The Impact of Basket Size on Consumer Purchase Incidence and Purchase Quantity in the Batteries Category

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Abstract

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This study uses a finite mixture approach to segment households on the basis of their response to marketing and situational variables in their purchase incidence and purchase quantity decisions. Purchase incidence is modeled using logit analysis while purchase quantity is modeled using poisson regression. The product category analyzed is batteries; a non-perishable and very easily storable product. Price and promotion are found to have substantially different effects across household segments. Furthermore, larger basket sizes are found to drive increases in purchase incidence for all shoppers as well as increases in purchase quantity for 37% of shoppers.

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Introduction

In both Canada and the United States there has been a decline in consumer shopping trips (The Nielsen Company, 2010). This trend has created an increasingly competitive environment for retailers who are fighting for these diminishing trips. Retailers have been selling more on promotion (The Nielsen Company, 2009) with the hopes of increasing the shopping trips made in their stores. While increasing shopping trips is a goal for each retailer, the declining trend makes it a difficult one to achieve. To compensate for this trend, it is important that shopping baskets increase in size in order for retailers to maintain sales. Shopping baskets can be increased by driving purchase incidence for a larger number of product categories during a store visit, but they can also be increased through a larger purchase quantity within the purchased product categories. Having a thorough knowledge of the factors that influence both purchase incidence and purchase quantity decisions is increasingly important for retailers as this knowledge will aid them in increasing trips and increasing the size of shopping baskets. Manufacturers must also have strong knowledge of these factors as their trade promotions must help to drive more trips and larger quantities purchased at the retail level.

This study will determine the impact of marketing variables on purchase incidence and purchase quantity in the batteries category. The batteries category differs from those typically researched as it is non-perishable as well as easily storable due to the small size of a battery cell. Many studies have analyzed the impact of marketing variables on purchase incidence and quantity, but most of these have focused on perishable products or products that require a significant amount of storage space. Categories studied include instant or ground coffee (Neslin, Henderson and Quelch 1985, Gupta

1988, Chiang 1991) which has a long shelf life, but requires a significant amount of storage space. Another frequently used and extremely perishable category is yogurt (Bucklin, Gupta and Siddarth 1998, Chintagunta 1993). Laundry detergent (Bucklin and Gupta 1992) has been studied and, while this category has a long shelf life, it requires a great deal of storage space. Bell, Chiang, and Padmanaghan (1999) studied 13 different categories which were classified as being more or less storable, but even the categories considered storable (soft-drinks, paper towels, bathroom tissue, dryer softeners, liquid detergents, and coffee) are larger in size which would likely lower stockpiling tendencies. The findings of this study will fill this knowledge gap by identifying the factors that impact consumer incidence and quantity decisions for a non-perishable and easily storable product.

Another important contribution of this paper is the variables considered in the study. Each of the studies noted above considered price and promotion as variables. Others also included brand loyalty and inventory (Gupta 1988, Chiang 1991, Chintagunta 1993, Bucklin, Gupta and Siddarth 1998). In no study was basket size considered. Including basket size as a variable could lead to interesting implications for retailers and manufacturers. For example, if battery purchase incidence or quantity is found to be increased during large basket trips, sales could be increased by placing battery displays next to items that are typically purchased during large basket trips.

The last contribution of this research is that it will allow for consumer heterogeneity by segmenting shoppers using the finite mixture approach. Since reactions to marketing stimuli vary across consumers, marketing variables must be properly targeted in order to optimize the return on investment of promotions. Linking

demographic factors to promotional response behaviors can help manufacturers and retailers better target their marketing activities to households that offer the most opportunity for incremental sales. This study will segment shoppers into groups based on their responses to marketing stimuli in the batteries category, allowing for the potential to more accurately target marketing activities to different demographic groups.

Literature Review

Purchase Incidence

Purchase incidence is the shopper's decision to buy or not to buy the category. This is a decision that has a significant impact on retailer and manufacturer performance, with the obvious benefit to retailers and manufacturers when a shopper decides to buy a given product rather than not to buy it. Price and promotion have each been shown to impact purchase incidence. Bucklin, Gupta, and Siddarth (1998) found that price had a strong impact on incidence for 79% of households. Gupta (1988) found that 14% of sales increase from promotion in the ground coffee category came from purchase acceleration. Chiang (1991) found similar results, showing that 13% of sales increase from features and 10% of sales increase from displays were due to increases in purchase incidence in the ground coffee category. Neslin, Henderson, and Quelch (1985) found that only feature promotions and no other promotional vehicles had the result of accelerating purchase rate. Their results showed that feature ads cut inter-purchase time by an average of 10%. As batteries are a more durable product than the ones tested in these studies, consumers might be more inclined to buy them even if their inventory is not low. Consequently, marketing variables could have a strong impact on purchase incidence in the batteries category.

Purchase Quantity

Purchase quantity is the shopper's decision of the number of units to purchase of a given product. Retailers and manufacturers benefit when shoppers decide to purchase a larger number of units during a shopping trip. Many studies have shown a rather small impact of price and promotion on purchase quantity. Bucklin, Gupta, and Siddarth (1998) found that 21% of households were not responsive to promotion in terms of their yogurt quantity of purchase. In Gupta's (1988) research, stockpiling due to promotion was found to account for less than 2% of sales increases in the ground coffee category. Chiang (1991) found similar results as his study showed that only 6% of sales increase from features and 5% of sales increase from displays were due to increases in purchase quantity in the ground coffee category. Promotional factors surely have very different impacts on purchase quantity depending on whether the promoted product is perishable or not. Probably the most significant difference is the greater possibility to stockpile non-perishable goods. Bell, Chiang, and Padmanabhan (1999) found that refrigerated products have larger price promotion impacts on purchase incidence than on purchase quantity, but the results were the opposite for storable products where quantity effects were much stronger than incidence effects. For this reason, it is expected that more consumers would react to price promotions by purchasing large quantities in the batteries category versus categories such as yogurt and ground coffee. This hypothesis cannot be included in this study as the data available only includes battery sales records. Comparing results from this study to those done in the past would be inconclusive since the studies are done many years apart and consumer behavior has likely changed. Due to the downturn of the economy in the last few years, many consumers have claimed that they will stockpile

more during promotions to help save money (The Nielsen Company, 2010). Thus, even if this study were to show that there is more stockpiling in the batteries category, this could be due to the current economic situation and not to the non-perishable nature of batteries. However, marketing variables are expected to have a strong effect on purchase quantity in this study, due to both the nature of the batteries category and the change in consumer shopping trends.

Basket Size

Kollat and Willett (1967) found that shoppers make an increasing amount of unplanned purchases as their basket size increases. They reasoned that the lower duration of a filler trip gives the shopper less time to process in-store information. Furthermore, less time in the store decreases the probability of walking through each aisle and of noticing categories for which a purchase was not planned. This finding indicates that a higher purchase incidence can be expected during larger basket shopping trips and vice versa.

Hypothesis 1: Purchase incidence in the batteries category will increase as basket size increases.

A similar relationship could be expected between basket size and quantity since having more time to process store information might lead a shopper to see the benefit in buying a larger quantity of batteries. Furthermore, if shoppers are already planning on buying a large basket of products, they might be more likely to buy a large quantity of batteries as well. Chintagunta (1993) found that total shopping trip expenditure had a significant positive effect on the dollars spent on yogurt. This effect was found to be very

small, likely because yogurt is a perishable product, but a strong relationship between basket size and quantity would be expected in the batteries category.

Hypothesis 2: Purchase quantity in the batteries category will increase as basket size increases.

