# ANALYSIS OF TRENDS AND DEMAND FOR SUPER-PREMIUM FRUIT AND VEGETABLE BEVERAGES

A Thesis

by

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## ABSTRACT

Super-premium beverages are a fast-emerging product subcategory. While often promoted for its nutritional properties, this subcategory does not conform to the definitions of 100% juices and juice drinks used for providing dietary guidance to consumers. Therefore, it can be difficult for consumers to apply the recommendations from the dietary guidelines and existing research findings to the super-premium subcategory. In light of this context and the lack of existing research related to super-premium beverages, understanding the market and demand for this particular subcategory is timely and relevant.

This study uses retail-level scanner data from 2007-2012 to analyze retail sales and pricing trends and demand for super-premium beverages as well as 100% fruit juices, fruit drinks, and vegetable juices. Results from this research indicate that total sales of super-premium beverages more than doubled between 2007 and 2012, with approximately 16% average annual growth, far outpacing the other subcategories included in the study. This high growth happened, despite the fact that these super-premium products have much higher prices compared to other juice and juice drink subcategories, reflecting consumers' willingness to pay for its differentiated characteristics. Demand estimation is conducted with the Quadratic Almost Ideal Demand System (QUAIDS) model of Banks, Blundell, and Lewbel (1997) and used to calculate elasticity values. Super-premium beverages were found to be considerably more responsive to changes in own price compared to other subcategories.

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# CHAPTER I

## INTRODUCTION

Healthy diets high in fruits and vegetables are widely recommended for their role in preventing several chronic diseases, including heart disease, obesity, cancer, and diabetes (USDA and DHHS, 2010). Levels of obesity and overweight have reached epidemic levels in the United States. Current estimates are that more than two thirds of American adults and close to one third of youth are either overweight or obese (Ogden et al. 2014). Obesity is, in turn, correlated to serious health concerns, including cardiovascular disease and diabetes (Must et al. 1999). In response to this context, the *2010 Dietary Guidelines for Americans* recommend increasing the consumption of nutrient-dense foods, such as fruits and vegetables, and decreasing energy intake from solid fats and added sugars that are currently consumed in excess. Despite this guidance, over 80% of Americans consume below recommended amounts of fruits and vegetables (Krebs-Smith, Guenther, Subar, Kirkpatrick, and Dodd, 2010), on average meeting only 42% and 59% of their fruit and vegetable target levels, respectively (USDA and DHHS, 2010).

Many individuals consume fruit and vegetable juices and drinks to meet a portion of their recommended daily servings, but there are challenges associated with this solution, especially in the case of fruit drinks, which contain added sugar. Added sugars contribute an average of 16% of total energy to American diets (USDA and DHHS, 2010). Nearly half of these levels are from sugar-sweetened beverages alone. Energy intake from sweetened beverages, such as soda and fruit drinks, is shown to have

increased by 135% from 1977 to 2001 (Nielsen and Popkin 2004), which is the result of consuming larger portions and more servings per day (Nielsen and Popkin 2004). Consumption of fruit juices, by contrast, has decreased in recent years (Wong 2013).

Misperceptions likely exist over the differences between fruit drinks, which generally contain 10% fruit juice or less and have approximately the same amount of sugar as sodas (Harris et al. 2014); other sugar-sweetened beverages; and 100% fruit and vegetable juices. In a recent study published in Public Health Nutrition assessing potential misperceptions on the part of parents when providing their children beverages, 30% of survey respondents indicated they considered fruit drinks to be healthy, whereas fewer than 10% felt that soda and sport drinks were healthy, despite the fact that fruit drinks on average do not contain much less sugar than sodas and far more than sport drinks (Munsell et al., 2015).

The 2010 Dietary Guidelines make a clear distinction between the 100% fruit juice and fruit drink subcategories, where 100% juices include only naturally occurring sugars. The guidelines indicate that consumption of fruit drinks should be minimized and they provide instruction on how to determine from a product's label whether or not a product contains 100% juice. While the body's reactions to naturally occurring sugars and added sugars may be no different, foods with added sugars often contribute to diets higher in calories, but do not add proportionate or sufficient value in terms of nutrient intake. Additional research has connected the consumption of sugar-sweetened beverages, including fruit drinks, with weight gain and incidence of type 2 diabetes and

discouraged their consumption in conclusion (Malik, Schulze, and Hu 2006, Shulze et al. 2004).

In contrast, 100% fruit and vegetable juices are noted in the guidelines as a suitable source of fruits and vegetables. At the same time, the guidelines note their lack of fiber content and potential contribution to a higher calorie diet. As such, they recommend that whole fruits and vegetables constitute the majority of those servings with more limited contributions from 100% juice. Several studies on the health impacts of juice consumption have indicated that consumption of 100% juices is not related to weight gain and the risk of obesity. They, too, recommend consuming 100% juice in moderation and as a replacement for sugar-sweetened beverages, given 100% juice's key nutrient contents, such as vitamin C and potassium that are under-consumed in the United States (Rampersaud and Valim 2015, Pereira and Fulgoni III 2010). Other research has indicated a positive relationship between 100% juice consumption and weight gain in certain cases (Dennison et al. 1999).

In economic terms, a substantial amount of research has been conducted to analyze the variables influencing demand for fruit juices and drinks, along with other beverage categories. These studies have revealed mixed results about how fruit drinks and juices respond to changes in their own prices, both appearing elastic in some cases (Zhen et al. 2011, Zhen et al. 2014), while in others, either juices (Okrent and MacEwan 2014) or fruit drinks (Dharmasena and Capps 2012) appear as inelastic. Some of this same literature also provides insights into the interrelationships betwen these two subcategories as well as their relationships with other beverage and non-beverage

products (Finkelstein et al. 2012). A number of them observe fruit drinks and juices to be substitutes (Zhen et al. 2011, Dharmasena and Capps 2012, Lin et al. 2011), where an increase in the price of fruit drinks would lead to a decrease in their consumption and an increase in the consumption of juices. Although this result may seem reasonable and intuitive, not all studies are consistent with this finding (Zhen et al. 2014). Given some of the mixed findings to date, additional contributions to the economic analysis of these product groups would be valuable, particularly with the use of the most up to date data available.

While a robust set of research exists on the overall juice and juice drink category (Okrent and MacEwan 2014; Zhen et al. 2011; Zhen et al. 2014; Finkelstein et al. 2012; Lin et al. 2011; Smith 2010; Dharmasena and Capps 2012), there is a new, fast-emerging subcategory within this market of so-called super-premium[1] fruit and vegetable juices and drinks, for which there is a gap in the existing research. These super-premium beverages[2] have several characteristics that set them apart from the other products in the juice and juice drink category. They are generally found refrigerated and often in the produce section when sold in supermarkets; are promoted for their health and nutrition-related properties; consist of new ingredients (relative to traditional juice flavors of orange, apple, cranberry, etc.) and appearances (i.e., in terms of packaging, color) as well as a wide variety of flavors; and are usually characterized by higher prices.

[1] While there is no one, single definition for "super-premium", this term is used widely by the beverage industry.
[2] Hereafter referred to as "super-premium juices" or "super-premium beverages", though we acknowledge the fact that the subcategory consists of a mix of 100% juices and products with lesser amounts of juice, such as "juice smoothies."

The health and nutritional properties that companies in the super-premium subcategory market their products for include the number of servings of fruits and vegetables they contain, levels of fiber and vitamins,[3] and antioxidant levels from so-called "super fruit" ingredients like pomegranate, acai, goji berry and blueberry.[4] Several of the super-premium brands have been acquired recently by large food and beverage companies that have substantial advertising, manufacturing and distribution resources, thus increasing their ability to market these health properties and sell these products to consumers. These same companies have been experiencing slowing or declining sales of their other, larger beverage categories, such as soda (Esterl 2015), and are incentivized to increase sales in alternative, healthier categories to compensate.

While super-premium beverages are marketed for their health properties, they do not uniformly fit within the definitional parameters of being either 100% juices or fruit drinks that are often used in beverage-related research or the dietary guidelines. Some of the super-premium products contain 100% juice without added sugar, while others contain somewhat lower percentages of juice and have added ingredients. Therefore, it can be difficult for consumers to apply the recommendations from the dietary guidelines and existing research findings to the super-premium subcategory.

In view of these dietary considerations, it is important to have an understanding of the consumption trends and characteristics related to these beverages. Such analysis

[3] In addition to reviewing industry and analyst articles stating this, nutritional claims on websites of more than 20 companies and packaging of over 100 products were reviewed as part of the research for this paper.

[4] Antioxidants, along with fruits and vegetables, have been shown to potentially reduce rates of cardiovascular disease and cancer (Genkinger et al. 2004).

enables us to determine how significant of a subcategory super-premium juices are relative to the overall juice and juice drink market and whether it is growing in popularity. Analysis of prices, specifically, provides an indication of consumer willingness to pay for the qualities that differentiate these products. Evaluating responsiveness of the market to changes in price as well as of the interrelationships of super-premium juice purchases with those of other beverages provides a more complete picture of the market.

