



AN EXAMINATION OF PRICE VARIATION IN RELATION TO
MEDIAN HOUSEHOLD INCOME: COMPARING A REGIONAL
AND INTERNATIONAL GROCERY STORE CHAINS' PRICING OF
HOUSEHOLD STAPLES IN SAN ANTONIO, TEXAS

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Table of Contents	1
I. Introduction.....	2
II. Background.....	3
III. Literature Review.....	6
IV. Methodology	
Zip Code and Store Selection.....	13
Grocery Item Selection.....	15
National Brand Groceries.....	16
Store Brand Groceries.....	18
Data Collection and Analysis.....	19
Store Data Mapping.....	21
V. Study Results	
Proposition 1 Results.....	22
Proposition 2 Results.....	29
Store Data Mapping Results.....	32
VI. Conclusion	35
References	37
Appendix.....	40

I. Introduction

There is considerable interest in the grocery industry, currently. Food deserts, unequal access to food and price disparities are among the most hotly debated grocery industry topics in the public forum right now. Unfortunately, most of the discussion and research into this topic has a racial, social or political commentary attached to it that can lead to skewed assumptions and interpretations. With the removal of the racial, social and political attachments that often comes along with research in this industry, two questions presented themselves.

The first question is still being grappled with in research and at the time of this project, had not been explored in the city of San Antonio; do the residents in poorer areas pay more for groceries than residents in more affluent areas? More specifically, to what extent do prices vary for a selected basket of staples at HEB and Walmart stores in San Antonio, TX by selected zip code? If price variations are found, are the grocery basket prices in a selected zip code positively correlated with the median household income levels of the same zip code? From these two questions the following propositions have been formulated:

Proposition 1: Prices the selected basket of staples at HEB and Walmart are varied, for both national brand items and store brand items, according to levels of household income in a particular zip code.

Proposition 2: Price variations for the selected basket of staples are positively correlated at statistically significant level to the median household incomes of zip codes in San Antonio, for both HEB and Walmart.

This research has contributed to the social justice literature, as currently there is a lack of research into the phenomena of price variations at every geographic scale, from country to city to

neighborhood. The goal of this study was not only to encourage other researchers to study the phenomenon, but also to lay a foundation for data on food purchases with respect to income. This research provides a stepping-stone to explain: 1) why the variations exist, 2) what is the impact of price variations on staple foods, 3) whether location plays a role in existing price variations.

This research also compares two different store chains, HEB and Walmart, which is unique and beneficial to any future research. With HEB being a regional store chain serving central and south Texas as well as northern Mexico, and Walmart being a global behemoth, the result of this study further investigates whether there are greater price variations between the prices of a regional chain as compared to an international chain that advertises “lowest prices” on all goods. The research produced price data collected in the field that may be expanded upon and analyzed further.

II. Background

San Antonio, Texas is the focal point of this study. Situated in south central Texas, this city has the 7th largest population in the United States with about 1.4 million residents (U.S. Census Bureau, 2014). San Antonio is also the 4th fastest growing city of the top 10 largest cities in America (City Mayor Statistics, 2012).

The city has an estimated median household income of \$45,399 (City Data, 2013) with a per capita income of \$22,414 (City Data, 2013). The city’s economy is primarily based on tourism, healthcare, oil/gas, military and government civil service sectors (Forbes, 2014; City of San Antonio, 2016). San Antonio is known for its vibrant colors and proud Hispanic heritage

while celebrating its ethnic, social and economic diversity. This diversity, particularly the economic diversity, made San Antonio appealing for geographic price variation research.

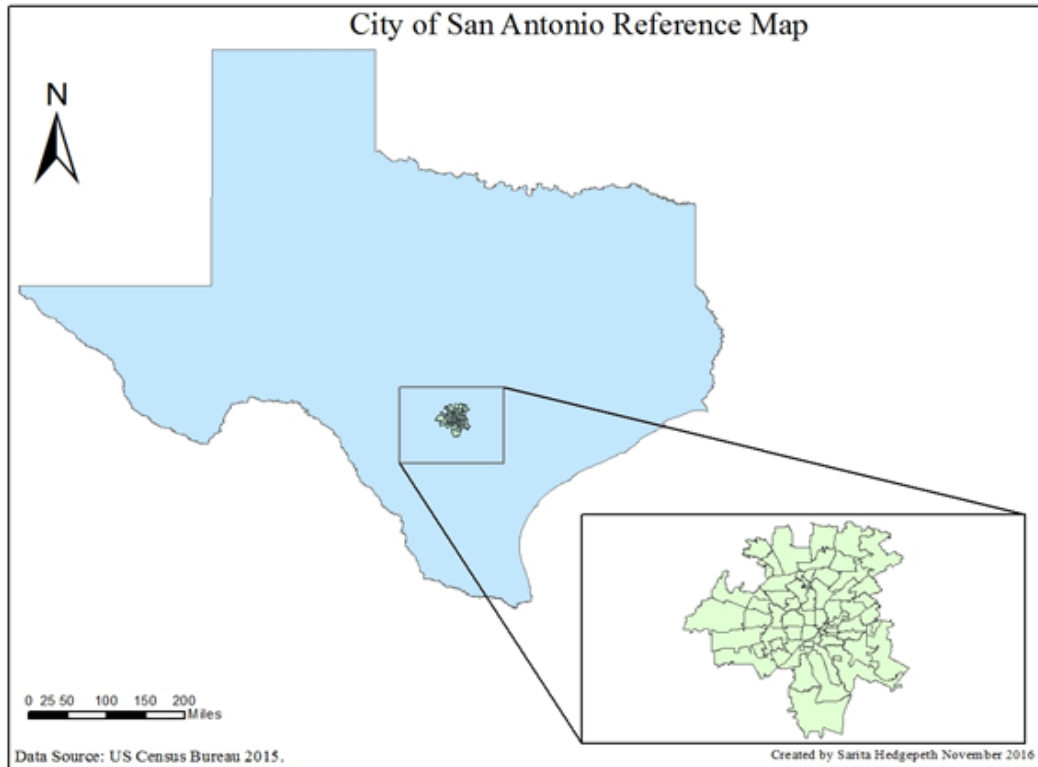


Figure 1. Reference Map of San Antonio, TX.

While the overall economic standing of residents has increased from 2000 to 2014 (U.S. Census Bureau, 2015), there is still a great deal of variation in the median household income between zip codes of San Antonio (U.S. Census Bureau, 2015). The average four-member household spends approximately \$568 to \$1107 per month on groceries across the United States (USDA, 2014). In the city of San Antonio, the average monthly grocery expenditure for a four-member household is \$782 (Career Trends, 2015). The following figures display the city of San Antonio in two ways: Figure 1 shows the zip codes of San Antonio with the total population of

each zip code while Figure 2 shows the economic dispersion, in median household income, in the city by zip code.

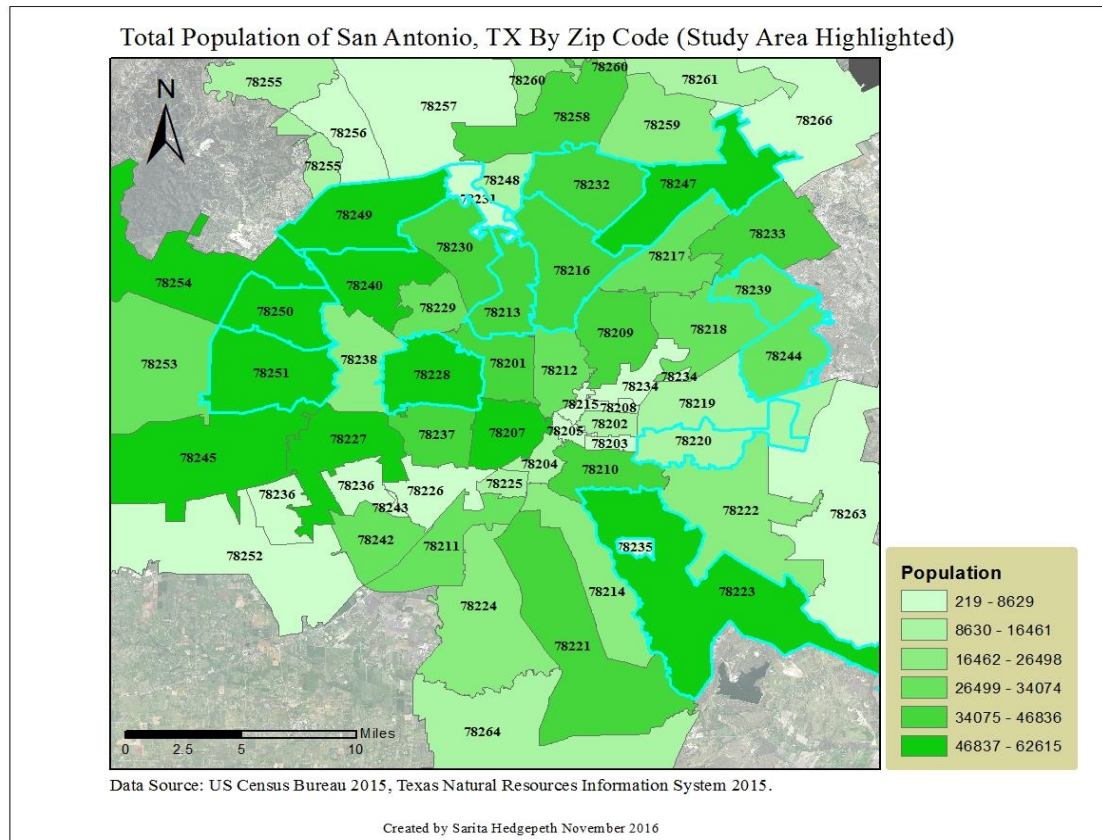


Figure 2. Map of Population Values of San Antonio, TX by Zip Code.

The HEB grocery chain is found throughout Texas, but is predominately in central and southern Texas with recent expansion into Mexico. The chain began in 1905 in Kerrville, Texas and has expanded to 370 stores with 318 in Texas and 52 in Mexico. There are approximately 50 stores in San Antonio. HEB is the largest private employer in Texas with over 76,000 employees and with an annual revenue estimated at more than \$23 billion (San Antonio Express News, 2015; HEB, 2016).

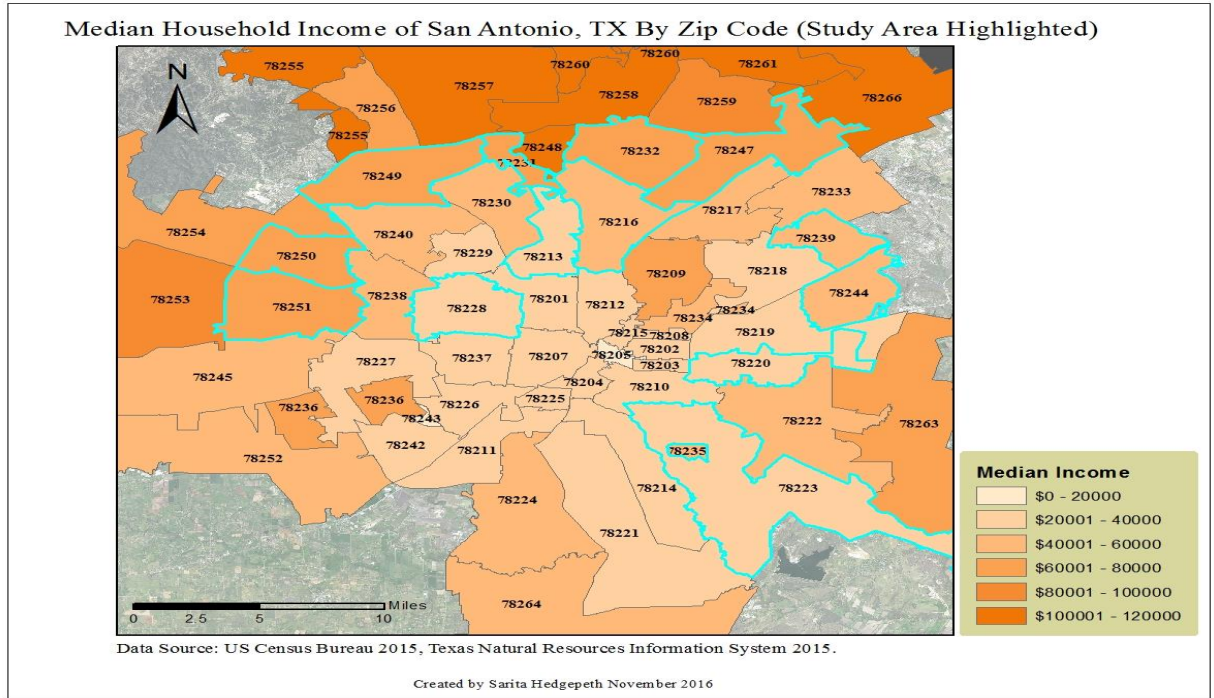


Figure 3. Median Household Income by Zip Code in San Antonio, TX.

Founded in 1962, Walmart is an international retail chain that currently operates in 28 countries with over 11,500 stores. About 4,700 international stores operate under a different name other than Walmart, including Walmex in Mexico, Asda in the United Kingdom, Seiyu in Japan and Best Price in India. Walmart employs approximately 2.2 million people worldwide with 1.4 million employees in the United States alone. In 2012, Walmart registered approximately \$444 billion in sales (Daily Finance, 2016; Walmart, 2016).

