Value Dynamics in the Secondary Market: How Pricing and Product Lines in the Primary Market Affect Value Retention

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Abstract: The secondary market, the market for used goods, is growing rapidly. Yet, research to date does not provide firm insights into how much value different products retain in this secondary market. Although most products lose value when transitioning from the primary to the secondary market, this research shows that not all products within a line lose value at the same rate. Sales data from the North American used automobile market and from used iPads on eBay are modeled to examine how product level factors, such as a product's features, and product line level factors, such as the breadth and boundaries of a product line and a product's position relative to others in its product line, affect value retention. The findings provide guidance for firms to optimize profits and pave the way for further research on the dynamics of value retention in the marketplace.

Keywords: Secondary Market, Product Line, Product Valuation, Price Dynamics

1. Introduction

Over $20 billion in used goods were sold in the United States from 2012 to 2017 (Guattery, 2017). This includes products such as clothing, furniture, and electronics but excludes motor vehicles and real-estate (Guattery, 2017). Realizing the potential additional revenue from the secondary market, firms are moving away from their historical focus on selling goods in the primary market through established channels (Achrol & Kotler, 1999). Firms such as Apple and Best Buy offer programs where consumers can return products purchased from them and receive a discount on newer products, a practice referred to as buyback or trade-in, and the firms can then sell these products in the secondary market. The ability to profit off of secondary market products has fueled its rapid growth.

These developments bring up the question: Which products within a product line retain the greatest amount of value in the secondary market? The rapidly evolving marketplace complicates product line pricing because product lines containing new products are available to customers in the primary market at the same time as product lines containing used products in the secondary market. This occurrence is becoming more commonplace as firms seek to capitalize on the value of products in the secondary market. The purpose of this research is to examine which products within a product line retain the most value in the secondary market. Specifically, we use two different markets (consumer electronics and automobiles) to examine value retention dynamics in the secondary market.

2. The Secondary Market

In line with previous work (Shulman & Coughlan, 2007), we define the secondary market as the market where previously owned goods are sold. Unlike in prior work (Arunkundram & Sundararajan, 1998), this conceptualization includes products sold by the original maker as refurbished products, those goods that consumers have returned due to a perceived defect, and that are resold after problems are fixed (Vorasayan & Ryan, 2006). Extending the definition of the secondary market to include both used and refurbished goods is necessary to reflect the increasing participation of manufacturers in the resale of their products in the secondary market through buyback and leasing programs. Both used and refurbished products are devalued from their counterparts in the primary market.

The secondary market is growing, offering a mounting array of product categories from automobiles and books (Huang, Yang, & Anderson, 2001) to smartphones (Hagerty, 2011), furniture, and fashions (Rodgers, 2015; Shulman & Coughlan, 2007). This market expands due to increased participation from both consumers and sellers. Consumers look to the secondary market to obtain products at a cost lower than in the primary market (Yin, Ray, Gurnani, Animesh, 2010). The secondary market may also be the beneficiary of greater technological change. Firms recognize that consumers may be apprehensive toward purchasing new technology that may become obsolete quickly and buyback options alleviate this apprehension and encourage purchase (Dasgupta, Silva-Risso, Sivaramakrishna, 2014). The increase in buyback programs results in more products needing to be resold in the secondary market. Although most products lose value between the primary and secondary market, products with limited supply such as real estate and collectibles are the exception due to scarcity.

The secondary market is more inclusive in nature: Lower prices enable a larger number of consumers to afford and thus purchase the product (Waldman, 2003). Another defining feature

of the secondary market is that manufacturers no longer maintain a monopoly on product sales (Levinthal & Purohit, 1989). Whereas in the primary market manufacturers maintain a certain degree of control over the channels through which they sell their products, in the secondary market, consumers' right of resale removes the monopoly condition. Although manufacturers have increasingly exerted more control of their products in the secondary market through buyback programs in order to increase prices (of products both in the primary and secondary markets), the presence of manufacturers in the secondary market has increased competition therein.

2.1. Product Lines

The defining characteristics of the primary and secondary markets are depicted visually in Figure 1 with lower cost / products with fewer features at the bottom and higher cost / products with more features at the top. In the primary market, a wide range of products within a product line appeals to different customers and thereby increases the probability of purchase (Schön, 2010). Product lines are anchored with a base model at the low end and then more expensive versions with more features along the range of the line. Figure 1 reflects the overlap in prices between primary and secondary markets: The lower-end products in the secondary market are priced lower and thus more affordable than the lower-end products in the primary market. In contrast, the higher-end products in the primary market are priced higher and less affordable than the higher-priced products in the secondary market. The secondary market, characterized by older and less expensive goods, appeals to a consumer segment willing to trade the elements of a new product for a lower cost.

<insert Figure 1 about here>

3. Modeling Product Valuation in the Secondary Market

The model integrates theories from economics, marketing, and psychology to advance a model for product valuation in the secondary market. The research focuses on goods that lose value when they enter the secondary market and does not apply to products for which demand far outstrips supply (e.g. real estate, collectibles) because the limited nature of these products increases their valuations in the secondary market.

3.1.Value Loss due to Asymmetry, Obsolescence and Contamination.

The loss in value in the secondary market is partly explained by asymmetry effects, obsolescence, and contamination. Consumers are unsure of the true quality of a product and this uncertainty reduces the amount they are willing to pay (Kirmani & Rao, 2000). Obsolescence reduces demand for products that have a recently improved alternative (Shih & Schau, 2011), and contamination can trigger feelings of disgust from potential consumers who then devalue a product despite the absence of asymmetry or obsolescence (Argo, Dahl, Morales, 2006).

