

## Why Do Consumers Buy Extended Service Contracts?

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### **Abstract**

We examine purchases of extended service contracts, which are essentially insurance products, for electronic products in a retail setting. The primary insurance purchase determinants are perceived probability of loss, extent of loss, risk aversion and amount of insurance premium. We examine how product characteristics (hedonic/utilitarian, manufacturer warranty) and retailer actions (promotions, feature advertising) influence the purchase of extended service contracts. We also investigate the impact of consumer characteristics (income, gender, and prior usage) on these insurance purchase determinants. To test the predictions, we use revealed preferences from panel data of electronic purchases across several product categories.

## INTRODUCTION

Examining how consumers make decisions under uncertainty is a fertile field of research in several domains. The purchase of extended service contracts provides an excellent opportunity to understand consumer behavior under uncertainty in a field setting. Extended Service Contracts (ESCs) are usually offered by retailers and sometimes by manufacturers to lengthen the coverage provided by the manufacturer's basic warranty. They are also sometimes referred to as Extended Warranties or Extended Service Plans. Technically, ESCs are insurance products which require consumers to pay premiums up front for protection against possible failures or problems in later periods. Usually, a salesperson or checkout staff recommends the purchase of the ESC immediately after the consumer buys a product.

First introduced by large electronics stores in the late 1980s, ESCs have become a core product for many retailers and cover a wide range of categories. Their cost usually ranges between 10% and 50% of a product's original price (*Business Week* 2004). Typically, ESCs are priced at a category specific level based on the product price tiers. For example, the ESC for Televisions below \$199.99 costs \$39.99, whereas that for televisions priced between \$200 and \$499.99 would be \$59.99, and so on. Therefore ESC prices vary across price tiers but not across products or brands within a tier. The terms typically last from one to three years, depending on the product category. Generating approximately \$15 billion dollars annually for retailers (*Warranty Weeks*, January 19, 2005), ESCs are extremely profitable. For example, even though they account for only 3-4% percent of the revenue, in 2003, they contributed more than 50% of Best Buy's profit and almost 100% (amounting to \$194.5m) of Circuit City's profits (*Business Week*, 2004). Some analysts estimate that the average margin for the ESCs is 50-60%, or

approximately 18 times the margin for regular products (*Business Week*, 2004). Thus, selling service contracts has become a dominant profit growth strategy for retailers of durable products (*Warranty Week*, 2004). Even Wal-Mart, which initially resisted recommending ESCs has started exploiting this profit generator (*Business Week*, 2005, *Consumer Affairs*, 2005).

Although most consumer magazines and experts advocate consumers should not buy extended service contracts, because they provide little value, it is intriguing that the demand for service contracts remains high. Many consumers purchase ESCs because they say the plans provide them with “peace of mind” (ABC News, 2006). Given the financial stake that retailers have and the costs to consumers, understanding the factors that affect consumer purchase decisions of ESCs and whether the process can be influenced is both theoretically and substantively important.

Literature on extended service contracts is sparse and mainly uses an analytical paradigm (e.g., Padmanabhan and Rao 1993). While this stream of analytical research significantly advances our understanding of the function of extended warranties from manufacturer’s perspective in a competitive setting, the mechanism(s) underlying consumer behavior regarding the purchase of insurance products such as extended service contracts in a retail environment are not well understood.

Insurance literature identifies the major determinants of purchase as being the probability of loss, the extent of loss, the insurance premium charged and buyer’s risk aversion (Mossin 1968; Schlesinger 1999). These determinants have been shown to influence purchase of flood (Browne and Hoyt 2000), life (Hammond, Houston, and Melander 1967) and health (Cameron et al 1988; Feldman et al 1989) insurance. With very few exceptions, the empirical literature in insurance considers these determinants to be objective. From the consumer decision making

perspective, it is important to note that these determinants are not always objective but can be subjective. For example, different consumers may have very different perceptions of the probability that the same model of a TV will fail. Most insurance literature also assumes risk aversion to be consumer specific rather than product or context specific. Our focus in this paper is on understanding how the likelihood of ESC purchase can be influenced by product characteristics and the marketing actions taken by retailers. In addition, consumer characteristics can accentuate or attenuate the effect of these insurance purchase determinants. We examine how differences in consumer characteristics impact ESC purchases.

More specifically, first, we examine the product categories in which consumers purchase extended service contracts. We use the categorization of hedonic versus utilitarian products and investigate whether consumer purchase patterns differ based on this product characteristic. Furthermore, there is evidence in the literature that product price and the length of a manufacturer's warranty coverage signal quality (Boulding and Kirmani 1993). We examine whether ESC coverage length increases consumers' utility. Second, we examine retail influences on perceptions of ESCs because retail environments and retailer controlled decisions may affect ESC sales. Retailers decide on price promotions and whether to advertise these promotions, we investigate whether advertised and unadvertised promotions alter consumers' risk attitudes and hence their propensity to purchase extended service contracts. Third, we examine whether consumers with certain demographic variables (e.g. gender, income, past experience of ESCs) are more likely to purchase extended service contracts. To test our predictions, we use a panel data provided by the electronic department of a retailer on the consumer purchase histories of ESCs across several categories. Thus, we test our predictions using consumers' revealed preferences.

To the best of our knowledge, our study is the first attempt to examine consumers' purchase of extended service contract in a retail environment using field data. We thus depart from existing research in several important ways. First, in contrast to the empirical testing in the existing literature which aims to verify analytical models, we are interested in understanding the consumer decision making under uncertainty and how ESC purchase propensities are influenced by product, retail, and consumer factors. Second, unlike prior survey based research that generally covers only one category (e.g., automobiles), we use purchase history data across several categories. Third, unlike most previous research which relies on self-reported risk attitudes and objective loss probabilities, we infer these factors from consumers' revealed preferences. Fourth, whereas prior literature largely views the ESC purchase decision as exogenous and based primarily on consumers' inherent risk aversion and usage patterns, we demonstrate that marketing actions can influence purchase likelihood. Fifth and finally, we provide interesting insights into why the ESC purchase process may differ across demographics (e.g., between high- and low-income consumers).

## **LITERATURE REVIEW**

As the literature on ESCs is fairly small, we summarize the key findings. The early literature in ESCs rationalizes their use on the basis of consumer segmentation variables such as risk aversion, demographics and usage rates. Using an agency theory framework, Padmanabhan and Rao (1993) examine optimal manufacturer warranty policies in a market characterized by the moral hazard problem and consumers with heterogeneous risk aversion. The authors conclude that manufacturers should offer a menu of warranties in light of the heterogeneity in risk

aversion that includes ESCs as a part of the menu to appeal to risk averse consumers.