Given the above, this research aims to contribute to the literature in two primary ways. First, it provides a detailed trend analysis of estimated retail dollar sales, sales volume and retail price for: super-premium juices and drinks; 100% fruit juices; fruit drinks; and vegetable juices and drinks using data from 2007 through 2012. While particularly focused on understanding the market for super-premium juices, this trend analysis adds to an up-to-date understanding of the overall retail, ready-to-drink fruit and vegetable juice and drink market. Differences are evaluated across geographic regions and distribution channel to better understand where consumers are purchasing these products and the patterns of relative rates of growth or decline in sales. Second, a contribution is made to the literature through the estimation of a demand model and analysis of the super-premium subcategory's responsiveness to changes in its own-price as well as its relationships with other subcategories, namely 100% fruit juices, fruit drinks and vegetable juices and drinks, evaluated through cross-price elasticity values.

The overall consumption of higher-end juices and juice drinks includes super-premium products sold at retail outlets as well as freshly-pressed juices sold at juice and

smoothie bars and those prepared at home by individuals using fresh fruits and vegetables. Collectively, this substantially larger set of products are part of a popular trend of “juicing”, which people are engaged in to enjoy the health benefits of fruits and vegetables in a more efficient manner that accommodates busy lifestyles (Blumenthal 2012). This research contributes to the specific understanding of the ready-to-drink, pasteurized retail segment of this larger market for juicing.

# CHAPTER II

# DATA AND METHODOLOGY

## 2.1 Data

Data for this research were obtained from three sources: Nielsen Inc.'s retail scanner data for the period of January 2007 through December 2012; the USDA Economic Research Service Rural-Urban Continuum Codes; and the U.S. Census Bureau's American Community Survey. The Nielsen data consist of weekly price and quantity information for individual products, identified by a Universal Product Code (UPC) from point-of-sales systems of participating retail stores. The data are from more than 35,000 stores on a national basis. Participating stores are classified by channel - as convenience, drug, food (i.e., grocery, supermarket), liquor, or mass merchandiser. The USDA Rural-Urban Continuum Codes data classifies counties as either metropolitan or nonmetropolitan based on population size and degree of urbanization. These designations were used to evaluate the influence of metro versus non-metro areas on the demand for beverages.

From the third data source, the American Community Survey (ACS), several socio-economic and demographic variables were included in the demand estimation, including median income, average household size, and education attainment. The ACS is conducted annually by the U.S. Census Bureau to provide up-to-date population information at the community level in between publications of the decennial census. Approximately 3.5 million housing units are selected annually for the ACS, across every county in the nation. The 2012 data set and the five-year estimates that are provided as

part of it were used. The five year estimates are based on the largest sample size and the highest level of coverage across counties and therefore, offer the highest level of precision. Both the USDA ERS and U.S. Census Bureau datasets were merged to the Nielsen dataset by state and county FIPS codes.

The Nielsen dataset was used as the primary source of data, allowing us to extract and analyze price and quantity information by product subcategory at the county and individual store levels. It is an appropriate source in support of the research objectives for several reasons. First, it is highly comprehensive in terms of capturing national retail sales across store channel type relevant to this study's target product category and in so doing, provides a large, representative sample. Second, data were available for the period 2007-2012. This time frame corresponds to a period when juicing became increasingly popular and beverage companies responded to changing consumer tastes by providing healthier options and new flavors at the retail level. This set of years also captures a substantial window of the entire time these new super-premium products have been sold in the marketplace to date.

Data were extracted from the Nielsen product group defined as "juice, drinks-canned, bottled." From this group, data were separated into four subsets: super-premium juice and drinks; 100% fruit juice; fruit drinks; and vegetable juice and drinks. This set of products was used, given this study's objective to examine specifically super-premium juices and their relation to other ready-to-drink juices and juice drinks.[5]

[5] A broader set of beverages, such as carbonated soft drinks, sport drinks, bottled waters or coffees, was not included in this study and was left as a topic for future studies.

A few important notes must be made regarding the organization of the four subcategories. First, while many studies have compared fruit drinks to either fruit juices or all juices (Dharmasena and Capps 2012, Finkelstein et al. 2012, Lin et al. 2011, Zhen et al. 2011, Zhen et al. 2014), this study separates out vegetable juices and drinks. Observing this subcategory independently is useful in this case, because vegetable juices and drinks are also marketed for their health and nutritional properties. Therefore, it serves as an insightful comparison group to super-premium juices and drinks. Second, cranberry fruit drinks and juices were reported jointly by Nielsen. Based on the assumption that the majority of sales of cranberry-based beverages have less than 100% juice, all products classified as cranberry were included as fruit drinks. Third, ciders were all assumed to be 100% juice, but "fruit juice nectars" were included under fruit drinks, given that nectars can include added ingredients like sweeteners and this research attempts to separate out fruit drink products that are not 100% juice.

When extracting the data set for super-premium beverages, brands were identified and selected where their products matched this study's definition of the subcategory. To be included, products had to have the following characteristics: ready-to-drink, refrigerated, pasteurized, generally sold in the produce section of super markets, sold at a higher price point, containing non-traditional ingredients, and promoted for health and nutritional properties. To make these selections, a combination of more than 30 company websites, hundreds of unique products, and multiple online grocery stores were reviewed as well as industry information sources that recognized

"super-premium" as a subcategory in the juice market (e.g., BevNET.com[6]). It should be recognized that variations on this definition could be used for the subcategory, which may affect the selection of brands. Therefore, it is important to view the results of this research in light of the aforementioned definition and process.

Several brands that were identified as belonging to this subcategory did not appear in the Nielsen dataset. Through review of websites and industry articles, it was determined that several of these instances were the result of those brands not yet being available on the market within the 2007-2012 timeframe covered by the data set used; it appears several new brands emerged in 2013 and 2014. In addition, private label products are not associated with specific brands in the Nielsen dataset in order to protect the proprietary sales information of such companies and their stores. It is, therefore, possible that such products that otherwise would have been included as super-premium were included instead in one of the other three subcategories.

The Nielsen codes associated with the selected super-premium brands were then used to identify the Universal Product Codes that corresponded to their products. This, in turn, allowed the relevant observations with price and quantity information to be extracted to form a complete data set for the super-premium subcategory. All Nielsen product modules within the "juice, drinks-canned, bottled" product group were searched in this process, given the wide variety of super-premium flavors and product types, though for certain product modules within this group there were no observations

[6]As stated on the BevNET.com website, as of May 2015: "the BevNET.com web site reviews non-alcoholic, ready-to-drink beverages and provides comprehensive, up-to-the-minute information about the beverage industry. It has the highest traffic and most content of any web site dedicated to the non-alcoholic beverage industry and has been online since 1996."

corresponding to super-premium products. All products for the selected brands under the "juice, drinks-canned, bottled" product group were included in the super-premium dataset. All super-premium-related observations were then removed from the other data sets, so that each of the four subcategories and their corresponding data were mutually exclusive of one another. Coffee, tea or bottled water products from the same brands used to identify super-premium juices or juice drinks, but coded under a separate Nielsen product group, were not included in the study sample.

With the separate data files in place containing price and quantity information for each of the four subcategories, total dollar sales and volume of sales were calculated at the individual store level for each week represented in the 2007-2012 data. Dollar sales per store per week were calculated by the following formula:

*Price per unit[7] (price/Nielsen's price multiplier) * Number of units sold*

where the "price multiplier" is a variable included by Nielsen that indicates where a price is associated with a store promotion of multiple items for a single price (e.g., 2 for $4). Sales volumes per store per week were calculated by the following formula:

*Number of units sold * Number of units in a multipack, if relevant **

[7] Within the Nielsen dataset, "units" refers to the number of individual item sold as opposed to a unit of measurement, whereas the variable "size1_units" refers to the unit of measure and "size1_amounts" refers to the quantity of that unit of measure.

*Numeric quantity of the good's unit of measure per individual unit (i.e., the number of ounces in a particular container sold)*

Dollar sales and sales volumes were then aggregated per individual store on a quarterly basis (1 quarter = 13 weeks[8]), with January-March comprising quarter one for each of the six years. These quarterly data were used in order to capture the effect of seasonality on demand. Weighted, average prices per ounce were then calculated by dividing total sales in dollars by total volume in ounces. Dollar per ounce prices were used for all analysis, including the demand estimation, in order to standardize prices for comparison purposes. Similar calculations of weighted, average prices were used in conducting annual trend analysis.

All current nominal prices were converted to real values, in order to account for adjustments to the purchasing power of the dollar and to remove the effect of general price level changes across time periods. December 2012 was used as the reference period and monthly index values of the United States Bureau of Labor Statistics Consumer Price Index were used to adjust the nominal prices. The following formula was used to make these calculations:

*Real price = Nominal price * (Base period CPI-U / Current period CPI-U)*

[8] Within the dataset, 53 weeks fall within 2011, as opposed to 52, which is the case for each of the other five years. The additional week appears in the final month of the 2011 data. This results from the particular day on which 2011 ended and 2012 being a leap year. To address this additional week and avoid misinterpretation from the results, the data for the final month of 2011 were scaled to be equivalent to a 4-week month.

These adjustments were applied to total dollar sales figures and therefore, all dollar-based figures presented in the results section are in real terms.

In order to evaluate percentage changes in sales from year to year within a region for the trend analysis and differences in mean prices within and across regions for Appendix B, regional variables were established based on the Census Bureau's nine divisions, namely Northeast, Mid Atlantic, South Atlantic, East South Central, West South Central, East North Central, West North Central, Mountain and Pacific. The data then were merged to the USDA ERS Rural-Urban Continuum Codes and the selected variables from the Census Bureau's American Community Survey from 2012. Finally, two additional variables, volume per item sold and price per item sold, were calculated by dividing volume and dollar sales by total number of units, respectively, and used for the trend analysis and the pricing analysis featured in Appendix B.

