.21	**
CAMCORDER	0.679	0.064	10.53	***
CAMERAS	0.665	0.091	7.3	***
CASSETTES-AND-CHANGERS	0.68	0.122	5.56	***
CD-BOOMBOXES	-0.16	0.09	-1.79	*
CD-PLAYER--AUTO	0.167	0.058	2.9	***
CLOCK-TABLE-RADIO	0.179	0.188	0.95	
COMPACT-DISC-PLAYER	-0.116	0.087	-1.34	
COMPUTER-INPUT-DEVICES	-0.146	0.237	-0.62	
COMPUTER-MONITOR	0.428	0.128	3.35	***

COMPUTER-PRINTERS	1.068	0.176	6.06	***
DESKTOP-COMPUTERS	1.9	0.118	16.03	***
DIGITAL-AUDIO-RECORDING	0.425	0.146	2.91	***
DIGITAL-CAMERAS---SOHO	0.583	0.073	8.05	***
DIGITAL-VIDEO	0.028	0.057	0.5	
DIGITAL-VIDEO-RECORDERS	0.765	0.344	2.22	**
DIRECTV-SYSTEMS	-0.466	0.063	-7.39	***
DISHWASHERS	0.193	0.206	0.94	
DISNEY-ELECTRONICS	-1.467	0.269	-5.46	***
DIVX--DVD	0.15	0.278	0.54	
DRYERS---ELECTRIC	0.183	0.179	1.02	
DRYERS---GAS	0.13	0.242	0.54	
ELECTRONIC-GAMES	-1.159	0.112	-10.35	***
FACSIMILES	0.714	0.168	4.25	***
FREEZERS	0.898	0.197	4.57	***
FRS-RADIOS	0.063	0.22	0.29	
HEADPHONES	-0.648	0.161	-4.02	***
IN-WALL-LOUD-SPEAKERS	-0.722	0.42	-1.72	*
INTERNET-HARDWARE	0.284	0.166	1.71	*
LOADED-ENCLOSURES	0.504	0.179	2.81	***
MICROWAVE-OVENS	0.782	0.212	3.69	***
MINI-COMPONENT-SYSTEMS	0.144	0.089	1.61	
MOBILE-VIDEO	0.885	0.152	5.81	***
NETWORKING	-0.064	0.131	-0.49	
NOTEBOOK-COMPUTERS	1.542	0.125	12.31	***
OPTICAL-DRIVES	0.071	0.314	0.23	
PDA-S	0.961	0.11	8.72	***
PERIPHERALS	-0.704	0.135	-5.2	***
PERSONAL-PORTABLES	0.491	0.1	4.93	***
PHONE-ANSWERING-DEVICES	1.118	0.207	5.4	***
PHONES---CORDLESS	0.586	0.123	4.77	***
PHONES---STD	0.841	0.179	4.68	***
PORT--COMPACT-DISC	-0.08	0.066	-1.21	
PORTABLE-DIG-AUDIO-PLAYER	-0.652	0.127	-5.15	***
PORTABLE-MINI-DISCS	0.101	0.235	0.43	
POWER-AMP---AUTO	0.766	0.113	6.79	***
POWERED-SUBWOOFERS	-1.356	0.227	-5.96	***
RADIOS	0.682	0.341	2	**
RANGES---ELECTRIC	0.538	0.24	2.25	**
RANGES---GAS	1.265	0.267	4.74	***

RECEIVER	0.609	0.093	6.52	***
RECORDERS	0.529	0.132	4.01	***
REFRIGERATOR-SIDE-BY-SIDE	1.143	0.193	5.93	***
REFRIGERATORS---TOP-MOUNT	0.962	0.202	4.75	***
SATELLITE-DISHES	-0.32	0.184	-1.74	*
SATELLITE-RADIO	0.063	0.119	0.53	
SCANNERS	0.814	0.158	5.14	***
SET-TOP-DECODERS	-0.331	0.192	-1.72	*
SPEAKER	-0.534	0.096	-5.59	***
SPEAKER---AUTO	0.411	0.067	6.1	***
SPECIALTY-TELECOM	-0.569	0.182	-3.13	***
SPECIALTY-TV	-0.275	0.186	-1.48	
TELECORDER	0.797	0.133	6.01	***
TELEVISION	0.392	0.252	1.56	
TV-PROJECTION	0.587	0.124	4.73	***
UNIVERSAL-REMOTE-CONTROLS	-0.084	0.202	-0.41	
VCR-HOME	0.021	0.062	0.34	
WASHERS	0.261	0.152	1.72	*
WIRELESS-HANDSETS	0.937	0.127	7.35	***
WIRELESS-PHONE	0.406	0.166	2.44	**