Padmanabhan (1995b) argues that since products bought by heavy users are more likely to fail, these consumers have a stronger incentive to purchase the optional extended warranty compared to consumers who are light users. In a heterogeneous market where the relative number of heavy users is high, the profitability by offering ESCs reduces. He concludes that extended warranties should not be offered in such a market or if it is, then consumers with high usage rates must be expressly excluded.

Another set of papers investigate manufacturer strategies for extended service plans in the presence of competition from third-party insurers. Lutz and Padmanabhan (1995) propose that manufacturers should not offer extended warranties in this context. They provide two reasons: first, manufacturers have to consider the increased expected costs of both the basic warranty and the extended warranty. Second, if consumers buy the extended warranty from the third-party insurers, they likely will reduce their maintenance effort in the product during the warranty period. They suggest that the manufacturers are better off altering their pricing strategy and withdrawing the extended warranty. Lutz and Padmanabhan (1998) also show that the manufacturers will limit the range of extended warranty menus when third-party insurers enter the market. Desai and Padmanabhan (2004) pose the question on whether manufacturers or retailers should sell extended warranties and find that, even in the presence of third-party insurers, it is either equally or more profitable to sell extended warranties through retailers.

Despite the rich analytical literature, empirical research on ESCs is limited. In a qualitative study using focus groups, Day and Fox (1985) find that while general attitudes towards ECSs are negative, consumers are more favorably inclined to extended warranties that provide insurance against catastrophic loss or those that provided regular maintenance. They

conjecture that income levels, risk attitude, product usage and product experience may relate to attitude towards ESCs. They also find that ESCs could impact product quality perceptions but the direction is not clear.

Using automobile purchase data and where risk attitudes measured using a survey. Padmanabhan and Rao (1993) find that demand for ESCs is higher for consumers who are more risk averse, who are single and who have higher income levels but find no support for an effect of high product usage on ESCs purchase. They also find that consumers who buy more expensive cars and cars with shorter manufacturer warranty coverage are more likely to buy ESCs.

Padmanabhan (1995b) tests the relationship between high product usage rate and ESC purchases. Using data pertaining to automobiles with 3-year/3600-mile base warranties, he finds support for the model as consumers with higher usage rates (business versus non-business) and those who intend to keep the cars longer are more likely to buy extended warranties. Marital status provides another explanatory factor (singles were more likely) but risk attitude and income do not.

## CONCEPTUAL DEVELOPMENT

### Product Characteristics

*Hedonic and Utilitarian Products.* A robust finding in the insurance literature is that the relationship between the monetary value of the object and likelihood of purchase of insurance is positive (e.g., Browne and Hoyt 2000). Therefore, given the same price of any two products and equal probability of breakdown of two products, consumers should be equally likely to insure both products. However, this argument does not take into account that equally priced products



may be valued quite differently by consumers. Products are characterized by a combination of utilitarian and hedonic attributes (Dhar and Wertenbroch 2000; Okada 2005). Utilitarian products provide consumers with functional benefits that are useful, practical and necessary whereas hedonic products are associated with fantasy, fun and pleasure. Dhar and Wertenbroch (2000) show that equivalently priced hedonic products are valued more than utilitarian products in forfeiture situations but both are equally valued in acquisition decisions. This finding is qualified by Okada (2005) who shows that the purchase context impacts the relative consumer valuations of hedonic and utilitarian products even in acquisition decisions (Okada 2005). Specifically, where consumers evaluate products one at a time in acquisition decisions, hedonic items are valued higher than utilitarian item.

When purchasing durable products, consumers typically decide the category prior to visiting the store and then make their brand or model selection within the store. After the purchase decision, a salesperson suggests the purchase of the extended service contract. When deciding on the ESC purchase, the consumer must elaborate on the possibility of losing the product which is a state that approximates the forfeiture situation. Dhar and Wertenbroch (2000) suggest that hedonic items are valued more than utilitarian products in forfeiture situations for two reasons. First, because the attributes of hedonic products are more sensory and image evoking, consumers are more likely to imagine and elaborate on them (MacInnis and Price 1987). Second, they suggest that forfeiture scenarios prompt upward prefactual thinking that may cause consumers to minimize their emotional loss by valuing the hedonic items more (Sanna 1999).

Given the same price of a product, consumers are more likely to purchase a service contract for a product they value more as compared with a product that is ascribed lower value. In a series of interesting experiments, Hsee and Kunreuther (2000) manipulate the emotional

value of an identical object (e.g., a painting) by asking participants to imagine that they “fell in love” with the product. They find that, holding the level of expected compensation the same, people are more willing to purchase insurance for products for which they develop greater fondness. They argue that when valuation increases due to higher affection for the product, the pain of loss is higher and the compensation from the insurance serves can provide a consolation for the loss. Given equivalent prices, because consumers attach greater worth to hedonic products than to utilitarian products, we predict they are more likely to buy extended service contracts for hedonic products.

Another set of arguments for why consumers are more likely to purchase extended service contracts for hedonic products is that compared with purchasing utilitarian products, the purchase of hedonic goods often are decadent and involve self gratification which can cause feelings of guilt (Khan, Dhar and Wertenbroch 2005). Consumers then use coping mechanisms to reduce or minimize their feelings of guilt such as finding reasons to support or justify the purchase. For example, consumers might consider the hedonic product a reward to themselves or categorize income they spend as obtained from a windfall (Strahilevitz and Myers 1998). The justification routes identified in the literature mainly address the reasoning that consumers use prior to their purchase decision. Instead of rationalization, an alternative route to such post purchase justification is to take actions after purchase that serve the guilt reduction objective. One such sequential action is insuring the product by the purchase of an ESC – a behavior that is very prudent. Additionally and more directly, there is evidence that guilt is associated with risk aversion (Mancini and Gangemi 2004). To summarize, given the same price, the extent of loss associated with hedonic products is greater than for utilitarian products. Additionally, because purchase of hedonic products induces more guilt, this may lead to greater risk aversion. We

therefore predict that, all else being equal, consumers are more likely to purchase extended service contracts for products with relatively higher hedonic value than for those with relatively less hedonic value.

*Hypothesis 1: Consumers are more likely to purchase ESCs for products with relatively higher hedonic value than for products with relatively higher utilitarian value.*

*Manufacturer Warranty.* During the purchase decision, consumers do not have perfect knowledge about the reliability of the product and therefore of the likelihood of product failure in the future. There is large body of evidence that when decisions are made under uncertainty, consumers look for cues which help them infer product reliability (Dodds, Monroe and Grewal 1991). Prior research has indicated product price and terms of the manufacturer's basic warranty as important sources of information regarding product reliability. The literature on warranties shows that warranty terms impact consumer perceptions of product quality (Shimp and Bearden 1982) and purchase intentions (Boulding and Kirmani 1993). Warranty terms include the length and scope of the warranty while product quality dimensions cover overall quality, probability of breakdown and specific attribute quality. A generalizable finding from this stream of research is that the length and scope of the manufacturer's warranty indicate higher quality and more specifically lower perceptions of product failure (e.g., Boulding and Kirmani 1993, Purohit and Srivastava 2001). Since consumers are less likely to purchase ESCs for highly reliable products, we predict that the likelihood of purchasing ESCs lowers when manufacturer warranties are longer.