Asymmetry, obsolescence, and contamination all impact consumer valuation of products in the secondary market. As captured in the model presented earlier, the lowest-priced models in the secondary market are less than the lowest-priced versions in the primary market. In contrast, models on the higher end of a product line in the secondary market overlap with models of the product line in the primary market (see Figure 1). Consumers who want to avoid asymmetry, eliminate contamination, and/ or purchase products that are not obsolete can choose to buy new products in the primary market despite the higher costs. The primary difference between the secondary market and the primary market is price. Anchoring the low end of the product line is the base model which is usually the cheapest within the line. Products at the low end of the

product line in the secondary market are less expensive than the cheapest products in the primary market which makes the base model the most affordable by the majority of consumers.

We conducted a preliminary exploration with the automobile market data to examine the relationship between a product's positioning in the product line and its value retention in the secondary market. In the scatterplot displayed in Figure 3, the x-axis displays the product cost within the product line (the logarithm of the cost above the base model), with more expensive models within the line furthest from the intersection of the x and y-axes. The y-axis displays the proportion of product value retained when a vehicle moves from the primary to the secondary market (i.e. if a product sells for the same price in the secondary market as the primary market then the proportion of value retained is 100%.) The dispersion of data supports the argument that lower priced models retain more value than more expensive models, and provides the impetus for more formal testing.

We advance the following hypothesis to test the above argument:

H1: Within a product line, the lower the price of the product, the more value it retains in the secondary market.

Hypothesis 1 has implications in terms of product line breadth, the number of models within a line. As the number of products within the line increases, so too does the contrast between lower and higher priced models. If the lowest priced models retain the most value because they are viewed as inexpensive options to the primary market then broader product lines would amplify this contrast. A product line with only two products would have a more expensive and a less expensive version (baseline version), and arguably, the baseline version would be cheaper than any new product. The more expensive version may only be seen as a better version of the base version because there is only one comparison product in the line. As the number of

products within the line increases, consumers have more options to buy less expensive versions of the product and the contrast increases. With five products in a line, the lowest price version is the most desirable but the version just above (in terms of price) may also be desirable because there are still three versions at higher prices to compare to. Given that, as argued earlier, less expensive products retain the most value, increasing the number of products within the line should have a positive impact on the amount of value that all products within the line retain.

H2: The greater the number of products within a product line, the more value products within the product line retain in the secondary market.

Building onto the premise that products at the low end of the product line retain the most value, the model further accounts for the fact that product lines differ in terms of their low boundaries (the price of the baseline model). For instance, the baseline model of the BMW M5 product line starts at a price higher than the baseline model of the Honda Accord product line. If the lowest-priced product in a line retains the most value, then it could be inferred that the least expensive product in the primary market becomes the most desirable in the secondary market. The Nissan Versa, the lowest-priced new car in 2017 would arguably retain the most value because it is the most affordable. Yet, prior work has established that consumers generally have a zone of acceptance for prices (Janiszewski & Lichenstein, 1999) and may hesitate to pay too little for a product because it may not contain the desired features or because low prices may trigger concerns regarding quality (Monroe & Petroshius, 1981). This impacts products in the secondary market because the drop in prices in the secondary market may move some products below consumers' zone of acceptance, hence decreasing demand for those products. In other words, the lowest priced product (e.g. a Nissan Versa in 2017) could be seen as too cheap. Our argument suggests that a product line anchored by a very inexpensive base model would not

retain as much value as a product line anchored by a higher-priced based model. We capture the argument regarding the impact of a product line's low price boundary on value retention in the secondary market in the following hypothesis:

H3: The price of the lowest priced version within a product line in the primary market (baseline model) has a positive impact on the amount of value retained by all products within that line in the secondary market.

4. Data and Empirical Contexts

We tested the hypotheses in two different contexts: automobiles and personal electronics. Hypotheses 1 to 3 proposed relationships regarding the impact of a product line or placement within a product line on valuations in the secondary market. Testing these relationships requires a large number of product lines and diversity within each product line. For these, we rely on data from the used car market, well-established as one of the oldest and largest secondary markets in the economy (Sullivan, 1998). The diversity of product lines within the automobile sector therein made it ideal to test Hypotheses 2-3. However, in that market, the true price paid by consumers in the primary market is often negotiated and rarely revealed outside of the transaction; the unavailability of true prices in the primary market may skew our ability to fully test Hypothesis 1 using the automobile sector. To alleviate this concern, we supplement the used cars dataset with a dataset of used iPads to test Hypothesis 1. The iPads market is ideal because primary market prices are set. In other words, the automobile dataset, which contains multiple product lines, was used to test Hypotheses 1 to 3 and the dataset for used iPads, which contains prices in both primary and secondary markets, was used as a supplementary test for Hypothesis 1.

4.1.Automotive Sample and Data Selection

The automotive sample consists of sales data on 170 different vehicles sold in the secondary market across 39 different product lines manufactured by 21 different automakers. We collected sales data (in the secondary market) for the months of May and June in 2012 and 2013, generating a total of 661 data points. Because the original primary market price was not available, we used the more recent sales price available in the secondary market (2013) as the denominator and the older sales price (2012) as the numerator to calculate how much value the product lost. With the suggested price in the primary market as the denominator and the sales

price in the secondary market from the year prior as the numerator, we calculated the residual value as the dependent variable. All products were only one year removed from the primary market, to control for possible product cannibalization from new product lines and multiple transactions. In other words, the analysis controlled for the impact of product age by including only products that had entered the secondary market after only one year in the primary market. We also removed any models that underwent significant redesign between two years. The Kelley Blue Book (KBB) was used to identify vehicles that, by the estimation of KBB, underwent a significant change in design between years. Six cars[1] fell under this category and were thus removed from the total sample. The pricing data was obtained from the *NADA Official Used Car Guide*, which lists average retail prices based on actual sales of used cars by dealers in the Eastern region[2] of the United States in the relevant year (NADA, 2012). As espoused by Sullivan (1998) in her work on automobiles, the main advantage of NADA used-car prices is that they are based on market transactions and therefore reflect car buyers' actual valuations of the products. Another advantage is that all cars were sold as certified used cars by institutional sellers, hence the quality uncertainty and the problem of lemons would be reduced (Rao, Narasimhan, John, 2009). The NADA used-car databases provide the average price negotiated for the sale of that particular product in the secondary market as well as the price in the primary market listed as the manufacturer's suggested retail price (NADA, 2012). The NADA used-car price database also provides a listing of vehicles in each product line. We excluded cars that contained hybrid or diesel technologies because these vehicles may hold their value differently in the secondary

[1] Redesigned cars removed from the sample are as follows: Ford Focus, Honda CRV, Mercedes SLK, VW Beetle, and VW Passat

[2] The Eastern Region consists of the following states: Connecticut, Delaware, D.C, Maryland, New Jersey, Pennsylvania, Virginia, & West Virginia

market due to enhanced technological obsolescence (Majid & Russell, 2015). Table 1 provides a description of the used cars dataset.