Segmentation

Segmentation has been one of the most important areas of research as it allows for more effective targeting and positioning of marketing variables. Some researchers have used finite mixture as a segmentation method while others have used the Bayes method. Andrews, Ansari, and Currim (2002) compared the two methods and found that each one performs well. Finite mixture is used in this study as response segments are determined post hoc once response to marketing stimuli has been observed (Kamakura and Russell 1989).

Bucklin and Gupta (1992) found that purchase acceleration was more likely for consumers that live in houses and where both spouses do not work, likely due to having more space to store additional products and to having more time to search for bargains (Bucklin and Gupta, 1992). It was also found that higher income individuals did not accelerate their purchases, but rather changed brand choice due to promotions (Bucklin and Gupta, 1992). Chiang (1991) found that as family size increased so did price sensitivity in the decision to buy or not to buy. Given these findings, it is expected that pricing and promotional impacts on incidence will be stronger for larger households with lower incomes and fewer work hours.

Family size has been found to be positively related to purchase quantity (Gupta 1988). This is not a surprising finding as households with more family members likely

have higher usage rates for many household products. However, Chiang (1991) found that as family size increased so did price sensitivity in the purchase quantity decision. Given this finding, price and promotion are expected to have a stronger impact on quantity for larger households.

Data

The data used are from The Nielsen Company Homescan panel; a panel of households across Canada who scan all of their purchases once they get home from a shopping trip. Since the purchased products are scanned after the purchase was made and not at the point of sale (POS) there is a higher likelihood of error in price records and deal information. While there is a higher margin of error than POS, the benefit of the Homescan source of data is that it provides access to household information. Retailer POS scanning data does not offer visibility into who is buying the product, but through the Homescan panel each purchase is tied to a specific household. This makes it possible to follow a household's purchases from one shopping trip to another and to tie demographic data to each purchase.

The data is for sales records between December 27th, 2007 and June 26th 2009. The batteries category is defined as batteries used for household devices such as television remote controls, flashlights, children's toys, etc. The initial data included 14,488 households who made a total of 2,991,047 trips, 37,787 of which included a battery purchase. This includes all households in the Homescan panel, regardless of whether they made a battery purchase in the 18 month period.

The marketing variables for the top 14 brands were determined for each day by assuming that price and deal activity were the same throughout each flyer week within a

retail banner. If there was no sales record of a brand for an entire flyer week, the average price of the brand at that retail banner for the 18 month period was used and it was assumed that there was no deal. These "brands" are not only the brand names, but also the chemical types and the cell sizes. These 14 brands represent 80.6% of all AA and AAA battery dollar sales. Only AA and AAA cell sizes are included in the study as these are the battery types used most frequently. The share for each brand can be found in table 1 in the appendix (the brand names and chemical types have been hidden for confidentiality reasons). These brands are offered in various pack sizes, but there would have been too many brand splits had the various pack sizes been considered separately. While only the marketing variables for the top 14 brands were calculated, all brand purchases are included in the study. The marketing variables were estimated by week for the top 22 outlets which represent 80.6% of all battery dollar sales. Only purchases made in these outlets are considered in the study. The names and category share of these outlets can be found in Table 2 in the appendix.

The first six months of the data is used as the initialization period and the remaining twelve months are used to do the analysis. In order to improve the significance of the results only households that made at least one purchase in the initialization period and three purchases in the remaining twelve months are used. This results in a sample which includes heavier battery buyers, but since these are the most important consumers for the batteries category the results of this analysis are still very relevant. The resulting data used for analysis includes 782 households who made 96,301 trips overall, 3,491 of which included a battery purchase.

Demographic variables used in the study include income level, family size, presence of children, education level of the male and female head of household, and number of work hours of the male and female head of household. Households are also described in terms of their average basket size and average number of shopping trips. Finally, households are described in terms of their number of battery shopping trips, their average quantity of batteries purchased per trip, and their overall purchase quantity of batteries.

Models

Segmentation

Finite mixture is used to allow for consumer heterogeneity and segmentation of consumers that have similar response patterns. Similarly to Bucklin, Gupta, and Siddarth (1998), households are classified into segments based on their response behavior, their classifications are not pre-specified. As Kamakura and Russell (1989) note, by making the number of segments sufficiently large, it is possible to explain all variability in response behavior. However, to allow for practical use of the results, the number of segments will be limited to a manageable amount using Akaike's information criterion (AIC).

Incidence Model

Logistic regression analysis is used to estimate the purchase incidence model since the dependent variable is binomial, with 0 representing no battery purchase and 1 representing a battery purchase. This regression process predicts the probability that a purchase will be made; for the prediction to be positive the probability must be over 0.5.

The probability of purchase incidence for household h in segment s on a store visit at time t is given by (e.g., Bucklin, Gupta, and Siddarth 1998)

1. $$P_{st}^{h}(inc) = \sum_{s=1}^{S} \pi_s \left(\frac{\exp(\gamma_{s0} + \boldsymbol{\gamma} \boldsymbol{Y}_{st}^{h})}{1 + \exp(\gamma_{s0} + \boldsymbol{\gamma} \boldsymbol{Y}_{st}^{h})} \right)$$

where γ_{s0} is the intercept and $\boldsymbol{\gamma}$ is the vector of response coefficients for the explanatory variables $\boldsymbol{Y}_{st}^{h}$. The explanatory variables are consumption rate (CR), inventory (INV), average price (AP), minimum price (MP), number of brands on deal (D), and basket size (BS).

Consumption rate (CR) is a household's daily consumption of batteries. This variable was calculated during the 6 month initialization period where the number of batteries purchased was divided by the number of days. A positive sign is expected for this variable as households with a higher consumption rate would be more likely to buy batteries on any given day than those with a lower consumption rate.

The inventory (INV) variable helps to determine a household's potential need for batteries on any given day. Inventory levels are set at 0 at the beginning of the initialization period and remain at zero until the first battery purchase. Following the first purchase, it is assumed that households decrease their inventory linearly at their rate of consumption (CR). The inventory is calculated in the same way as Chintagunta (1993), as follows:

2. $$INV_t^h = (Inventory\ on\ previous\ visit_t^h + units\ purchased\ on\ previous\ visit_t^h) - (CR^h * numbe$$

A negative sign is expected for INV since having more batteries on hand will decrease the need to purchase the category.

To assess the utility of the batteries category for each consumer the variables average price per cell (AP), minimum price per cell (MP), and number of brands on deal (D) are also included. The average price per cell is weighted by the market share of each brand. A negative sign is expected for each price variable as generally when price increases the probability of purchase decreases. For the deal variable a positive sign is expected as an increased number of brands on deal will likely increase the probability of category purchase. Since the data used is panel data and not POS scanning data, the deal variable reflects the perceived deal by the shopper. Once the shopper scans the product at home, they are prompted to answer the question "was this item purchased on deal?" It should be noted that not all perceived deals are necessarily actual deals. For example, a shopper may have purchased a product that was on display but not discounted, but because it was on display they might think it was discounted and thus perceive the purchase as a "deal". This measure could be considered more appropriate than actual deal since a shopper's decision to purchase a category will be more influenced by whether they perceive a deal than whether there actually is one.

Finally, unit basket size (BS) is included to determine whether battery purchases are typically made during big or small shopping trips. Purchase incidence is expected to increase as basket size increases since shoppers might be more likely to make unplanned purchases during larger basket trips.