The final sample used for this analysis is in the form of pooled cross-sectional data and consists of 824,064 quarterly store-level observations, with 38,880 unique stores in 2,566 counties for the period of 2007 through 2012. Therefore, there could be an observation for the same store in each of the quarters for each of the years, if that store remained in the sample. About 6% of stores in the sample were convenience stores, 35% drug stores, 28% food (or grocery) stores, 1% liquor, and 30% were mass merchandiser stores.

For purposes of the trend analysis, projections of total national sales were calculated and used (unless specific otherwise as regionally-based figures in Chapter III and Appendix B below) in order to provide as complete a representation as possible of

the U.S. market for ready-to-drink juice and juice drink products[9]. To make these calculations, total sales from the sample were aggregated across stores by year and by subcategory. Then, the total annual sales values from the sample were weighted, based on the approximate "percent of stores selling" figures that were provided by Nielsen for each channel. The resulting weighted sales figures were used to represent total, national-level projections. Corresponding mean market share, annual growth and price figures are also based on these national level projections. These same weights were not applied to the data used for the demand estimation.

In terms of terminology, the more general term "dollar sales" is used throughout the trend analysis in Chapter III below, as it is best describes the total value of sales in dollar terms for a given subcategory, time period, or other subset of the data. By contrast, in describing the demand model and demand estimation results, the more specific terms "expenditure share" (of a particular subcategory) and "total expenditure" are used, which also relate to total dollar sales. The term "volume of sales" is used to refer to the standardized level of purchases in terms of number of ounces.

### 2.2 Demand Model

The Quadratic Almost Ideal Demand System (QUAIDS) model of Banks, Blundell, and Lewbel (1997) is estimated, specified as follows:

[9] The Nielsen dataset used does not include Wal-Mart sales. Figures should be evaluated with this understanding.

$$w_{it} = \alpha_i + \sum_j \gamma_{ij} \ln p_{jt} + \beta_i \ln\left(\frac{x_t}{\alpha(p)}\right) + \frac{\lambda_i}{b(p)}\left\{\ln\left[\frac{x_t}{a(p)}\right]\right\}^2 + e_{it}$$

where $i$ = 1, 2, 3, 4 indexes the four subcategories, $t$ = 1,2, . ., 24 corresponds to the data periods (four quarters per each of the six years), $p_{jt}$ is the price of the $j^{th}$ subcategory for period $t$, $x_t$ is the total expenditure, $w_{it}$ (= ($p_{it} * q_{it}$) / $x_t$) is the budget shares of subcategory $i$ in period $t$, $p$ is the Translog price index given by:

$$\ln \alpha(p) = \alpha_0 + \sum_i \alpha_i \ln p_{it} + \frac{1}{2}\sum_i \sum_j \gamma_{ij} \ln p_{it} \ln p_{jt}$$

The Cobb-Douglas price aggregation is defined as:

$$b(p) = \prod_{i=1}^{n} p_i^{\beta_i}$$

and

$$\lambda(p) = \sum_{i=1}^{n} \lambda_i lnp_i, \text{ where } \sum_i \lambda_i = 0$$

The error term is denoted by $e_{it}$.

The following restrictions are imposed in estimation of the constrained model:

$\sum_{i=1}^{n} \alpha_i = 1$, $\sum_{ji}^{n} \gamma_{ij} = 0$, $\sum_i \lambda_i = 0$ and $\sum_{i=1}^{n} \beta_i = 0$ for adding up,

$\sum_j^n \gamma_{ij} = 0$ for homogeneity, and

$\gamma_{ij} = \gamma_{ji}$, $\forall\, i \neq j$ , for symmetry.

The own-price and cross-price uncompensated (Marshallian) elasticities were calculated using:

$$\epsilon_{ij}^{M} = \frac{\gamma_{ij} - \mu_i(\alpha_j + \sum_k \gamma_{jk} lnp_{kt}) - \frac{\lambda_i \beta_j}{b(p)}\left\{ln\left[\frac{x_t}{a(p)}\right]\right\}^2}{w_{it}} - \delta_{ij}$$

with $\delta_{ij} = 1$ if $i = j$ (own-price elasticity) and $\delta_{ij} = 0$ if $i \neq j$ (cross-price elasticity).

The expenditure (or income) elasticity was calculated using

$$e_i = \frac{\mu_i}{w_{it}} + 1, \qquad \text{where} \quad \mu_i = \beta_i + \frac{2\lambda_i}{b(p)}\left\{ln\left[\frac{x_t}{a(p)}\right]\right\}.$$

Compensated price elasticities are calculated from the Slutsky equation:

$$\epsilon_{ij}^{C} = \epsilon_{ij}^{M} + e_i w_{jt.}$$

# CHAPTER III

## DESCRIPTIVE TRENDS ANALYSIS

From this study's analysis of trends of total sales, shares of sales and volume, and prices (see also Appendix B for additional analysis on prices), we observe considerable differences across and within the four beverage subcategories. Super-premium juices and drinks particularly stand out. They represent a fast-growing share of the overall market, albeit a relatively small one. Super-premium annual growth rates, in both dollar and volume terms, were considerably higher than the other three subcategories (100% fruit juices, fruit drinks, and vegetable juices and drinks) across each of the years. They were also sold at substantially higher per unit prices and on average, in smaller containers; the data suggests greater prevalence of single serving-sized items.

In terms of market share (Table 1), the fruit drink subcategory was the largest among the subcategories. It represented over 50% of the market share in terms of dollars and 60% in terms of volume in each of the years from 2007-2012. In addition to being the largest, its share of sales and volume also increased over this period. In contrast, the 100% fruit juice subcategory, the second largest behind fruit drinks, experienced a decline in its share of sales from 2007 to 2012. The third subcategory, vegetable juices and drinks, represents a small share of the market, closer in size to the super-premium beverages. Its share fluctuated somewhat from 2007 to 2012, but increased overall during the period.

**Table 1. Projected total sales, average prices and market shares in dollar and volume terms, by subcategory, 2007-201**

| | Fruit Drink | | | | 100% Fruit Juice | | | |
|---|---|---|---|---|---|---|---|---|
| Year | Projected Total Sales[a] | Mean Price[b] | Mean Sales Share | Mean Volume Share | Projected Total Sales | Mean Price | Mean Sales Share | Mean Volume Share |
| 2007 | 8.442 | 0.039 | 0.525 | 0.625 | 6.346 | 0.054 | 0.395 | 0.334 |
| 2008 | 8.912 | 0.039 | 0.530 | 0.629 | 6.449 | 0.055 | 0.383 | 0.328 |
| 2009 | 8.783 | 0.040 | 0.527 | 0.617 | 6.376 | 0.053 | 0.382 | 0.339 |
| 2010 | 9.393 | 0.040 | 0.551 | 0.638 | 5.972 | 0.051 | 0.350 | 0.313 |
| 2011 | 9.363 | 0.039 | 0.552 | 0.652 | 5.809 | 0.054 | 0.343 | 0.295 |
| 2012 | 9.024 | 0.039 | 0.549 | 0.659 | 5.469 | 0.055 | 0.333 | 0.280 |

| | Super-premium | | | | Vegetable | | | |
|---|---|---|---|---|---|---|---|---|
| Year | Projected Total Sales | Mean Price | Mean Sales Share | Mean Volume Share | Projected Total Sales | Mean Price | Mean Sales Share | Mean Volume Share |
| 2007 | 0.474 | 0.187 | 0.030 | 0.007 | 0.805 | 0.070 | 0.050 | 0.033 |
| 2008 | 0.548 | 0.189 | 0.033 | 0.008 | 0.910 | 0.073 | 0.054 | 0.035 |
| 2009 | 0.628 | 0.189 | 0.038 | 0.009 | 0.886 | 0.072 | 0.053 | 0.034 |
| 2010 | 0.724 | 0.181 | 0.042 | 0.011 | 0.973 | 0.068 | 0.057 | 0.038 |
| 2011 | 0.830 | 0.171 | 0.049 | 0.013 | 0.950 | 0.064 | 0.056 | 0.040 |
| 2012 | 0.986 | 0.166 | 0.060 | 0.017 | 0.949 | 0.062 | 0.058 | 0.043 |

[a] Sales (real $ in billions) represent total, national-level projections
[b] Prices are real, mean prices weighted across stores ($/ounce)

**Table 2. Growth rates of total sales year to year, by subcategory, 2007-2012**

| Period | Fruit Drink (%) | 100% Fruit Juice (%) | Super-premium (%) | Vegetable (%) |
|---|---|---|---|---|
| 2007-2008 | 5.57 | 1.63 | 15.53 | 12.98 |
| 2008-2009 | -1.45 | -1.13 | 14.64 | -2.57 |
| 2009-2010 | 6.94 | -6.33 | 15.23 | 9.83 |
| 2010-2011 | -0.32 | -2.73 | 14.60 | -2.38 |
| 2011-2012 | -3.62 | -5.84 | 18.90 | -0.14 |
| Overall Rate 2007-2012 | 6.89 | -13.81 | 107.98 | 17.86 |
| Average Annual Rate | 1.34 | -2.93 | 15.77 | 3.34 |

In comparing the largest two subcategories, 100% fruit juices and fruit drinks, in more detail, an overall decrease in the dollar sales of 100% fruit juice sales of approximately 14% over 2007-2012 is observed, whereas juice drink sales increased by 7% (Table 1 and Table 2). In terms of total annual sales[10], they increase from approximately $8.44 billion to $9.02 billion for fruit drinks and decrease from $6.35 billion to $5.47 billion for 100% fruit juices. Within these aggregate trends across the entire period, the change in sales of fruit drinks fluctuated from year to year, whereas 100% fruit juice dollar sales consistently decreased from 2008-2012. The total volume of fruit drink sales grew by 6% from 2007-2012, whereas 100% fruit juice declined in this same period by 16%. Separate studies that were based on overlapping years to those covered by this analysis, though based on different data, also found this trend of decreasing juice sales (Okrent and MacEwan 2014, Bloom 2014) and increasing fruit drink sales (Bloom 2014).