<insert Table 1 about here>

4.2.Measures and Models

In order to model the product value retained in the secondary market, we utilize a hedonic pricing model. Hedonic price models have been used as early as 1961 to study the pricing of automobiles (Griliches, 1961). The hedonic price model extracts elements associated with the product and uses it to form valuations of the product (Baltas & Saridakis, 2009; Ohta & Griliches, 1976). Two brands with identical combinations of attributes/ product features must charge identical prices (Kalita, Jagpal, Lehmann, 2004) but any difference between models would then theoretically account for the difference in prices (Baltas & Saridakis, 2009). Hedonic pricing models are frequently used in research on automobile pricing (Baltas & Saridakis, 2010; Sullivan, 1998, Ohta & Griliches, 1976). Prior work has argued that price differentiations can be attributed to product characteristics, such as engine size (Esteban-Bravo & Lado, 2011) or attributes that do not depend upon output such as reputation (Ohta & Griliches, 1976). We thus build on previous studies with hedonic price models in the automotive sector by taking the price differentials within product lines and then examining the differences that remain within the secondary market. Our argument is that, whereas high end products are less desirable in the secondary market because they overlap with the product line in the primary market, lower end secondary market products that do not overlap with the same product line in the primary market are less expensive and thus more accessible to consumers.

Our model is tested using a hierarchical linear regression model to predict product value. To reflect the fact that each product is contained within a product line, there are two levels of analysis: the product and the product line level. To examine the effect of multiple levels, we use a hierarchical linear model with variables related to the product representing level one and variables associated with the product line representing level two.

In order to capture value, we transform the product price (cars and iPad) into a residual value: The proportion of the original price of the vehicle/iPad that buyers in the secondary market are willing to pay after the vehicle/iPad was previously owned. Thus, the surplus that buyers enjoy from purchasing a product dissipates if buyers do not hold on to the existing stock of the product at or above the market price (Sullivan, 1998). The residual value is the price (P) of model *m*, *t* is the model year of the car while *a* is the age of the car divided by the original sales price. To illustrate, the price of a car that was resold in the secondary market in 2013 was divided by its original price in the primary market in 2012.

$$RV_{cars} = \frac{P_{m,t+a}}{P_{st}}$$

The below equation represents the residual value (RV) for iPads, with price (P), model *m*, and the retail price in the secondary market s, divided by the price in the primary market *pr*.

$$RV_{\_iPad} = \frac{P_{m,s}}{P_{m,pr}}$$

We emphasize that this analysis is within product lines, unlike prior work (Jindal, Sarangee, Echambadi, & Lee, 2016), which compared between models. Within a product line the advertising share, dealer share, and editor rating are controlled for and not included in the final analysis. We also reiterate that, in the empirical model using the automobile sample, the

denominator was the sales price negotiated the first time the vehicle was resold in the marketplace. Given the unavailability of the original sales price in the primary market, we relied on the average sales price negotiated by the buyer and the seller when the car was in the secondary market for one year. The reason for using the year one sales price in the secondary market as our denominator for residual value was two-fold. Firstly, the automobile market is notorious for price negotiations, hence the need to capture the actual price paid and value lost based on actual prices versus simply the manufacturer's suggested retail price. Second, this method reduces issues of endogeneity. In the primary market it can be argued that the price paid for vehicles contains the amount of residual value that consumers hope to recoup when they trade in or sell their car, this may be impacting prices in the primary market. Due to the lower prices found in the secondary market, consumers who purchase in the secondary market would arguably be less likely to consider the value they would receive from reselling the product.

In both datasets, a product's ranking as high- vs. low-end within a product line was determined by the price of the product above the base model (LogCostAboveBase). The variable (LogCostAboveBase) orders the products within the product line and defines who (if any) is the neighbor product above or below. The higher the value the higher the product is in terms of the product line.

Table 2 provides a complete listing of all independent and control variables.

<insert Table 2 about here>

5. **Hypothesis Testing**

5.1. Hypotheses 1-3: Hierarchical Linear Model

Hierarchical linear modeling (HLM) is particularly suited to test the value retention of cars in the secondary market (Hypotheses 1 to 3) because cars have both individual and product line characteristics. The hierarchical model is represented by Equations 4 through 8. The term RV_{jk} refers to the residual value for vehicle j in product line k. It should be noted Equation 4 represents a polynomial function with PMPrice (Primary Market Price) squared. Similar to Equation 3 which tested iPads, this accounts for a possible non-linear relationship between PMPrice and RV. The dependent variable (RV_{jk}) is a function of the price the model sold for in its second year in the secondary market divided by the price the model sold for in the first year in the secondary market. The natural logarithm of the lowest priced product within the product line (LogLP) was the random effects variable in our equation.