II. Literature Review

Studies strongly suggest that variations exist in grocery prices at all geographic scales including variations across countries like in Europe or across neighborhoods like in Australia. A study conducted by the European Commission Internal Market and Services (ECIMS) examined grocery prices in 15 different markets in countries that are members of the European Union

(ECIMS, 2014). While the study confirmed that price variations existed throughout the markets, the factors normally thought to contribute to price variations, such as taxes, income levels and market structure had very little impact on the grocery prices (ECIMS, 2014).

Another study conducted in Sydney, Australia, yielded results that also confirmed price variations, but in a smaller geographic scale (Southern Sydney Retailers Association Ltd., 2013). This study uncovered drastic price variations between three store locations of a particular grocery store chain, Woolworth, that were in very close proximity to one another. For example, the price for a kilogram of Pink Lady apples at the three store locations, Fairfield, Wetherill Park and Greystanes, were \$0.99, \$2.48 and \$4.44, respectively (Southern Sydney Retailers Association Ltd., 2013). The study discounted the variable of cost for different distributors, as the items were sourced from the same distributor, but could not offer explanations as to why the variations existed.

A study conducted in the St. Paul area of Minnesota also found price variations. The study examined 55 stores, 24 of which were inner city stores while the remaining 31 were in suburban areas and examined the discrepancies between chain stores versus non-chain stores, inner city versus suburban stores and poor versus non-poor areas (Chung and Myers, 1999). The researchers found that prices were not uniformly higher in the inner city, some items had higher prices while others had lower prices. The average cost of all the commodities sampled were only about 2 percent higher in the inner-city stores than in the suburban stores (Chung and Myers, 1999).

The study did, however, find substantial price differences between chain stores and non-chain stores in the sample. There was a price difference of \$16.62 between non-chain stores and chain stores, \$1.18 price difference between the inner city and suburban stores, and \$5.15 price

difference in poor area store and non-poor area stores (Chung and Myers, 1999). The study also found substantial differences in the availability of commodities between the inner-city and suburban stores, the largest availability discrepancy being in produce and the smallest being in personal items (Chung and Myers, 1999). An important point made in this study is that, “The problem is the location of the chains and not poverty alone...More significant is that people who shop in non-chain store pay an even larger premium-whether they shop in poor or affluent areas” (Chung and Myers, p. 292). This study supports the proposition of this research that there are price variations even though the two sampled stores in the study were chain stores.

Many attempts have been made to identify the causes of geographic price variations. Location theory states that price may be explained by store size and location, as well as, the size of the firm that owns the structure/land. These variables affect the variations in price observed with the ability to go beyond single geographic variable studies (Johnston and Hays, 1980). A slight variation of location theory was used in an earlier price variation analysis in Ireland. These price variations were attributed to organizational type, size of the store, distance from neighborhood, and the distance to the city center (Parker, 1974).

A 2015 study by Steve Martinez also suggested that price variations were strongly influenced by the type of store the consumer purchases from. Using the Hedonic Pricing Model and consumer purchasing data from Nielson Homescan, this study examined the price of produce in three locales: direct-to-consumer outlets (farmer’s markets), grocery stores, and supercenters. The study found that consumers shopping at direct-to-sales outlets paid the least for produce and the most at grocery stores (Martinez, 2015). Use of the hedonic model allowed the researchers to assess the amount of influence that multiple variables had on produce prices, and found that were several more factors that contributed to the price variations. Organic produce, higher home

income, fresh produce (instead of prepackaged), and name brand, generally, led to increases in the price paid by consumers. The hedonic price modeling study supports the secondary proposition of this research that there is a positive correlation between the median incomes of a zip code and grocery prices.

There were several economic theories used to explain product-pricing variation (Siegfried et al., 1992). One was Cost-based Theory that argues: the greater market share and cost of market share that a company has, the higher prices will be (Siegfried et al., 1992). This is supported by Williamson who states that, “If assets are nonspecific, markets enjoy advantages in both production cost and governance cost respects; static scale economies can be more fully exhausted by buying instead of making; markets can also aggregate uncorrelated demands, thereby realizing risk-pooling benefits; and external procurement avoids many of the hazards to which internal procurement is subject” (Williamson, 1981, p. 558).

The next is Concentration Theory, which states that a higher market concentration leads to higher market share, which leads to higher prices (Siegfried et al., 1992). Similarly, Scitovsky and colleagues state that, “Concentration can influence the profit margins and prices charged in product markets as well as the prices paid. It can also affect income distribution by making it more expensive and more difficult for newcomers to enter the market” (Scitovsky, 1955, p. 103).

Consumer Demand Theory postulates that a higher demand for a product will lead to a higher price for that product (Siegfried et al., 1992). This theory heavily emphasizes consumer choice, as the consumer will seek to maximize his/her satisfaction by selecting the best combination of product that can be afforded (Clarkson, 1962).

Lastly, there is Retailer Demand Theory, which has slightly different implications depending upon the author. The first is that a retailer's preference for a product will result in higher availability and price of the product (Siegfried et al., 1992). Product availability may increase or dampen consumer demand (Craig et al., 2016). Low stock might lead consumers to assume that the product is more desirable and, therefore, will lead to higher demand (Gallino et al., 2013). In other cases, however, low stock could lead to product and even retailer abandonment by the consumer (Fitzsimons, 2000).

There are also factors on behalf of the retailers that may be used to explain price variations. An article of retailing trends in the *Journal of Retailing* gives several components that may influence the pricing practices of retailers. There are four components, pertinent to this research, of grocery price variations. The first component is *segment-based pricing effects*. This component suggests that customers in a higher income area may be less sensitive to price than those in less affluent areas, and because of that factor, retailers may implement different prices and promotions across different markets (Levy et al., 2004). As Levy and colleagues state, "A retailer's ability to segment and charge differential pricing also may hinge on the price awareness levels of consumer segments" (Levy et al., 2004, p. 17).

The next component is *cross-category effects* which refers to the implied relationship between two or more products. For example, if a retailer is evaluating the price for toothbrushes, they should also consider the impact it will have on the sales of related products, like toothpaste. (Levy et al., 2004) This would allow the retailer to be in a better position for price optimization and promotions (Levy et al., 2004).

The third component is *retail competition*. This component has two parts: 1) a retailer's lack of knowledge of their competitors' prices, and 2) the sensitivity of demand to prices in the

stores of their competitors. There are research reports that specialize in price data collection that retailers may use to assist in pricing strategies, but as the article points out, there is also the added responsibility for the retailer to anticipate the customer's shopping habits and needs (Levy et al., 2004).

When implementing retail prices there are several factors that retailers must take into consideration, the most important being *psychological price thresholds* and *price changing costs*. *Psychological price* thresholds refer to the manufacturer's suggested retail price for an item, perhaps \$4.90, but the retailer charges \$4.99. This tactic leads to small profit for the retailer, at no cost to them, but remains indistinguishable to the consumer since they typically pay little attention to the last digit in a price (Levy et al., 2004). The second factor of *price changing costs* has the opposite effect on profits for the retailer. According to an earlier article by the same research team, changing a price may cost a retailer between \$0.25 and \$0.50 per item (Levy et al., 1997). This article offered invaluable insight into the process that retailers must complete in order to reach an optimal price for products, which may contribute to understanding why price variations exist in an area.

In previous studies that examined geographic price variations, particularly grocery price variations, there was a lack of consensus with respect to what items should be examined. This study offered a more concise approach to grocery item selection and served as guide to future inquiries about geographic price variations, regardless of geographic scale chosen. As noted there were suggestions as to what categories and outside influences should be taken into consideration.

Todd and Leibtag (2010) stressed the need to thoroughly consider the types of products that should be observed in a geographic price study. In addition, the researchers point out that seasonal variations exist for certain products which may affect food prices, particularly perishable foods such as, fruits and vegetables (Todd and Leibtag, 2010). Finally, Todd and Leibtag suggested measuring food prices on a quarterly basis, and at the market level, as they claimed it would better reflect the effect of prices on food choices (2010).

An earlier study by Warntz (1959) and Jones (1968), examined agricultural commodities, and produced findings that were indicative of causal influences of temporal and spatial variations in supply and demand (Johnston and Hay, 1980). This point was given special consideration while choosing the basket of staples discussed later in the methodology.

A commonly ignored factor in geographic price studies was the existence of generic brands in the marketplace. While research has been conducted on economic demand of national brand products, there was a major lack of research in regards to the effect and/or variation of prices of generic brands (Cotterill and Putsis, 2000). There was also inconsistency in the geographic scales that were used.

This present research was the first to examine the geographic price variations in the city of San Antonio by zip code. Another unique contribution of this study was the examination of a global grocery chain, Walmart versus a regional grocery chain, HEB. In sum, geographic price variations on food items is a phenomenon that spans across all socio-economic levels, and should be given more attention and study.

IV. Methodology

Zip Code and Store Selection

The positivist approach employed in this project produced a descriptive statistical analysis of price variations in San Antonio grocery stores as well as a basic understanding of correlations between prices and median household income. The first task was to determine which zip codes were suitable for data collection. This meant identifying zip codes that had both a Walmart and HEB location within it. A master list was compiled of all the zip codes in the City of San Antonio. Once the list was compiled, a store location search was conducted on both the Walmart and HEB websites by using the “store location” link on both websites. The address and store number for each store was recorded on a separate list of zip codes. If a zip code had multiple locations for an HEB or Walmart, one store was randomly chosen from the available search results.

Once the list of store locations by zip code was completed, it was cross referenced with a master list of all zip codes. The master list was then narrowed by excluding all zip codes that had no HEB and no Walmart, or having only an HEB or Walmart present. This left a sample of zip codes for a final list having both an HEB and Walmart. After the exclusion process the following 13 zip codes were left: 78213, 78216, 78220, 78223, 78228, 78231, 78232, 78239, 78244, 78247, 78249, 78250, and 78251. [An address list for the HEB and Walmart store locations examined is available in the appendix section of this research.]

It should be noted that the zip code 78209 was excluded from the eligible zip codes, even though both store chains were present, because of the type of HEB that was present. The HEB location was not a traditional HEB but an upscale version called Central Market. While Central

Market is an HEB owned entity, it is designed to cater to a more affluent clientele and offers a slightly different product line. Although many of the national brand items are still offered at this location, the store brand (HEB brand) items were not available and price variations would be unfairly skewed due to the type of store.

The next task was to collect Census data for the zip codes to obtain median household income of the zip codes previously listed. Based on 2015 economic data from the U.S. Census Bureau, a table was created containing the previously selected zip codes and their respective median household income values.

Table 1. 13 Eligible Zip Codes with Median Household Income

ZIP Code	Median Household Income (In US Dollars)
78213	\$39,806
78216	\$41,853
78220	\$31,277
78223	\$36,581
78228	\$36,113
78231	\$77,155
78232	\$65,997
78239	\$57,231
78244	\$57,412
78247	\$67,906
78249	\$68,942
78250	\$62,059
78251	\$64,463

As seen in the table, there were significant variations in median income levels of the zip codes that were used in the study. Five of the 13 zip codes were below the median income level of the city, \$45,399, while the remaining eight zip codes were above the city's median income

value. There were also significant geographic variations in the zip codes that had both an HEB and Walmart store within it, which provided a sufficient amount of geographic variation to counteract any spatial autocorrelation that could occur.

Grocery Item Selection

After the zip codes and stores were selected, the next task was to select a list of grocery staples that would be representative of the average household's items of use. In an attempt to cover all grocery categories, strong consideration was given to determining which items would normally be found in a household's grocery basket. For the purpose of this study, the term "normal use items", was defined as, *items that are considered essential and necessary for a household or individual to function within a domicile activity, i.e. washing dishes, washing laundry, eating, etc.* In the task of item selection, special consideration was needed for geographic and year-round availability. In order to make this research universally applicable and understandable, the following three rules were used for the grocery item selection process:

- 1) Items that had seasonal variations in price and/or availability were excluded from the eligible items. This exclusion applied to produce, fresh meat and seafood.
- 2) Store delicatessen items were excluded from the eligible items. While store delis may have national brands available for purchase like Oscar Mayer or Boar's Head, they often had store-only brands and/or region specific offerings, like Hill Country Fare or tamales and guacamole, which might have hindered the universalism of the item selection.
- 3) Only the regular "everyday" prices for an item were recorded. This meant that if an item on the selected list below was on sale during the timeframe of the data collection, the regular price would be recorded, not the sale price.

National Brand Groceries

With the selection parameters in place, 16 national brand grocery items were selected from the grocery categories of dairy, frozen, condiments/sauces/spread, soup/canned goods, snacks, breakfast/cereal, laundry, paper/cleaning, personal care, baking goods, grains/pasta and bakery. The grocery categories were based on the categories provided by the *Peapod.com* website, an online grocery store, which closely follows the same logical categorization that I would employ if having to categorize these items from scratch (not to be confused with physical grocery store organization by aisles, which is most often set by a corporate schematic plan, not logical groupings). The 16 items in the following table were organized into the format of item brand, category of item, type of item (flavor or scent) and the size of item (6-pack, 24 ounces, etc.).