These variables are summarized in the incidence model below. The utility derived by household h for making a battery purchase at time t, given that the household belongs to segment s, is expressed as

3. $$INC_{st}^{h} = \gamma_{s0} + \gamma_{s1} CR^{h} + \gamma_{s2} INV_{t}^{h} + \gamma_{s3} AP_{t} + \gamma_{s4} MP_{t} + \gamma_{s5} D_{t} + \gamma_{s6} BS_{t}^{h}$$

Quantity Model

In the quantity model, the dependent variable is assumed to have a poisson distribution since purchase occasions typically include only a small number of unit purchases. Consequently, poisson regression analysis is used. Given that a purchase was made at time t and that brand i was chosen, the probability that household h buys q_{ist}^{h} = 1, 2… n battery cells can be written as (e.g., Bucklin, Gupta, and Siddarth 1998)

4. $$P(Q_{ist}^{h} = q_{ist}^{h} | Q_{ist}^{h} > 0) = \sum_{s=1}^{S} \pi_s \left(\frac{\exp(-\lambda_{ist}^{h})(\lambda_{ist}^{h})^{q_{ist}^{h}}}{[1 - \exp(-\lambda_{ist}^{h})] q_{ist}^{h}!} \right)$$

where λ_{ist}^{h} is the purchase rate of household h in segment s for brand i at time t.

To estimate purchase quantity in the batteries category, the variables purchase rate (PR), inventory (INV), brand loyalty (BL), price (P), brand deal (BD), and basket size (BS) are included.

Purchase rate (PR) is a household's average quantity of batteries bought per purchase occasion. This variable was calculated using the six month initialization period where the number of batteries purchased was divided by the number of purchase occasions. A positive sign is expected for this variable as households with a higher purchase rate would be more likely to buy a larger number of batteries on any given purchase occasion.

The inventory (INV) variable is the same as defined in the incidence model. A negative sign is expected for INV since having more batteries on hand will likely decrease the amount of batteries purchased.

Brand loyalty (BL) is the dollar share of each brand within each individual household. While Bucklin, Gupta, and Siddarth (1998) calculated each brand's share

during the initialization period and kept this share constant throughout the analysis period, the brand loyalty variable in this study changes as new purchases are made. A positive sign is expected for this variable as a stronger brand loyalty towards the purchased brand would likely lead to a higher number of batteries purchased.

Price (P) refers to the price per cell of the battery purchased at the time of purchase. A negative sign is expected for this variable as a higher price per cell will likely lead to fewer battery cells purchased. Brand deal (BD) is a dummy variable with value = 1 if the buyer perceived there to be a deal during that day for the purchased brand and value = 0 if the buyer did not perceive there to be a deal. A positive sign is expected for this variable as the perception of a deal might push the shopper to purchase a higher quantity of batteries.

Similarly to the incidence model, unit basket size (BS) is included to determine whether the quantity purchased changes depending on the size of the shopping basket. Quantity is expected to increase as basket size increases as large basket shoppers will likely tend to stockpile more than small basket shoppers so they may want to stockpile on batteries as well, especially since it is a non-perishable and easily storable product.

These variables are summarized in the quantity model below. The poisson rate parameter for brand i and household h belonging to segment s at time t, is

5. $$\lambda_{ist}^{h} = \exp\left(\theta_{is0} + \theta_{s1} PR^{h} + \theta_{s2} INV_{t}^{h} + \theta_{s3} BL_{it}^{h} + \theta_{s4} P_{it} + \theta_{s5} BD_{it} + \theta_{s6} BS_{t}^{h}\right)$$

Analysis Results

Incidence model results

The minimum AIC for the incidence model was not reached at four classes, however declines in the AIC were minimal for the five segment model and onwards (see

table 3 in appendix) so the four class segmentation is used for this analysis. The first class represents 35% of respondents, the second class 29%, the third class 24%, and the fourth represents the remaining 11%. Parameter results are shown in the appendix (table 4). The differences between classes were significant for the following variables: male head of household work hours, battery quantity per trip, battery trip frequency, total battery purchases, and total trip frequency (See tables 5,6,7,8, and 9 in appendix for ANOVA results).

The parameters for consumption rate are significant for classes two and three but they are not in the hypothesized direction; as the consumption rate decreases the probability of buying in the category increases. This relationship can be explained in two ways. First, some of these shoppers might be households that have a high usage of batteries but buy high quantities of batteries per shopping trip, thus needing to do fewer shopping trips for this category. Second, some consumers may have a low consumption rate but buy very small quantities per trip and thus run low on inventory quickly. However, a more likely explanation is the long purchase cycle of batteries and the short time frame available for this analysis; panelists who bought a larger quantity of batteries during the initialization period may not have needed to buy as many in the following twelve month period used for the analysis. This will be discussed further in the limitations section of this paper.

The inventory parameter estimates for each of the four classes are significant and in the hypothesized direction; as inventory decreases the probability of buying in the category increases. Inventory impacts purchase decision most for classes one and three and least for classes two and four. A weaker influence of inventory for certain consumers

is likely due to the fact that batteries are a non-perishable and easily storable product, so even if inventory is not completely depleted consumers can purchase the category and store any surplus for future use.

The parameter estimates for minimum price are significant for segments two and four and in the hypothesized direction; purchase incidence increases as the minimum price available decreases. This does not necessarily indicate that these shoppers buy the lowest priced brand, but rather that they are increasingly attracted to the category as the lowest available price decreases.

The weighted average price significantly impacts all four consumer segments. Interestingly, the parameters for the first two classes are not in the hypothesized direction; as the average price increases, purchase incidence increases as well. A possible explanation is that these households prefer the more expensive brands or the more expensive chemical types such as lithium and rechargeable, so when there is a good selection of these more premium products they are more drawn to the category. The third and fourth classes have the expected negative correlation for this variable.

The deal parameters are significant for the first three classes and in the hypothesized direction; as the number of brands on deal increases so does the probability of buying the category. The fourth segment is not influenced by deal activity.

Finally, purchases are more likely during larger basket trips for all four classes of households. This supports hypothesis 1 and fits with Kollat and Willett (1967) and Park, Iyer, and Smith's (1989) findings that unplanned purchases increase as the basket size increases. As batteries are not a product that is typically purchased weekly, larger (and

thus longer) basket trips gives shoppers more time to make unplanned purchases in this category.

The first class of households is the second highest in terms of overall battery purchases. These households make the lowest number of shopping trips overall, perhaps in an effort to save time since the male heads of household work the most hours of all segments. This group is increasingly likely to buy the category as the average weighted price increases, indicating that they may have a preference for more expensive chemical types which last longer and allow them to reduce purchase frequency. Despite their busy lifestyle, the probability that these households take the time purchase the batteries category can be increased through promotional activity.

Households in the second segment are not the prime targets for battery manufacturers and retailers as they are the households that buy the least amount of batteries. However, these households make the highest number of store visits which indicates an opportunity to increase purchase incidence of the batteries category. The probability of a battery purchase can be increased through promotions and pricing. Interestingly, they are increasingly drawn to the category as the minimum price decreases, but also as the average price increases. This may indicate that, despite being price conscious, these shoppers have an interest for premium brands or chemical types.

The third segment of households should be the top priority for manufacturers and retailers in the batteries category as they are the heaviest purchasers of batteries. Likely due to their high need for batteries, their probability of purchasing the category increases more than other household segments in response to average price decreases and

promotional increases. Their sensitivity to price and promotion makes them the ideal targets for marketing activities.

The fourth segment is the least influenced by inventory and at the same time the most influenced by minimum price and the second most influenced by average price. In light of this, it is likely that these households take advantage of good prices when they see them and do not necessarily wait until they need new batteries. The male head of household tends to work fewer hours than the average which gives them more time to search for these lower prices.

Quantity model results

The AIC is not minimized at five classes, but in the six class model and onwards some of the classes are extremely small so the five class model is chosen (See table 10 in appendix). The first class represents 31% of respondents, the second class 24%, the third 22%, the fourth 16%, and fifth class represents the remaining 7%. The parameter values are shown in the appendix (Table 11). All demographic variables are significantly different between segments except for female head of household education and work hours (See tables 12 to 21 in appendix).

For each of the five classes of households, the relationship between price and quantity is significant and in the expected direction. This indicates that battery buyers will increase their purchase quantity as the price per cell of the brand they are purchasing decreases.