(1) $RV_{jk} = \beta_{0j} + \beta_{1j}LogCostAboveBase_{jk} + \beta_{2j}LogCostAboveBase^{2}{}_{jk} + \beta_{1j}LogMTnc_{jk} + \mathcal{E}_{jk}$

(2) $\beta_{0j} = \gamma_{00} + \gamma_{01}RP_k + \gamma_{02}LogLP_k + \gamma_{03}LogHP_k + \gamma_{04}LogRange_k + \gamma_{04}NumProduts_k + \mu_{0k}$

(3) $\beta_{1j} = \gamma_{10} + \gamma_{11}LogLP_k + \mu_{1k}$

In accordance with Singer (1998), we calculated the intra-class correlation to validate our choice of a hierarchical linear model. The intra-class correlation is used to describe how strongly the cars (Toyota Camry LE, Toyota Camry SE, etc.) in each product line are related to each other.

$$p = \frac{0.03758}{0.03758+0.00078} = 0.979$$

This signals a close clustering of Residual Values within each product line and suggests that an OLS regression analysis of these data would yield misleading results (Singer, 1998). A

three-level model was also explored, with product, product line, and parent brand levels but given the low levels of clustering at the parent brand level, as revealed by the intra-class correlation, a two-level model was preferred.

An important consideration in HLM is sample size, both *at* the group level and *within* the group level. As the number of groups increases, the resulting estimation bias decreases to a more acceptable level. Maas and Hox (2005) recommend that models should contain close to 30 groups in order to avoid understating the standard errors. Our sample of 39 different product lines exceeds the sample size recommended by Maas and Hox (2005).

The random effects within the model show that the variance components for intercepts or slopes are not significantly different than 0 ($p = 0.1108$ and $p = 0.2021$ respectively); therefore, we cannot reject the null hypothesis that intercepts and slopes vary by product line. This also suggests that the variation in the residual value for each product line is sufficiently explained by product line level variables. The component representing the covariance between intercepts and slopes is also small (0.0018) and we cannot reject the null hypothesis that it, too, is 0 ($p = 0.1418$). These effects can be interpreted as showing that the relationship between the intercept and slope do not differ by product line. We explored the random intercept model and found the intraclass correlation to be higher for the random intercept and slope model, thereby justifying our current choice of model. We checked that our dependent variable was not correlated with the variable LogCostAboveBase using the Hausman test of endogeneity and found that it was not ($p = 0.97$).

Table 3 provides descriptive statistics and Pearson correlation coefficients and Table 4 reports the HLM results of two models. Model 1, the base model, contains only the control variables and Model 2 includes the predicted main effects. The main effects reveal a direct

negative relationship between a product's cost above the base model ($Log\,\mathrm{Cos}\,tAboveBase_{jk}$) and the value retained (-0.082, $p < 0.01$). In support of Hypothesis 1, this effect indicates that products at the higher end of a product line lose more value in the secondary market than products at the lower end of the line. Stated differently, products that were at the lower end of the line retain more value than those at the higher end, as predicted.

<insert Tables 3 & 4 about here>

Hypothesis 2 focuses on the breadth of the product line, i.e. the number of models within a given vehicle line, arguing that higher breadth would have a positive impact on the amount of value retained in the secondary market. The positive coefficient for the *NumProducts* variable (.003, $p < 0.001$) offers support for this hypothesis; the broader the product line, the more value is retained by all products in the product line.

Hypothesis 3 argued that, because consumers may not want the cheapest product available (Janiszewski & Lichenstein, 1999) product lines anchored by a higher priced base model will retain more value than product lines anchored by a cheaper base model. The positive beta coefficient for *LogCostAboveBase* x *LogLPrice* in Model 2 (.012, $p < 0.05$) provides support for this hypothesis by showing that, as the price of the base model in the product line increases, all products within that line retain more value.

In order to check the model's robustness we also tested it using ordinary least squares (OLS) regression techniques. The parameter estimates of interest for all three hypotheses had a significant impact on the proportion of value retained (please see Appendix A). We removed the value of the baseline models in a further test of robustness and found that the LogCostAboveBase variable remains significantly and negatively related to the proportion of value that the vehicle retained in the secondary market. Further, in an additional test of our

argument pertaining to H2 (the number of substitutes within a product line), we calculated the coefficient of variation for each product line to determine whether the price dispersion within a product line was impacting the relationship between the number of substitutes and the proportion of value each vehicle retained. The coefficient of variation had a positive impact but it was not significantly significant.

5.1.iPad Sample and Data Selection

The iPad sample consists of sales data for 224 different used iPads sold in the secondary market on the online auction market eBay.com. All were listed as refurbished by sellers in the eBay marketplace and none stated any damage such as cracks or scratches. The iPads were not sold at auction but rather consumers were given an opportunity to purchase them at a set price. We avoided auction-based formats because the initial price and the number of bidders are known to increase the final price of the product (Ariely & Simonson, 2003; Majid, Bryant, & Rau, 2014). Lower initial prices tend to attract more sellers, which signals demand for the product. The secondary market price was the price the item sold for on eBay.com, and the primary market price was obtained from Apple who sets all first-time prices for its products. We documented the generation of the iPad (lower generations correlated with older iPads) and the amount of GB that each iPad had. Lower amounts of storage were classified as lower-end models in the product line, while higher amounts of storage were classified as higher-end models. All sellers were located in the United States and the analyses controlled for the seller rating.

5.2.Hypothesis 1: Linear Regression

H1 posits that the least expensive models in the primary market should retain the greatest proportion of value. This hypothesis was tested by regressing the iPad's residual value on the product's ranking as an independent variable, controlling for the generation of the iPad as a dummy and the natural logarithm of the seller rating. To account for the possibility that the original, primary market price may be impacted by the amount that consumers will receive when they trade the product in or sell it in the secondary market (i.e. the independent variable would not truly be independent of the dependent variable), we transformed equation 3 into a polynomial function that tests for a non-linear relationship. All iPads were given a value that represented their cost relative to the base line model ($Log\,\mathrm{Cos}tAboveBase$). The higher the value the greater the difference between that model and the base model.