*Hypothesis 2: Consumers are less likely to purchase ESCs for products with relatively longer manufacturer warranties because they perceive a lower probability of failure.*

## Retail Factors

*Promotions.* Price promotions are ubiquitous and retailers spend considerable amount of money communicating the promotions. While there is considerable research that examines promotions (see Neslin 2002 for an excellent review), the relationship between price promotions offered on products and purchase of service contracts is not obvious.

A line of reasoning suggests that there could be a positive relationship between buying a product on promotion and buying an extended service contract. The savings accrued by buying a discounted product results in the income effect. There is considerable evidence that the income effect resulting from a promotion leads to the purchase of more expensive brands (e.g. Allenby and Rossi 1991; Blattberg and Wisniewski 1989). The increase in income from a promotion can also induce consumers to spend the extra money on the ESC. We therefore hypothesize that when a product is purchased at a discount, consumers are more likely to purchase ESCs.

*Hypothesis 3: Consumers are more likely to purchase ESCs for products they have purchased on promotion.*

*Unadvertised Promotions.* Very often, retailers offer price promotions on products but do not advertise those promotions. The literature has identified two benefits of this strategy. First, using an analytical framework, Rao and Syam (2001) show that unadvertised price cuts is an equilibrium strategy for retailers as it helps them retain customers who frequent the store. Heilman, Nakamoto and Rao (2002) find that unexpected in-store coupons cause consumers to increase their expenditures by making more unplanned purchases. One account for this

behavior is that the increased spending is caused by consumers' unexpected psychological increase in income. More important, they also argue that the unexpected windfall gain makes people feel good resulting in an elevated positive mood.

Mood can affect risk taking behavior. Isen and her colleagues have demonstrated that a positive mood can cause people to become more risk averse. When the situation is in the domain of gains, the effect of positive mood leads to risk seeking, whereas in the domain of losses, people become more risk averse (Dunegan et al 1992; Isen and Patrick 1983). Isen, Nygren and Ashvy (1988) also show that positive mood makes people become more sensitive to losses and that they prefer to minimize their losses rather than maximize their gains. In a business decision making context too, Mittal and Ross (1998) also show that positive mood causes low risk taking. The underlying mechanism is that the positive mood affects the subjective utility value of the potential outcomes. As compared with a neutral mood, a positive mood causes potential losses to appear worse. The reasoning is that besides the negative financial outcome, the loss also leads to the demolishing of the positive mood. Interestingly, Isen and Geva (1987) find that people carefully elaborate about negative outcomes when they are in a happy mood. In summary, anticipating a loss is more unpleasant for those who are in a relatively happy mood compared with those who are in a neutral mood.

As compared to consumers who expect a promotion, consumers who purchase a product on an unadvertised promotion are likely to have an elevated mood because of the unexpected positive surprise. When faced with the ESC purchase, this elevated positive mood, in turn, is likely to make them more risk averse.

*Hypothesis 4: Unadvertised promotions are more likely to increase consumers' risk aversion and therefore increase their propensity to purchase ESCs.*

## Consumer Characteristics

We now discuss how consumer characteristics influence the ESC purchase decisions. The consumer characteristics we examine are gender, income, and prior experience with ESCs.

*Gender.* The role of gender in risk taking has received considerable interest in both the economics (Dekel and Scotchmer 1999) and psychology literature (Magnan and Hinsz 2005). In a meta-analysis of research that uses an experimental paradigm, Byrnes, Miller and Schafer (1999) conclude that women are less prone to risk taking than men. Empirical studies reinforce these results by finding that women are less risk taking in their allocation of retirement savings plans (Sunden and Surette 1998), selecting term life insurance (Halek and Eisenhauer 2001) and buying health insurance (Feldman et al 1989). As ESC is essentially an insurance product, we also expect to confirm that women are more likely to purchase these contracts.

*Hypothesis 5: Women are more likely to purchase ESCs than men because they are more risk averse.*

*Income.* A decreasing absolute risk aversion which implies that income is negatively related to insurance purchase is widely accepted in theoretical analysis of insurance demand. (Mossin 1968). However, the empirical findings in the insurance literature find mixed results where some studies show a positive relationship between income and purchase of insurance (e.g., Browne and Hoyt, 2000 for flood insurance), while others find a negative relationship (e.g., Cicchetti and Dubin, 1994 for telephone line service contracts). Padmanabhan and Rao (1993)

find that higher income consumers are more likely to buy ESCs in the automobile category. We therefore view the effect of income as an empirical question.

*Past Usage of ESCs.* Consumers who purchase ESCs in any category consist of two segments post purchase: The first segment does not experience product failure in the category purchased and therefore does not avail of any benefits from the purchase of the ESC. The second segment does face a problem with the product and has to exercise the contract. We argue that consumers who do face a product failure problem, regardless of the category where product failure is experienced, are more likely to view purchasing the ESC more favorably on any subsequent purchase occasions. There is evidence that purchase of insurance is prone to biases due to past claims (Johnson et al 1993). Prior claims can distort future product failure rates due to availability and vividness biases. The past product failure is likely to increase the potential perceived probability of future related and even unrelated product category breakdowns. Therefore, if ESCs have been used in the past, consumers' perceived probability of failure will increase which, in turn, increases their propensity to purchase ESCs for other related or unrelated products.

*Hypothesis 6: Prior usage of a service contract increases consumers' perceptions of product failure rates and therefore makes it more likely that they purchase ESC for other products.*

In summary, we conceptualize that product characteristics, retailer actions and consumer characteristics influence the purchases of ESCs. The mechanisms of these influences include altering the perceptions of the probability of loss, the extent of loss and risk aversion or through

the psychological income effect. We test the predictions of the outcomes using data on observed choices made by consumers and the associated mechanisms permitted by the available data.

### **DATA DESCRIPTION**

Our data come from the electronics department of one retailer. Some retailers, such as Circuit City and Wal-Mart, offer consumers a menu of ESCs that vary in length and price, whereas others, such as Best Buy and Target, provide only one plan. Our focal retailer offers only one plan. We have access to the consumer purchase histories of ESC plans of 604 households from November 2003 to October 2004, which includes 1,676 purchases of products and 553 purchases of ESCs. More specifically, the data consists of the complete history of the households' purchases of electronic durables and service contracts during these 12 months. It contains detailed information about the products and service contracts, such as product type, product price, promotion offered on the product, presence of a feature (i.e., advertised promotion), price and length of coverage of the service contracts, and time and location of purchases. We also have access to consumer characteristics such as income, gender, and a dummy variable that identifies whether a consumer has used an ESC in the past (even before starting of the observation period). Since the number of product types is unmanageable, we follow the retailer's practice and classify products into seven categories on the basis of their general function: video, audio, phone, camera, computer, game, and mobile audio.