There were more items from the cleaning/paper good category than any other category. This was because I assumed there was more universalism in cleaning items throughout households than in household food items, therefore, more emphasis was placed on these items. This assumption was based on the logic that every person, regardless of race/ethnicity, age, gender, or economic status, needs the items in the cleaning, personal care and paper goods category. While not every household may have *Chips Ahoy* cookies in their cabinet, it is a reasonable representation of the snack category. For the purpose of this study, the term “household staples” referred to the 16 grocery items on the table that were identified.

Table 2. 16 Selected National Brand Grocery Items Including Brand, Category, Type and Size of Item

Item Brand	Item Category	Type of Item	Size of Item
Tide ©	Laundry	Liquid, Original Scent	150 oz. jug
Quilted Northern Soft & Strong ©	Paper Goods	Unscented Double Roll 2-ply	12 count
Palmolive ©	Cleaning	Liquid, Original Scent	25 oz. bottle
Dial ©	Personal Care	Bars, Gold	8 count
Colgate Total ©	Personal Care	Mint Flavor	6 oz. tube
General Mills Cheerios ©	Breakfast/Cereal	Honey Nut Flavor	12.25 oz. box
JIF Peanut Butter©	Condiment/Spread	Creamy	16 oz. jar
Heinz Tomato Ketchup ©	Condiment/Spread	Original Flavor	32 oz. bottle
Kraft Macaroni & Cheese ©	Grain/Pasta	Original Flavor	7.25 oz. box
Kraft Natural Shredded Cheese ©	Dairy	Yellow, Sharp Cheddar	8 oz. bag
Nature's Own Bread ©	Bakery	100% Whole Wheat	22 oz. loaf
Crisco Oil ©	Baking Goods	Vegetable	48 oz. bottle
Morton Salt ©	Baking Goods	Iodized	26 oz. can
Nabisco Chips Ahoy! ©	Snacks	Original Chocolate Chip	13 oz. pack
DiGiorno Pizza ©	Frozen Food	Pepperoni Rising Crust	27.5 oz. box
Campbell's Condensed Soup ©	Soup/Canned Goods	Chicken Noodle	10.7 oz. can

Store Brand Groceries

The three previously stated rules were applied to the selection process of the store brand grocery basket. For HEB, the term store brand refers to any item that bears the HEB name on the label. For Walmart, the term store brand refers to any items that bear the Great Value name on the label. For both store brands, items that were the equivalent of national brand items were identified and selected to form new versions of the household staples for each store.

Unfortunately, not all the national brand items had a store brand equivalent. For example, HEB had a store brand equivalent for laundry detergent while Walmart did not. Walmart had a store brand equivalent for vegetable oil while HEB did not. Neither store had an equivalent item for toothpaste and bar soap. The following charts list the HEB and Walmart brand equivalent item information.

Table 3. 12 Selected HEB Store Brand Grocery Items Including Brand, Category, Type and Size of Item

Item Brand	Item Category	Type of Item	Size of Item
HEB Bravo Plus Liquid Detergent	Laundry	Original	150 oz. jug
HEB Finest Ultra Strong Toilet Paper	Paper Goods	Unscented Double Roll 2-ply	16 count
HEB Dish Detergent	Cleaning	Original Blue	22 oz. bottle
HEB Toasted Oats	Breakfast/Cereal	Honey Nut Flavor	12.25 oz. box
HEB Peanut Butter	Condiment/Spread	Creamy	18 oz. jar
HEB Ketchup	Condiment/Spread	Original Flavor	32 oz. bottle
HEB Mac & Cheese	Grain/Pasta	Original Flavor	7.25 oz. box
HEB Shredded Cheese	Dairy	Yellow, Sharp Cheddar	8 oz. bag
HEB Bakery Bread	Bakery	100% Whole Wheat	24 oz. loaf
HEB Salt	Baking Goods	Iodized	25 oz. can
HEB Chocolate Chips Galore	Snacks	Original Chocolate Chip	14.3 oz. pack
HEB Classic Selections Pizza	Frozen Food	Pepperoni Rising Crust	28.3 oz. box

Table 4. 12 Selected Walmart Store Brand Grocery Items Including Brand, Category, Type and Size of Item

Item Brand	Item Category	Type of Item	Size of Item
Great Value Ultra Strong Toilet Paper	Paper Goods	Unscented Double Roll 2-ply	12 count
Great Value Dish Detergent	Cleaning	Original	24 oz. bottle
Great Value Honey Nut Spins	Breakfast/Cereal	Honey Nut Flavor	21.6 oz. box
Great Value Peanut Butter	Condiment/Spread	Creamy	18 oz. jar
Great Value Ketchup	Condiment/Spread	Original Flavor	24 oz. bottle
Great Value Mac & Cheese	Grain/Pasta	Original Flavor	7.25 oz. box
Great Value Shredded Cheese	Dairy	Yellow, Sharp Cheddar	8 oz. bag
Great Value Bread	Bakery	100% Whole Wheat	20 oz. loaf
Great Value Vegetable Oil	Baking Goods	Vegetable	48 oz. bottle
Great Value Salt	Baking Goods	Iodized	26 oz. can
Great Value Chocolate Chip Cookies	Snacks	Original Chocolate Chip	13.75 oz. pack
Great Value Soup	Soup/Canned Goods	Chicken Noodle	10.5 oz. can

Data Collection and Analysis

The next task was to collect the field data of the prices for the household goods. For this task, I traveled to all the stores listed in the tables in the Appendix section. Each item was located in the store and its price data recorded in a field journal. Once the data was collected for all the household staples, the data was entered into an Excel spreadsheet already created to simplify the organization process. The data spreadsheet for the household staples is provided in Tables A1-A6 of the Appendix section.

For the testing of **Proposition 1** that: Prices for the selected basket of staples at HEB and Walmart will be varied according to levels of household income in a particular zip code, descriptive statistics were employed to analyze the data. By using descriptive statistics, I was

able to pinpoint any variations present between the grocery basket total costs of the study groups, where a *group* was each store. The total value for each group was the summation all 16 item prices, 12 item prices for the store brands, collected for a single store.

During this portion of analysis an extra step had to be taken in order to equalize the store brand data collected. As noted earlier, HEB and Walmart did not have equivalent products for all the products sampled in the national brand grocery basket. HEB did not have an equivalent product for bath bar soap, toothpaste, vegetable oil and chicken noodle soup. Walmart did not have equivalent products for laundry detergent, bath bar soap, toothpaste and frozen pizza. Since these items were not available in the store brand, a new series of graphs was generated with these absent items being taken into account. Item compensation graphs were made by removing the national brand items for which there was no equivalent store brand products from the dataset. With these items removed, new summation rows were calculated and new graphs were generated to reflect total baskets costs not skewed by absent product data. Based on the results of this portion of analysis, I was able to determine whether to reject, or not reject, the proposition that grocery staple prices varied by zip code.

For the testing of **Proposition 2** that: Prices for the selected basket of staples will be varied and positively correlated to higher median household incomes of zip codes in more affluent areas, for both HEB and Walmart, while being negatively correlated to median household incomes for zip codes in poorer areas, a correlation test was used. Since two store chains, HEB and Walmart, were examined in the study, it was necessary to run separate correlation analysis. Using the total basket price costs for each store that were previously calculated, the correlation analysis determined the relationship between the mean price values of the HEB stores and median household incomes of the zip codes. This step was repeated for the

total basket price costs from Walmart stores and median household incomes of the zip codes. Four graphs were generated for the portion of analysis. The first two graphs display the correlation for total basket costs of national brand products in HEB and Walmart and the median household incomes of their respective zip codes. The third and fourth graph display the correlation for the total basket costs of store brand products and the median household income of their respective zip codes. The use of this test resulted in correlation coefficient values ranging from -1 to 1, where -1 was interpreted as a perfect negative correlation and 1 was interpreted as a perfect positive correlation (Rogerson, 2010). Based on the results, the study determined whether to reject, or not reject, the proposition that grocery prices were positively correlated against the median income of a zip code. During the analysis portion, I also examined whether there were significant differences between the variations in grocery prices in the HEB and Walmart chain.

Store Data Mapping

When the data analysis was completed, the address data for the store locations was uploaded and geocoded in ArcGIS to generate a reference map of the data collection sites. For each store location, an attribute table was created for each site that contained the pricing data for the household staples and median household income data by zip code. After uploading the data to ArcGIS, a map for each store was created to clearly display the variations of prices and incomes of the zip codes. Graduated colors were used to display the median household income values and text boxes were attached to each zip code to display the total basket costs for each zip code. For this portion of analysis four maps were generated to reflect the pricing variations. The first two maps display the total basket costs of national brand items for HEB and Walmart, as well as, the median household income for each zip code in the study area. The third and fourth

maps display the total basket costs for store brand items for HEB and Walmart, as well as, the median household income for each zip code.

V. Study Results

Proposition 1 Results

With the completion of the analysis portion of this project, I reached the conclusion that while there was variation in a few of the zip code total basket costs, the variations were very slight and in roughly half of the zip codes, nonexistent. The following figures display the results of the descriptive statistical analysis in bar graph format to easily visualize what variations, if any, were found in the grocery basket totals.

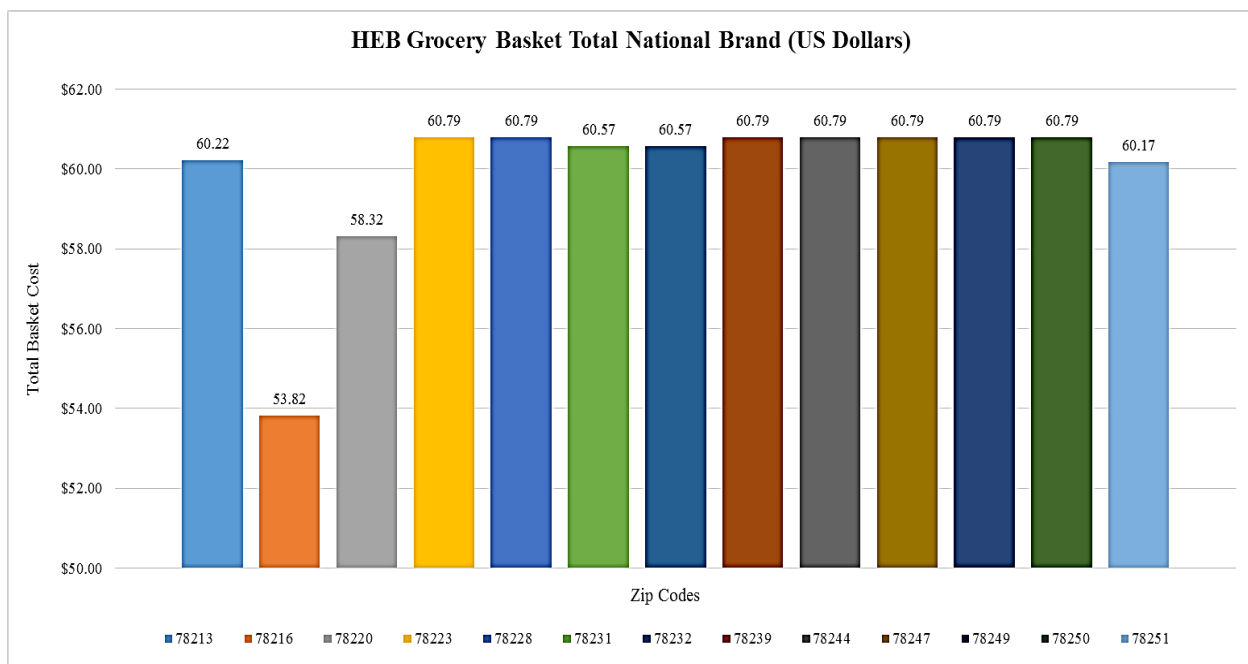


Figure 4. Price Variations for HEB Total Basket Costs

There was a large price variation noticeable in above in two zip codes, 78126 and 78220. This variation existed because the two items were not available at the particular HEB locations.

In the 78216 location, Quilted Northern toilet paper was not available and the 78220 location did not have Palmolive dish detergent. If these products had been available at these locations at the same price as in the other HEB locations, \$6.97 for Quilted Northern and \$2.47 for Palmolive, it would have been safe to assume that the price variation present would not have existed or would have been minimal.