(4) $RV\_iPad_t = \beta_0 + \beta_1 LogSeller + \sum_{t=1}^{4} \delta_t(Gen_t) + \beta_2 LogCostAboveBase + \beta_3 LogCostAboveBase^2 + \varepsilon_t$

The results, shown in Table 5, reveal a significant negative relationship between the log of the cost above the base model ($Log\,\mathrm{Cos}tAboveBase$) and the amount of value the product retains upon transitioning into the secondary market ($\beta_2 = -.103,\ p < 0.10$). A post hoc power analysis was conducted using a sample size of 224. A four-predictor variable equation was used as a baseline. The alpha level used for this analysis was $p < 0.05$. The post hoc analysis revealed the statistical power for this study was .33 for detecting a small effect, whereas the power exceeded .99 for the detection of moderate to large effects. Thus, there was more than adequate power at the moderate to large effect size level, but less than adequate statistical power at the small effect size level (Louis, 2009).

As predicted by H1, the most expensive products within a product line lose the most value in the primary - secondary market transition and the least expensive products within a product line retain the most value.

<insert Table 5 about here>

6. **Discussion**

This research documents which products within a product line retain the most value when they transition to the secondary market. Modeling of data from two secondary markets reveals that value retention varies as a function of a product's ranking within a product line, the range of prices within the product line, and the lowest price anchor of the product line. In contrast to the primary market, where the value that consumers place on products and their features is represented by their price within the product line, this research uncovers different value dynamics in the secondary market. The two studies reveal that a) products initially priced higher in a product line lose more value in the primary-secondary market transition than products initially priced lower and b) the greater the difference between the highest-priced product and the lowest-priced product within the product line, the more value all products within the product line lose in the secondary market. These value retention dynamics are illustrated in a 2 X 2 matrix showing the interplay of a product's price within a product line and of the price range of the product line (Figure 2). Value retention in the secondary market is greatest for products within a narrow product line that are closest to the base model (including the base model). The finding that a wide range of pricing negatively impacts product valuation in the secondary market challenges prior beliefs that firms benefit from offering a diverse range of product versions

within a product line (Johnson & Sohi, 2014). These new insights have implications both for theory and for practice.

<insert Figure 2 about here>

6.1.Implications for Theory and Research

Prior research on product valuation has focused primarily on products for sale in the primary market. Yet, assuming that consumers can only purchase options that are available in the primary market ignores secondary market price dynamics. Recognizing secondary market dynamics may affect many aspects of research and practice across marketing mix elements, from product design to promotional incentives. For example, researchers who study whether rebates encourage purchase intentions by lowering perceived price should acknowledge and account for the fact that consumers often also have lower-priced options in the secondary market.

These previously undocumented price dynamics within the secondary market yield insight into why a lower-priced product retains more value when it transitions to the secondary market. Extant research on product line influences and product valuation has primarily focused on the primary market, where a price decrease on a higher-end good within a product line can spur greater demand (Kalish, 1985). Yet, our research shows that the secondary market's characteristics alter these price dynamics by increasing demand for certain products while reducing it for others in a manner that differs from primary market dynamics.

Our research indicates that, largely due to the defining characteristics of the secondary market, the traditional models of product valuation do not translate directly from the primary to the secondary market. For instance, conventional logic holds that firms can increase products' valuation by adding features that other products do not contain (Nowlis & Simonson, 1996), or by using marketing communications that affect consumers' perceptions of value (Glazer, 1991).

Increasing valuation through additional attributes can be especially impactful if it creates clear differentiation from competing products (Bloch, 1995). In the secondary market, however, the novelty of owning a newly released product is removed and the majority of marketing communications focus on versions of the product in the primary market (Majid & Russell, 2015). Consumers form their valuations of secondary market products with the knowledge that similar products exist in the primary market. Taking into consideration their resource constraints, the value consumers derive from purchasing secondary market products must exceed the value they would derive from comparable products in the primary market, otherwise they would simply purchase the product in the primary market.

6.2.Managerial Implications

The research brings practitioners clear guidelines about how to make the most of the secondary market value dynamics. In particular, the finding that the size of a product line and the absolute and relative (in terms of ranking) price of products in a product line in the primary market all affect their value retention in the secondary market suggests ways for firms to use secondary market options to augment revenue generated from the primary market. Leasing and buyback options attempt to reduce consumers' apprehension regarding product obsolescence and subsequent hesitation to upgrade current products (Shih & Schau, 2011) allows the firms both to sell more products in the primary market (Yin et al., 2010) and to receive revenues from the secondary market (Desai & Purohit, 1998). Based on Desai and Purohit's (1998) argument that leasing becomes profitable if a product retains good value in the secondary market, this study's perhaps counterintuitive findings indicate that the most suitable candidates for leasing options are those products priced the lowest in the primary market because these products can then be resold in the secondary market. On the other hand, because more expensive products lose a

greater portion of their value, firms should focus on selling these products in the primary market rather than relying on a combination of leasing and resale in the secondary market. Our research aligns with prior findings that augmenting a product with additional features related to form and function may produce decreasing returns in the marketplace (Jindal et al., 2016). Indeed, we find that the core product within each product line retains the most amount of value. From a product design perspective, firms that augment their products with additional features risk decreasing the potential secondary market value of these products. From a buyback perspective, firms can offer sales promotions on their low-end models because these models' greater value retention in the secondary market will compensate for this promotional investment. From a leasing perspective (e.g. car rentals), the findings suggest that firms should offer only the core product for lease because these products lose less value in the secondary market.

Adding to previous research that has warned practitioners of brand line stretches in the primary market (Bayus & Putsis Jr., 2005; Kirmani, Sood, & Bridges, 1999; Schulze, Skiera, & Wiesel, 2012), this research further suggests that brand managers should be cautious about product line structure and its implications with regards to value retention. Given the increasing and increasingly fast obsolescence of technological products (Guide Jr. & Li, 2010), product line management is especially important in the technology area.