As reported in Table 3, total dollar sales of 100% fruit juice decreased in supermarkets by 22% from 2007 to 2012. In contrast, total sales of 100% fruit juice increased in the subcategory's second and third largest channels, convenience and mass merchandiser stores, at rates of 17% and 28%, respectively. Fruit juices are the only subcategory where dollar sales decreased in every region from 2007-2012. The regions with the highest levels of declines in sales were East North Central (-18%), South Atlantic (-20%), and Pacific (-23%) (Table 4).

[10] Dollar sales figures and related mean market share, percentage change and prices reported throughout Chapter III represent annual, projected national totals, unless specified.

While total dollar sales of fruit drinks decreased slightly in supermarkets, also the channel with the highest level of fruit drink sales, they increased substantially at convenience stores, the second largest channel for sales of this subcategory. At the third largest channel for fruit drink sales, mass merchandisers, sales increased by 30%, from a share of 11% to 14%. Fruit drink dollar sales fluctuated considerably within and across regions. Those regions with the highest growth rates were West North Central (+23%), East South Central (+11%), and West South Central (+ 10%). The regions with declines in sales were Pacific (-10%) and Mountain (-6%).

**Table 3. Percentage of total dollar sales, by channel type, by subcategory, 2007-2012**

| Channels | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|
| ***Fruit Drink*** | | | | | | |
| Convenience stores | 0.25 | 0.29 | 0.28 | 0.29 | 0.29 | 0.28 |
| Drug stores | 0.04 | 0.03 | 0.04 | 0.04 | 0.04 | 0.04 |
| Supermarkets and grocery | 0.59 | 0.54 | 0.55 | 0.54 | 0.53 | 0.53 |
| Liquor stores | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| Mass merchandiser | 0.11 | 0.11 | 0.11 | 0.12 | 0.13 | 0.14 |
| ***100% Fruit Juice*** | | | | | | |
| Convenience stores | 0.09 | 0.11 | 0.11 | 0.12 | 0.12 | 0.13 |
| Drug stores | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| Supermarkets and grocery | 0.79 | 0.77 | 0.76 | 0.75 | 0.73 | 0.72 |
| Liquor stores | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| Mass merchandiser | 0.07 | 0.08 | 0.08 | 0.09 | 0.10 | 0.11 |
| ***Super-premium Juices and Drinks*** | | | | | | |
| Convenience stores | 0.10 | 0.19 | 0.26 | 0.31 | 0.32 | 0.29 |
| Drug stores | 0.01 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| Supermarkets and grocery | 0.85 | 0.76 | 0.67 | 0.62 | 0.59 | 0.58 |
| Mass merchandiser | 0.04 | 0.04 | 0.04 | 0.05 | 0.08 | 0.11 |
| ***Vegetable Juices and Drinks*** | | | | | | |
| Convenience stores | 0.09 | 0.15 | 0.15 | 0.13 | 0.11 | 0.12 |
| Drug stores | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| Supermarkets and grocery | 0.80 | 0.74 | 0.74 | 0.75 | 0.76 | 0.73 |
| Liquor stores | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Mass merchandiser | 0.07 | 0.08 | 0.08 | 0.09 | 0.10 | 0.13 |

[a] Dollar sales figures used for this analysis are based on national-level projections.

**Table 4. Percentage change in dollar sales, by region, by subcategory, 2007-2012**

| Subcategory Name | US Census Bureau Region Name | 2007-2008 | 2008-2009 | 2009-2010 | 2010-2011 | 2011-2012 | 2007-2012 |
|---|---|---|---|---|---|---|---|
| ***Fruit Drinks*** | | | | | | | |
| | East North Central | 0.00 | 0.01 | 0.11 | -0.01 | -0.01 | 0.09 |
| | East South Central | 0.00 | 0.01 | 0.12 | -0.02 | 0.01 | 0.11 |
| | Mid Atlantic | 0.01 | 0.00 | 0.07 | -0.01 | -0.03 | 0.04 |
| | Mountain | -0.02 | -0.04 | 0.04 | -0.01 | -0.03 | -0.06 |
| | Northeast | 0.00 | 0.02 | 0.07 | -0.02 | 0.00 | 0.07 |
| | Pacific | -0.03 | -0.02 | -0.03 | 0.00 | -0.03 | -0.10 |
| | South Atlantic | -0.03 | 0.01 | 0.06 | -0.02 | -0.02 | 0.00 |
| | West North Central | 0.02 | 0.03 | 0.08 | 0.05 | 0.03 | 0.23 |
| | West South Central | 0.07 | 0.02 | 0.05 | 0.04 | -0.07 | 0.10 |
| ***100% Fruit Juice*** | | | | | | | |
| | East North Central | 0.02 | -0.02 | -0.07 | -0.04 | -0.07 | -0.18 |
| | East South Central | -0.02 | -0.01 | -0.05 | -0.04 | -0.07 | -0.17 |
| | Mid Atlantic | -0.01 | -0.01 | -0.05 | -0.03 | -0.08 | -0.17 |
| | Mountain | 0.01 | 0.00 | -0.08 | -0.02 | -0.06 | -0.15 |
| | Northeast | -0.03 | -0.01 | -0.05 | -0.02 | -0.06 | -0.16 |
| | Pacific | 0.00 | -0.03 | -0.10 | -0.05 | -0.07 | -0.23 |
| | South Atlantic | -0.01 | -0.03 | -0.08 | -0.04 | -0.07 | -0.20 |
| | West North Central | 0.00 | 0.00 | -0.04 | -0.02 | -0.04 | -0.10 |
| | West South Central | 0.03 | 0.01 | -0.07 | -0.02 | -0.08 | -0.12 |
| ***Super-premium Juices and Drinks*** | | | | | | | |
| | East North Central | 0.12 | 0.18 | 0.18 | 0.09 | 0.22 | 1.07 |
| | East South Central | 0.04 | 0.13 | 0.13 | 0.14 | 0.41 | 1.16 |
| | Mid Atlantic | 0.20 | 0.22 | 0.16 | 0.17 | 0.18 | 1.35 |
| | Mountain | -0.01 | -0.06 | 0.03 | 0.11 | 0.16 | 0.24 |
| | Northeast | 0.08 | 0.19 | 0.12 | 0.13 | 0.19 | 0.95 |
| | Pacific | 0.01 | -0.05 | 0.03 | 0.07 | 0.20 | 0.27 |
| | South Atlantic | 0.05 | 0.13 | 0.15 | 0.15 | 0.29 | 1.02 |
| | West North Central | 0.07 | 0.02 | 0.04 | 0.07 | 0.14 | 0.38 |
| | West South Central | 0.15 | -0.01 | 0.05 | 0.14 | 0.21 | 0.64 |
| ***Vegetable Juices and Drinks*** | | | | | | | |
| | East North Central | 0.07 | -0.04 | 0.13 | -0.02 | -0.05 | 0.09 |
| | East South Central | 0.05 | -0.05 | 0.13 | -0.03 | -0.05 | 0.05 |
| | Mid Atlantic | 0.11 | 0.08 | 0.18 | -0.01 | -0.03 | 0.36 |
| | Mountain | 0.00 | -0.07 | 0.08 | -0.01 | -0.01 | -0.02 |
| | Northeast | 0.10 | 0.08 | 0.15 | -0.05 | -0.02 | 0.26 |
| | Pacific | 0.02 | -0.06 | 0.10 | 0.01 | 0.02 | 0.08 |
| | South Atlantic | 0.06 | 0.00 | 0.12 | -0.03 | -0.01 | 0.15 |
| | West North Central | 0.08 | -0.03 | 0.08 | -0.02 | -0.01 | 0.10 |
| | West South Central | 0.05 | -0.05 | 0.10 | 0.00 | -0.02 | 0.08 |

[a] Dollar sales figures used for this analysis were not weighted to represent national-level projections.

A few drivers may explain these opposing shifts with fruit juices versus fruit drinks. Declines in 100% juice purchases may reflect a change in awareness on the part of health-conscious consumers of the sugar and calorie content levels in juices. This change in perception could be driven by the influences of popular diets such as Atkins and South Beach, which recommended restrictions to carbohydrate intakes and were promoted in the years leading up to and during the period covered by this thesis.[11] Further, guidance from the medical community has warned of over consumption of juices by children as a substitute for whole fruits (American Academy of Pediatricians, Committee on Nutrition 2001), which may have affected parents' decisions to purchase them.