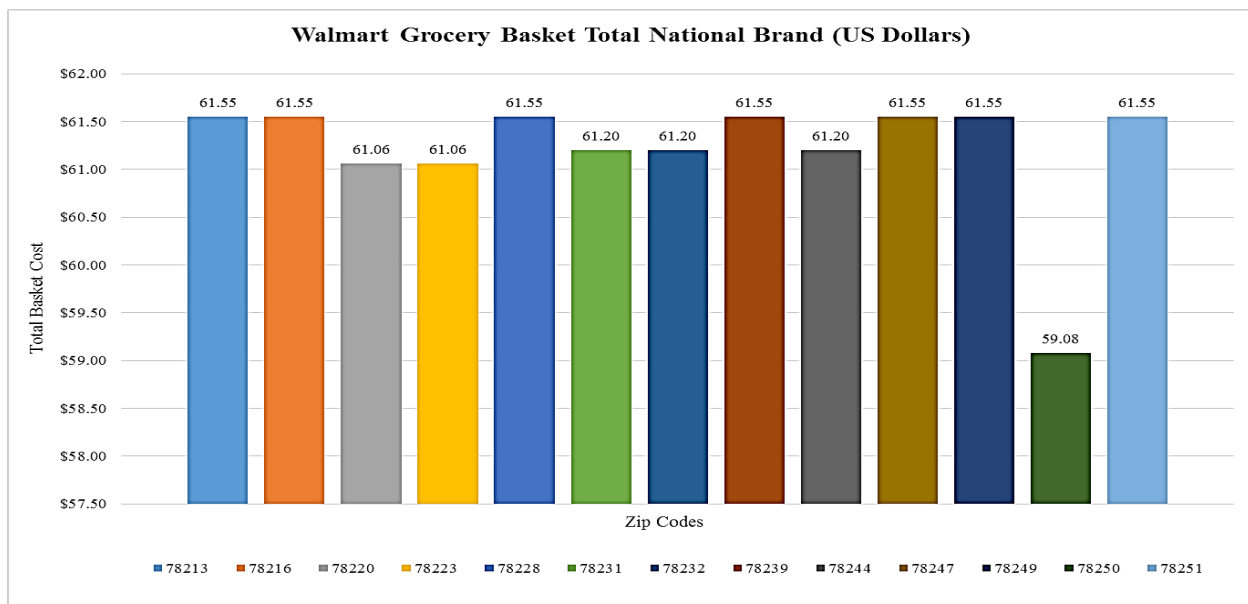


Figure 5. Price Variations for Walmart Total Basket Costs

As seen with the HEB dataset, there was a substantial price variation present in the Walmart dataset because of an item not being available in a particular store location. At the Walmart location in zip code 78250, Palmolive dish detergent was not offered. If this product was offered at the same price as the other Walmart locations, \$2.47, it would have been assumed that this variation also would have been minimal or non-existent.

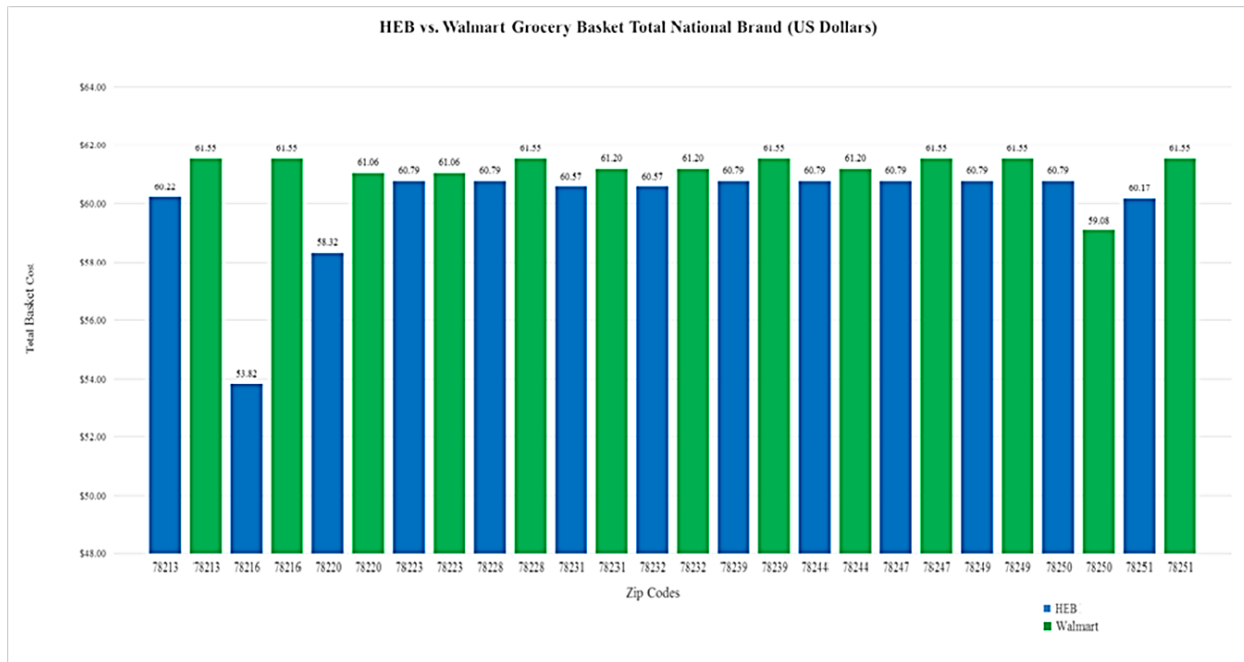


Figure 6. Price Variations for HEB and Walmart Total Basket Costs

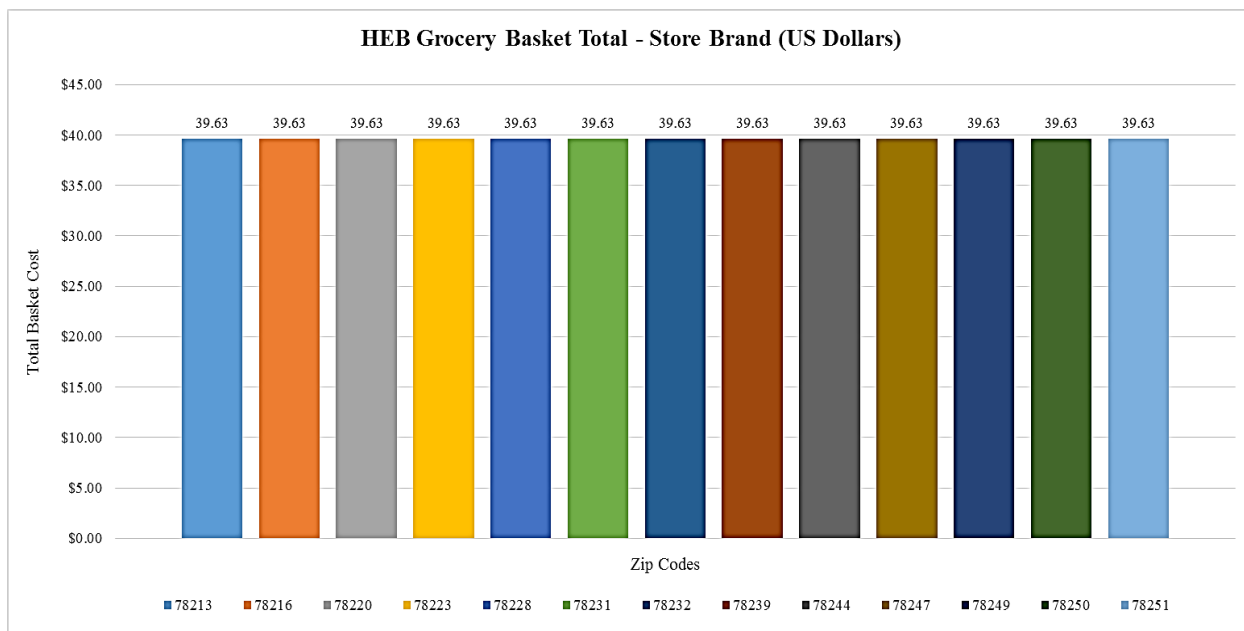


Figure 7. Price Variations for HEB Store Brand Total Basket Costs

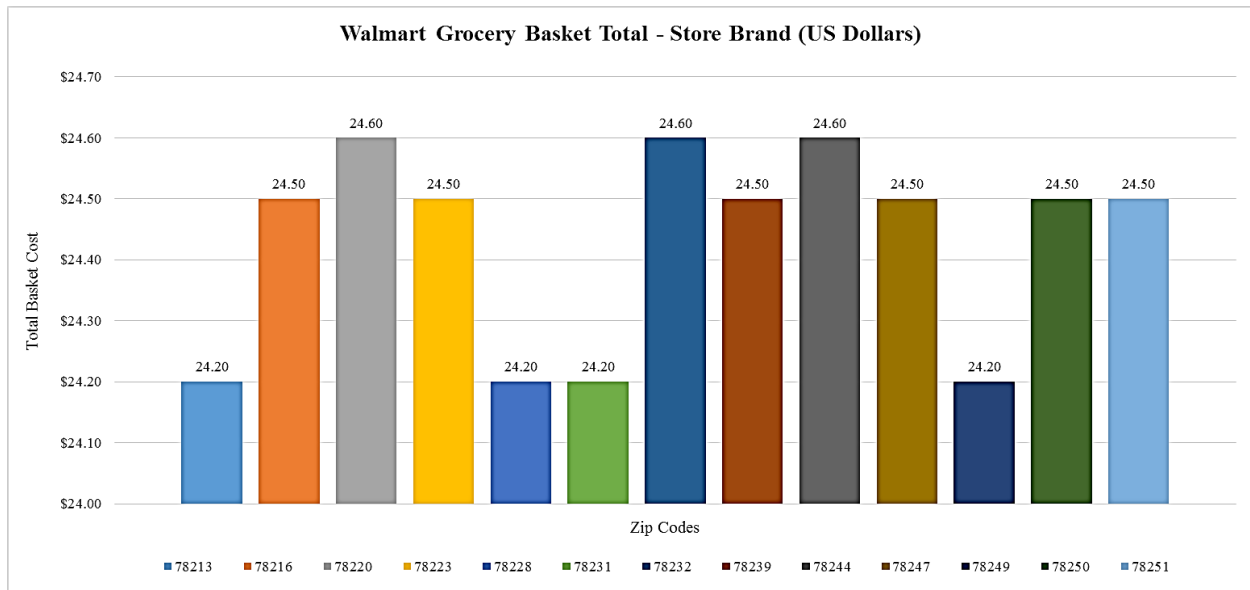


Figure 8. Price Variations for Walmart Store Brand Total Basket Costs

HEB locations showed no price variations for store brand products. Walmart showed minimal variations for store brand products with a price difference of \$0.40 between the highest and lowest basket costs.

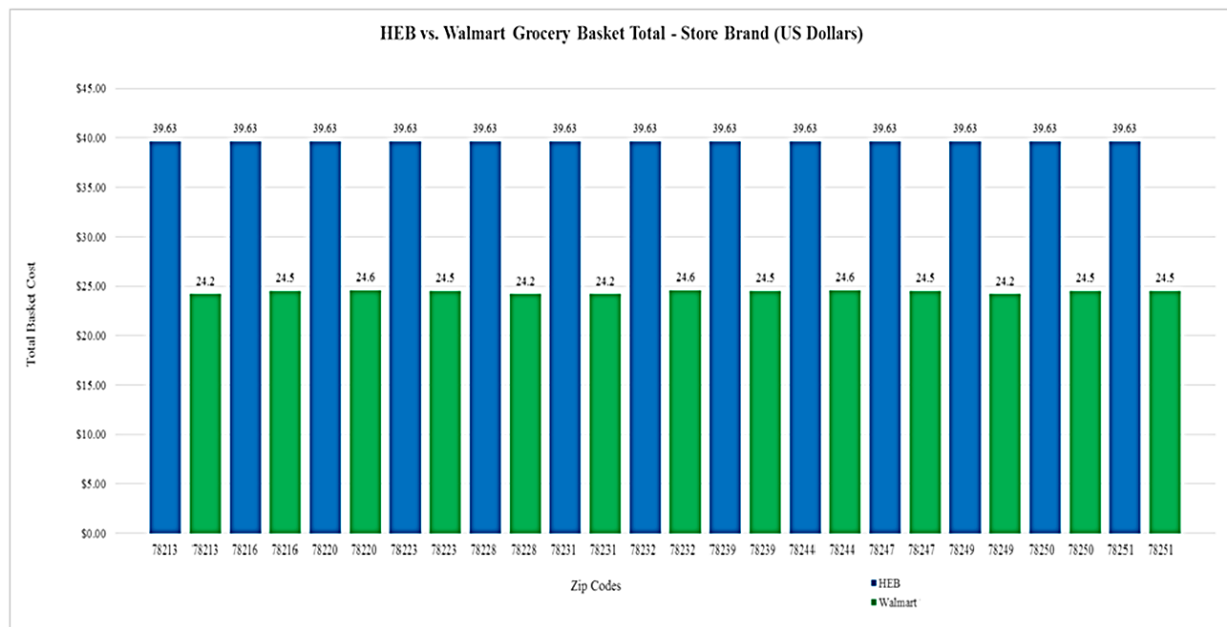


Figure 9. Price Variations for HEB and Walmart Store Brand Total Basket Costs

The exaggerated price variations observed was attributed to absent equivalent products being available in the store brand product lines which caused a skew in the pricing data requiring the item compensation process discussed in the methodology.