The relationship with deal is significant and in the expected direction for each of the five segments. For all classes of households, the quantity of batteries purchased increases when the buyer perceives there to be a deal on the purchased brand.

The purchase rate parameters are significant and in the hypothesized direction for each of the five segments. This relationship indicates that if a household usually purchases a large amount of batteries per trip, then they have a higher probability of buying a larger amount and vice versa.

Only the inventory parameter for the third class is significant and it is in the hypothesized direction; these buyers are increasingly likely to purchase a larger quantity as their inventory decreases. The lack of significance of inventory for the other classes could be because batteries are a non-perishable product so having a higher inventory is okay because the product will not go to waste. Furthermore, batteries are not very big so shoppers might be more likely to stockpile in this category than in others where products are bigger in size and more difficult to store.

The relationship between brand loyalty and purchase quantity is significant for classes one, two, and five. The parameters are in the hypothesized direction for classes two and five; when they are purchasing their favorite brand they tend to purchase a higher number of batteries. However, the first segment's quantity of purchase decreases as the brand loyalty of the purchased brand increases. One potential explanation for this relationship is that these households enjoy trying new things and the lack of excitement that they get from buying a product that they are familiar with causes them to buy a lower quantity.

Finally, two of the five parameters for basket size are significant. The third segment of households buy higher quantities of batteries during larger shopping trips as predicted. The more time they have during longer trips likely gives them enough time to evaluate the benefits of buying a larger quantity. However, the second segment buys

higher quantities during smaller shopping trips. This could be because when they are already buying a large basket they try to save money where they can, and thus chose to buy a smaller amount of batteries.

Households in the first class are those who buy the least amount of batteries. Their lower need for batteries can be explained by the fact that they are the least likely to have children and thus have the smallest household size. Interestingly, they make the highest number of battery shopping trips, but their overall battery purchases are brought down by their very low quantity purchased per trip. A lower price and a perceived deal on the purchased brand can help to increase purchase quantity, but less so than for most of the other household segments. Their income is also the lowest of the five segments, but the fewer household members to support might explain why these households are among the least sensitive to price and deal. Finally, this segment is the only one to have an inverse relationship with brand loyalty, so these shoppers prefer buying a larger quantity when they are buying an unfamiliar brand.

In contrast to the first segment, households in the second segment are the most brand loyal; purchase quantity increases when the purchased brand is a favored one. They are also the second most influenced by perceived deal, so promotions can have a positive impact on the quantity purchased. These households are the only ones who increase their quantity purchased during smaller shopping trips. In terms of demographic factors these households have an average household size, an average probability of children, and an average income. They are overall average buyers of the batteries category.

The third segment ranks fourth out of the five segments in terms of battery consumption, likely because they also rank fourth in family size. This segment is the only

one impacted by inventory; however, inventory is not the only driver of purchase quantity as these households also respond positively to lower prices and deals. They are the only households who increase purchase quantity as their basket size increases.

Despite having the second highest income level, households in the fourth segment are the best target for promotions as they increase quantity purchased the most for a low price or a deal. This is likely because these households have the biggest families; despite a higher income, more members to support means having to be more careful with spending. These households rank second in terms of battery purchases, driven by a high quantity of batteries per trip which makes up for the fewer than average battery purchase trips that they make.

Finally, households in the fifth segment have the highest battery purchases overall likely due to the fact that they have the second largest families. They are the least responsive to deals, perhaps due to their high income level, however, these households rank second in terms of price sensitivity. Interestingly, they make the least number of shopping trips overall as well as the least number of battery shopping trips. The fewer number of trips provides less opportunity to make contact in store so it is important that retailers offer the right price at the right time to optimize purchase quantity for these households.

Incidence & Quantity

Combining the incidence and quantity classifications results in 20 different household segments (4 incidence segments x 5 quantity segments). The six biggest segments, which together represent 54.3% of households, are described below (see appendix, table 22, for percentage of households in each segment). There is a significant

difference between these segments for all demographic variables except female head of household education and work hours and male head of household education (see appendix tables 23 to 30 for ANOVA results).

The biggest segment is households that belong to the second incidence segment and the first quantity segment; they represent 11.6% of all households. Shoppers in this segment are the lightest buyers of batteries but they make the most shopping trips overall; this provides many points of contact with the shopper so there is an opportunity for retailers and manufacturers to increase purchase incidence of the batteries category. Promotion and pricing can be used to increase purchase incidence for these buyers as well as a good assortment of premium products. A competitive price and a deal can help to increase purchase quantity per trip.

The second largest segment includes households that belong to the first incidence segment and the first quantity segment; they represent 10% of all households. These shoppers make more trips for batteries than the average shopper, but their lower quantity per trip results in an under-average overall purchase quantity. However, purchase quantity per trip could be increased with promotions and competitive pricing. Furthermore, purchase incidence could be increased with the use of promotions and a good assortment of premium battery products.

The third segment includes households that belong to the first incidence segment and the third quantity segment; they represent 9.6% of all households. Purchase incidence for these households can be increased with promotions and a good assortment of premium brands. For this segment of shoppers, both purchase incidence and quantity can be increased by displaying battery products near items typically bought during larger

basket trips. Quantity purchased per trip can also be increased through competitive pricing and promotions.

The fourth segment includes households that are in the first incidence segment and the second quantity segment; they represent 8.7% of all households. These households purchase a higher than average overall quantity of batteries driven by a very high number of battery shopping trips. While purchase incidence is already high for these households, it can be further increased through deals as well as a good assortment of premium brands. These shoppers are the most brand loyal so having the right assortment of the top brands in the category can help to increase purchase quantity. Furthermore, a good deal and a competitive price will also help to increase the quantity purchased.

The fifth group includes households from the third incidence segment and the first quantity segment; they represent 7.3% of all households. These households are some of the lowest purchasers of batteries due to an extremely low quantity of batteries purchased per trip. To increase the quantity purchased per trip by these shoppers promotional activity and a competitive price can be used. Furthermore, as this segment is the most deal sensitive in their purchase incidence decision, the probability of purchasing for these shoppers can be increased by offering good promotions. Finally, lowering the average price per cell in the category can help to drive purchase incidence as well.

Finally, the sixth segment includes households from the second incidence segment and the second quantity segment; they represent 7.2% of all households. The goal for this group should be to increase purchase incidence of the batteries category as these households make a very high number of shopping trips overall but a low number of battery shopping trips. Purchase incidence for batteries can be increased through

promotion as well as a competitive lowest price option. However, a good assortment of premium brands and positioning next to products typically purchased during large basket trips can also help to drive incidence.

Summary and Discussion

Perceived deal was found to positively influence purchase incidence in 89% of consumers and purchase quantity in 100% of consumers. This highlights the importance of promotional activity in the batteries category. Analysts can use retailer POS scanning data to determine the percentage of volume actually sold on deal and compare this to the percentage sold on perceived deal through Nielsen's Homescan panel. This will determine whether shoppers are realizing that they are buying on deal, or whether the promotions are being done in vain. If perceived deal is found to be much lower than actual volume sold on deal, promotional activity should be modified until the two measures show similar results. It is important to determine what is perceived as a good deal by consumers. For some battery buyers, a perceived deal might not be the result of a low price, but rather might be the result of a reasonable price for a favored brand. In this post-recession environment consumers are still being cautious in their spending, but they are responding to good value (The Nielsen Company, 2010). Retailers and manufacturers must determine what shoppers see as good value in the batteries category.