While 100% fruit juices may still be perceived as healthier alternatives to many fruit drinks, they are also more expensive. The data indicate that fruit juice prices are anywhere between 30-40% higher, on average, than those of fruit drinks from 2007-2012, with fruit drinks at under $0.04 per ounce and juices at over $0.05 per ounce (Table 1). This situation, combined with other possible economic considerations, may have reduced consumers' willingness to pay for the same quantity of the more expensive 100% juices, while favorably affecting the sales of fruit drinks, which are often perceived as providing many of the same benefits. Further to this point, the period covered by the data set in this thesis largely coincides with the 2007-2009 financial recession (Guidolin and Tam 2012). The recession led to a sharp increase in

[11] The Atkins diet is promoted by Dr. Robert Atkins in, among other publications, his 2002 book titled "Dr. Atkins New Diet Revolution". The South Beach diet is promoted by Dr. Arthur Agatson in his 2003 book, "The South Beach Diet".

unemployment that subsided somewhat after the recession period ended, but remained higher than previous levels had been. While at-home consumption (which is what this retail scanner data set applies to) decreased by less than consumption of food away from home during the recession, 100% juices have been shown to be among the products that exhibit reduced frequency of consumption among 26 to 58 year olds when there is a higher unemployment rate (Dave and Kelley 2012). Again, these factors could also have contributed to the positive trend in fruit drink consumption over the same period, if consumers selected fruit drinks deliberately as a lower-priced and next-best alternative to 100% juices. It is worth noting that fruit drink sales also declined from 2008-2009, despite positive growth in the periods before and after, perhaps reflecting a broader trend related to household spending on food items during the peak period of the recession.

Further, when compared to other sugar-sweetened beverages, fruit drinks may be viewed as a healthier alternative. Among survey participants of a recently-conducted study, Munsell et al. (2015) found that fruit drinks remain a popular item for parents to provide to their children. In fact, they were purchased more often than any other sweetened beverage category, including soda, sport drinks, teas and flavored water and were ranked healthier than each of those beverage types, with the exception of flavored water.

Finally, there is a supply side factor that may be contributing to 100% juice sale declines. Production levels of oranges in Florida, where the majority in the United States are produced for the juice industry, decreased substantially between 1997/98 and 2006/07, as the result of such factors as hurricanes and the onset of citrus greening

[Morris, 2010]. These decreases in production and availability likely led to an increase in the prices of oranges and grapefruits and in turn, citrus juice prices, and consequently, a decline in the quantity of citrus juice consumed. Given that citrus juice, and orange juice in particular, is a large component of the 100% juice subcategory, this situation may have contributed significantly to the declines in fruit juice purchases. It should be noted that the overall decline in the volume of sales for 100% juices begins in 2009-2010, which may reflect a lag time in consumer response to these supply-driven price increases.

Vegetable juice and drink sales increased substantially between 2007 and 2012. As reported in Table 1, dollar sales increased by 17.9% over this period. The volume of sales increased by nearly 33%, reflecting decreases in average prices in the subcategory. In terms of total annual sales, they increase from approximately $805.17 million to $948.96 million. There is considerable fluctuation in vegetable juice sales from year to year. As reported in Table 2, 2007-2008 and 2009-2010 both exhibit strong growth, whereas 2010-2012 reflects slowing growth in volumes terms, and declines in dollar terms. Interestingly, there are also declines from 2008-2009, as was the case with both fruit juices and drinks, possibly reinforcing that there was a general decline in food purchases over this period in response to the recession.

Industry articles regarding the vegetable juice market (Watson 2013, Shroeder 2015) cite multiple reasons why these trends in slowing sales may be taking place with vegetable juices. For one, they note poor performance in the shelf stable juice subcategory, generally. Second, they cite the efforts of Campbell's, a major supplier of

vegetable juices, to introduce new products with fruit-based ingredients (e.g., their V8 V-Fusions). This is in attempt to make these juice products more appealing to individuals whose tastes and preferences are moving away from juice products that are purely or predominantly tomato-based. This paper's analysis also reflects that the vegetable-based beverages had higher prices than both fruit drinks and juices throughout 2007-2012, averaging 74% more than fruit drinks and 27% more than 100% fruit juices at approximately $0.070 per ounce (Table 1), though this price declines by 11% from $0.070 in 2007 to $0.062 in 2012, with initial increases from 2007-2009 and subsequent decreases from 2009-2012. The impact of the recession and its aftermath could have led to a downward shift in demand for vegetable juices as well. A decline in demand based on these factors and the resulting excess supply in the marketplace, may have led firms to reduce prices to clear the market and maximize their profits.

In terms of market channels, vegetable juice dollar sales demonstrated a particularly large increase at mass merchandiser stores, where annual sales increased by more than 100% from 2007-2012. Sales at convenience stores also increased substantially, whereas supermarket sales increased only slightly (Table 3). Vegetable juice sales increased in every region from 2007-2012, with the exception of the Mountain region, where they declined slightly by 2% (Table 4), though they fluctuated considerably from year to year, with increases in some years and decreases in others. The regions with the greatest increases in vegetable juice sales were Mid Atlantic (36%), Northeast (26%), and South Atlantic (15%).

Super-premium beverages stand out considerably in terms of increases in totals sales within the overall fruit and vegetable juice and drink category. Their annual growth rates in dollar and volume terms are consistently double-digit figures, far exceeding each of the other three subcategories. In terms of dollars, super-premium juice sales increased by 108% from 2007-2012, growing by between 14.6% and 18.9% per each year (Table 1 and Table 2). In terms of totals, they increase from approximately $474.25 million to $986.36 million across the six-year period. The volume of sales increased by a higher level of 133.2%, at annual rates of between 14.4% and 22.1%, reflecting a decline in super-premium prices over this time. There is an overall drop of 10.8% in the average price of super-premium products from 2007-2012, which began over the period 2009-2010.

While super-premium dollar sales increased within each of the channels from 2007-2012, sales at convenience stores and mass merchandiser stores increased at much higher levels, at rates of 500% and 469%, respectively, as opposed to the 42% increase in sales at supermarkets (Table 3). This situation results in a considerable shift in the shares of sales by channel type for the super-premium subcategory. Supermarkets declined from representing 85% of super-premium sales to 58% from 2007-2012, whereas convenience store sales increased from 10% to 29% and mass merchandiser sales were up from 4% to 11%. All of the 9 regions exhibited substantial growth from 2007-2012 in the super-premium subcategory (Table 4). The regions where super-premium juice sales grew at the highest levels were the Mid Atlantic (+135%), East South Central (+116%), East North Central (+107%), and the South Atlantic (102%).

The regions with the lowest growth rates were the Mountain (+24%), Pacific (+27%), and West North Central (+38%).

This high growth within the super-premium subcategory happens, despite the fact that these products have much higher prices than other fruit and vegetable juices and drinks. Super-premium prices are on average 3.60 times higher than fruit drinks, 2.36 than 100% fruit juices, and 1.65 than vegetable juices and drinks over the period 2007-2012, as Table 1 indicates. Prices of super-premium juices are sufficiently higher than those of the vegetable juices, the next highest-priced subcategory, that their dollar sales increased from being only 58.9% of vegetable juice dollar sales in 2007 to nearly 104% of them by 2012, whereas their sales volumes reach only 38.7% of vegetable juice volumes by 2012.

These trends suggest not only possible increases in the quantities demanded of super-premium beverages in response to price declines, but likely also an overall increase in the demand. Such increases in demand likely reflect adjustments in consumer tastes and preferences in favor of the perceived health and nutritional benefits of super-premium beverages; their convenience in providing those benefits as ready-to-drink items with longer shelf lives than freshly-pressed juices; and the variety of newly-introduced flavors and ingredients they offer. Given their higher prices, it is also likely that a substantial portion of super-premium beverage purchases are made by higher income earners. The increases in incomes of top earners from 2010-2013 (Bricker et al. 2014) may help explain how this subcategory outperformed the others. Another potential factor driving these increases could be the increased sales of items with larger-

sized containers. Super-premium juices and drinks have the smallest average container size, less than half the size of each of the other subcategories (Figure 1). However, the average size of each super-premium item sold increased by 9.4%, from 22 to 24 ounces between 2007 and 2012. This may reflect an effort on the part of the firms manufacturing and selling super-premium beverages to better penetrate the market for family size containers (e.g., 36-64 ounces vs. individually-sized 8-16 ounces), given a firm's ability to increase revenue and total profit-earned with larger volumes sold per transaction. This trend toward larger container sizes may also help explain the drop in the price per ounce of super-premium juices.