Firms can increase their profitability in the secondary market by capitalizing on two important market features related to the dynamics of product valuation: leasing and buybacks. The findings suggest that a firm can lease its product at a rate higher than depreciation and then sell the product after the lease ends for a profit (Dasgupta et al., 2014). In the automobile industry, the practice of first leasing and then selling cars in the secondary market is estimated to provide billions of dollars in additional revenue above selling cars outright in the primary

market. Products that retain a significant amount of value over time can first be leased at a rate higher than depreciation and then sold (Dasgupta, Siddarth, & Silva-Risso, 2007; Dasgupta, Silva-Risso, et al., 2014). By contrast, products that do not retain a significant amount of value would yield greater revenue if they were sold outright without any form of buyback (Dasgupta et al., 2007). For example, if the Toyota Camry LE retains more value than the SE model, it would be more beneficial for dealerships to offer the Camry LE for lease and the Camry SE for sale. Alternatively, firms can sell the product outright but then operate a buyback program. Buyback programs are increasingly commonplace in the high technology sector, where consumers frequently apprehend purchasing new technology for fear of obsolescence (Shih & Schau, 2011). Buyback programs alleviate this anxiety by guaranteeing that consumers will retrieve a portion of their investment (Ferrer & Swaminathan, 2006). Once the firm repurchases the products, it can resell them as refurbished goods in the local or international market. The dynamics of the secondary market uncovered in this paper provide clear guidance to firms as to which product in their product lines should be offered in a leasing and/or buyback form.

6.3.Limitations and Further Research

Notwithstanding its novel contributions, this research has some limitations. For one, it focuses on only two industries: personal electronics and the car market. Future research should explore whether the dynamics of the secondary market uncovered here also apply to other growing product categories, such as clothing or furniture, where emotional as well as economic value may further enter into value perceptions (Brough & Isaac, 2012). The used cars sample contained only 661 models which, although in line with prior research on the used car market (Baltas and Saridakis 2010), may not be large enough to detect small relationships. The used car market was ideal to uncover the effects of product line breadth and the absolute and relative price

of products with their product lines on secondary market value retention. We explored relative value loss as a function of the suggested retail price in the primary market. Yet we recognize that pricing varies by region and can be dependent upon the negotiation between the seller and buyer so actual prices in the primary market may have varied. Thus, our relative results may have additional variation due to the lack of availability of negotiated prices in the primary market.

Future research could also explore the role of other brand signals in affecting value retention, such as brand prominence which was not included in this analysis (Han, Nunes, Drèze, 2010). Signals other than price may be important in product categories such as clothing or fashion accessories. The degree to which a brand is conspicuous, or prominent, may, like price did in this study, affect consumers' perceptions of its ranking in a product line, and thus affect value retention. Future research should also explore the impact of other the product-level dimensions, such as specific design features, on value retention in the secondary market (Jindal et al., 2016).

Potential extensions of this research could focus on dynamics beyond the secondary market, when secondary market products are sold yet again. This research focused only on the first layer but, given longer product lives, the number of times products can be sold and resold will likely continue to increase and each resale brings a new market layer with its own dynamics of value loss and retention.

7. **Conclusion**

As products last longer yet become updated more quickly, the secondary market will continue to grow. As a result, it is vital from both a researcher's and a practitioner's perspective to provide insights into which products retain the most value. Drawing from the central defining characteristics of the secondary market, this research reveals how the structure of pricing and

product lines in the primary market affects the value of goods in the secondary market and paves the way for further research on the dynamics of value retention of consumer goods in the marketplace.

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Table 1

Sample of Automobile Product Lines

Brand	Product Lines	Number of Models	Range of Prices in the Secondary Market
Audi	A6	8	36,600 - 62,700
	A8	6	53,400 - 116,775
BMW	3 Series	15	26,925 - 53,275
	Z Series	3	33,575 - 43,325
Buick	Lacrosse	8	21,000 - 25,575
Chevrolet	Corvette	27	33,975 - 57,550
	Impala	6	14,000 - 17,175
	Malibu	8	15,150 - 17,850
Dodge	Charger	10	19,450 - 39,100
Ford	Mustang	6	19,400 - 45,175
	Fusion	7	15,025 - 20,175
Honda	Accord	9	17,425 - 19,625
	Civic	6	15,300 - 19,825
	Fit	2	14,450 - 15,575
Hyundai	Accent	3	13,175 - 13,800
	Elantra	5	15,125 - 17,075
	Sonata	5	15,700 - 20,675
Infiniti	G - Series	9	24,375 - 34,175
	M - Series	5	31,900 - 37,600
Jaguar	XK8	7	55,750 - 87,125
Kia	Optima	4	16,625 - 23,025
	Rio	6	13,250 - 15,300
Lexus	LS	5	47,575 - 69,075
	GS	3	48,750 - 75,750
Lincoln	MKZ	4	30,550 - 36,750
Mazda	3	8	14,175 - 18,100
	6	5	15,450 - 21,175
	Miata	5	16,875 - 19,350
Mercedes	C Class	9	26,550 - 51,650
	E Class	11	35,450 - 67,375

	S Class	5	47,800 - 90,925
Mitsubishi	Lancar	9	11,875 - 34,450
Nissan	Altima	8	16,150 - 18,275
	Maxima	3	21,500 - 25,650
Subaru	Forrester	6	20,150 - 26,725
Toyota	Corolla	3	15,225 - 16,700
	Avalon	4	18,700 - 26,275
Volkswagen	Jetta	9	13,575 - 22,550
Volvo	XC70	3	26,350 - 32,125

*Number of models per product line was similar between May and June.