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Insert Table 1 about here



We present the sample statistics in table 1, which reveals that 31% of consumers purchase an ESC at least once during the observation period, and ESC purchases constitute approximately 33% of all purchase occasions. Among the seven product categories, consumers are most likely to purchase service contracts for mobile audio and cameras and least likely for video and game systems. The average price of the products purchased is \$340.09. The most expensive product is plasma television ranging between \$4000 and \$5000. The average price of the service contracts is \$59.25, which means they are priced at roughly 17.42% of the product price. The average length of coverage is 33 months, varying from 24 to 48 months. Among the product purchases, 35% included a price promotion, with an average promotion discount of \$20.53. Of the price promotions, 28% had been advertised through circulated publications and local newspaper inserts. Finally, 8% of consumers had used ESCs at least once during the observation period. 62% of the sample consists of male consumers. In the data set, income is provided as a 100-point index, the average being 64.48.

To determine the hedonic and utilitarian values of each product, we conducted a survey on a sample of 107 adults using the same methodology as Okada 2005. Respondents were asked to rate each product category on one hedonic scale anchored between “not at all hedonic” (0) and “extremely hedonic” (6) and one utilitarian scale anchored between “not at all utilitarian” (0) and “extremely utilitarian” (6). Following Okada (2005), hedonic items were described as fun/pleasant/enjoyable, whereas utilitarian products were described as useful/practical/functional. We report the results in table 2. We code  $HEDONIC_j$  as the difference between the hedonic and utilitarian values of a category.

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Insert Table 2 about here

## EMPRICAL ANALYSIS

### Model

We consider consumers  $i = 1, \dots, I$  who bought electronic products in product categories  $j = 1, \dots, J$  during purchase occasion  $t$  and therefore use  $D_{ijt}$  to represent whether consumer  $i$  purchases an ESC for product  $j$  at occasion  $t$ :

$$(1) \quad D_{ijt} = \begin{cases} 1, & \text{if consumer } i \text{ buys ESC for product } j \text{ at time } t, \\ 0, & \text{otherwise.} \end{cases}$$

*Perceived Failure Rate.* Because consumers buy ESCs to cover the risk of future replacement or repair cost incurred by product breakdowns, purchase decisions should depend on the likelihood of product failure. However, at the time of purchase, consumers face uncertainty regarding this precise probability. According to the literature, consumers often use the price of the product and the length of coverage of the manufacturer's warranties as quality cues for assessing product reliability (Boulding and Kirmani 1993; Erdem, Keane, and Sun 2007; Purohit and Srivastava 2001). Accordingly, we model the consumer's the consumer's perceived product failure rate using the following function:

$$(2) \quad V_{ij} = \beta_{0i} + \beta_{0j} + \beta_{1i}PRICE_j^P + \beta_{2i}COVER_j^M + e_{ij},$$

where  $V_{ij} = \bar{V}_{ij} + e_{ij}$ . This formulation is based on Erdem, Keane, and Sun's (2007) empirical finding that price signals quality and Boulding and Kirmani (1993) who show that manufacturer warranty signals quality.  $PRICE_j^P$  represents the price of product  $j$  within each product category, and  $COVER_j^M$  is the length of coverage of the manufacturer's basic warranty, which comes free

with the product. We include this latter variable to control for the potential association of a longer manufacturers' warranty coverage with lower failure rates, which would affect ESC purchase propensities. Finally,  $e_{ij}$  refer to unobservable factors that affect consumers' perceptions of breakdown rates.

The coefficient  $\beta_{0i}$  is consumer-specific constant that captures unobserved factors that may affect perceptions of failure rates across product categories. For example, consumers with children may perceive a higher probability of product failure. Next,  $\beta_{0j}$  is a category-specific constant term that captures different failure rates across categories. For example, product categories with the newest technology or multiple sophisticated features may be perceived as more likely to break down.  $\beta_{1i}$  captures the effect of product price on perceived failure probabilities and  $\beta_{2i}$  measures the effect of the length of the manufacturer's basic warranty.

Assuming  $e_{ij}$  follows an independent and identically extreme value distribution, the probability of product failure is given by a binary logit model:

$$(3) \quad \rho_{ij} = \frac{e^{\bar{v}_{ij}}}{1 + e^{\bar{v}_{ij}}}.$$

*Expected Benefit of Purchasing Service Contract.* The decision to purchase an ESC requires a comparison between the cost and benefit of owning it. Whereas the price represents the cost to the consumer, the benefits are uncertain as they accrue only if the product breaks down. If the product does not fail, an ESC purchase involves only cost; if the product fails, the ESC enables consumers to avoid out-of-pocket expenses to repair or replace the product.

At the time of purchase, consumers must assess the benefits according to the expected replacement or repair costs they may avoid by buying the ESC. For simplicity, we assume that

the terms of the ESC include replacing the failed product with a similar product at a similar price. Because consumers do not observe information about repair costs, the cost of replacement provides a reasonable surrogate; high labor costs mean many consumers simply elect to replace rather than repair their durable products. In addition, repair cost usually is proportional to replacement cost.

Because consumers' perceived failure rate is  $\rho_{ij}$ , the expected cost of replacement is given by  $\rho_{ij}PRICE_j^P$ , where  $PRICE_j^P$  is the price for product  $j$  paid by consumer  $i$ . Thus, the expected benefit of owning a service contract equals the replacement price, weighted by the perceived probability of product failure. According to the special property of Bernoulli distribution, the variance of the expected replacement cost is  $\rho_{ij}(1-\rho_{ij})PRICE_j^{P2}$ .

*Purchase Decisions.* Under uncertainty, consumers make purchase decisions on the basis of their expected utilities, given the perceived probability of failure  $\rho_{ij}$ , which consumer  $i$  develops for product  $j$ . We then assume that the expected utility that affects the ESC purchase decisions is given by

$$(4) \quad E[U_{ij} | \rho_{ij}] = \alpha_{0i} + \alpha_1 HEDONIC_j + \alpha_{2i} \rho_{ij} PRICE_j^P + \alpha_{3i} \rho_{ij} (1 - \rho_{ij}) PRICE_j^{P2} + \alpha_{4i} PROM_{ij} \\ + \alpha_{5i} PRICE_j^{ESC} + \alpha_{6i} COVER_j^{ESC} + \alpha_{7i} PP_{it} + \alpha_8 \rho_{ij} (1 - \rho_{ij}) PRICE_j^{P2} * HEDONIC_j \\ + \alpha_9 \rho_{ij} (1 - \rho_{ij}) PRICE_j^{P2} * UNADPROM_{ij} + \alpha_{10} \rho_{ij} (1 - \rho_{ij}) PRICE_j^{P2} * ADPROM_{ij} + \varepsilon_{ij}$$

where  $HEDONIC_j$  is the difference between the hedonic value and utilitarian value of product  $j$ .