The incidence model showed that 40% of households increased their likelihood of buying the category as the minimum price decreased. This result shows that, while a low price is important for some consumers, an even higher percentage of shoppers will not be increasingly drawn to the category by a low price point. To further strengthen this argument, an even higher percentage of households (65%) were increasingly likely to

purchase the category as the average price increased. This indicates that retailers should have a strong assortment of premium battery products to help attract shoppers to the category. However, a competitive price is still important as all consumers were found to increase the quantity purchased as the price per cell of the purchased brand decreased.

Finally, increases in basket size were found to positively impact purchase incidence for 100% of households and purchase quantity for 37% of households. This is a very interesting finding for both manufacturers and retailers who compete in the batteries category. To help increase battery purchase incidence and quantity, displays for batteries should be placed close to products that are typically purchased during large basket shopping trips.

Limitations and Future Research

The first limitation of this paper is that joint estimation was not done. As Bucklin, Gupta, and Siddarth (1998) found, results can differ between separate estimation and joint estimation procedures. Since the purchase incidence and purchase quantity decisions are made simultaneously by shoppers, modeling these consumer responses together may have resulted in more significant findings.

Another important decision made by shoppers is their brand choice and this would be an interesting area of research for future studies. Results from a brand choice study would be useful for manufacturers of the batteries category as they could benefit from insights into ways of increasing the probability that their brands are chosen by consumers. Retailers would also benefit since they could use results to increase sales for their private label battery products.

A third limitation is the low pseudo R^2 of approximately 7% for the incidence model. This indicates that there are important variables that may not have been included in the model. Chintagunta (1993) found that the larger the brand, the greater impact its marketing variables have on purchase incidence. Given this result, including a brand share measure in the incidence model could help improve the model's pseudo R^2. Another variable that could be added to the incidence model is store loyalty. As Kahn and Schmittlein (1992) claim, larger shopping trips typically occur at a shopper's favorite store. Since basket size was found to increase purchase incidence for all battery buyers in this study, it is possible that the larger basket purchases done in favored stores would drive higher purchase incidence. However, Kahn and Schmittlein (1992) also suggest the possibility that consumers might be more open to non-planned purchases when they are outside of their regular routine, thus in a non-favorite store. This suggests that store loyalty could have a negative impact on purchase incidence. Further research could determine which (if any) assumption is correct by determining if store loyalty impacts purchase incidence. Store format could also have been included in the purchase incidence model. Retail banners such as Costco and Wal-Mart typically experience larger basket sales, so shopping in these retailers could positively influence the likelihood of purchase in the batteries category. Furthermore, the number of categories in the shopping basket might impact the purchase incidence decision since buying many different categories suggests that shoppers walked through more aisles in the store, increasing the probability of walking past the batteries category and making a purchase.

Another factor that may have negatively impacted the incidence model is the long purchase cycle of the batteries category; this category is not one that is purchased

frequently by many households. While only households that did at least three purchases during the twelve month estimation period were included in the study, this may not be enough. This might also explain why the consumption rate variable was negatively correlated with purchase incidence. It is possible that the consumers who purchased more batteries in the initialization period needed to buy less in the twelve month period that followed. Having a longer period of data may have improved the significance of this variable.

The method in which the deal variable is recorded in the data retrieval process could also be considered a limitation. All that is known from this variable is that the shopper perceived the purchase to be on deal but the type of promotion (if any) is unknown. The promotion could be a flyer ad, a display, a coupon, or simply a price reduction in store. Knowing these additional facts would help to narrow down the influence that promotions have on incidence and quantity and would help to determine which types of promotions should be used for the various household segments. Having this level of detail may also have improved the pseudo R^2 of the incidence model.

A final limitation is that only one product category was studied so the results do not necessarily apply to all other categories. There would probably be significant differences for product categories that are not easily storable as inventory would likely play a much more significant role in both purchase incidence and purchase quantity decisions. Future studies could focus within non-perishable products and segment product categories by size as consumers should be more likely to stockpile smaller products.

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Appendices

Table 1 – Brand Shares

Brand Indicator	Brand	Chemical	Cell Size	Shr	Cum Shr
1	A	A	AA	23.9	23.9
2	B	A	AA	12.6	36.5
3	A	A	AAA	12.4	48.9
4	B	A	AAA	8.7	57.5
5	B	B	AA	4.3	61.8
6	B	C	AA	2.9	64.7
7	A	B	AA	2.8	67.5
8	C	A	AA	2.3	69.8
9	D	A	AAA	2.0	71.8
10	E	A	AA	1.9	73.6
11	D	A	AA	1.8	75.5
12	C	A	AAA	1.8	77.2
13	F	A	AAA	1.7	78.9
14	B	B	AAA	1.7	80.6

Table 2 – Outlet Shares

Outlet	Outlet Share	Cum Shr
Wal-Mart	19.2	19.2
Price/Costco	17.2	36.5
Canadian Tire	8.0	44.5
Real Canadian Superstore West	4.9	49.4
Zellers	4.9	54.3
Shoppers Drug Mart	4.9	59.2
Safeway	2.5	61.7
Jean Coutu	1.9	63.6
Atlantic Superstore	1.6	65.2
Dollarama	1.6	66.8
Wal-Mart Supercentre	1.6	68.4
All Other Stores	1.5	69.9
London Drugs	1.5	71.3
Sobeys	1.4	72.8
Loblaws	1.3	74.1
Home Hardware	1.3	75.4
Business Depot/Staples/Bureau En Gros	1.1	76.4
Zehrs	0.9	77.3
Pharma Plus	0.9	78.2
Real Canadian Superstore	0.8	79.0
Extra Foods	0.8	79.8
Future Shop	0.8	80.6

Table 3 – Incidence Model AICs

Classes	AIC	Difference
1	28411	
2	27846	565
3	27608	238
4	27480	128
5	27420	60
6	27362	58
7	27330	32
8	27314	16
9	27287	27
10	27302	-15

Table 4 – Incidence Parameters

Model for Dependent																	
	Class1			Class2			Class3			Class4			Overall				
R^2	0.0367			0.0111			0.0938			0.1417			0.0717				
Size	35%			29%			24%			11%							
	Class1	s.e.	z-value	Class2	s.e.	z-value	Class3	s.e.	z-value	Class4	s.e.	z-value	Wald	p-value	Wald(=)	p-value	Mean	Std.Dev.
Intercept	-4.041	0.300	-13.479	-2.840	0.313	-9.068	-0.549	0.186	-2.954	2.6376	0.3632	7.261	475.0062	1.70E-101	352.1357	5.10E-76	-2.0974	2.1416
Basket Size	0.046	0.003	16.118	0.029	0.003	10.208	0.042	0.003	12.148	0.0496	0.0074	6.7447	776.4317	9.80E-167	20.3711	0.00014	0.0408	0.0076
Consumption Rate	-0.300	0.247	-1.217	-1.342	0.472	-2.841	-1.276	0.330	-3.871	-1.165	0.7434	-1.5673	29.4819	6.20E-06	8.4846	0.037	-0.938	0.4744
Inventory	-0.013	0.002	-8.652	-0.010	0.002	-4.074	-0.012	0.002	-7.160	-0.009	0.0036	-2.4403	192.627	1.40E-40	2.2354	0.52	-0.0114	0.0018
Minimum Price	-0.002	0.002	-0.922	-0.040	0.005	-7.780	0.002	0.003	0.646	-0.0966	0.0088	-11	217.4671	6.60E-46	213.5436	5.00E-46	-0.023	0.0316
Average Price	0.005	0.002	3.042	0.006	0.002	2.859	-0.035	0.002	-15.251	-0.0164	0.0022	-7.7186	466.8141	1.00E-99	461.5828	1.00E-99	-0.0066	0.0172
Deal Count	0.479	0.044	10.969	0.175	0.062	2.812	0.633	0.058	10.997	-0.0066	0.1168	-0.0559	322.4782	1.50E-68	47.7074	2.50E-10	0.373	0.219
Model for Classes																		
Intercept	Class1	s.e.	z-value	Class2	s.e.	z-value	Class3	s.e.	z-value	Class4	s.e.	z-value	Wald	p-value				
	0.4297	0.1148	3.7427	0.2405	0.1295	1.8563	0.0503	0.1165	0.4313	-0.7204	0.1671	-4.3107	24.9703	1.60E-05				