Table 2

LISTING OF VARIABLES

Variable	Operationalization	Level (Product or Line)	Type	Sources
iPads				
LogCostAboveBase	The price of the model above the base model, the relative price to the base model was used as a proxy for placement on the product line. For iPads the base model in a line was the lowest priced model with the least number of features and memory, i.e. an iPad with 16 GB of memory. Every higher priced iPad contained more memory (32, 64, or 128 GB). The highest end model contained 128 GB of memory.	Product	Independent	Apple
Gen	The generation is the sequence in which the iPad was released into the marketplace. The first generation was the 1st version released in 2010. The latest version in our dataset is the 4th.	Product	Control	Apple
LogSeller	The natural logarithm of the seller's rating on the eBay.com marketplace.	Seller	Control	eBay
Cars				
LogLP	The natural logarithm of the lowest priced product from the product line in the primary market.	Product Line	Independent	National Automobile Dealers Association (NADA)
LogLP	The natural logarithm of the lowest priced product from the product line in the primary market.	Product Line	Independent	NADA
LogMtnc	The natural logarithm of the total cost of five years of vehicle maintenance (Dasgupta, Siddarth, & Silva-Risso, 2007)	Product	Control	Edmunds.com
LogRange	The natural logarithm of the difference between the lowest-priced and the highest-priced product within the same product line, both prices from the primary market.	Product Line	Independent	NADA
LogCostAboveBase	Similar to iPads, the base model is the lowest priced model with the least number of features (verified with a comparison of model features). The greater the cost above the base model the closer the model is to the upper end of the line. The price of the model in the primary market. Models with more features or more advanced technologies were typically priced higher. This inference was supported through a comparison between the features of each model in the product line.	Product	Independent	Edmunds.com
RP	The automaker's reputation. A composite measure formed using the same methods as Rhee and Haunschild (2006).	Automaker	Control	NADA, J.D Power and Associates, *Consumer Reports*

NumProducts	The number of models within the product line.	Product Line	Control	NADA

Table 3

DESCRIPTIVE STATISTICS AND PEARSON CORRELATION COEFFICIENTS FOR ANALYSIS OF USED CARS

(N = 661, level of significance below correlation coefficient)

Variable	Mean	S.D.	Min.	Max.	1	2	3	4	5	6	7	8	Covariances
1. Residual Value	0.887	0.051	0.726	0.943		-0.201 *<.001*	-0.161 *<.001*	-0.264 *<.001*	-0.232 *<.001*	-0.118 *<.05*	0.127 *<.01*	-0.305 *<.001*	.003
2. LogMcst	3.841	0.161	3.546	4.317			0.232 *<.001*	0.849 *<.001*	0.671 *<.001*	0.228 *<.001*	0.483 *<.001*	0.601 *<.001*	-.003
3. Rep	0.514	0.266	0	1				0.313 *<.001*	0.195 *<.001*	-0.04 0.347	-0.232 *<.001*	0.315 *<.001*	-.002
4. LogHP	4.602	0.228	4.19	5.077					0.883 *<.001*	0.261 *<.001*	0.425 *<.001*	0.666 *<.001*	-.003
5. LogRange	4.133	0.413	2.954	4.816						0.448 *<.001*	0.883 *<.001*	0.195 <.001	-.005
6. LogCostAboveBase	3.693	1.656	0	5.802							0.303 *<.001*	0.109 *<.01*	.042
7. NumProducts	9.975	6.715	2	28								0.221 <.001	-.003
8. LogLP	4.395	0.264	3.881	4.834									-.003

Table 4

FIXED ESTIMATES OF RESIDUAL VALUE FOR CARS

(N = 661), Dependent Variable is the Residual Value: Price in the Secondary Market 2012/ Price in the Secondary Market 2013

Variables	Model 1	Model 2
Constant	1.140***	1.711***
	(.214)	(.226)
LogMcst	.021	.045
	(.082)	(.085)
RP	.027	.034
	(.025)	(.026)
LogHprice	-.043	-.014
	(.056)	(.073)
LogRange	-.039†	-.058*
	(.022)	(.020)
LogCostAboveBase (H1)		-.082**
		(.026)
LogCostAboveBase (squared)		-.004†
		(.000)
NumProducts (H2)		.005*
		(.002)
LogLprice		-.210*
		(.082)
LogCostAboveBase x LogLprice (H3)		.021**
		(.006)
AIC	-1708.0	-1235.2
SBC	-1701.1	-1231.8
-2LL	-1716.0	-1239.2

Notes:

1. Standardized coefficients are shown
2. Standard errors are shown in parentheses
3. All p values reported are at two-tailed significance

† p < .1 * p < .05 ** p < .01 ***p < .001

Table 5
FIXED ESTIMATES OF RESIDUAL VALUE FOR iPADS

(N = 224), Dependent Variable is the Residual Value: Price in the secondary market/ Price in the primary market

Variables	Standardized Coefficients	Standard Errors	p-value
Constant	.576	(.057)	.000
Gen	.011	(.017)	.527
LogSeller	.004	(.015)	.079
LogCostAboveBase (H1)	-.103	(.017)	.096
LogCostAboveBase(sqrd)	.013	(.031)	.674