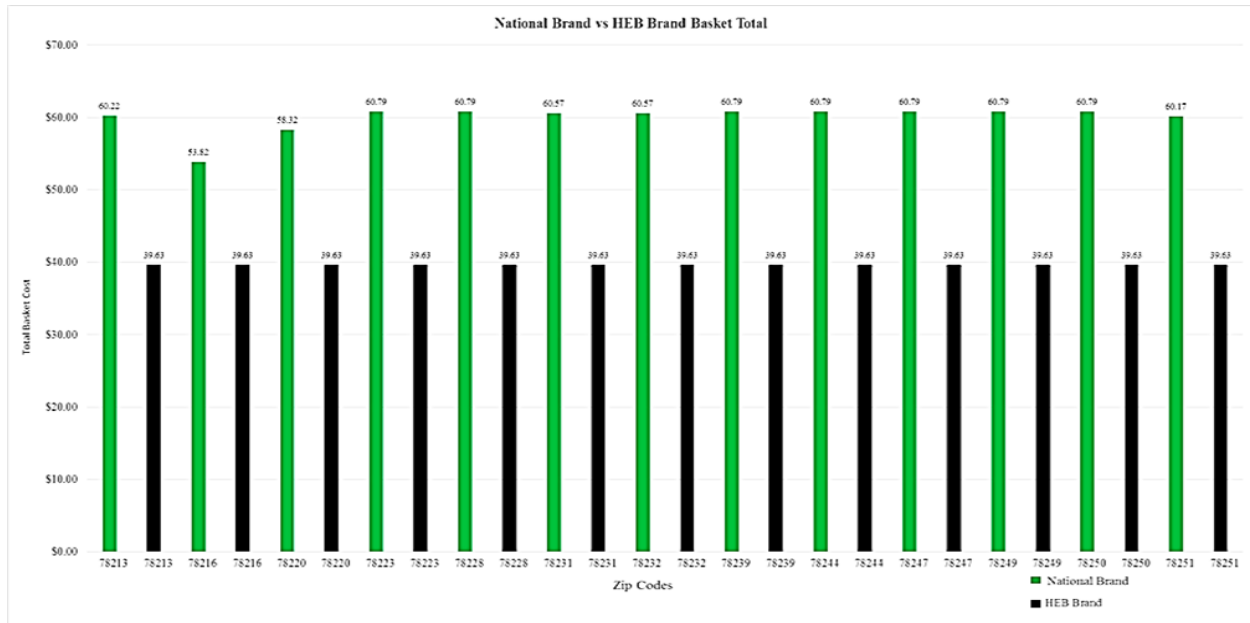


Figure 10. Price Variations for HEB National and Store Brand Total Basket Costs

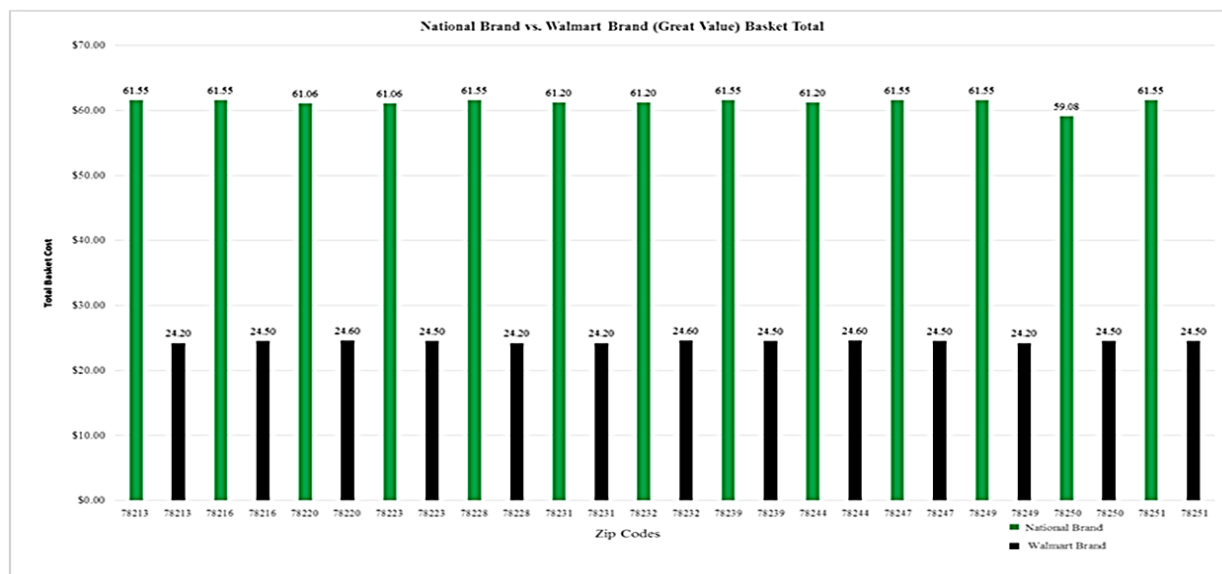


Figure 11. Price Variations for Walmart National and Store Brand Total Basket Costs

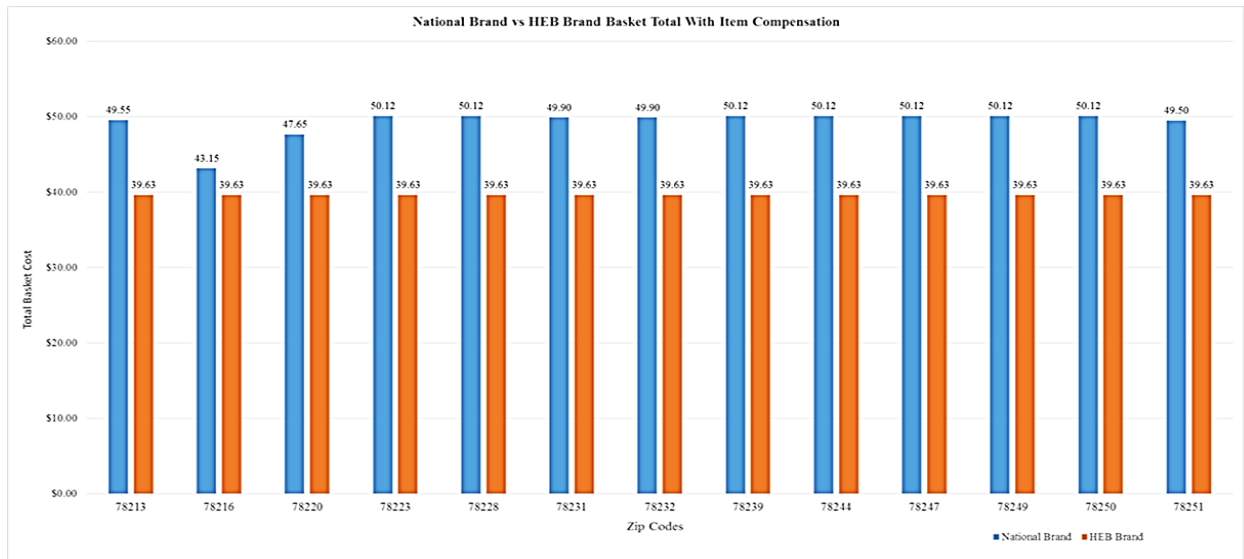


Figure 12. Price Variations for HEB National and Store Brand Total Basket Costs

After the item compensation process the for absent store brand equivalent products, there was a drastic reduction in the price variations that were displayed in the previous graphs. HEB total prices remained static with a value of \$39.63 while the national brand items had a maximum value of \$50.12 and minimum value of \$43.15.

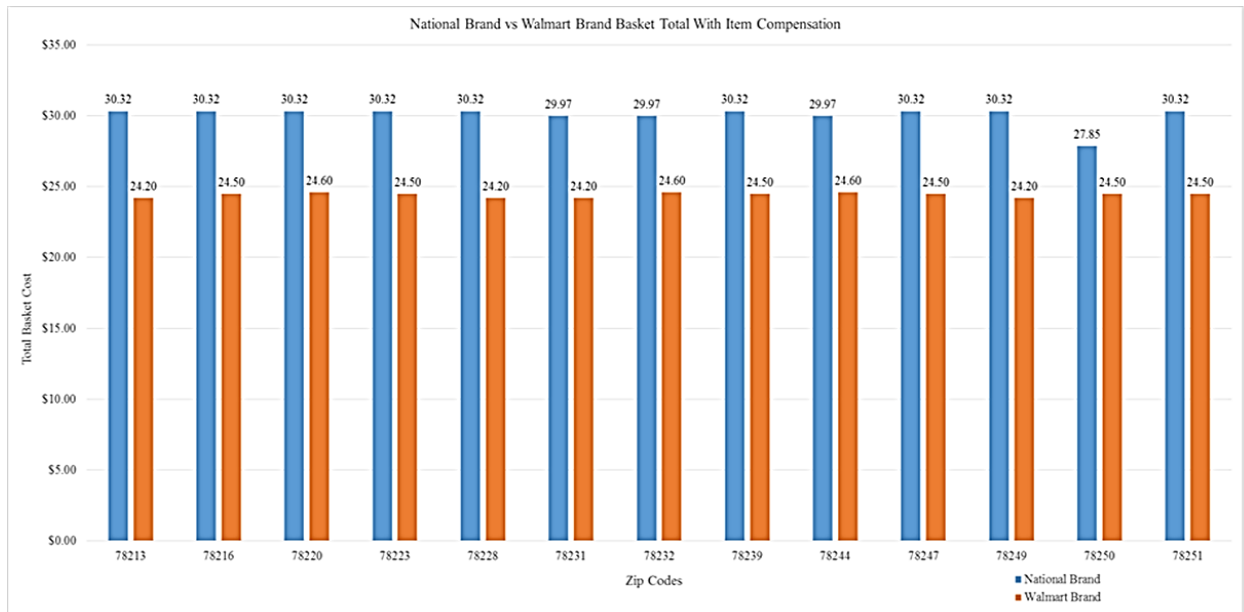


Figure 13. Price Variations for Walmart National and Store Brand with Compensated Total Basket Costs

Walmart had minimal total price variations in store brand items as did the total price variations for national brand products once the absent equivalent items had been compensated for. Walmart store brand total prices had a variation of \$0.40 while the national brand total prices had a variation of \$0.35 (disregarding the total price of 78250 due issues previously discussed).

After the item compensation process, there were minimal price variations between the HEB store brand total prices and the Walmart store brand total costs.

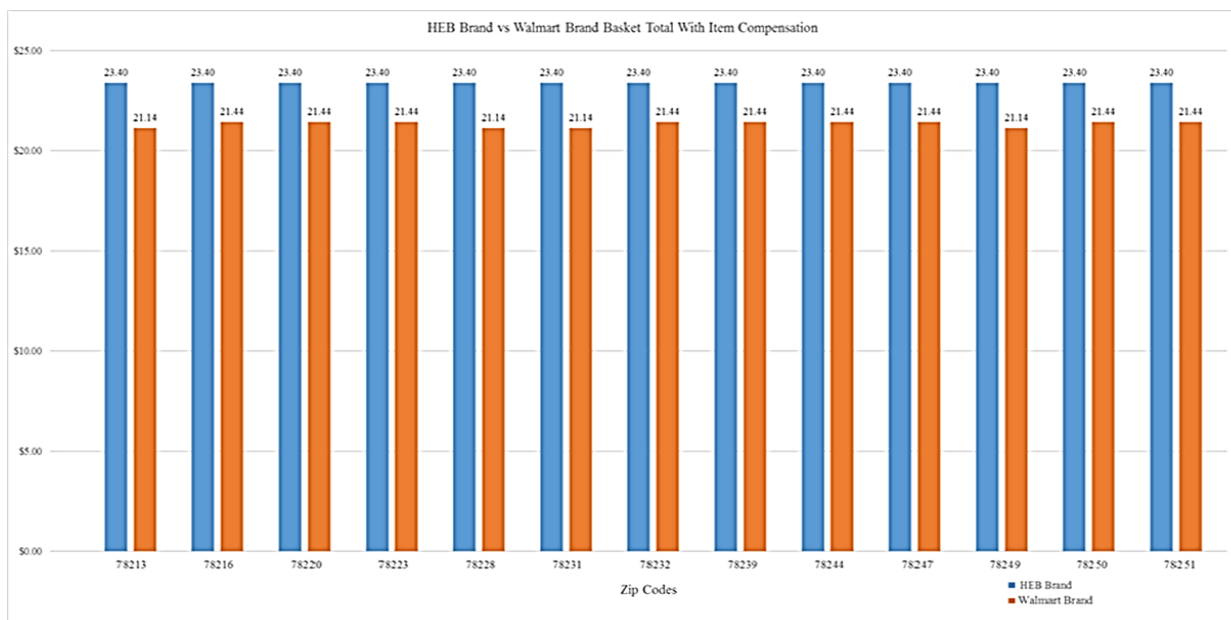


Figure 14. Price Variations for HEB and Walmart Store Brand with Compensated Total Basket Costs

HEB and Walmart had minimal variations in the total basket cost for national brand items. The total basket cost for store brand items in HEB showed no variations. The total basket cost for store brands in Walmart showed minimal variations. The largest price variation between the HEB and Walmart store brands was \$2.26 and smallest price variation was \$1.96. Although not shown in the graph, if the study had further compensated to completely equalize the dataset

between the HEB and Walmart products offered, the price variation between the two store brands ranged from \$0.02 to \$0.42, with Walmart being higher.

Even though the price variations were not as significant as expected, there still were variations present among the total basket costs for both HEB and Walmart with national brand products and in the total basket costs of the Walmart store brand products. With these variations present, I failed to reject **Proposition 1** for three of the four components stated, while rejecting the proposition for one component. Prices for the selected basket of staples at HEB and Walmart did vary for national brand items and store brand items at Walmart. Prices for the selected basket of items did not vary at HEB for store brand items.

Proposition 2 Results

The following graphs display correlations between the total basket costs for HEB and Walmart median household income values for each zip code in the study area.