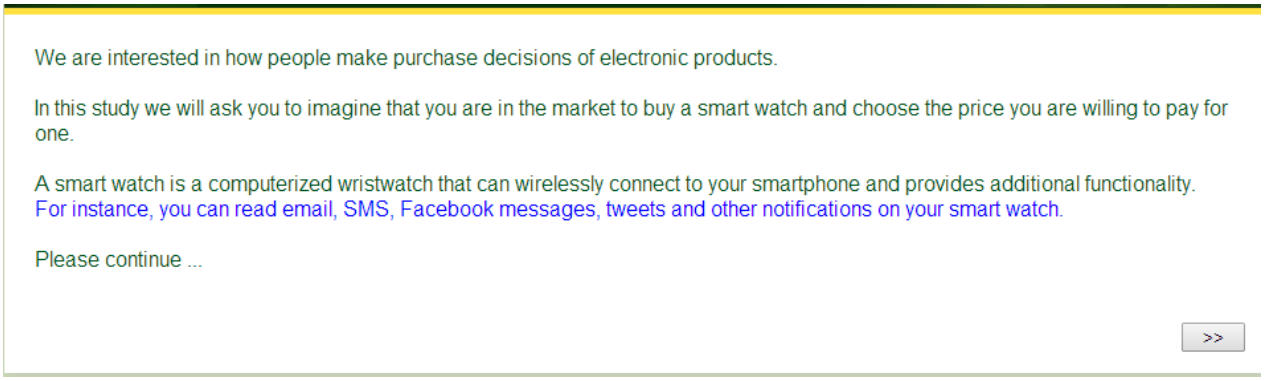
Heckit Selection Sub-model				
Explanatory variables	**Coefficient**	**Std. Err.**	**Z**	**Significance**
Intercept	-1.674	0.177	-9.48	***
Hedonic score	-0.055	0.05	-1.1	
Log of Extended warranty price (1000 dollars)	-0.435	0.026	-16.93	***
Product price (1000 dollars) (H4)	0.412	0.045	9.17	***
Squared product price (1000 dollars)	-0.054	0.004	-12.52	***
Quarterly brand sales	0.009	0.009	1.02	
Brand equity (H1)	0.766	0.267	2.87	***
Store ESC selling power (H2)	1.01	0.185	5.45	***
Past purchase dollar sum (1000 dollars)	-0.202	0.049	-4.14	***
Online transaction (H3)	0.189	0.086	2.21	**
ESC purchase ratio	293.884	15.926	18.45	***
Discounted product	-0.032	0.09	-0.35	
Sex(male=1)	-0.047	0.027	-1.75	*
Age	0.002	0.001	2.22	**

income				
2	-0.046	0.076	-0.61	
3	0.013	0.059	0.22	
4	0.037	0.059	0.63	
5	0.045	0.064	0.7	
6	0.012	0.05	0.24	
7	-0.036	0.053	-0.68	
8	-0.104	0.061	-1.7	*
9	-0.076	0.054	-1.42	
quarter				
3	-0.051	0.071	-0.72	
4	0.027	0.072	0.37	
5	-0.051	0.065	-0.79	
6	-0.009	0.07	-0.13	
7	-0.12	0.072	-1.68	*
8	-0.141	0.074	-1.92	*
9	-0.24	0.066	-3.66	***
10	-0.053	0.062	-0.86	
11	-0.233	0.073	-3.17	***
12	-0.155	0.071	-2.19	**
13	-0.352	0.065	-5.43	***
14	0.02	0.062	0.32	
15	-0.288	0.074	-3.88	***
16	-0.353	0.069	-5.12	***
17	-0.405	0.072	-5.61	***
18	-0.566	0.08	-7.08	***
19	-0.454	0.084	-5.43	***
20	-0.491	0.085	-5.77	***
21	-0.606	0.075	-8.12	***
22	-0.571	0.085	-6.69	***
23	-0.674	0.085	-7.97	***
24	-0.615	0.085	-7.21	***
25	-0.894	0.096	-9.28	***
Subcategories				
25----UP-TV-VCR-COMBI	0.058	0.157	0.37	
25--TELEVISION	0.275	0.083	3.31	***
27--TELEVISIONS	0.248	0.059	4.2	***