We include this variable to test whether a product with greater hedonic value makes consumers more likely to purchase ESCs. The term  $\rho_{ij}$  refers to consumer  $i$ 's perceived failure rate for product category  $j$ , as described by equations 1–3, and  $\rho_{ij}PRICE_j^P$  is the expected cost of replacement. In addition,  $\rho_{ij}(1-\rho_{ij})PRICE_j^{P2}$  equals the variance of the expected cost of

replacement, which contains information about the accuracy of consumers' perceived failure rate. This formulation is consistent with Levy and Markowitz (1979), who allow the mean and variance to affect expected utility functions. As in standard marketing and economics literature, we interpret coefficient  $\alpha_{3i}$  as sensitivity to uncertainty, a measure of consumer risk attitude (Erdem and Keane 1996). We include  $PROM_{ij}$ , the depth of the price promotion on product  $j$  that consumer  $i$  receives, to test whether a price discount makes consumers more or less likely to purchase service contracts.  $PRICE_j^{ESC}$  is the price of the ESC charged by the retailer which represents the cost for consumers to buy the ESC. The variable  $COVER_j^{ESC}$  refers to the length of coverage of ESC, which we include to determine whether longer length attracts consumers to ESCs. Finally,  $PP_{it}$  captures consumer  $i$ 's ESC purchase history. Conceptually similar to Guadagni and Little's (1983) loyalty index,  $PP_{it}$  is the weighted average of purchases of ESC prior to occasion  $t$ ; it includes the purchase of an ESC in any product category. Therefore,

$$(5) \quad PP_{it} = \theta PP_{it-1} + (1 - \theta) \sum_{j=1}^J D_{ijt-1},$$

where  $\theta$  is the smoothing factor.

To test whether purchasing a hedonic product makes consumers more risk averse, we include the interaction term between hedonic value and uncertainty (variance of the expected replacement cost),  $\rho_{ij}(1 - \rho_{ij})PRICE_j^{P2} * HEDONIC_j$ .  $UNADPROM_{ij}$  indicates an unadvertised price promotion, and its interaction with uncertainty,  $\rho_{ij}(1 - \rho_{ij})PRICE_j^{P2} * UNADPROM_{ij}$ , enables us to test the possibility that consumers become more risk averse with a surprise promotion. Similarly,  $ADPROM_{ij}$  indicates if the promotion is advertised, and we again include its interaction with uncertainty,  $\rho_{ij}(1 - \rho_{ij})PRICE_j^{P2} * ADPROM_{ij}$ .

In the expected utility function of equation 4, parameter  $\alpha_{0i}$  indicates consumers' intrinsic preference to buy ESCs;  $\alpha_1$  measures whether consumers are more likely to purchase ESCs for products with relatively higher hedonic value;  $\alpha_{2i}$  measures sensitivity to the expected replacement cost;  $\alpha_{3i}$  indicates their level of risk aversion;  $\alpha_{4i}$  denotes the effect of a promotion on the purchase of a service contract;  $\alpha_{5i}$  measures price sensitivity with respect to the price of the ESC;  $\alpha_{6i}$  represents whether the length of ESC coverage affects ESC purchase;  $\alpha_{7i}$  indicates whether prior purchases of ESC's increase the likelihood of purchasing ESCs;  $\alpha_{8i}$  measures whether a hedonic product purchase makes the consumer more risk averse; and  $\alpha_{9i}$  and  $\alpha_{10i}$  indicate the effects of unadvertised and advertised promotions on risk aversion.

We use the vector  $\Theta_i$  to represent parameters to be estimated, that is

$\Theta_i = (\beta_{0i}, \beta_{0j}, \beta_{1i}, \beta_{2i}, \alpha_{0i}, \alpha_1, \alpha_{2i}, \alpha_{3i}, \alpha_{4i}, \alpha_{5i}, \alpha_{6i}, \alpha_{7i}, \alpha_{8i}, \alpha_{9i}, \alpha_{10i})$  for all  $j$ . Define  $\bar{U}_{ij} = U_{ij} - \varepsilon_{ij}$  as the deterministic part of the utility functions. Assuming the error term  $\varepsilon_{ij}$  is independently and identically extreme value distributed, we obtain the probability of consumer  $i$  choosing ESC for product  $j$  conditional on  $\Theta_i$ :

$$(6) \quad \text{Pr } ob(D_{ijt} = 1 | \Theta_i) = \frac{e^{E[\bar{U}_{ijt} | \rho_{ij}]}}{1 + e^{E[\bar{U}_{ijt} | \rho_{ij}]}}.$$

Consistent with the insurance literature, we allow consumers to make purchase decisions on the basis of perceived failure rates, expected replacement cost, and uncertainty associated with the future replacement costs.

*Heterogeneity and Estimation.* To measure the effect of consumer heterogeneity on responses to the main variables (i.e., coefficients in the perceived failure rate and utility

functions), we assume each parameter is a linear function of consumer demographic variables, such as income, gender, and experience with ESCs, and thereby characterize how the coefficients in the utility function differ across consumer demographics and past usage with ESCs:

$$(7) \quad \Theta_i = \gamma_0 + \gamma_1 INCOME_i + \gamma_2 MALE_i + \gamma_3 USE_i + e_i,$$

where  $INCOME_i$  and  $MALE_i$  refer to the income and gender of consumer  $i$  and  $USE_i$  is a dummy variable indicating whether consumer  $i$  has ever used a service contract. The coefficients of these consumer-specific variables measure how the impact of these factors on perceptions of failure probability and ESC purchase probabilities differ across consumers. Note that by modeling this heterogeneity, we introduce interaction terms among the three consumer demographic variables and all coefficients from the perceived failure rate and utility functions in a parsimonious way. The coefficient estimates in the heterogeneity equation 7 reveal how consumer characteristics moderate all the main effects. For example, if  $\alpha_{2i}$  is estimated as positive and  $\gamma_1$  is estimated as negative, it implies that consumers are sensitive to expected replacement cost on average, but higher income consumers are less so.

We assume the unobserved part of equation 7 is distributed as multivariate normal, or  $e_i \sim MVN[0, \Sigma]$ . We use a hierarchical Bayesian approach to estimate the model. For identification,  $\beta_{04}$  is fixed. Readers interested in the estimation procedure are referred to Gelfand and Smith (1990) and Allenby and Rossi (1999) for details.