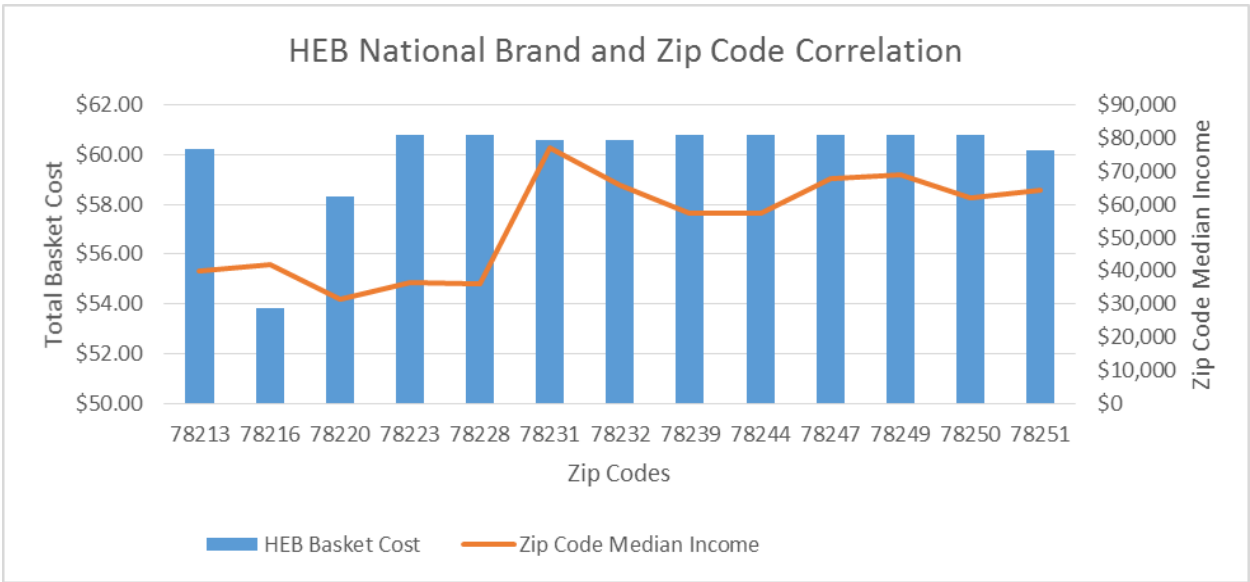


Figure 15. HEB National Brand Total Costs with Zip Code Median Income Correlations

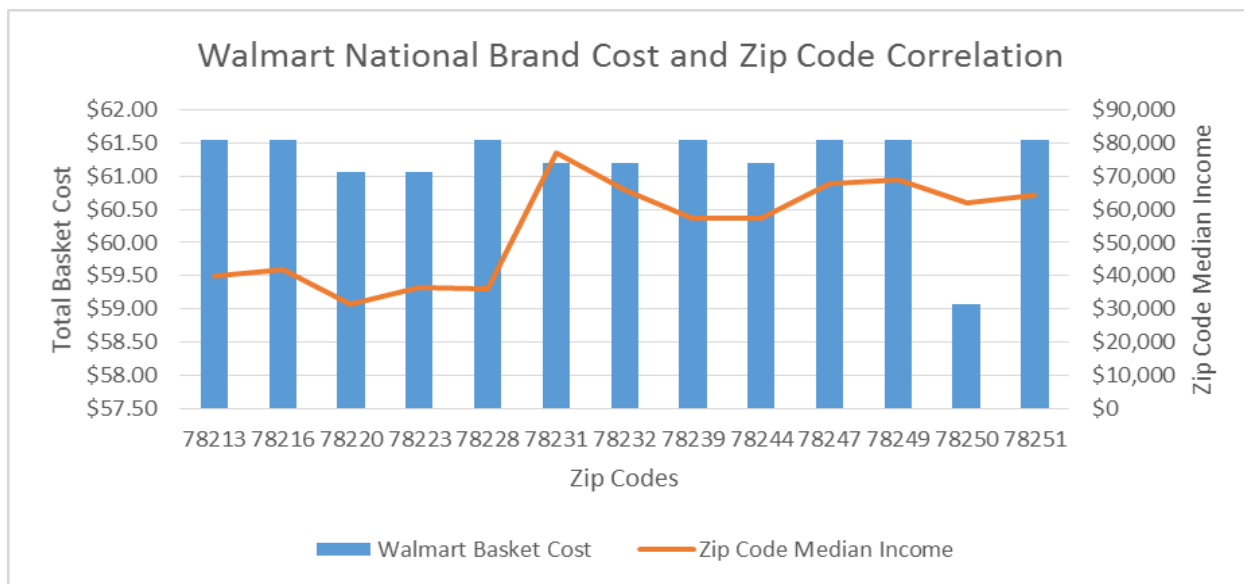


Figure 16. 12 Walmart National Brand Total Costs with Zip Code Median Income Correlations

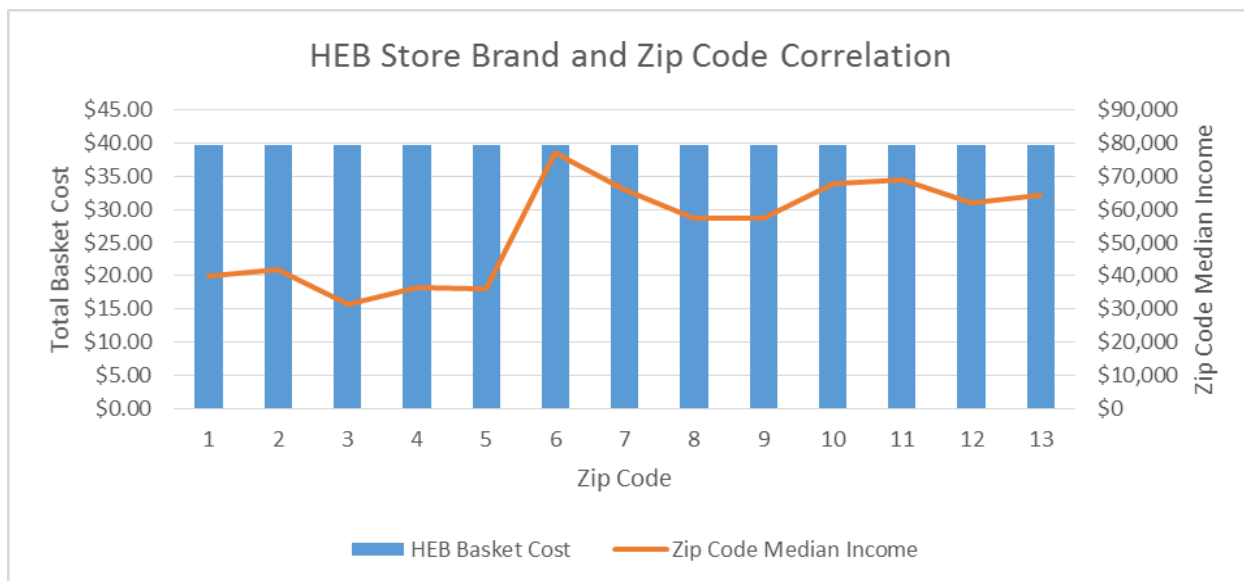


Figure 17. HEB Store Brand Total Costs with Zip Code Median Income Correlations

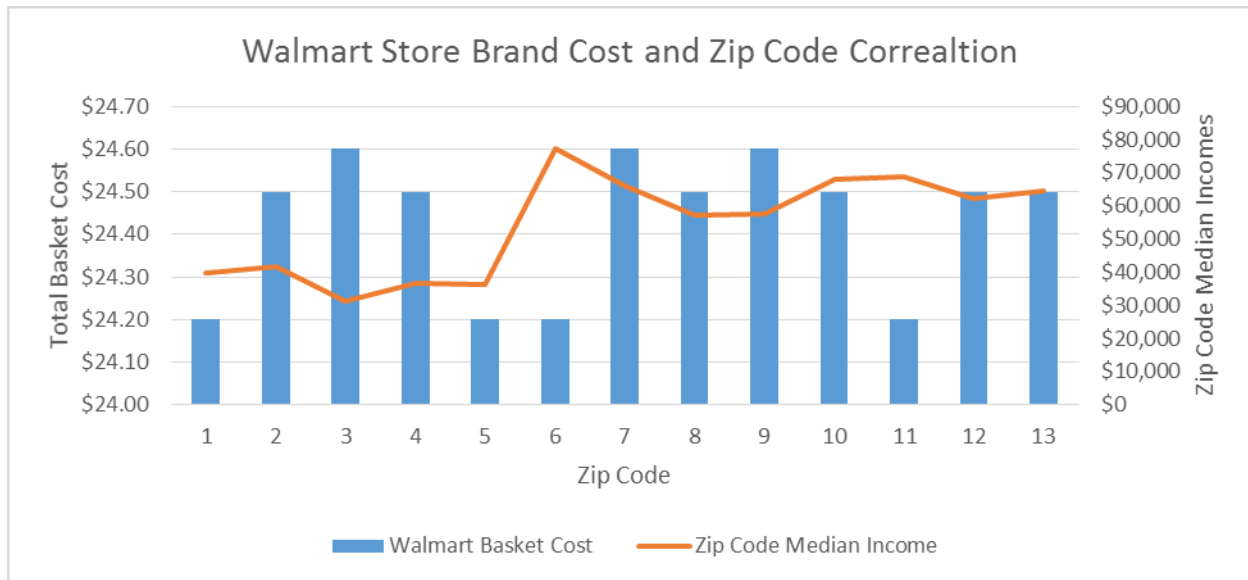


Figure 18. Walmart Store Brand Total Costs with Zip Code Median Income Correlations

There did not appear to be a statistically significant correlation between the total basket costs at HEB and Walmart, for both national brand and store brand products, and the median household incomes of the zip codes. The correlation coefficient for HEB national brand products and zip code median incomes was 0.387. The correlation coefficient for Walmart national brand product and zip code median incomes was -0.098. The correlation coefficient for HEB and Walmart store brand products and zip code median incomes was 0.0 and -0.073, respectively.

Although the largest correlation coefficient value was 0.387, with a small sample such as the one used in this study, it still did not meet that minimum value required for significance, which was 0.514 (Rogerson, 2010). Based on these results, **Proposition 2** was rejected. Prices for the selected basket of staples was not found to be positively correlated at any statistically significant level to median household incomes of zip codes, for both HEB and Walmart.

Store Mapping Results

The store locations were successfully geocoded in ArcGIS and displayed in the following maps. Both the HEB and Walmart locations appeared evenly distributed across San Antonio with minimal clustering towards the north side of the city.

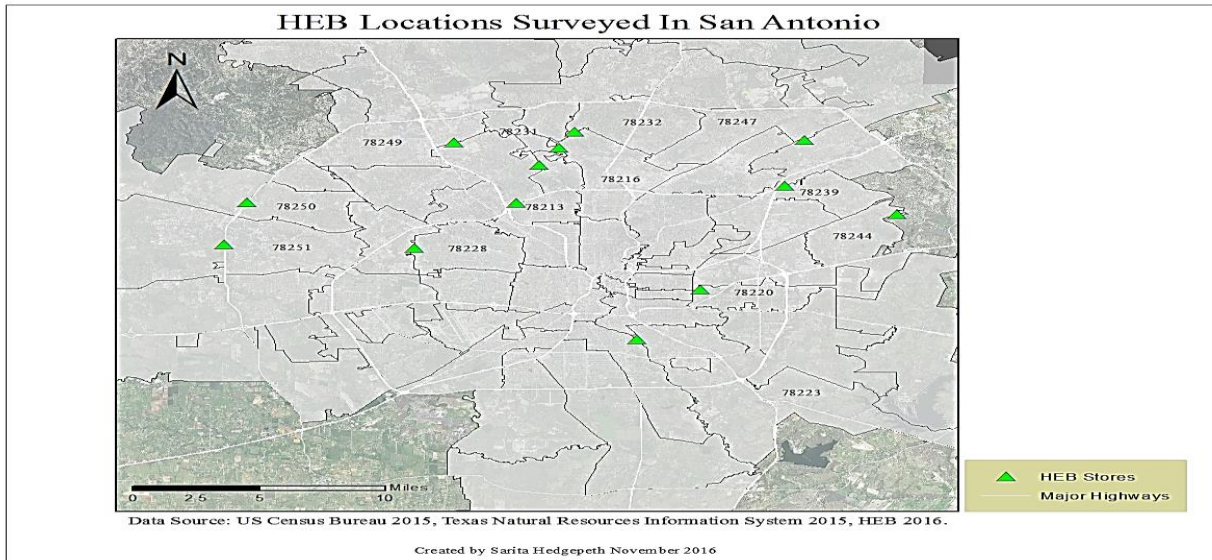


Figure 19. Geocoded HEB Study Locations in San Antonio, TX

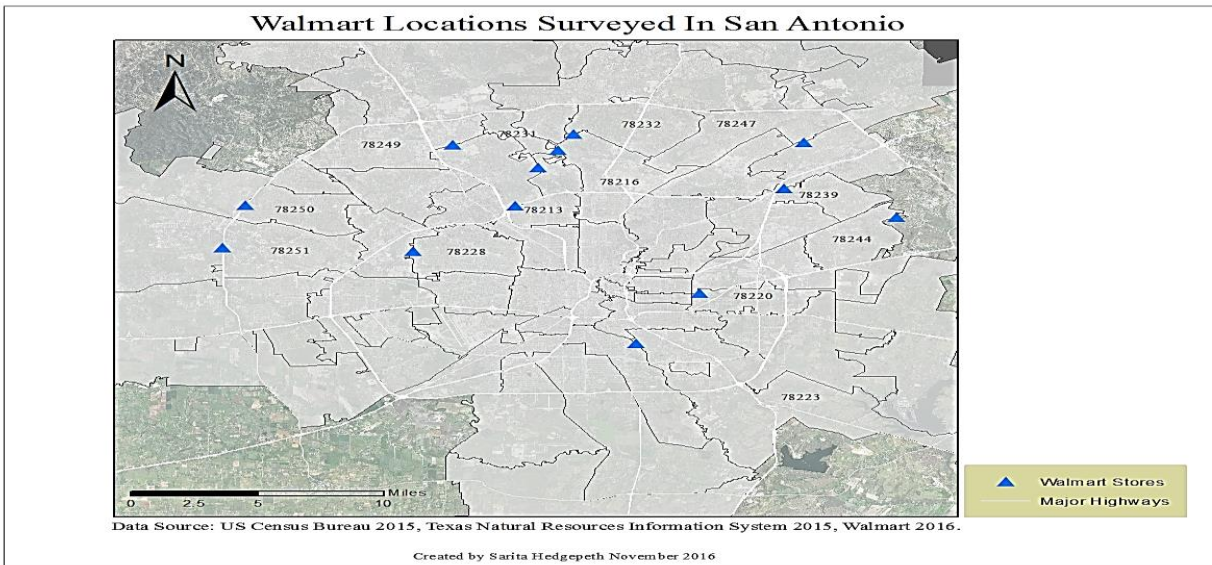


Figure 20. Geocoded Walmart Study Locations in San Antonio, TX

The following maps display the total basket costs for both store chains by zip code along with median household income values for each of the study zip codes.