30--AND-LARGER-TV-S	0.66	0.124	5.34	***
9-16--COLOR-TV	-0.125	0.075	-1.67	*
ADVANCED-TECHNOLOGY-TV	0.602	0.489	1.23	
ANALOG-COMPONENTS	-0.126	0.125	-1.01	
AUDIO-FOR-VIDEO	0.158	0.084	1.87	*
AUTOMOTIVE-SECURITY	-0.111	0.235	-0.47	
CALCULATORS	0.587	0.396	1.48	
CAMCORDER	0.409	0.061	6.7	***
CAMERAS	0.292	0.095	3.09	***
CASSETTES-AND-CHANGERS	0.12	0.124	0.96	
CD-BOOMBOXES	0.291	0.131	2.23	**
CD-PLAYER--AUTO	0.374	0.082	4.58	***
CLOCK-TABLE-RADIO	-0.291	0.167	-1.74	*
COMPACT-DISC-PLAYER	0.078	0.098	0.8	
COMPUTER-INPUT-DEVICES	-0.218	0.214	-1.02	
COMPUTER-MONITOR	-0.408	0.146	-2.8	***
COMPUTER-PRINTERS	-0.312	0.215	-1.45	
DESKTOP-COMPUTERS	0.227	0.127	1.79	*
DIGITAL-AUDIO-RECORDING	0.279	0.143	1.94	*
DIGITAL-CAMERAS---SOHO	0.202	0.068	2.99	***
DIGITAL-VIDEO	-0.052	0.051	-1.03	
DIGITAL-VIDEO-RECORDERS	-0.328	0.242	-1.36	
DIRECTV-SYSTEMS	-0.173	0.087	-1.99	**
DISHWASHERS	-0.334	0.156	-2.14	**
DISNEY-ELECTRONICS	-0.369	0.395	-0.93	
DIVX--DVD	0.286	0.287	0.99	
DRYERS---ELECTRIC	-0.199	0.142	-1.41	
DRYERS---GAS	-0.424	0.194	-2.19	**
ELECTRONIC-GAMES	0.049	0.168	0.29	
FACSIMILES	-0.174	0.179	-0.97	
FREEZERS	0.136	0.179	0.76	
FRS-RADIOS	-0.663	0.185	-3.57	***
HEADPHONES	-0.313	0.115	-2.73	***
IN-WALL-LOUD-SPEAKERS	-0.36	0.399	-0.9	
INTERNET-HARDWARE	-0.187	0.166	-1.12	
LOADED-ENCLOSURES	-0.05	0.178	-0.28	
MICROWAVE-OVENS	-0.119	0.216	-0.55	
MINI-COMPONENT-SYSTEMS	-0.046	0.085	-0.55	
MOBILE-VIDEO	0.269	0.183	1.47	
NETWORKING	-0.326	0.144	-2.26	**

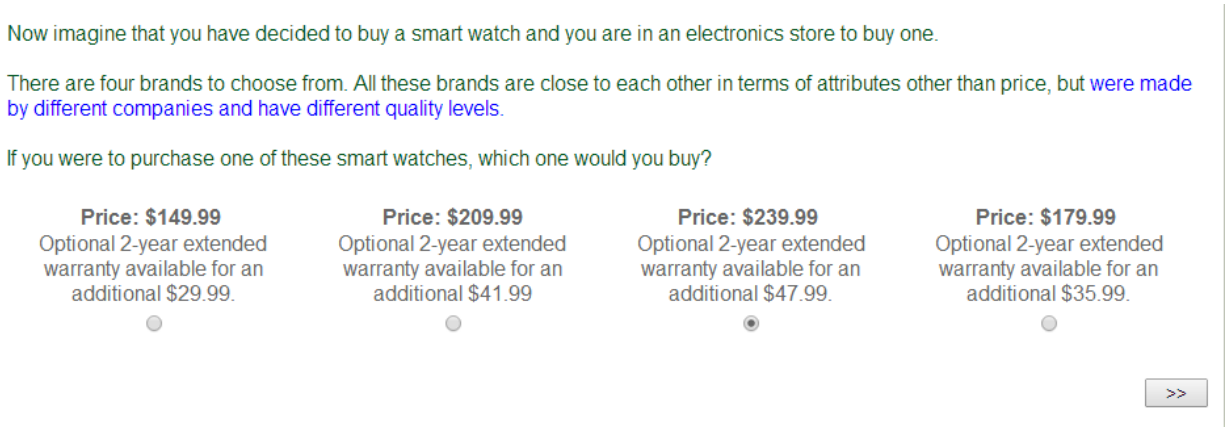
NOTEBOOK-COMPUTERS	0.465	0.129	3.59	***
OPTICAL-DRIVES	-0.075	0.4	-0.19	
PDA-S	0.313	0.116	2.69	**
PERIPHERALS	-0.146	0.12	-1.22	
PERSONAL-PORTABLES	0.292	0.127	2.3	**
PHONE-ANSWERING-DEVICES	-0.224	0.222	-1.01	
PHONES---CORDLESS	-0.235	0.137	-1.72	*
PHONES---STD	-0.257	0.178	-1.44	
PORT--COMPACT-DISC	0.15	0.089	1.68	*
PORTABLE-DIG-AUDIO-PLAYER	-0.131	0.136	-0.96	
PORTABLE-MINI-DISCS	-0.017	0.24	-0.07	
POWER-AMP---AUTO	0.089	0.14	0.64	
POWERED-SUBWOOFERS	-0.314	0.186	-1.69	*
RADIOS	-0.122	0.294	-0.42	
RANGES---ELECTRIC	-0.088	0.211	-0.42	
RANGES---GAS	0.48	0.271	1.77	*
RECEIVER	-0.129	0.09	-1.43	
RECORDERS	0.179	0.15	1.19	
REFRIGERATOR-SIDE-BY-SIDE	0.146	0.162	0.9	
REFRIGERATORS---TOP-MOUNT	-0.2	0.175	-1.14	
SATELLITE-DISHES	-0.24	0.184	-1.3	
SATELLITE-RADIO	-0.011	0.272	-0.04	
SCANNERS	-0.07	0.175	-0.4	
SET-TOP-DECODERS	-0.371	0.186	-2	**
SPEAKER	-0.353	0.086	-4.09	***
SPEAKER---AUTO	0.036	0.078	0.46	
SPECIALTY-TELECOM	-0.581	0.201	-2.89	***
SPECIALTY-TV	-0.429	0.148	-2.9	***
TELECORDER	0.062	0.144	0.43	
TELEVISION	0.2	0.242	0.83	
TV-PROJECTION	0.685	0.15	4.56	***
UNIVERSAL-REMOTE-CONTROLS	-0.348	0.153	-2.28	**
VCR-HOME	0.015	0.053	0.28	
WASHERS	-0.159	0.117	-1.36	
WIRELESS-HANDSETS	0.175	0.142	1.24	
WIRELESS-PHONE	-0.15	0.159	-0.94	