## Results

To explore the fit of our proposed model, we estimate three benchmark models. The first is a basic logit model, in which the utility function is a linear function of the category constants,

price of the product, promotion, price of ESC, and coverage length of ESC. This is our proposed model without perceived failure rate, expected replacement cost, uncertainty, interaction terms, and heterogeneity. The second model matches our proposed model but without hedonic value and the three interaction terms with uncertainty. Finally, in the third model, we exclude just heterogeneity from our proposed model. In table 3A, we provide the log-likelihood and Akaike information criterion (AIC) model comparison results. As the results show, our proposed model fits the data better. By taking into account consumer perceived failure rate, the modifying effects of product characteristics, advertising, promotion, and consumer characteristics, our model explains the observed data better than the benchmark models.

In table 3B, we compare the predicted ESC purchase probabilities with those from the sample for each product category. Given the discrete nature of the dependent variable, our estimated consumer model approximates the data reasonably well. To further establish model validity, we obtain the available breakdown rates published by *Consumer Reports* and *PC Magazine* in the same period and compare them with the perceived probabilities of breakdown inferred from the model. The rank order of the calculated perceived failure rates is consistent with those indicated by the publications. For example, the actual breakdown rates determined by the magazine surveys for video, game, and phone equipment are 9%, 18%, and 26%, respectively. Our model produces consumers' perceived rates to be 16%, 32%, and 39%.

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Insert Table 3A and 3B about here

In table 4, we report the parameter estimates in the perceived probability function. As expected, the results show that consumers tend to associate higher prices with a lower probability



of product failure. We thus confirm the conventional wisdom that product price plays a significant role in signaling product reliability and reduces consumer concerns about product failure. However, the length of the manufacturer warranty has no significant impact on the perceived probability of failure. This result is inconsistent with prior experimental findings (Boulding and Kirmani 1993) and hypothesis 2. Unlike experimental research where the manufacturer warranty length is manipulated, our data contains manufacturers' warranties that are similar in length for most electronic categories. We do not believe that these results contradict existing theory; rather, the data may lack sufficient variation to provide results consistent with experimental research.

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Insert Table 4 about here

In the purchase utility equation, the coefficient of the dummy variable  $HEDONIC_j$  is positive and significant ( $\alpha_1 = 0.21$ ). This result provides support of hypothesis 1 confirming that consumers are more likely to purchase ESCs for products with relatively higher hedonic value than for products with relatively higher utilitarian value. The  $\alpha_{2i}$  parameter also is significant and positive, which implies consumers are sensitive to the expected cost of replacement and increase their probability of purchasing ESCs when they estimate a higher replacement cost. This result is consistent with existing findings in insurance literature that consumers are more likely to purchase insurance for products where expected cost of replacement is high (Williamson, Ranyard, and Cuthbert 2000). The coefficient of the squared term of the expected replacement cost  $\alpha_{3i}$  also is positive and significant, which suggests that consumers are risk averse, and greater uncertainty about the replacement cost increases their propensity to purchase ESCs. The coefficient of price promotion is positive and significant indicating that if consumers receive a

price discount, they are more likely to purchase an ESC. We find support for hypothesis 3. As anticipated, consumers also are sensitive to the price (insurance premium) of the ESCs ( $\alpha_{5i} = -17.00$ ), though we find no impact of its length. This absence of effects may result from the lack of variation in the length of ESC, as we speculated for the manufacturer warranty. Finally, the coefficient for past purchase of ESC ( $\alpha_{7i} = 5.23$ ) is significant indicating that consumers who have purchased ESCs in the past are more likely to do so in the future.

The interaction of hedonic value and uncertainty is not significant ( $\alpha_{8i} = 0.06$ ). Therefore, we must reject the explanation that guilt following the purchase of hedonic increases risk aversion. Eliminating this explanation suggests that, consumers may be more likely to buy ESCs because they value hedonic items more, consistent with experimental results of Hsee and Kunreuther (2000).

In hypothesis 4, we predict that unadvertised promotions create a positive mood and increase risk aversion. The interaction between unadvertised promotion and uncertainty is positive and significant ( $\alpha_{9i} = 0.42$ ). Thus, when a retailer uses unadvertised promotions, consumers' risk aversion increases and this makes them more likely to buy ESCs. This supports hypothesis 4. The interaction between advertised promotions and uncertainty is not significant ( $\alpha_{10i} = 0.04$ ), which confirms that only unadvertised promotions alter risk aversion levels.

We now turn to examine the coefficients in the heterogeneity equations reported in Table 5. These estimates describe how consumers with different characteristics respond differently to our focal variables in the perceived product failure and utility equations. We discuss only on the significant estimates. Please note that the estimates in the heterogeneity equations can be interpreted as interactions between heterogeneity characteristics and the explanatory variables in the probability and utility equations. For example, the coefficient of men (0.77) in the

heterogeneity equation for  $\beta_{1i}$  indicates that, relative to women, men are less likely to associate higher product price with lower probabilities of failure. Said differently, women are more likely to believe that high priced products are more reliable.

Income level does not affect perceived probabilities of product failure rate. However, as indicated by the negative coefficient of income in the heterogeneity equation for  $\alpha_{2i}$  (-2.02), relative to low income consumers, higher income consumers are less sensitive to the expected cost of replacement. The higher-income consumers also are less sensitive to promotions (-0.40) and less likely to purchase ESCs even when the product is on promotion.

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Insert Table 5 about here

The overall effect implies that given everything else equal, lower income consumers are more prone to buying ESCs. Two explanations account for this finding: first, lower income consumers are more sensitive to the replacement cost which is not very surprising since the more limited disposable income makes it much harder for them to repurchase the product in event of product failure. Second and more interesting, the impact of price promotions on the purchase of extended service contracts is more for low income consumers. The conjecture that low income consumers are more prone to ESC purchases is inconsistent with the findings of Padmanabhan and Rao (1993) and Padmanabhan (1995b). These results can be accounted for by the differences in the automobile category examined in the earlier studies and the cheaper electronic product categories. In the relatively cheaper electronic categories, higher income consumers have the ability to self insure their purchases but the lower income consumers do not. Another possibility is that the insurance objective for automobiles and electronics products differs. In automobiles, the goal of purchasing the ESC is primarily repair and maintenance while for electronic products,

it is replacement. Since higher income consumers have higher time costs, they may be more willing to purchase ESCs for automobiles rather than for electronic products where product replacement is the primary goal.

Gender also entails several differences. Compared with women consumers, men are less likely to rely on price to infer product reliability (0.77) and more sensitive to expected replacement costs (10.18). Consistent with prior findings, men appear less risk averse than women (-6.72). However, it remains difficult to predict whether ESC purchases relate to gender overall. Although women are inherently more risk averse, they also rely more on product price to infer product reliability. The raw data shows that across the purchase occasions, 33.46% of men and 32.23% of women purchase ESCs. Thus, we cannot confirm hypothesis 5.

Finally and interestingly, if a consumer has previously exercised a service contract, they perceive a greater probability of product failure, regardless of the product category (2.02). This could be due to the the availability bias (Tversky and Kahneman 1974) or perhaps past failures may make consumers less confident about the way they handle products. No other parameters are significant. This result confirms hypothesis 6 that past product failure increases perceptions of future product failure and consequently impacts subsequent purchase of ESC s.