Table 5 – ANOVA – Incidence - Male Head of Household Work Hours

Summary

Groups	*Count*	*Sum*	*Average*	*Variance*
1	232	565	2.435345	1.519611
2	195	399	2.046154	2.033941
3	148	304	2.054054	2.119507
4	60	107	1.783333	2.138701

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	30.27211	3	10.0907	5.380613	0.00116	2.619022
Within Groups	1183.366	631	1.875381			
Total	1213.638	634				

Legend:
0- Not employed for pay
1- Under 25 hours
2- 25-35 hours
3- 36-50 hours
4- More than 50 hours

Table 6 – ANOVA – Incidence - Battery Quantity per Trip (# of battery cells)

Summary

Groups	*Count*	*Sum*	*Average*	*Variance*
1	289	3683.261	12.74485	68.28656
2	231	2425.529	10.50012	67.52197
3	184	2949.325	16.02894	109.6482
4	78	832.5449	10.67365	24.08246

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	3475.704	3	1158.568	15.78117	5.7E-10	2.616348
Within Groups	57116.56	778	73.4146			
Total	60592.26	781				

Table 7 – ANOVA – Incidence - Number of Battery Purchase Trips

Summary

Groups	*Count*	*Sum*	*Average*	*Variance*
1	289	1428	4.941176	5.854167
2	231	863	3.735931	1.134312
3	184	779	4.233696	2.682793
4	78	421	5.397436	11.56727

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	265.9751	3	88.65836	20.72277	6.34E-13	2.616348
Within Groups	3328.522	778	4.278306			
Total	3594.497	781				

Table 8 – ANOVA – Incidence - Total Battery Purchases

Summary

Groups	*Count*	*Sum*	*Average*	*Variance*
1	289	17450	60.38062	1886.209
2	231	8817	38.16883	760.6366
3	184	11718	63.68478	1792.272
4	78	4255	54.55128	1076.069

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	86942.26	3	28980.75	19.97048	1.77E-12	2.616348
Within Groups	1129018	778	1451.179			
Total	1215960	781				

Table 9 – ANOVA – Incidence - Number of Total Shopping Trips

Summary

Groups	*Count*	*Sum*	*Average*	*Variance*
1	289	26442	91.49481	3026.508
2	231	37150	160.8225	5659.981
3	184	24440	132.8261	4844.789
4	78	8269	106.0128	4963.493

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	657566.7	3	219188.9	49.54047	2.63E-29	2.616348
Within Groups	3442215	778	4424.441			
Total	4099782	781				

Table 10 – Quantity Model AICs

Classes	AIC	Difference
1	32240	
2	25982	6258
3	24717	1265
4	24057	660
5	23756	301
6	23450	306
7	23147	303
8	22961	186

Table 11 – Quantity Model Parameters

Model for Dependent																			
	Class1			Class2			Class3			Class4			Class5			Overall			
R^2	0.148			0.6014			0.5263			0.7461			0.4382			0.7128			
Size	31%			24%			22%			16%			7%						
Class1	s.e.	z-value	Class2	s.e.	z-value	Class3	s.e.	z-value	Class4	s.e.	z-value	Class5	s.e.	z-value	Wald	p-value	Wald(=)	p-value	Mean	Std.Dev.
Intercept																			
2.025	0.052	39.03	2.911	0.050	58.86	2.870	0.058	49.25	4.189	0.053	79.48	3.888	0.056	69.24	14297.1	1.2e-3099	1201.365	0.000	2.90	0.75
Price																			
-0.002	0.000	-11.44	-0.005	0.000	-20.36	-0.008	0.001	-14.31	-0.020	0.001	-24.76	-0.009	0.000	-20.43	1179.797	0.000	721.742	0.000	-0.01	0.01
Brand Deal																			
0.175	0.065	2.71	0.390	0.053	7.36	0.272	0.062	4.37	0.413	0.046	8.94	0.150	0.040	3.70	220.700	0.000	29.282	0.000	0.28	0.10
Purchase Rate																			
0.011	0.002	7.16	0.014	0.001	12.81	0.006	0.001	5.40	0.010	0.001	7.39	0.007	0.002	4.03	314.906	0.000	30.198	0.000	0.01	0.00
Inventory																			
0.000	0.001	0.48	0.000	0.000	-0.77	-0.004	0.000	-8.73	0.000	0.000	0.25	0.000	0.000	0.30	79.458	0.000	61.249	0.000	0.00	0.00
Brand Loyalty																			
-0.264	0.045	-5.86	0.603	0.042	14.45	0.039	0.081	0.49	0.073	0.048	1.52	0.107	0.054	1.99	271.676	0.000	201.356	0.000	0.09	0.32
Basket Size																			
0.002	0.001	1.54	-0.007	0.001	-5.40	0.016	0.001	14.03	0.000	0.001	0.08	0.003	0.002	1.39	257.106	0.000	235.068	0.000	0.00	0.01
Model for Classes																			
Intercept																			
Class1	s.e.	z-value	Class2	s.e.	z-value	Class3	s.e.	z-value	Class4	s.e.	z-value	Class5	s.e.	z-value	Wald	p-value				
0.5321	0.0839	6.3396	0.3015	0.091	3.313	0.1917	0.0964	1.9893	-0.1437	0.1103	-1.303	-0.8816	0.123	-7.1656	83.2132	3.60E-17				

Table 12 – ANOVA – Quantity - Household Size

Summary

Groups	*Count*	*Sum*	*Average*	*Variance*
1	254	632	2.488189	1.507765
2	178	494	2.775281	1.87012
3	178	482	2.707865	1.801181
4	116	390	3.362069	1.693853
5	56	170	3.035714	2.071429

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	65.47691	4	16.36923	9.491663	1.70509E-07	2.383392
Within Groups	1340.006	777	1.72459			
Total	1405.483	781				

Table 13 – ANOVA – Quantity – Income Level

Summary

Groups	*Count*	*Sum*	*Average*	*Variance*
1	254	2356	9.275591	13.52849
2	178	1789	10.05056	12.78274
3	178	1761	9.893258	13.35012
4	116	1227	10.57759	12.14175
5	56	656	11.71429	9.98961

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	337.8153	4	84.45382	6.566031	3.37E-05	2.383392
Within Groups	9993.956	777	12.86223			
Total	10331.77	781				

Legend:

1- Under $10,000
2- $10,000-$14,999
3- $15,000-$19,999
4- $20,000-$24,999
5- $25,000-$29,999
6- $30,000-$34,999
7- $35,000-$39,999
8- $40,000-$44,999
9- $45,000-$49,999
10- $50,000-$54,999
11- $55,000-$69,999
12- $70,000-$84,999
13- $85,000-$99,999
14- $100,000-$124,999
15- $125,000+

Table 14 – ANOVA – Quantity – Presence of Children

Summary

Groups	*Count*	*Sum*	*Average*	*Variance*
1	254	78	0.307087	0.213625
2	178	69	0.38764	0.238716
3	178	59	0.331461	0.222846
4	116	69	0.594828	0.243103
5	56	24	0.428571	0.249351

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	7.261415014	4	1.815354	7.950452	2.78E-06	2.383392
Within Groups	177.4150556	777	0.228333			
Total	184.6764706	781				