Appendix 3-1: Cover story for the pilot study

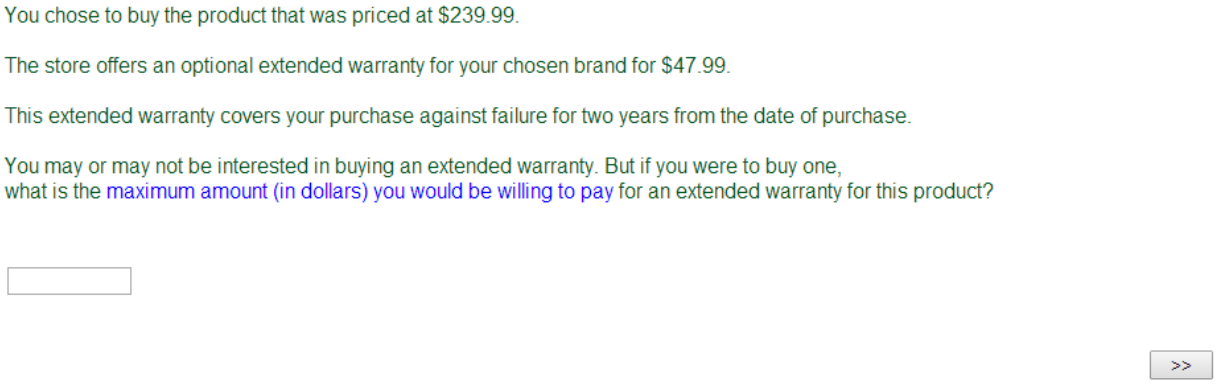


Appendix 3-2: The simultaneous scenario condition

Screen 1:

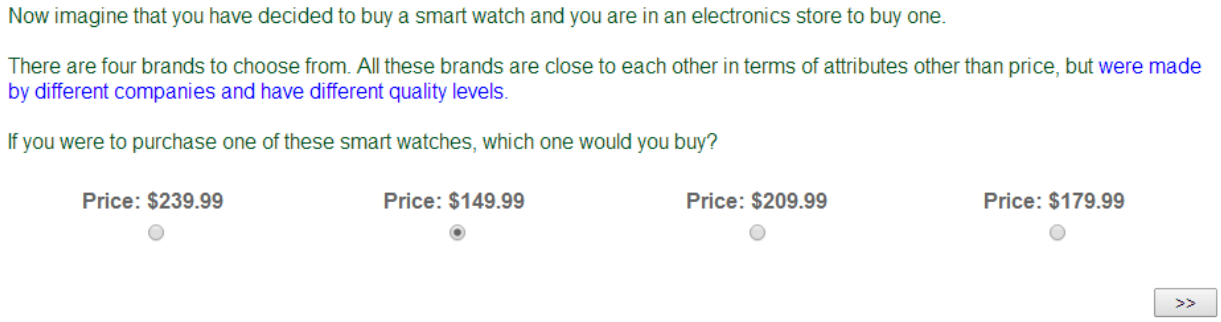


The above four price points are used in all conditions in a randomized order. If a participant had chosen the third option from the above choice set, the next screen would be:

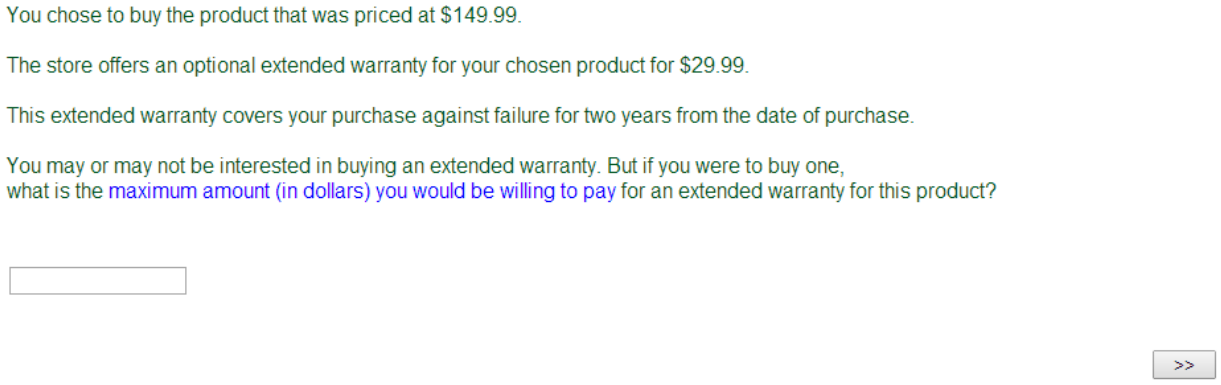


Appendix 3-3: The delayed scenario condition

Screen 1:

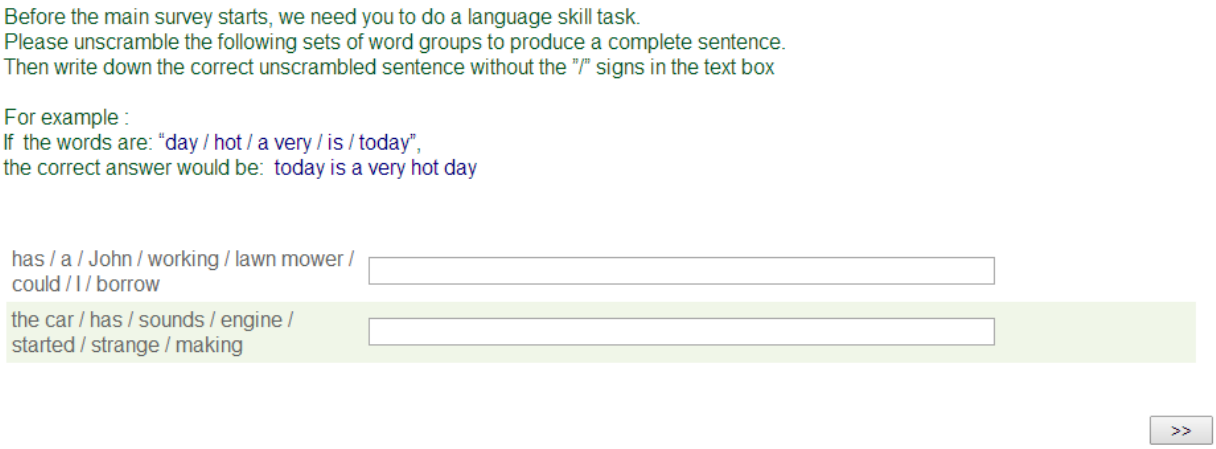


If a participant had chosen the second option from the above choice set, the next screen would be:

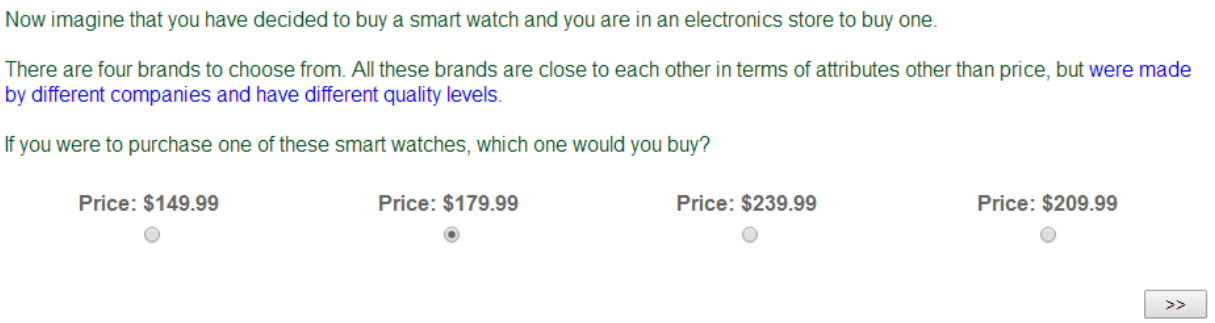


Appendix 3-4: The Primed delayed scenario condition:

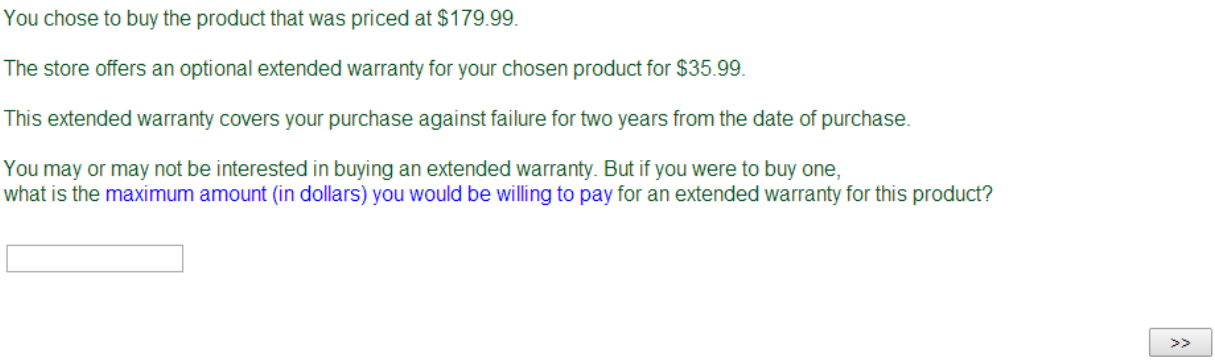
Screen 1:



Screen 2:



If a participant had chosen the second option from the above choice set, the next screen would be:



Appendix 3-5: Survey questions used for variables in the regression model for the pilot study

Variable	Survey question
Quality importance	**Please rate the importance of product quality in your purchase of electronic products.** (1=Extremely important, 2=Moderately important, 3=Somewhat important, 4=Neutral, 5=Somewhat unimportant, 6=Moderately unimportant, 7=Extremely unimportant)
Reference price	**There are a few stores that offer extended warranties for smart watches in your area. On average, how much do you think these stores might charge (in dollars) for a two-year extended warranty of a $200 smart watch? _____**
Buy reliable	**To what extent, do you agree or disagree with the following statement?** *I usually try to make sure I'm buying a reliable electronic product that is not likely to break down.* (1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)
Tech savviness	**To what extent, do you agree or disagree with the following statement?** *I consider myself to be technology savvy.* (1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)
Financial risk taking	Average of ratings from the DOSPERT scale (Blais and Weber 2006) : **For each of the following statements, please indicate the likelihood that you would engage in the described activity or behavior if you were to find yourself in that situation.** 1. Investing 10% of your annual income in a moderate growth mutual fund. 2. Betting a day's income at the horse races. 3. Betting a day's income at a high-stake poker game. 4. Investing 5% of your annual income in a very speculative stock. 5. Betting a day's income on the outcome of a sporting event. 6. Investing 10% of your annual income in a new business venture. (1=Extremely unlikely, 2= Moderately unlikely, 3= Somewhat unlikely, 4=Not Sure, 5= Somewhat likely, 6= Moderately likely, 7= Extremely likely)

Appendix 3-6: Results of Table 3-2 for a model including interactions

DV: WTP ratio	Coefficient	Std. Err.	t-statistic	P-value	Significance
Condition (base=delayed)					
Primed delayed	0.007	0.02	0.43	0.67	
Simultaneous	**0.053**	**0.02**	**2.37**	**0.020**	**
Reference Price	**0.002**	**0.0007**	**2.99**	**0.004**	***
Sex (Female)	0.02	0.03	0.81	0.42	
Age	0.01	0.009	1.39	0.17	
Income	-0.003	0.003	-1.14	0.26	
Financial Risk Taking	-0.005	0.006	-0.82	0.42	
Tech savviness	0.009	0.009	1.45	0.15	
Quality Importance	-0.005	0.006	-0.83	0.41	
Buy Reliable	**-0.036**	**0.014**	**-2.50**	**0.014**	**
Buy Reliable x Condition					
Primed delayed	**0.085**	**0.0269**	**3.16**	**0.002**	***
Simultaneous	**0.070**	**0.0274**	**2.54**	**0.013**	**
Sex x Condition					
Primed delayed	0.009	0.039	0.24	0.81	
Simultaneous	-0.052	0.046	-1.15	0.25	
Reference Price x Condition					
Primed delayed	-0.002	0.001	-1.52	0.13	
Simultaneous	0.0008	0.001	0.52	0.57	
Age x Condition					
Primed delayed	-0.022	0.014	-1.56	0.12	
Simultaneous	0.008	0.018	0.44	0.65	
Income x Condition					
Primed delayed	0.009	0.005	1.55	0.11	
Simultaneous	-0.001	0.006	-0.23	0.81	
Financial R.T. x Condition					
Primed delayed	0.001	0.015	0.10	0.92	
Simultaneous	0.002	0.014	.016	0.87	
Tech savviness x Condition					
Primed delayed	-0.012	0.021	-0.58	0.57	
Simultaneous	-0.026	0.026	0.31	0.31	
Quality Importance x Condition					
Primed delayed	0.009	0.009	1.05	0.30	
Simultaneous	0.005	0.010	0.48	0.64	
Intercept	0.101	0.011	8.67	0.000	***
$F(26,87) = 3.66$, $R^2=0.41$, Adjusted $R^2=0.24$, , Significance codes: 0.01 '***'; 0.05 ' **'; 0.1 ' * ' ;					

Appendix 3-7: Product attribute definitions and choice set screenshots for the choice experiment in Essay 2

The TV set attributes are:

Style: the type of pedestal on the TV set: Single-leg vs. Double-leg

Price: price in dollars before taxes

Quality score: Average owner quality ratings collected by an online retailer

Screen size: The diagonal length of the TV screen in inches

Resolution: Resolution is related to the number of pixels on the screen. The higher the resolution, the more detailed and accurate the resulting images. 720p HD and 1080p HD are two available High Definition (HD) resolutions commonly referred to as HD and Full HD, respectively.