F- Value = 4.74, R^2 = .284

Figure 1
Characteristics of the Primary and Secondary Markets

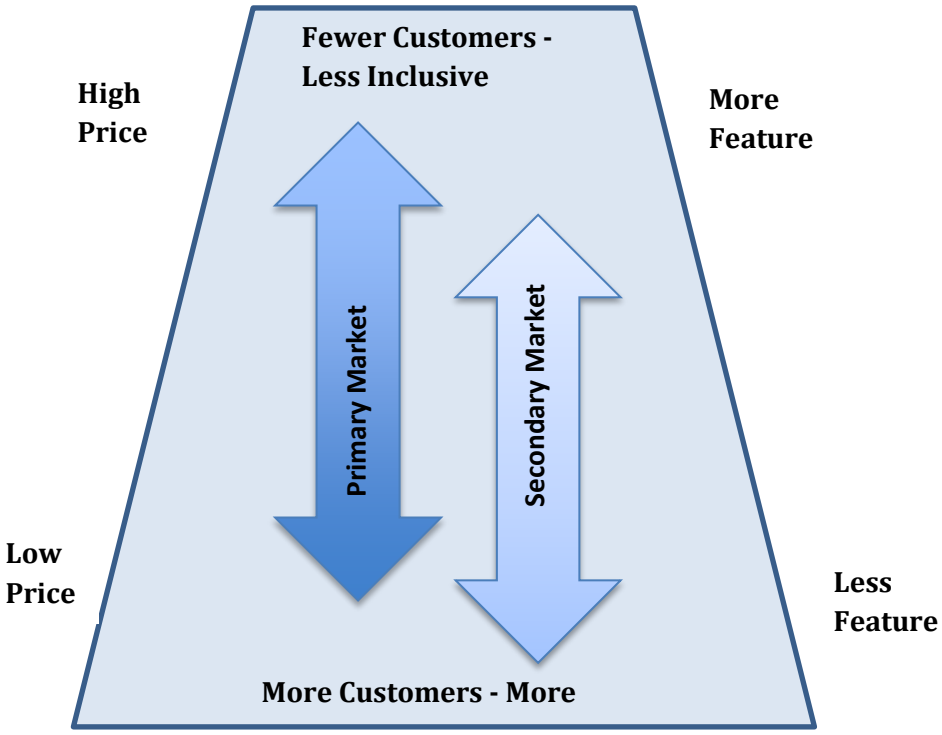
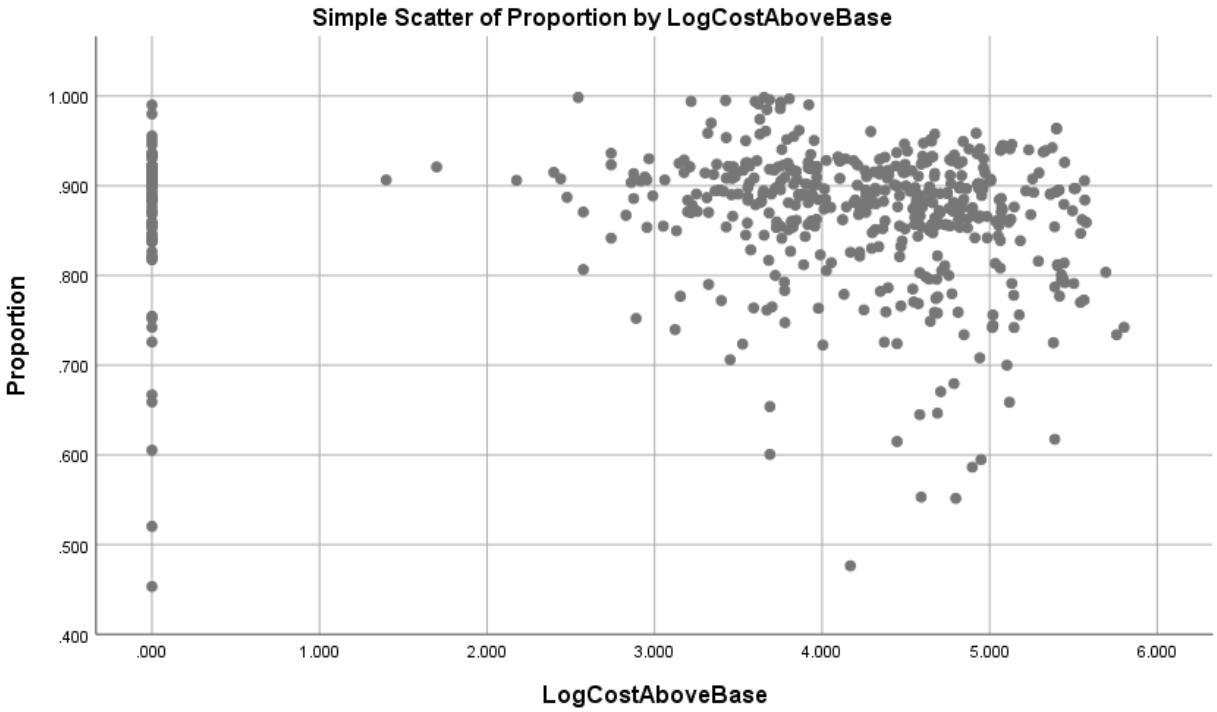


Figure 2 – Dynamics of Value Retention in the Secondary Market

		Price of the Product within a Line	
		Closest to Base Model	Furthest from Base Model
Range of Prices within the Product Line	Narrow Line	Greatest Value Retention: The base model loses the least amount of value when there is little difference between the highest-priced product and the lowest-priced product	Value Retention Depends on Price Differential from Base Model: The greater the price differential from the base model, the more value a product loses
	Broad Line	Value Retention Depends on the Range of Prices within the Product Line: When a product price is close to the base model, the value lost increases as the differential between the lowest- and the highest-priced model within the line increases	Lowest Value Retention: The highest-priced model loses the most amount of value when there is a large difference between the highest- and the lowest-priced products

Figure 3


Simple Scatter of Proportion by LogCostAboveBase
Proportion
1.000
.900
.800
.700
.600
.500
.400
.000
1.000
2.000
3.000
4.000
5.000
6.000
LogCostAboveBase

Appendix A

OLS PARAMETER ESTIMATES OF RESIDUAL VALUE FOR CARS

(N = 661), Dependent Variable is the Residual Value: Price in the Secondary Market 2012/ Price in the Secondary Market 2013

Variables	Model 1	Model 2
Constant	1.118***	1.218***
	(.068)	(.069)
LogMcst	.025	.008
	(.029)	(.029)
RP	-.015	.013
	(.009)	(.010)
LogHprice	-.070*	.098*
	(.034)	(.048)
LogRange	-.001†	-.048**
	(.013)	(.016)
LogCostAboveBase (H1)		-.080*
		(.050)
LogCostAboveBase (squared)		-.003**
		(.001)
NumProducts (H2)		.003***
		(.000)
LogLprice		-.146***
		(.035)
LogCostAboveBase x LogLprice (H3)		.013*
		(.006)
R-Squared	.078	.202

Notes:

1. Standardized coefficients are shown
2. Standard errors are shown in parentheses
3. All p values reported are at two-tailed significance

† p < .1 * p < .05 ** p < .01 ***p < .001

Appendix B - Test of Heteroskedasticity