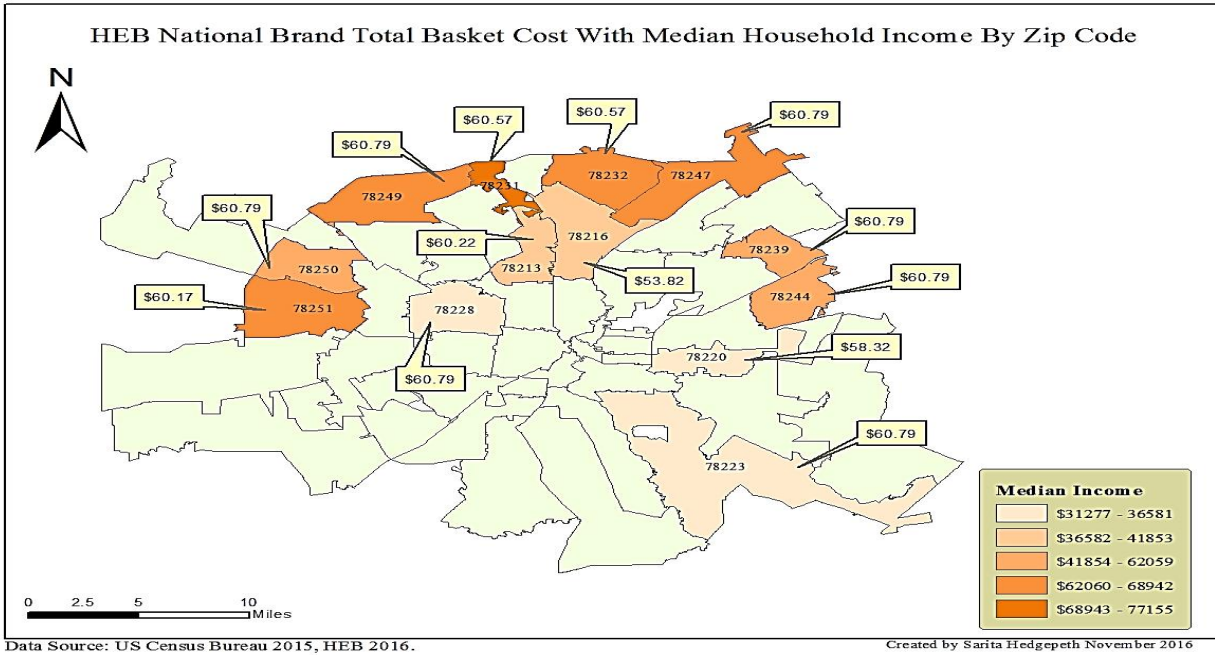


Figure 2113. HEB National Brand Total Basket Costs with Respective Median Income by Zip Code

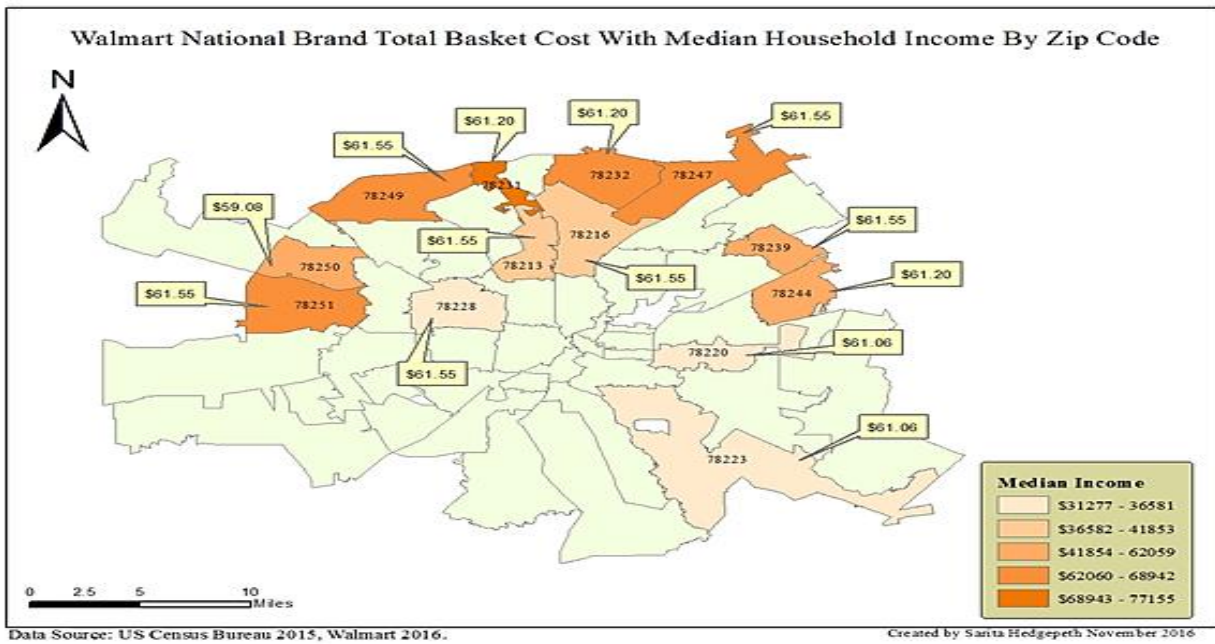


Figure 2214. Walmart National Brand Total Basket Costs with Respective Median Income by Zip Code

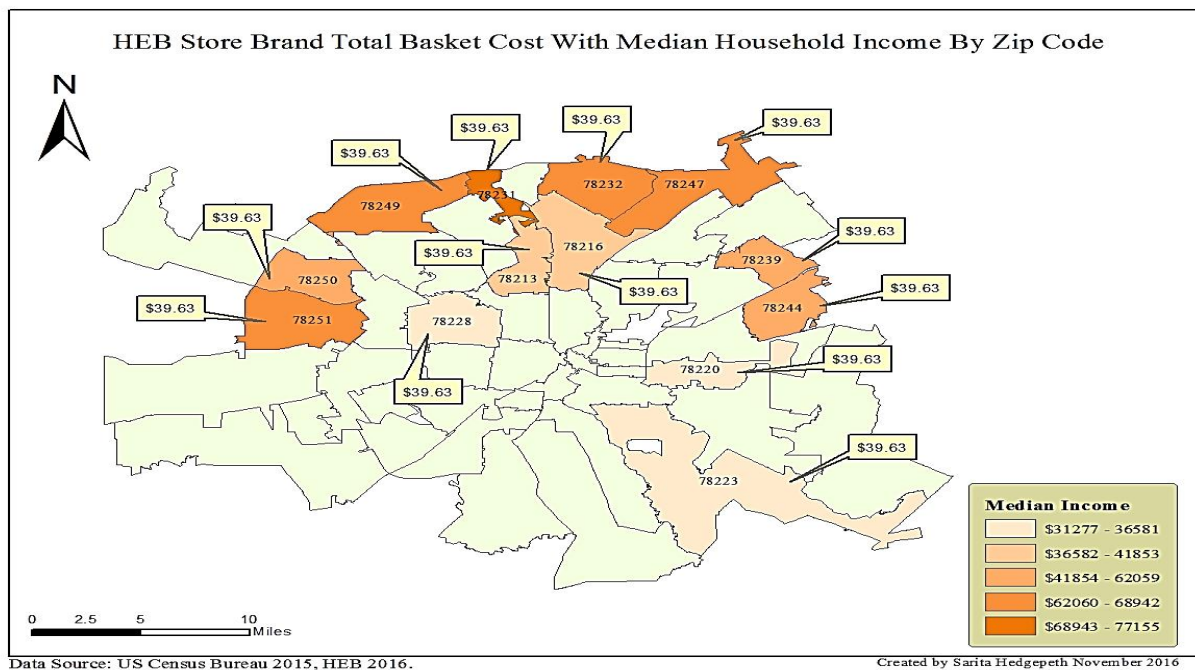


Figure 23. HEB Store Brand Total Basket Costs with Respective Median Income by Zip Code

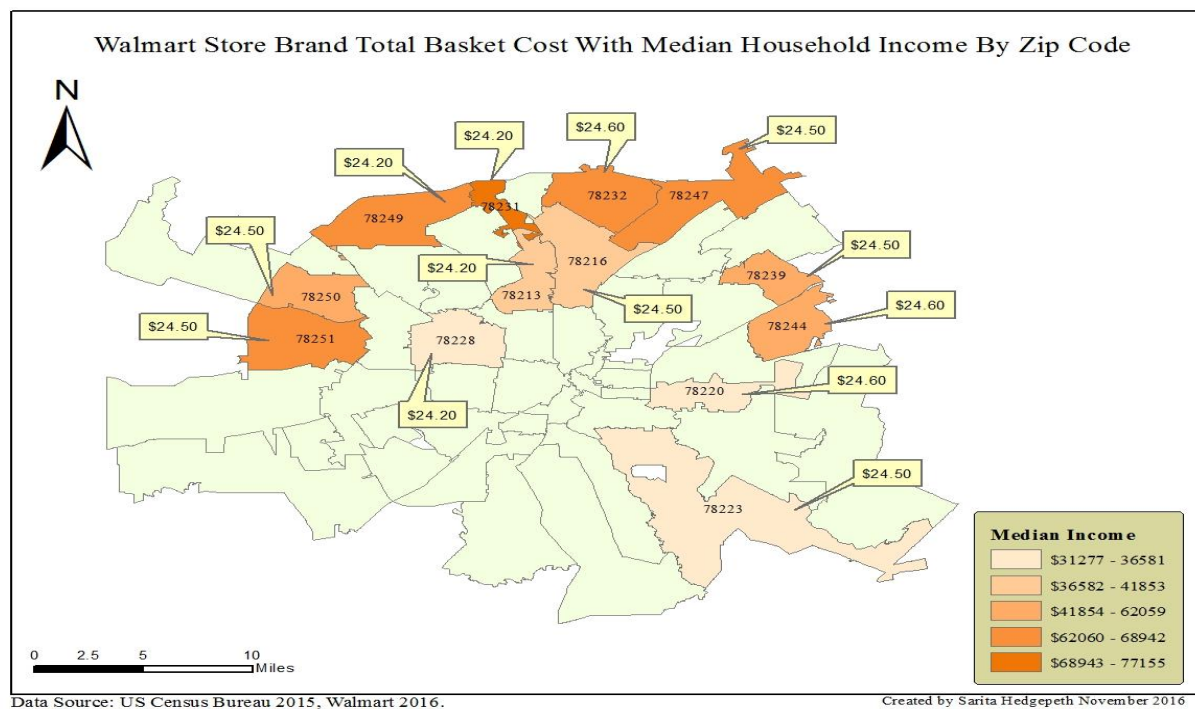


Figure 24. Walmart Store Brand Total Basket Costs with Respective Median Income by Zip Code

The use of graduated colors to represent the median household incomes, zip codes, and drag signs, for the basket costs for the stores located in the zip codes, made it easier to illustrate the price variations in a geographical framework. There did not appear to be any geographic patterns in the economic distribution of the city, nor did there appear to be a pattern to the total costs found in the stores sampled.

VI. Conclusions

This project sought to answer two questions: To what extent do prices vary for a selected basket of staples at HEB and Walmart stores in San Antonio, TX by selected zip code? If price variations do exist, to what extent might the grocery basket costs in a selected zip code positively correlate with the median household income levels of the same zip code? Based on the statistical analysis performed, I failed to reject **Proposition 1** for three of the four components stated, while rejecting the proposition for one component. Prices for the selected basket of staples at HEB and Walmart did vary, for national brand items and store brand items at Walmart. Prices for the selected basket of items did not vary at HEB for store brand items.