## **DISCUSSION**

In this article, we use consumer purchase decisions of extended service contracts to understand their decision making under uncertainty. The decision to purchase insurance requires consumers to assess the probability of loss and magnitude of loss and make a decision

on the basis of their perceptions of risk and the premium charged. Our results suggest that this decision is context specific and can be influenced by marketing actions.

We conceptualize and demonstrate that the purchase of extended service contracts is influenced by three major factors: hedonic/utilitarian value of products, price promotions and advertising, and consumer characteristics. We develop hypotheses about the impact of these three factors on consumers' perceptions of product failure probability and likelihood of purchasing an extended service contract. To test the predictions, we apply a consumer choice model to panel data containing consumer purchase histories of service contracts from the electronics department of a retail store.

We hypothesize that consumers are more likely to purchase insurance provided by extended service contracts for products that have relatively higher hedonic value than utilitarian value for two reasons. First, given equal prices, consumers' valuation of hedonic products is higher which increases the pain of loss. Second, the purchases of hedonic products also elicit feelings of guilt and heighten risk aversion. The results confirm that the perceived probability of purchasing extended service contracts is greater for products with high hedonic value though not necessarily because consumers feel guiltier about such purchases. The results reinforce the findings of Dhar and Wertenbroch (2000) which show that valuation of hedonic products is more than utilitarian products. The results also suggest that consumers are willing to pay a premium to protect the additional valuation.

Our results on the impact of retail environment demonstrate that retailer actions can influence ESC sales. Promotions increase the likelihood of purchasing extended service contracts because there may be a psychological increased income effect realized from savings due to the price promotion. We also predict and find support that unadvertised promotions

augment the effects of promotions. The unexpected gains from unadvertised promotions evoke positive moods in consumers (Heilman, Nakamoto and Rao 2002). The positive mood, in turn, increases their risk aversion and consequently the purchase of extended service contracts.

We confirm earlier empirical findings that product price serves as a cue of quality (Erdem, Keane and Sun 2007). Consumers use high price as an indicator of product quality and assign a lower chance of the product failure if it has a higher price. The results do not confirm that the basic manufacturer warranty length is an indicator of quality. We suspect however that this is an artifact of the real world data where there is little variation in the length of warranty offered across brands. The results also suggest that state dependence in the purchased of extended service contracts. Consumers who have purchased service contracts in the past are also likely to do again in other product categories in the future.

The results from the heterogeneity analysis are intriguing. In contrast to the prior empirical findings (Padmanabhan and Rao 1993; Padmanabhan 1995b), we find that low income consumers are more likely to purchase ESCs. The analysis reveals that they are likely to do so because they are more sensitive to the replacement costs in event of product failure. Unlike the case of automobiles where high income consumers buy ESCs to avoid maintenance because they have higher time costs, in the electronics product category, low income consumers buy insurance to hedge against out-of-pocket costs of replacing the product. Additionally, lower income consumers are also more predisposed to exercising the savings obtained from promotions to purchase ESCs.

If the extended service contracts do, in fact, offer little value, the results imply a perverse impact on consumer welfare. The lack of financial ability of low income consumers to replace products induces them to pay a potentially unnecessary and overpriced insurance premium. On

the other hand, high income consumers for whom product replacement is not a cause for anxiety incur a lower total cost of product acquisition. These findings are somewhat ironic in the light of observations that the poor sick patients unable to afford health insurance pay the highest prices for drugs (e.g., Frank 2001). In the health domain, poor patients are unable to afford insurance in a category where it is salubrious to but opt for insurance in an area where the investment is inexpedient.

We find confirmatory evidence that women are more risk averse than men. However, the higher aversion does not necessarily translate in increased likelihood of buying ESCs. According to the raw statistics, the proportion of men and women who purchase ESCs is approximately the same. The propensity to buy insurance reduces for women as they are more likely to use price as an indicator of product reliability. Additionally, they are also less sensitive to expected replacement cost.

Finally, the analysis confirms that consumers who have encountered product failure and have utilized their ESC in the past increase their estimates of subsequent product failures. We conjecture that perceptions of risk are higher for these consumers due to the availability bias.

#### Future Research

With data based on revealed choices in a store environment, we focus primarily on examining outcomes of the decision process. Unlike experimental research, which can pinpoint the processes by controlling all other factors, empirical research is more exploratory. The main advantage of conducting empirical research is that we have revealed preference data collected in a real setting. Thus, we can investigate the simultaneous impact of many factors on the purchase decision. More important, it allows us to establish the external validity of the key effects. Finally, empirical research captures effects that may be difficult to replicate using hypothetical

experimental scenarios. For example, it may be hard to simulate the positive mood evoked by an unexpected price promotion.

Consistent with the nature of our data though, we cannot test for all underlying processes, which is an endemic limitation of empirical research. Although our primary objective has been predicting outcomes based on theoretical reasoning, when the data allow, we make the best possible attempt to gain an understanding of the processes. It is important that experimental research be conducted to confirm the underlying mechanisms.

The mechanisms that influence perceptions of value, perceived probability of failure, and risk aversion require more in-depth analysis, including through experimentation. For example, we find that consumers are more likely to purchase ESCs in response to unadvertised promotions, but we cannot determine post hoc whether consumers actually were unaware of these promotions, so research in an experimental setting should confirm this effect. In addition, our data indicate that guilt following purchase of hedonic items does not account for ESC purchases, so research should examine our proposed explanation that high hedonic valuation prompts insurance purchase.

A key difference between ESCs and other insurance is that the purchase process for the latter is more deliberate. For most ESC purchases, decision making likely takes place quickly and with less deliberation. These differences suggest potential avenues for exploration. Such exploration also might consider the different ESC offers among retailers: some of them offer a single ESC option where the only decision a consumer faces is whether to buy or not buy. Other retailers offer menus of ESC contracts. It is interesting issue for future research to investigate how consumers choose among a menu of ESC plans.



We adopt a static approach for our analysis, whereas further research might model consumer dynamics explicitly in the choice of service contracts. Structural models in which consumers learn the benefits of ESCs, incorporate prior information to form their expectations of product reliability, develop expectations about future replacement costs, and are forward looking about risk might help investigate the dynamic nature of consumer decision processes. Finally, additional consumer decisions, such as product returns, could be studied in conjunction with the ESC purchase decision.