Legend: 0 – No Children
1 - Children

Table 15 – ANOVA – Quantity – Male Head of Household Education

Summary

Groups	*Count*	*Sum*	*Average*	*Variance*
1	191	828	4.335079	2.950289
2	146	690	4.726027	3.20718
3	144	621	4.3125	2.593969
4	105	493	4.695238	2.790842
5	49	259	5.285714	2.375

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	50.20149	4	12.55037	4.390725	0.001653	2.386075
Within Groups	1800.781	630	2.858383			
Total	1850.983	634				

Legend:
1- Elementary School
2- Some High School
3- Completed High School
4- Some Technical or College
5- Completed Technical or College
6- Some University
7- Completed University

Table 16 – ANOVA – Quantity – Male Head of Household Work Hours

Summary

Groups	*Count*	*Sum*	*Average*	*Variance*
1	191	378	1.979058	2.115349
2	146	331	2.267123	1.824705
3	144	275	1.909722	2.068716
4	105	282	2.685714	0.986813
5	49	109	2.22449	2.136054

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	46.1538	4	11.53845	6.226401	6.4451E-05	2.386075
Within Groups	1167.484	630	1.853149			
Total	1213.638	634				

Legend:
0- Not employed for pay
5- Under 25 hours
6- 25-35 hours
7- 36-50 hours
8- More than 50 hours

Table 17 – ANOVA – Quantity – Battery Quantity per Trip (# of battery cells)

Summary

Groups	*Count*	*Sum*	*Average*	*Variance*
1	254	1498.823	5.900878	2.98169
2	178	2414.38	13.56393	34.0639
3	178	1989.246	11.17554	22.32373
4	116	2390.31	20.60612	86.98416
5	56	1597.9	28.53393	114.1283

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	33577.05	4	8394.262	241.4322	1.1113E-134	2.383392
Within Groups	27015.22	777	34.76862			
Total	60592.26	781				

Table 18 – ANOVA – Quantity – Number of Battery Purchase Trips

Summary

Groups	*Count*	*Sum*	*Average*	*Variance*
1	254	1192	4.692913	7.012044
2	178	809	4.544944	3.921697
3	178	790	4.438202	4.157176
4	116	484	4.172414	2.561319
5	56	216	3.857143	0.924675

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	45.08066	4	11.27016	2.467143	0.043589	2.383392
Within Groups	3549.417	777	4.568104			
Total	3594.497	781				

Table 19 – ANOVA – Quantity – Total Battery Purchases

Summary

Groups	*Count*	*Sum*	*Average*	*Variance*
1	254	7129	28.06693	348.5923
2	178	10752	60.40449	1093.44
3	178	8616	48.40449	726.2083
4	116	9642	83.12069	2127.394
5	56	6101	108.9464	1998.233

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	451135.1	4	112783.8	114.5792	8.6E-77	2.383392
Within Groups	764824.8	777	984.3305			
Total	1215960	781				

Table 20 – ANOVA – Quantity – Total Shopping Trips

Summary

Groups	*Count*	*Sum*	*Average*	*Variance*
1	254	34064	134.1102	6428.494
2	178	22911	128.7135	5474.352
3	178	20029	112.5225	4260.499
4	116	13497	116.3534	4542.231
5	56	5800	103.5714	2636.322

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	82950.15	4	20737.54	4.011387	0.003153	2.383392
Within Groups	4016832	777	5169.668			
Total	4099782	781				

Table 21 – ANOVA – Quantity – Average Shopping Basket Size

Summary

Groups	*Count*	*Sum*	*Average*	*Variance*
1	254	1975.55	7.777754	24.66951
2	178	1599.243	8.98451	40.66417
3	178	1512.008	8.494429	27.3889
4	116	1240.124	10.69073	47.93752
5	56	457.662	8.172536	21.69965

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	712.8024	4	178.2006	5.540009	0.000212	2.383392
Within Groups	24993.08	777	32.16612			
Total	25705.88	781				

Table 22 – Percentage of Households in Each Segment – Incidence & Quantity

Incidence Class	Quantity Class	% of Households
1	1	10.0
1	2	8.7
1	3	9.6
1	4	6.9
1	5	1.8
2	1	11.6
2	2	7.2
2	3	6.8
2	4	3.2
2	5	0.8
3	1	7.3
3	2	4.9
3	3	3.6
3	4	3.6
3	5	4.2
4	1	3.6
4	2	2.0
4	3	2.8
4	4	1.2
4	5	0.4

Table 23 – ANOVA – Incidence & Quantity - Household Size

Summary

Groups	*Count*	*Sum*	*Average*	*Variance*
11	78	196	2.512821	1.447885
12	68	200	2.941176	2.026339
13	75	197	2.626667	2.291171
14	54	173	3.203704	1.712439
15	14	35	2.5	1.961538
21	91	235	2.582418	1.379243
22	56	148	2.642857	1.761039
23	53	139	2.622642	1.085631
24	25	85	3.4	2.25
25	6	18	3	3.2
31	57	131	2.298246	1.463033
32	38	103	2.710526	1.616643
33	28	94	3.357143	1.867725
34	28	100	3.571429	1.291005
35	33	108	3.272727	2.017045
41	28	70	2.5	2.259259
42	16	43	2.6875	2.3625
43	22	52	2.363636	1.290043
44	9	32	3.555556	1.527778
45	3	9	3	1

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	95.65631	19	5.034543	2.928876	2.96831E-05	1.600194
Within Groups	1309.827	762	1.718933			
Total	1405.483	781				

Table 24 – ANOVA – Incidence & Quantity – Income Level

Summary

Groups	*Count*	*Sum*	*Average*	*Variance*
11	78	769	9.858974	11.88894
12	68	674	9.911765	13.66374
13	75	738	9.84	14.75784
14	54	534	9.888889	14.81761
15	14	154	11	9.846154
21	91	891	9.791209	13.78926
22	56	549	9.803571	12.16071
23	53	515	9.716981	15.39913
24	25	280	11.2	7.583333
25	6	69	11.5	4.7
31	57	469	8.22807	14.78634
32	38	391	10.28947	13.6707
33	28	303	10.82143	7.633598
34	28	312	11.14286	11.38624
35	33	404	12.24242	10.00189
41	28	227	8.107143	10.61772
42	16	175	10.9375	10.19583
43	22	205	9.318182	10.98918
44	9	101	11.22222	9.194444
45	3	29	9.666667	24.33333

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	619.2533	19	32.59228	2.557042	0.000291	1.600194
Within Groups	9712.518	762	12.74609			
Total	10331.77	781				

Legend:

1- Under $10,000
2- $10,000-$14,999
3- $15,000-$19,999
4- $20,000-$24,999
5- $25,000-$29,999
6- $30,000-$34,999
7- $35,000-$39,999
8- $40,000-$44,999
9- $45,000-$49,999
10- $50,000-$54,999
11- $55,000-$69,999
12- $70,000-$84,999
13- $85,000-$99,999
14- $100,000-$124,999
15- $125,000+

Table 25 – ANOVA – Incidence & Quantity – Male Head of Household Work Hours

Summary

Groups	*Count*	*Sum*	*Average*	*Variance*
11	59	142	2.40678	1.659264
12	56	145	2.589286	1.410065
13	57	125	2.192982	1.72995
14	48	128	2.666667	0.907801
15	12	25	2.083333	2.628788
21	75	146	1.946667	2.024144
22	46	93	2.021739	2.110628
23	45	81	1.8	2.3
24	24	66	2.75	0.978261
25	5	13	2.6	2.3
31	38	57	1.5	2.364865
32	30	69	2.3	1.803448
33	25	44	1.76	2.106667
34	25	65	2.6	1.5
35	30	69	2.3	2.07931
41	19	33	1.736842	2.649123
42	14	24	1.714286	2.065934
43	17	25	1.470588	2.389706
44	8	23	2.875	0.125
45	2	2	1	0