The results indicated that **Proposition 2** be rejected. Prices for the selected basket of staples were not found to be positively correlated at any statistically significant level to median household incomes of zip codes, for both HEB and Walmart.

Although the statistical results indicated that residents in zip codes with a lower median income did not pay more for groceries than residents in zip codes with a higher median income in an absolute sense, they did pay more in groceries in a different way—proportionally. Since prices for groceries were relatively static across the zip codes studied and the median incomes of zip codes did not positively correlate with prices charged for groceries, residents in zip codes

having lower median incomes paid more for groceries, that is, the grocery basket costs required a larger proportion of their disposable income for the same amount of groceries. For example, on average, a family of four in San Antonio spends approximately \$782 a month on groceries. For a twelve-month period, that amounts to about \$9400 for groceries. In a zip-code such as, 78220 where the median household income was \$31,227 for the year, a family of four spends approximately 30 percent of their annual income on groceries. In a zip-code such as, 78231 where the median household income was \$77,155, a family of four spends only about 12 percent of their annual income on groceries.

This study had several limitations worth noting. The first was the immense size of possible grocery items that might have been selected. It was impossible and implausible to capture all the price variations that might exist between particular items and brands. Not every brand can be examined in any given study so I sought to capture a “snapshot” by representing each category of grocery items in a reasonable manner. By choosing an item from each category, I strived to represent any variations that existed. There was also the limitation of geographic scope. While it was feasible to examine two store chains in San Antonio, there were numerous grocery chains that were available at different geographic scopes. For example, while HEB and Walmart were chosen for this study due to their prevalence in the City of San Antonio, a statewide study would require an adjustment, either the addition or substitution of another store chain, because HEB has yet to become a truly statewide grocery chain. The last limitation encountered in this study was the possible instability in zip code eligibility due to the timeframe of when the data was collected for this study. While 13 zip codes were eligible at the time of the study, that number was projected to change in the near future due to market expansion, relocation and/or reduction, on the part of both HEB and Walmart.

While this research had limitations, such as possible changes in zip code eligibility and an expansive list of items that might have been sampled, measures were enacted to counteract those limitations, such as ensuring representation for the grocery categories in order to create a “snapshot” of the variations. By implementing the three rules outlined in the methodology: 1) items that had seasonal variations in price and/or availability were excluded from the eligible items, 2) store delicatessen items were excluded from the eligible items, 3) only the regular “everyday” prices for an item was recorded, I attempted to eliminate possible situational and outside influences that might have skewed the data.

In addition to answering the previously stated research questions, this research serves as a basis for future researchers who seek to explain why price variations exist. Regardless of the geographic scope, the methodology in this study will serve as a guide toward assessing geographic price variations in the grocery retail industry. With future research, the item selection list may be expanded to encompass a wider variety of items depending upon the needs of the researcher. As Texas continues to grow, the reapplication of this study is useful in assessing price variations as the demographics and economics of state changes.

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Appendix

Table A1. Address List of the 13 HEB Store Locations Selected

ZIP Code	HEB Store Address
78213	Corporate #389 6000 West Avenue, San Antonio, TX
78216	Corporate #178 6839 San Pedro, San Antonio, TX
78220	Corporate #106 1015 South W.W. White Road, San Antonio, TX
78223	Corporate #444 3323 South East Military Drive, San Antonio, TX
78228	Corporate #189 2130 Culebra, San Antonio, TX
78231	Corporate #102 8503 Northwest Military Highway, San Antonio, TX
78232	Corporate #164 15000 San Pedro, San Antonio, TX
78239	Corporate #384 6030 Montgomery Road, San Antonio, TX
78244	Corporate #294 6580 F.M. 78, San Antonio, TX
78247	Corporate #230 14087 O'Connor Road, San Antonio, TX
78249	Corporate #623 9238 N. Loop 1604 West, San Antonio, TX
78250	Corporate #224 7951 Guilbeau Road, San Antonio, TX
78251	Corporate #494 10660 West FM 471, San Antonio, TX

Table A2. Address List of the 13 Walmart Store Locations Selected

ZIP Code	Walmart Store Address
78213	Store #5145 1603 Vance Jackson Road, San Antonio, TX
78216	Store # 2404 8500 Jones Maltsberger Road, San Antonio, TX
78220	Store #3279 2100 Southeast Loop 410, San Antonio, TX
78223	Store #5245 3302 Se Military Drive, San Antonio, TX
78228	Store #3058 918 Bandera Road, San Antonio, TX
78231	Store #4162 12639 Blanco Road, San Antonio, TX
78232	Store #1198 1515 N Loop 1604 East, San Antonio, TX
78239	Store #4661 6938 Walzem Road, San Antonio, TX
78244	Store # 3112 4096 North Foster Rd, San Antonio, TX
78247	Store # 765 16503 Nacogdoches Road, San Antonio, TX
78249	Store # 2599 5555 De Zavala Road, San Antonio, TX
78250	Store # 2835 9006 Guilbeau Road, San Antonio, TX
78251	Store # 5226 9526 West Military Drive, San Antonio, TX

Table A3. Excel National Brand Data Entry Form (First Half)

	H78213	W 78213	H 78216	W 78216	H 78220	W 78220	H 78223	W 78223	H 78228	W 78228	H 78231	W 78231	H 78232	W 78232
Tide	17.92	17.92	17.92	17.92	17.92	17.92	17.92	17.92	17.92	17.92	17.92	17.92	17.92	17.92
Quilted Northern*	6.97	6.47	NC	6.47	6.97	6.47	6.97	6.47	6.97	6.47	6.97	6.47	6.97	6.47
Palmolive*	2.47	2.47	2.47	2.47	NC	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47
Dial**	3.97	4.88	3.97	4.88	3.97	4.88	3.97	4.88	3.97	4.88	3.97	4.88	3.97	4.88
Colgate Total	2.96	2.96	2.96	2.96	2.96	2.47	2.96	2.47	2.96	2.96	2.96	2.96	2.96	2.96
Cheerios	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62
JIF	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48
Heinz	2.53	2.88	2.88	2.88	2.88	2.88	2.88	2.88	2.88	2.88	2.88	2.88	2.88	2.88
Kraft Mac & Cheese	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Kraft Shredded Cheese	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Nature's Own	2.53	2.88	2.53	2.88	2.53	2.88	2.53	2.88	2.53	2.88	2.53	2.53	2.53	2.53
Crisco	2.74	2.74	2.74	2.74	2.74	2.74	2.74	2.74	2.74	2.74	2.74	2.74	2.74	2.74
Morton Salt	0.62	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.62	0.84	0.62	0.84
Chip Ahoy	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
DiGiorno	5.47	5.47	5.47	5.47	5.47	5.47	5.47	5.47	5.47	5.47	5.47	5.47	5.47	5.47
Campbell's Soup	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Grocery Basket Total (US Dollars)	60.22	61.55	53.82	61.55	58.32	61.06	60.79	61.06	60.79	61.55	60.57	61.20	60.57	61.20

Table A4. Excel National Brand Data Entry Form (Second Half)

	H 78239	W 78239	H 78244	W 78244	H 78247	W 78247	H 78249	W 78249	H 78250	W 78250	H 78251	W 78251
Tide	17.92	17.92	17.92	17.92	17.92	17.92	17.92	17.92	17.92	17.92	17.92	17.92
Quilted Northern*	6.97	6.47	6.97	6.47	6.97	6.47	6.97	6.47	6.97	6.47	6.97	6.47
Palmolive*	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	NC	2.47	2.47
Dial**	3.97	4.88	3.97	4.88	3.97	4.88	3.97	4.88	3.97	4.88	3.97	4.88
Colgate Total	2.96	2.96	2.96	2.96	2.96	2.96	2.96	2.96	2.96	2.96	2.96	2.96
Cheerios	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62	2.62
JIF	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.43	2.48
Heinz	2.88	2.88	2.88	2.88	2.88	2.88	2.88	2.88	2.88	2.88	2.53	2.88
Kraft Mac & Cheese	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Kraft Shredded Cheese	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Nature's Own	2.53	2.88	2.53	2.53	2.53	2.88	2.53	2.88	2.53	2.88	2.53	2.88
Crisco	2.74	2.74	2.74	2.74	2.74	2.74	2.74	2.74	2.74	2.74	2.74	2.74
Morton Salt	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.62	0.84
Chip Ahoy	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
DiGiorno	5.47	5.47	5.47	5.47	5.47	5.47	5.47	5.47	5.47	5.47	5.47	5.47
Campbell's Soup	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Grocery Basket Total (US Dollars)	60.79	61.55	60.79	61.20	60.79	61.55	60.79	61.55	60.79	59.08	60.17	61.55

Table A5. Excel Store Brand Data Entry Form (First Half)

	H78213	W 78213	H 78216	W 78216	H 78220	W 78220	H 78223	W 78223	H 78228	W 78228	H 78231	W 78231	H 78232	W 78232
Laundry Detergent	11.98	-	11.98	-	11.98	-	11.98	-	11.98	-	11.98	-	11.98	-
Toilet Paper	7.67	6.23	7.67	6.23	7.67	6.23	7.67	6.23	7.67	6.23	7.67	6.23	7.67	6.23
Dish Detergent	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97
Bath Bar Soap	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Toothpaste	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Honey Nut Cereal	1.98	2.93	1.98	2.93	1.98	2.93	1.98	2.93	1.98	2.93	1.98	2.93	1.98	2.93
Peanut Butter	2.37	2.18	2.37	2.18	2.37	2.18	2.37	2.18	2.37	2.18	2.37	2.18	2.37	2.18
Ketchup	2.19	0.86	2.19	0.86	2.19	0.86	2.19	0.86	2.19	0.86	2.19	0.86	2.19	0.86
Mac & Cheese	0.62	0.75	0.62	0.75	0.62	0.75	0.62	0.75	0.62	0.75	0.62	0.75	0.62	0.75
Shredded Cheddar Cheese	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22
Whole Wheat Bread	1.88	1.48	1.88	1.78	1.88	1.78	1.88	1.78	1.88	1.48	1.88	1.48	1.88	1.78
Vegetable Oil	-	2.28	-	2.28	-	2.38	-	2.28	-	2.28	-	2.28	-	2.38
Iodized Salt	0.50	0.54	0.50	0.54	0.50	0.54	0.50	0.54	0.50	0.54	0.50	0.54	0.50	0.54
Chocolate Chip Cookies	2.00	1.98	2.00	1.98	2.00	1.98	2.00	1.98	2.00	1.98	2.00	1.98	2.00	1.98
Frozen Pepperoni Pizza	4.25	-	4.25	-	4.25	-	4.25	-	4.25	-	4.25	-	4.25	-
Chicken Noodle Soup	-	0.78	-	0.78	-	0.78	-	0.78	-	0.78	-	0.78	-	0.78
Grocery Basket Total (US Dollars)	39.63	24.20	39.63	24.50	39.63	24.60	39.63	24.50	39.63	24.20	39.63	24.20	39.63	24.60

Table A6. Excel Store Brand Data Entry Form (Second Half)

	H 78239	W 78239	H 78244	W 78244	H 78247	W 78247	H 78249	W 78249	H 78250	W 78250	H 78251	W 78251
Laundry Detergent	11.98	-	11.98	-	11.98	-	11.98	-	11.98	-	11.98	-
Toilet Paper	7.67	6.23	7.67	6.23	7.67	6.23	7.67	6.23	7.67	6.23	7.67	6.23
Dish Detergent	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97
Bath Bar Soap	-	-	-	-	-	-	-	-	-	-	-	-
Toothpaste	-	-	-	-	-	-	-	-	-	-	-	-
Honey Nut Cereal	1.98	2.93	1.98	2.93	1.98	2.93	1.98	2.93	1.98	2.93	1.98	2.93
Peanut Butter	2.37	2.18	2.37	2.18	2.37	2.18	2.37	2.18	2.37	2.18	2.37	2.18
Ketchup	2.19	0.86	2.19	0.86	2.19	0.86	2.19	0.86	2.19	0.86	2.19	0.86
Mac & Cheese	0.62	0.75	0.62	0.75	0.62	0.75	0.62	0.75	0.62	0.75	0.62	0.75
Shredded Cheddar Cheese	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22
Whole Wheat Bread	1.88	1.78	1.88	1.78	1.88	1.78	1.88	1.48	1.88	1.78	1.88	1.78
Vegetable Oil	-	2.28	-	2.38	-	2.28	-	2.28	-	2.28	-	2.28
Iodized Salt	0.50	0.54	0.50	0.54	0.50	0.54	0.50	0.54	0.50	0.54	0.50	0.54
Chocolate Chip Cookies	2.00	1.98	2.00	1.98	2.00	1.98	2.00	1.98	2.00	1.98	2.00	1.98
Frozen Pepperoni Pizza	4.25	-	4.25	-	4.25	-	4.25	-	4.25	-	4.25	-
Chicken Noodle Soup	-	0.78	-	0.78	-	0.78	-	0.78	-	0.78	-	0.78
Grocery Basket Total (US Dollars)	39.63	24.50	39.63	24.60	39.63	24.50	39.63	24.20	39.63	24.50	39.63	24.50