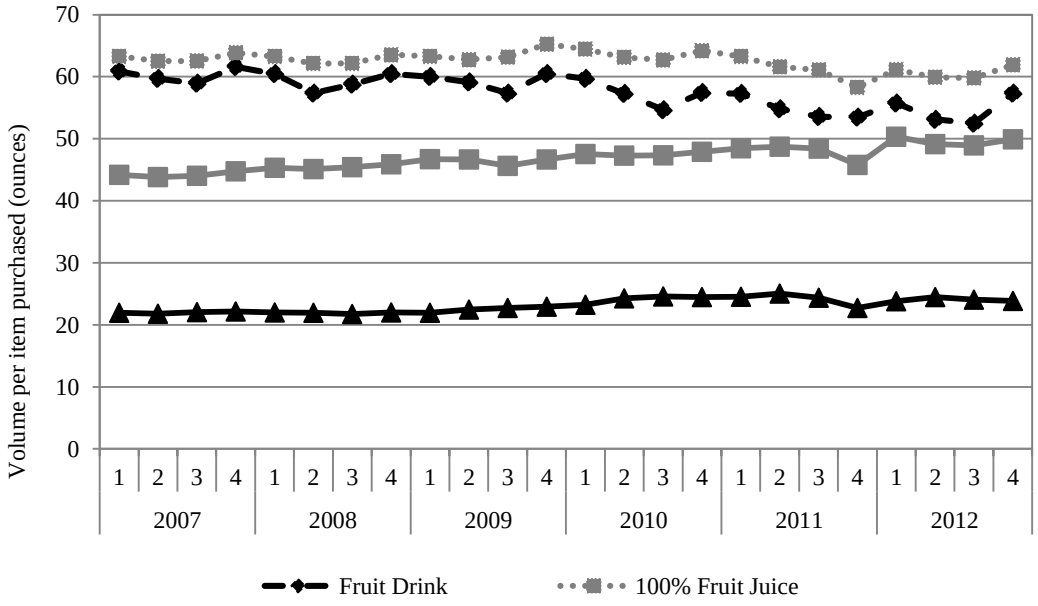


**Figure 1. Annual average volume per item sold (ounces), by subcategory, 2007-2012**

# CHAPTER IV

## DEMAND ESTIMATION RESULTS

The pooled cross-sectional data sample containing 824,064 quarterly store-level observations from 2007-2012 was used for the demand estimation. Stata 14 statistical software's QUAIDS commands were used to estimate the parameters of the nonlinear Quadratic AIDS model and subsequently to calculate own-price, cross-price and expenditure elasticities, based on mean values of the sample variables included. Mean values of explanatory variables used in the estimation of the QUAIDS model are reported in Table 5.

Year and quarter dummy variables were included in the model to account for the time trend and seasonality, as notable fluctuations in total sales for some of the subcategories by year and season were observed (Figure 2). Dummy variables were included for metropolitan versus non-metropolitan designations per county, based on the USDA Rural-Urban Continuum Codes. The county-level socio-demographic variables were included as well to serve as proxy indicators and control for population characteristics. These variables were median income, mean household size, and education attainment level (percentages of those with a high school diploma or fewer years of education; college graduates; or those with a graduate degree). These variables capture the differences among counties where stores in the sample are located (e.g., average household size or median income in one county versus another) in order to help explain variations in sales and strengthen the model.

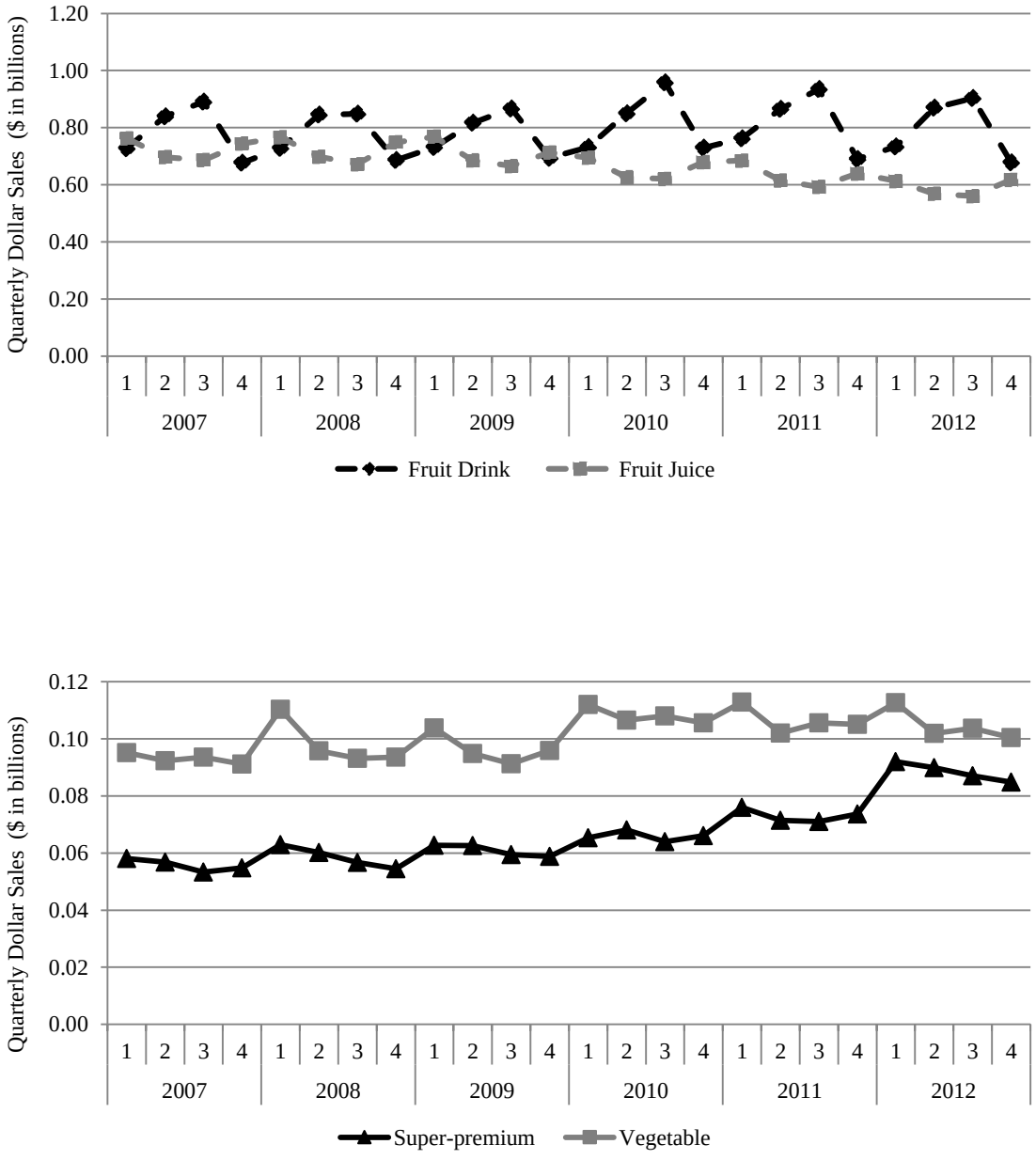


**Figure 2. Total quarterly sales, by subcategory, 2007-2012**
Note: the figure has been divided into two parts, given the substantial differences in scale across subcategories and in order to provide an informative depiction of the sales trends in terms of value.

**Table 5. Mean values for variables in demand estimation model**

| Variables | Mean |
|---|---|
| Year 2007 | 0.161 |
| Year 2008 | 0.162 |
| Year 2009 | 0.166 |
| Year 2010 | 0.172 |
| Year 2011 | 0.170 |
| Year 2012 | 0.169 |
| Quarter 1 | 0.250 |
| Quarter 2 | 0.249 |
| Quarter 3 | 0.251 |
| Quarter 4 | 0.250 |
| Metropolitan | 0.841 |
| Nonmetropolitan | 0.159 |
| Median Income ($) | 54,336 |
| Average household Size | 2.486 |
| Less than High School/High School | 0.427 |
| Some College/Associate/College | 0.468 |
| Graduate School | 0.105 |

The parameter estimates from the Quadratic AIDS model (Appendix A) were used to calculate uncompensated and compensated own- and cross-price elasticities, as well as expenditure elasticities, which are exhibited in Tables 6 and 7. Own-price elasticity is a measurement of the responsiveness of the quantity demanded of a good to changes in that same good's price. Specifically, the elasticity value represents the percentage change in quantity in response to a single percentage change in price. An elasticity calculation with an absolute value between 0 and 1 is defined as inelastic, while an absolute value greater than 1 is considered elastic. Uncompensated elasticity calculations are used to evaluate own-price elasticities.

Cross-price elasticities represent the responsiveness to the quantity demanded of one good in response to the change in price of another. In the case of this research, cross-price elasticities reflect the changes in the quantities demanded of one subcategory (e.g., super-premium juices) in response to increases in the price of another (e.g., fruit drinks). Compensated cross-price elasticity calculations are used to evaluate whether goods are substitutes or complements for one another. Finally, the expenditure elasticities represent the effect of a change in the overall expenditure level (in this case, total expenditures on the complete retail, ready-to-drink fruit and vegetable juice and drink group of goods) on the expenditure of one of the four subcategories included in the study.

From the uncompensated elasticity calculations in Table 6, we see that own-price elasticities were all negative, indicating that they are all normal goods in terms of price and reflecting an inverse relationship between price and quantity changes. This is consistent with our theory-based expectations. Super-premium juices were considerably

more responsive to changes in their prices than the other three subcategories, with an own-price elasticity of -2.696. This finding could be the result of the relatively higher prices of super-premium beverages. It may also reflect the availability of substitute products, such as freshly-squeezed juices from juice and smoothie bars or other specialty, non-juice-based products similarly promoted for their health properties like kombucha teas or coconut water. 100% fruit juices were also found to be elastic with a value of -1.601 but less elastic compared to the super-premium subcategory, while fruit drinks and vegetable juices were nearly unit elastic, with a value of -1.080 and -1.048, respectively. As noted in Chapter I, other studies also find both fruit juices and drinks to be elastic (Zhen et al. 2011, Zhen et al. 2014), while in others, either juices (Okrent and MacEwan 2014) or fruit drinks (Dharmasena and Capps 2012) appear as inelastic. These studies primarily used Nielsen's Homescan data with broader sets of beverage products, including items such as milk, coffee, and soft drinks, but did not separate vegetable or super-premium juices or drinks from 100% juices and juice drink subcategories.