Simultaneous

	(A)	(B)	(C)	(D)
Style				
Price	$988.85	$374.85	$794.85	$789.85
Quality Score	★★★★½	★★★★☆	★★★★½	★★★½☆
Screen size	52"	46"	46"	52"
Resolution	1080p HD	1080p HD	720p HD	1080p HD

Delayed

	(A)	(B)	(C)	(D)
Style				
Price	$579.85	$993.85	$978.85	$589.85
Quality Score	★★★☆☆	★★★☆☆	★★★½☆	★★★★☆
Screen size	46"	52"	46"	40"
Resolution	720p HD	1080p HD	720p HD	1080p HD
	Optional 3-year extended warranty: $57.85	Optional 3-year extended warranty: $99.85	Optional 3-year extended warranty: $97.85	Optional 3-year extended warranty: $58.85

Appendix 3-8: Sequential decision model with additional variables

Models	Explanatory variables (Hypothesis #)	Mixed Logit (S.E.)	Mixed Logit with extra variables (S.E.)
Product Choice Model	1080p HD resolution dummy (vs. 720p HD)	1.66 (0.09) ***	1.67 (0.09) ***
	Single-Leg Pedestal dummy	0.26 (0.03) ***	0.26 (0.03) ***
	Product Price (in 1000 dollars)	-5.81 (0.29) ***	-5.85 (0.29) ***
	Product quality	1.27 (0.07) ***	1.28 (0.07) ***
	46" screen size (Reference level: 42")	0.4 (0.05) ***	0.4 (0.05) ***
	52" screen size (Reference level: 42")	1.15 (0.07) ***	1.16 (0.07) ***
	Product quality × Simultaneous condition	-0.18 (0.05) ***	-0.18 (0.05) ***
	Product price × Simultaneous condition	0.56 (0.14) ***	0.57 (0.14) ***
	Product Price × Product quality	-0.58 (0.12) ***	-0.58 (0.12) ***
	ESC ratio × Product Price × Simultaneous condition	–	0.19 (4.62)
	ESC ratio × Product quality × Simultaneous condition	–	0.87 (1.74)
Warranty Choice Model	Product quality	-0.01 (0.05)	-0.04 (0.05)
	ESC price ratio	-34.36 (4.65) ***	-24.27 (1.55) ***
	Simultaneous availability dummy	-0.79 (0.05) ***	-0.75 (0.04) ***
	Product quality × Simultaneous availability dummy	0.34 (0.08) ***	0.34 (0.08) ***
	ESC price ratio × Simultaneous availability dummy	7.67 (2.89) ***	4.49 (1.87) ***
	1080p HD resolution SD	1.71 (0.15) ***	1.73 (0.15) ***
	Single-Leg Pedestal dummy SD	0.01 (0.06)	0.01 (0.08)

Standard Deviations	Product Price SD	2.31 (0.34) ***	2.34 (0.34) ***
	Product quality SD	0.92 (0.13) ***	0.94 (0.13) ***
	46" screen SD	1.27 (0.16) ***	1.27 (0.16) ***
	52" screen SD	0.72 (0.2) ***	0.74 (0.19) ***
	product quality SD	1.05 (0.4) ***	1.07 (0.34) ***
	ESC price ratio SD	37.64 (9.73) ***	1.88 (6.21)
	Simultaneous availability dummy SD	0.01 (0.04)	0.01 (0.02)
	Model parameters / statistics		
	Log likelihood	-25518.41	-25522.34
	AIC	51082.82	51094.69
	BIC	51256.5	51283.47

Appendix 3-9: Additional model specification and estimation: Simultaneous decisions with scale heterogeneity

We manipulate ESC information availability and our expectation is that choice taste parameters might change under these manipulations. However, despite a substantial amount of similarity in the details of the choice experiments across the two conditions, it could be argued that part of potential differences in taste parameters could come from scale heterogeneity as taste parameters are confounded with scale (Swait and Louviere 1993). To control for such scale differences across conditions, and across participants, we also estimate the generalized multinomial Logit model (GMNL) developed by Fiebig et al. (2010) for the simultaneous-decisions model specified in the previous section. In this specification, we extend the second specification described in Section 3.7.2 to allow for scale heterogeneity as a validation check.

The GMNL model nests several well-known choice model specifications such as the mixed Logit, and multinomial Logit as special cases. An important advantage of using this model is that it allows us to simultaneously account for both residual taste heterogeneity and scale heterogeneity. In addition, it includes a parameter, called γ, that allows the "variance of residual taste heterogeneity vary with scale in a model that includes both" (Fiebig et al. 2010). While this parameter is not important to our research purpose, its inclusion allows for a richer specification of the relationship between scale heterogeneity and residual taste heterogeneity.