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TABLE 1. SAMPLE STATISTICS<sup>a</sup>

Variables	Explanations	Means or Frequency
$D_{ijt}$	Whether ESC was purchased	0.33
Audio		0.38
Video		0.24
Phone		0.31
Camera		0.45
Computer		0.34
Game		0.30
Mobile Audio		0.52
$PRICE_{jt}^{ESC}$	Price of ESC	\$59.25
$COVER_{jt}^{ESC}$	Coverage length of ESC (years)	2.75
$COVER_{jt}^M$	Coverage length of manufacturer's basic warranties (years)	0.87
$PRICE_{jt}^P$	Price of product	\$340.09
$HEDONIC_j$	The difference between hedonic and utilitarian values of a product	-0.49
$PROM_{ijt}$	Price promotion	\$20.53
$ADPROM_{jt}$	Whether a promotion is advertised/featured	28%
$UNADPROM_{jt}$	Whether a promotion is unadvertised/unfeatured	72%
$INCOME_i$	Income level on a 100 point index	64.48
$GENDER_i$	Whether the consumer is a male	62%
$USE_i$	Whether a previous purchase of ESC was availed	7.94%

a. The sample contains 604 households that purchased 553 service plans for 1,676 products between November 2003 and October 2004.

**TABLE 2. HEDONIC CATEGORIES vs UTILITARIAN CATEGORIES**

<b>Categories</b>	<b>Hedonic Value</b>	<b>Utilitarian Value</b>
Audio-visual receiver	3.92(.16)	4.02(.15)
Boom box	4.63(.15)	3.47(.20)
Car stereo	4.81(.16)	4.38(.19)
CD recorder	2.93(.31)	3.93(.29)
Cell phone	3.61(.31)	5.36(.16)
Computer peripheral	2.89(.33)	4.32(.23)
Desktop	2.50(.30)	4.88(.23)
Digital camcorder	4.56(.15)	4.42(.14)
DVD player	4.90(.16)	4.34(.17)
High end camera (>\$400)	4.51(.25)	3.06(.29)
High end speaker (>\$200)	4.11(.26)	3.03(.31)
Home CD changer	4.17(.19)	3.49(.18)
Home phone	1.75(.32)	4.57(.31)
Home theatre	4.66(.25)	3.83(.30)
Ipod	4.54(.24)	3.23(.28)
Low end camera (<\$400)	4.72(.15)	5.01(.12)
Low end speaker(<\$200)	2.53(.29)	3.63(.29)
Notebook	3.61(.28)	5.21(.16)
Pay phone	1.79(.29)	4.40(.35)
PDA	4.11(.16)	5.03(.14)
Portable CD player	4.91(.27)	4.17(.30)
Portable DVD player	3.97(.23)	2.76(.28)
Printer	2.25(.33)	5.06(.21)
Projection TV	4.77(.28)	3.21(.32)
Regular TV (<\$1000)	3.12(.25)	5.23(.24)
Shelf stereo system	4.46(.16)	3.99(.17)
Two way radio	3.13(.20)	4.15(.18)
VCR	2.65(.30)	3.91(.29)
Video game console	4.53(.30)	2.59(.31)
Video game controller	4.30(.31)	2.26(.32)
Voice recorder	3.06(.18)	4.46(.15)



**TABLE 3A. MODEL COMPARISON**

	<b>Benchmark Model 1</b>	<b>Benchmark Model 2</b>	<b>Benchmark Model 3</b>	<b>Proposed Model</b>
<b>Log-likelihood</b>	-997.56	-965.74	-956.29	-899.88
<b>AIC</b>	1008.56	979.74	974.29	956.88

**TABLE 3B. COMPARISON WITH SAMPLE STATISTICS**

	<b>Sample</b>	<b>Model</b>
<b>Predicted Purchase Probability</b>		
Audio	0.38	0.37
Video	0.24	0.22
Phone	0.31	0.28
Camera	0.45	0.36
Computer	0.34	0.35
Game	0.30	0.34
Mobile audio	0.52	0.46
<b>Hit Rate</b>		0.71
<b>Efron's RSQ</b>		0.18
<b>McFadden's RSQ</b>		0.15

TABLE 4. MODEL ESTIMATES

Parameters		Estimates (Standard Deviations)
<b>Perceived Probabilities</b>		
Constant Term		
Audio	$\beta_{0j}$	-0.83( 0.41)** <sup>a</sup>
Video		-2.01( 0.39)**
Phone		-0.90(0.67)
Camera		fixed
Computer		-1.40(0.25)**
Game		-1.15(0.39)**
Mobile audio		-0.73(0.70)
Price of the Product	$\beta_{1i}$	-0.95(0.23)**
Coverage of Manufacturer Warranty	$\beta_{2i}$	0.05(0.24)
<b>Utility Function</b>		
Constant Terms	$\alpha_{0i}$	-5.94( 2.96)**
Hedonic Product	$\alpha_1$	0.21( 0.11)**
Expected Replacement Cost	$\alpha_{2i}$	13.29(6.27)**
Variance of Expected Replacement Cost (Uncertainty)	$\alpha_{3i}$	6.85(3.12)**
Promotion	$\alpha_{4i}$	0.99(0.57)*
Price of ESC	$\alpha_{5i}$	-17.00( 1.96)**
Length of ESC	$\alpha_{6i}$	1.00( 0.77)
Past Purchases of ESC	$\alpha_{7i}$	5.23(2.11)**
Hedonic*Uncertainty	$\alpha_{8i}$	0.06(0.74)
Unadvertised Promotions*Uncertainty	$\alpha_{9i}$	0.42(0.12)**
Advertised Promotions*Uncertainty	$\alpha_{10i}$	0.04(0.11)

a. \*\* Significant at 0.05 level. \* Significant at 0.10 level.

**TABLE 5. HETEROGENEITY ESTIMATES**

Parameters		Estimates (Standard Deviations)		
		Income	Men	Prior Usage
<b>Perceived Probabilities</b>				
Constant Term	$\beta_{0i}$	-0.07(0.24)	-0.05(0.77)	2.02(0.96)**
Price of the product	$\beta_{1i}$	-0.01(0.05)	0.77(0.34)**	-0.02(0.18)
Coverage of Manufacturer Warranty	$\beta_{2i}$	0.05(0.08)	-0.10(0.36)	0.02(0.18)
<b>Utility Function</b>				
Constant Term	$\alpha_{0i}$	-0.01(0.32)	0.04(2.37)	-0.02(5.62)
Expected Replacement Cost	$\alpha_{2i}$	-2.02(1.03)**	10.18(3.08)**	0.53(2.62)
Uncertainty	$\alpha_{3i}$	-0.01(1.09)	-6.73(3.07)**	1.23(1.38)
Promotion	$\alpha_{4i}$	-0.40(0.19)**	0.55(0.57)	-1.71(1.08)
Length of ESC	$\alpha_{5i}$	-0.14(0.57)	0.23(0.93)	-3.25(2.30)
Price of ESC	$\alpha_{6i}$	0.13(0.73)	1.85(3.18)	0.83 (7.83)
Past Purchases of ESC	$\alpha_{7i}$	0.38 (0.47)	-1.80(1.43)	3.29(3.90)