**Table 6. Uncompensated own and cross-price elasticities and expenditure elasticities**

| | **Super-premium** | **100% Fruit Juice** | **Fruit Drink** | **Vegetable** | **Expenditure Elasticities** |
|---|---|---|---|---|---|
| Super-premium | **-2.696** | -1.555 | 2.493 | 0.543 | 1.212 |
| 100% Fruit Juice | -0.158 | **-1.601** | -0.002 | -0.154 | 1.920 |
| Fruit Drink | 0.106 | 0.363 | **-1.080** | 0.053 | 0.556 |
| Vegetable | 0.206 | -0.758 | 0.047 | **-1.048** | 1.556 |

**Table 7. Compensated own and cross-price and expenditure elasticities**

| | Super-premium | 100% Fruit Juice | Fruit Drink | Vegetable |
|---|---|---|---|---|
| Super-premium | **-2.671** | -1.214 | 3.283 | 0.601 |
| 100% Fruit Juice | -0.119 | **-1.061** | 1.248 | -0.063 |
| Fruit Drink | 0.117 | 0.519 | **-0.718** | 0.080 |
| Vegetable | 0.237 | -0.320 | 1.060 | **-0.974** |

From the compensated elasticity values in Table 7, we see that cross-price elasticities suggest a combination of complements and substitutes among the four subcategories. Fruit drinks and vegetable juices and drinks are both substitutes for super-premium juices, whereas 100% fruit juices are not. This may reflect that purchases of super-premium juices are driven more by flavor, unique ingredients, promoted health properties, and convenience (e.g., container size, use as a partial meal replacement while traveling), as opposed to as alternatives for traditional 100% juices. Further, it could reflect the successful marketing by beverage companies of health and nutritional properties of fruit drinks. This latter point is supported by the fact that fruit drinks also serve as substitutes for 100% fruit juices and vegetable juices. Super-premium juices, vegetable juices, and 100% fruit juice were substitutes for fruit drinks. 100% fruit juices and vegetable juices were both complements for one another.

From Table 6, we see that expenditure elasticities were all positive, indicating that the beverages are all normal goods. Except for juice drinks, the expenditure elasticities for 100% juices, vegetable juices and super-premium beverages were all greater than one, indicating that they are more responsive to changes in total expenditure

levels relative to fruit drinks and that they may be luxury goods. The fruit drink expenditure elasticity value, by contrast, is lower than one and less responsive to changes in total expenditures and may indicate it is a necessity good.

These elasticity calculations provide valuable insight for directing future research as well as to firms in developing suitable marketing and pricing strategies. For example, the fact that super-premium juices are elastic in their own prices indicates that an increase in price would lead to a decrease in the quantity demanded by a greater percentage, and therefore, a decrease in overall sales revenue, assuming all other factors remain equal (e.g., costs of production, impacts of other marketing and advertising efforts, general shifts in tastes and preferences). Further, such a price increase could encourage consumers to seek out substitute products, potentially offered by a competitor. Conversely, the higher (absolute) elasticity value indicates that reducing prices of super-premium products for a sales promotion would lead to an increase in quantity demanded by a greater percentage and therefore, an increase in overall sales revenue. By accounting for other factors related to an individual firm's case, including costs and prices specific to the product in question, these elasticity values can aid in the analysis of the net impact on overall profit levels from such a change in price, which could either increase or decrease depending on these factors. These calculations also help to evaluate the impact of a change in price on other business goals, such as reducing inventory levels, increasing awareness of a brand or expanding the customer base.

# CHAPTER V

# CONCLUSION

Super-premium juices and drinks are a unique product subcategory. They represent a relatively small portion of the overall fruit and vegetable juices and drinks market, but have grown much faster than the other juice and drink subcategories in recent years. With respect to responsiveness to changes in prices, the super-premium subcategory was more elastic in response to changes in its own price when compared to other subcategories considered in this study.

Analysis of trends and demand for super-premium beverages provides an important contribution to the understanding of the overall consumption of juices and drinks, particularly in the context of the recent, increasingly popular juicing trend. Given the limited research available on this new product area, this thesis focuses on establishing a foundational analysis, helping to identify more focused areas for future research. Beyond its use to industry, the findings presented here provide insight valuable for use in a health and nutrition context.

The relevance to health stems from the fact that super-premium juices are marketed for their nutritional value beyond traditional juices, yet they do not conform to the definitions of 100% juices and juice drinks, which are often used to provide dietary guidance to consumers. Further, they may be selected by consumers as substitutes for fresh fruits and vegetables. Given these facts and the rapid growth in consumption of the subcagetory as evidenced by the findings in Chapter III, consumers may benefit from additional information related to their relative benefits and any drawbacks. For example,

if a super-premium juice's nutritional value, such as fiber content, exceeded that of traditional juices, as can be the case, levels of their consumption exceeding those of traditional juices may be beneficial. At the same time, super-premium health claims and nutritional content, as well as their new flavors and product variety, may lead consumers to overlook and not appropriately weigh super-premium juices and drinks' calorie and sugar content against these potential benefits in choosing quantities to consume.

The following is a discussion of research questions that the results from this thesis help to identify and that, if answered, would add to the understanding of the role that super-premium juice consumption and in turn, the broader trend of juicing, play in shaping dietary habits and related outcomes of consumers. First, to what extent are consumers selecting super-premium juices because of the servings of fruits and vegetables they provide versus characteristics such as flavor and newly-introduced ingredients, or more specific health properties, such as antioxidant levels? Second, investigation would be valuable with additional product groups and expected substitutes for super-premium juices in order to understand how the decisions to consume these juices versus other foods and beverages are related. Such additional product groups could include health beverages like fresh-squeezed juices or so-called "functional" beverages like kombucha tea, as well as foods like fresh or processed fruits and vegetables. Finally, combining the investigation of these questions with the specific nutritional implications of resulting changes in consumption, both in terms of benefits, such as increased vitamin levels, fiber content, or antioxidant levels, as well as risks,

such as contributions to diets higher in calories and sugars, would provide valuable insight into the impact of the "juicing" trend on diet and health.

The data required for the above analyses can be challenging to locate and may require collaboration with industry or primary data collection (i.e., via consumer survey). Household panel data such as that provided by Nielsen or IRI could be an appropriate source in certain cases. Use of such consumer panel data would enable more precise analysis of individual or household purchasing decisions and the correlation of socio-economic and demographic variables thereto. For example, such data could be used to compare a set of households' purchases of super-premium juices relative to their purchases of other juices or fruits and vegetables and to determine whether they are correlated. Finally, experimental research could better inform what is driving the selection of super-premium juices versus other beverages and foods, address potential spurious correlations, and help determine causality.

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# APPENDIX A

## PARAMETER ESTIMATES OF THE QUAIDS MODEL[a]

**Table A-1. Parameter estimates from the QUAIDS model**

| Variable Name | Super-premium | 100% Fruit Juice | Fruit Drink | Vegetable |
|---|---|---|---|---|
| Intercept | 0.054 | 0.352 | 0.563 | 0.030 |
| Price Super-premium | -0.035 | -0.030 | 0.053 | 0.011 |
| Price 100% Fruit juice | -0.030 | -0.171 | 0.237 | -0.036 |
| Price Fruit drink | 0.053 | 0.237 | -0.316 | 0.026 |
| Price Vegetable | 0.011 | -0.036 | 0.026 | -0.002 |
| Expenditure$^2$ | 0.032 | 0.016 | -0.033 | -0.015 |
| Expenditure | 0.000 | 0.011 | -0.012 | 0.001 |
| Year 2007 | -0.006 | -0.003 | 0.012 | -0.004 |
| Year 2008 | -0.005 | -0.002 | 0.010 | -0.003 |
| Year 2009 | -0.004 | -0.004 | 0.012 | -0.003 |
| Year 2010 | -0.004 | -0.010 | 0.017 | -0.002 |
| Year 2011 | -0.003 | -0.009 | 0.015 | -0.002 |
| Quarter 1 | 0.000 | -0.003 | 0.003 | 0.000 |
| Quarter 2 | -0.002 | -0.026 | 0.031 | -0.003 |
| Quarter 3 | -0.002 | -0.028 | 0.033 | -0.003 |
| Metro | -0.001 | 0.001 | 0.002 | -0.002 |
| Median Income | 0.000 | 0.000 | 0.000 | 0.000 |
| Mean Household Size | 0.002 | -0.024 | 0.029 | -0.007 |
| High school education | -0.030 | 0.022 | -0.022 | 0.031 |
| College graduate | -0.015 | 0.013 | -0.040 | 0.042 |

[a] The level of significance used for this analysis is $\alpha$=0.01.

[b] All parameter estimates are significant at the 0.01 level except for Quarter_1 in the case of the vegetable juice equation. P values for all parameter estimates were < .000000, except for Quarter_1 in the case of the vegetable juice equation, which had a p value of 0.12600.

[c] The model was estimated using Stata 14 statistical software.