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	93.40983	19	4.916307	2.69903	0.000134	1.603471
Within Groups	1120.228	615	1.821509			
Total	1213.638	634				

Legend:
0- Not employed for pay
9- Under 25 hours
10- 25-35 hours
11- 36-50 hours
12- More than 50 hours

Table 26 – ANOVA – Incidence & Quantity –Battery Quantity per Trip (# of battery cells)

Summary

Groups	*Count*	*Sum*	*Average*	*Variance*
11	78	496.3662	6.363669	3.547204
12	68	859.9467	12.64628	30.0008
13	75	830.5382	11.07384	19.53411
14	54	1151.276	21.31993	107.473
15	14	345.1333	24.65238	69.21311
21	91	502.4286	5.521193	2.828946
22	56	723.2667	12.91548	25.31992
23	53	522.9095	9.866217	17.25038
24	25	501.7905	20.07162	121.8047
25	6	175.1333	29.18889	614.5394
31	57	326.4222	5.726706	2.590086
32	38	621.0762	16.34411	55.74216
33	28	397.0833	14.18155	38.18311
34	28	583.2762	20.83129	40.75983
35	33	1021.467	30.95354	49.41513
41	28	173.6061	6.200216	1.760018
42	16	210.0905	13.13065	12.44465
43	22	238.715	10.85068	10.99265
44	9	153.9667	17.10741	17.12938
45	3	56.16667	18.72222	13.89815

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	35177.36	19	1851.44	55.51064	1.3943E-129	1.600194
Within Groups	25414.9	762	33.35289			
Total	60592.26	781				

Table 27 – ANOVA – Incidence & Quantity – Number of Battery Purchase Trips

Summary

Groups	*Count*	*Sum*	*Average*	*Variance*
11	78	393	5.038462	7.985514
12	68	362	5.323529	6.371378
13	75	372	4.96	5.471351
14	54	249	4.611111	3.562893
15	14	52	3.714286	0.989011
21	91	337	3.703297	1.210989
22	56	212	3.785714	0.716883
23	53	202	3.811321	1.386792
24	25	90	3.6	1.416667
25	6	22	3.666667	1.066667
31	57	280	4.912281	4.652882
32	38	157	4.131579	2.33357
33	28	109	3.892857	1.728836
34	28	102	3.642857	0.904762
35	33	131	3.969697	0.967803
41	28	182	6.5	22.11111
42	16	78	4.875	3.983333
43	22	107	4.863636	7.551948
44	9	43	4.777778	2.194444
45	3	11	3.666667	0.333333

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	403.7524	19	21.25013	5.074864	1.59395E-11	1.600194
Within Groups	3190.745	762	4.187329			
Total	3594.497	781				

Table 28 – ANOVA – Incidence & Quantity – Total Battery Purchases

Summary

Groups	*Count*	*Sum*	*Average*	*Variance*
11	78	2512	32.20513	389.1782
12	68	4542	66.79412	1592.972
13	75	4014	53.52	891.0097
14	54	5118	94.77778	3404.893
15	14	1264	90.28571	1190.681
21	91	1854	20.37363	76.52552
22	56	2718	48.53571	456.2169
23	53	1956	36.90566	277.3179
24	25	1696	67.84	1055.307
25	6	593	98.83333	4841.767
31	57	1614	28.31579	240.9699
32	38	2448	64.42105	897.1152
33	28	1528	54.57143	777.1429
34	28	2094	74.78571	621.4339
35	33	4034	122.2424	1664.939
41	28	1149	41.03571	978.1839
42	16	1044	65.25	1124.733
43	22	1118	50.81818	811.2987
44	9	734	81.55556	867.7778
45	3	210	70	532

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	515402.5	19	27126.44	29.50558	3.24683E-78	1.600194
Within Groups	700557.4	762	919.3666			
Total	1215960	781				

Table 29 – ANOVA – Incidence & Quantity – Total Shopping Trips

Summary

Groups	*Count*	*Sum*	*Average*	*Variance*
11	78	6945	89.03846	3308.739
12	68	7003	102.9853	4665.358
13	75	6831	91.08	2273.183
14	54	4442	82.25926	1399.365
15	14	1221	87.21429	3659.72
21	91	15632	171.7802	5569.107
22	56	9215	164.5536	6576.87
23	53	7427	140.1321	4524.232
24	25	4192	167.68	5888.56
25	6	684	114	2707.6
31	57	8254	144.807	7080.409
32	38	5071	133.4474	3367.984
33	28	3514	125.5	5586.926
34	28	3944	140.8571	4125.683
35	33	3657	110.8182	2367.153
41	28	3233	115.4643	6298.925
42	16	1622	101.375	2685.583
43	22	2257	102.5909	5619.777
44	9	919	102.1111	6025.361
45	3	238	79.33333	120.3333

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	753479.8	19	39656.83	9.030417	1.24627E-23	1.600194
Within Groups	3346302	762	4391.473			
Total	4099782	781				

Table 30 – ANOVA – Incidence & Quantity – Average Shopping Basket Size

Summary

Groups	*Count*	*Sum*	*Average*	*Variance*
11	78	648.3681	8.312411	35.9392
12	68	595.9294	8.763667	38.59405
13	75	561.5271	7.487028	17.92233
14	54	598.8962	11.09067	67.49573
15	14	79.26603	5.661859	6.436905
21	91	739.543	8.126846	24.052
22	56	476.2848	8.505085	48.05094
23	53	504.0017	9.509467	39.66851
24	25	223.1598	8.926392	13.81626
25	6	85.04729	14.17455	91.80932
31	57	392.6281	6.888212	16.9387
32	38	382.36	10.06211	43.01498
33	28	252.0556	9.001985	37.09367
34	28	302.3751	10.79911	31.47515
35	33	262.9687	7.968749	10.16477
41	28	195.0105	6.964661	9.771062
42	16	144.6686	9.041789	21.13566
43	22	194.424	8.837455	15.08429
44	9	115.6934	12.85482	78.14787
45	3	30.37997	10.12666	4.130861

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	1456.851	19	76.67635	2.409473	0.000696558	1.600194
Within Groups	24249.03	762	31.82287			
Total	25705.88	781				

Table 31 – Covariance Analysis – Incidence

Correlation t-Statistic	AVG PRICE	CONSUMPTION RATE	DEAL	INVENTORY	MIN PRICE	BASKET SIZE
AVG PRICE	1 -----					
CONSUMPTION RATE	-0.006433 -1.996231	1 -----				
DEAL	0.083253 25.925	0.029728 9.229141	1 -----			
INVENTORY	-0.014989 -4.651858	-0.311995 -101.9054	-0.010171 -3.156284	1 -----		
MIN PRICE	-0.089029 -27.73773	0.010273 3.188179	-0.151963 -47.71137	0.0019 0.589486	1 -----	
BASKET SIZE	-0.124482 -38.93211	0.020346 6.315026	-0.061524 -19.12843	0.020948 6.502174	0.050924 15.82345	1 -----

Table 32 – Covariance Analysis – Quantity

Correlation t-Statistic	DEAL	INVENTORY	BASKET SIZE	PRICE	PURCHASE RATE	BRAND LOYALTY
DEAL	1 -----					
INVENTORY	0.024658 1.456947	1 -----				
BASKET SIZE	-0.017035 -1.006377	0.040189 2.375806	1 -----			
PRICE	0.00507 0.299506	-0.020072 -1.185825	-0.020777 -1.227493	1 -----		
PURCHASE RATE	0.07529 4.459893	-0.105838 -6.286909	0.073158 4.332866	-0.093156 -5.526549	1 -----	
BRAND LOYALTY	0.032087 1.896291	-0.013713 -0.810056	0.013275 0.784164	-0.14524 -8.670958	0.10712 6.363969	1 -----