The overall setup for the GMNL model is similar to the mixed Logit model, with the difference that taste parameters are specified as shown in equation (8):

$$\beta_i = \sigma_i\beta + \gamma\eta_i + (1-\gamma)\sigma_i\eta_i \qquad (8)$$

Where σ_i is a random variable that captures scale heterogeneity and η_i captures residual taste heterogeneity. Fiebig et al. (2010) identify two special cases of the GMNL depending on the value of the parameter γ, as shown by equations (9) and (10).

$$\beta_i = \sigma_i(\beta + \eta_i) \quad if\ \gamma = 0 \qquad \text{GMNL-I} \qquad (9)$$

$$\beta_i = \sigma_i\beta + \eta_i \quad if\ \gamma = 1 \qquad \text{GMNL-II} \qquad (10)$$

According to the specification by Fiebig et al. (2010), σ_i follows a log-normal distribution with standard deviation, and mean $\bar{\sigma} + \theta Z_i$, where $\bar{\sigma}$ is a normalization constant and Z_i represents the characteristics of the individual that might explain their differences in σ_i, which itself represents the idiosyncratic randomness in each consumer's choices. For this model specification, we estimated the vector of taste parameters, β and their standard deviations, similar to a mixed Logit model, as well as the additional parameters τ, θ, and γ. The parameter τ is the standard deviation of σ_i. The variables in the X vector are similar to the variables used in our second model specification in the previous section, and the Z vector includes demographic variables, namely age, income, and sex.

We use the implementation of GMNL by Gu et al. (2013). The estimation results for this model are provided in Table 1. The mixed Logit model results from Table 3-7 are also repeated in this table for comparison.

Model comparison criteria (i.e., AIC and BIC) favor the simpler mixed Logit model to the more complex GMNL model. Despite this result, we can see that all effects of interest are significant in both models. The significant effect for τ in the GMNL model suggests that there is some scale heterogeneity that is captured by this model in addition to residual taste

heterogeneity. Nevertheless, our previous findings are robust to these small levels of scale heterogeneity.

Table 1: Simultaneous-decisions model with scale heterogeneity

Models	Explanatory variables (Hypothesis #)	Mixed Logit (S.E.)	GMNL
Model of choice from 8 alternatives	1080p HD resolution dummy (vs. 720p HD)	1.93 (0.08) ***	1.62 (0.11) ***
	Single-leg pedestal dummy	0.23 (0.03) ***	0.19 (0.03) ***
	Product price (in 1000 dollars)	-7.48 (0.06) ***	-5.6 (0.39) ***
	Product quality	1.53 (0.09) ***	1.4 (0.11) ***
	46" screen size (Reference level: 42")	0.61 (0.04) ***	0.45 (0.04) ***
	52" screen size (Reference level: 42")	1.38 (0.06) ***	1.13 (0.08) ***
	Product price × Simultaneous availability dummy **(H3)**	0.91 (0.4) **	0.42 (0.24) *
	Product quality × Simultaneous availability dummy **(H4)**	-0.27 (0.13) **	-0.36 (0.08) ***
	Price * Quality	-0.91 (0.09) ***	-0.91 (0.12) ***
	withESC	-1.52 (0.18) ***	-1.22 (0.16) ***
	withESC × ESC ratio	-51.72 (0.07) ***	-51.04 (3.93) ***
	withESC × ESC ratio × Simultaneous availability dummy (H2)	7.63 (0.35) ***	7.33 (3.47) **
	withESC × Simultaneous availability dummy (H5)	-0.71 (0.21) ***	-0.56 (0.16) ***
	Age Level 2 (base= Level 1)	-	0.13 (0.03) ***
	Age Level 3	-	0.16 (0.04) ***
	Age Level 4	-	0.18 (0.06) ***

Heterogeneity parameters (θZ)	Age Level 5	-	0.24 (0.12) *
	Income Level 2 (base= Level 1)	-	-0.16 (0.07) **
	Income Level 3	-	-0.14 (0.06) **
	Income Level 4	-	-0.17 (0.06) ***
	Income Level 5	-	-0.09 (0.06)
	Sex (Male=1)	-	0.04 (0.03)
Standard Deviations	withESC SD	3.92 (0.12) ***	3.35 (0.21) ***
	46" screen size SD	0.01 (0.01)	-0.05 (0.04)
	52" screen size SD	-1.02 (0.05) ***	0.48 (0.07) ***
	1080p HD resolution dummy SD	-2.11 (0.08) ***	1.58 (0.11) ***
	Single-leg pedestal dummy SD	0.01 (0.02)	-0.01 (0.04)
	Product price (in 1000 dollars) SD	-5.6 (0.26) ***	4.36 (0.29) ***
	Product quality SD	1.69 (0.07) ***	1.3 (0.09) ***
GMNL params.	τ	-	0.07 (0.02) ***
	γ	-	0.14 (0.08) *
	Model parameters / statistics		
	Log likelihood Value	-17286.7	-18211.271
	AIC	34599.38	34859.86
	BIC	34697.54	35148.3