[d] Quarterly, pooled cross-section data with 824,064 store-level observations over the period 2007-2012 were used.

# APPENDIX B

## ADDITIONAL PRICE ANALYSIS FOR THE FRUIT AND VEGETABLE JUICE AND DRINK MARKET

Juicing has become a popular trend in recent years, with estimates that it is as big as a $5 billion industry in the United States (Blumenthal 2012). It is a fast-growing segment of the juice category, which in turn, makes up a substantial portion of the overall non-alcoholic beverage market, valued at hundreds of billions of dollars in sales each year. Within this juicing trend, there is a retail segment of ready-to-drink products called super-premium juices and smoothies, described in detail earlier in Chapter I. This appendix provides additional analysis specific to the pricing of this super-premium subcategory as compared to three other subcategories within the overall fruit and vegetable juice and drink category, namely 100% fruit juices, fruit drinks (with less than 100% juice content and added ingredients such as water and sugar), and vegetable juices and drinks. The same Nielsen retail scanner data from 2007-2012 described in Chapter II are used. This is relevant analysis for several reasons. Pricing of these retail juice and juice drink beverages affects the businesses along the supply chain, from the beverage companies themselves to producers of the raw fruit and vegetable inputs, transportation companies and grocery stores and other retailers. They also affect consumers and reflect consumers' willingness to pay for products.

As is the case in Chapter III above, prices are adjusted for inflation, using the Consumer Price Index and a reference period of December 2012, the most recent period included in the dataset. Prices are standardized for comparison and provided on a per

unit of volume basis, in the form of dollars per ounce. Mean prices are compared by subcategory across five different channels, including convenience, drug, liquor, grocery and mass merchandiser. These comparisons provide insight into consumers' overall willingness to pay for the convenience of shopping at a particular location, although they also reflect differences in the products being purchased at one type of store versus another. To further understand retail sales patterns and consumer choices, calculations of the mean volume and price per each item purchased are analyzed by channel. To capture geographic differences, prices are also compared by subcategory across nine regions in the United States. For this analysis, data are aligned to the US Census Bureau's nine census regions, as reflected in the map in Figure B-3.

While mean prices are used, summary statistics are reported for prices by subcategory (see Table B-1) in order to provide insight into the dispersion of the data. These summary statistics are taken from the data set at the individual store-level. From them, we see that the price data are somewhat skewed to the left across most years and subcategories, as median values are generally smaller than mean values. This skewness reflects observations in the data that have values close to zero, which were found within the first percentile. These outliers were left in the dataset, on the assumption that they reflected sales promotions as opposed to errors. The high maximum values reported likely reflect the high level of variation in volume sizes from different product types that we observe in the data.

From our analysis reported in Chapter III above (see Table B-3 and Figure B-1), we observed that super-premium prices are on average 3.60 times higher than fruit

drinks, 2.36 than fruit juices, and 1.65 than vegetable juices and drinks over the period 2007-2012. By comparison, vegetable juice prices average 74% more than fruit drinks and 27% more than fruit juices. In terms of changes, super-premium and vegetable prices decrease overall from 2007-2012, both in real and nominal terms, with decreases generally beginning over the 2008-2009 period. There is an overall drop of 10.8% in the average, real price of super-premium products from 2007-2012, which began over the period 2009-2010. Real vegetable juice prices similarly decline by 11.3% during this period. 100% fruit juice and drink prices, by contrast, increase in both real and nominal terms, though year to year, we observe fluctuations, with increases in some and decreases in others. Real fruit drink prices increase by just 0.7%, while real 100% fruit juice prices increase by 2.1%.

**Analysis by Distribution Channel:**

When analyzing prices by channels across the fruit and vegetable juice and drink product category, there are significant differences observed (see Table B-2 and Figure B-2). Average liquor store prices in the category are higher than the other channels, followed by convenience, drug, grocery and mass merchandiser stores, in that order. In this article, particular attention is paid to the grocery, convenience and mass merchandiser store channels, because they make up the overwhelming majority of total estimated sales within this overall juice and juice drink category, whereas drug and liquor store sales represent much smaller components, with percentages in the low single digits. In terms of changes, we see prices at grocery stores decrease by 3.8% over the period 2007-2012, while mass merchandiser and convenience store prices both increase, by 11.1% and

10.5%, respectively. Liquor store prices also increase by 9.5%, while drug store prices increase only slightly overall, with considerable fluctuations from year to year. As a result of these changes, convenience store prices are 61.2% higher than food store prices in 2007, but end up 85.2% higher than them by 2012. They are between 95.9% and 108.0% higher than mass merchandiser prices, depending on the year. Grocery store prices are higher than those of mass merchandisers, initially by 22.2% in 2007 and then, by 5.8% in 2012. A study that analyzed differences in prices across channels, also found that grocery store prices were higher than those at mass merchandisers and that convenience stores had even higher prices (Broad, Leiptag and Weinstein, 2009).

Customers at convenience stores are consistently purchasing smaller volume items at lower, average prices per item relative to grocery and mass merchandiser stores, as one might have expected. In 2012, the average container size per item purchased in convenience stores was 55.8% lower than in grocery stores and 55.7% lower than in mass merchandiser stores. By contrast, these average container sizes are similar in grocery and mass merchandiser channels. With the exception of liquor stores, the volume per item purchased decreases from 2007 to 2012 in each of the channels, which may reflect a broader strategy to sell more single serving-sized containers. The price per item purchased in convenience stores is also lower than in grocery and mass merchandiser stores across all years, though to a lesser extent than the volume per item figures, reflecting the higher per unit prices in convenience stores. This raises an interesting question of whether or not consumers are consciously noting the higher price per unit of volume and demonstrating willingness to pay for convenience of the store

location. Or are consumers evaluating price, instead, based on a price per item purchased-basis either within or across channels?

In terms of the separate subcategories (Table B-3), super-premium prices decline from 2007-2012 in the three major sales channels of grocery, convenience and mass merchandiser stores, explaining the overall decrease in prices within the subcategory. Mass merchandiser and grocery store prices declined substantially, at rates of 24% and 17%, respectively. Convenience store prices decrease only slightly by 3%, accounted for largely by a 4.1% decline in the period 2010-2011, followed by a 2.8% rebound from 2011-2012. The prices of the more minor sales of super-premium juices in drug stores increase slightly by 1.9%. The difference in prices across channels is not as significant in this subcategory as it is in the category overall, suggesting more consistent pricing for super-premium juices across channels. For example, in 2012, convenience store prices for super-premium juices are just 45.3% higher than grocery store prices and 47.2% higher than mass merchandiser prices.

Our analysis reveals substantial differences in the other three subcategories. Vegetable juice prices declined in grocery stores from 2007-2012, by 13.8%, but they behaved differently from super premium prices in each of the other channels. Vegetable juice prices in mass merchandiser and convenience stores both increased somewhat, though they experience declines from 2011-2012. Drug store prices for vegetable juices decreased substantially by 32.4%, far exceeding drug store price changes for any other subcategory, while liquor store prices increased by 23.7%. In the case of 100% fruit juices, prices increased considerably in every channel, except for grocery stores, where

they decreased overall by 2.5% from 2007 to 2012, after first declining by 9.6% from 2007-2010 and then rebounding somewhat from 2010-2012. This decrease in grocery store prices accounts for why 100% juice prices overall do not increase by more during this six-year period. In the second largest channel for 100% fruit juice sales, convenience stores, prices increase by 22.1%. In the third largest channel, mass merchandisers, prices for 100% juices increase by 10.4% from 2007 to 2012. In the case of fruit drinks, grocery store prices decline by 3.5%, whereas mass merchandiser and convenience store prices increase by 6.2% and 2.8%, respectively. Liquor store prices increase, while drug store prices remain nearly flat. These relatively small changes help explain the small overall increase in fruit drink prices of 0.7% from 2007-2012.

**Analysis by Region:**

In the super premium subcategory, the regions with the lowest mean prices in 2012 are in the more coastal regions, including the Pacific, Northeast and South Atlantic (see Figure B-3 for map of regions and Table B-4). The regions with the highest prices are in the more central regions, particularly in the West South Central, Mountain and West North Central. In terms of changes from 2007 to 2012, prices in the super-premium subcategory decrease in every region by levels ranging from 9.6% to 23.3% (Figure B-4 and Table B-4). The Northeast and West North Central decrease the least, followed by the Mid Atlantic and Mountain regions. The East South Central and East North Central decrease by the most, followed by the South Atlantic and Pacific.

Vegetable juices and drink prices also decrease in all regions, though they follow a different set of patterns than super-premium juices. Prices in the Pacific drop the most from 2007 to 2012, by nearly 20%, followed by the South Atlantic, Mid Atlantic and Northeast. In 2012, three of the four regions with the lowest super-premium prices also have the lowest vegetable juice prices, which are the Northeast, East South Central and South Atlantic. Similarly, the Mountain and West South Central regions are two of the three regions with the highest vegetable juice prices, as they are with super-premium juices. Dissimilarly, the Pacific region is the region with the second-highest vegetable juice mean price in 2012, whereas it has the lowest super-premium price.

For 100% fruit juices, prices increase in some regions and decrease in others from 2007 to 2012, though changing at lower rates on average (when compared in absolute value terms) than super-premium and vegetable juices. The mean price in the Pacific region decreases the most for 100% fruit juices, by 4.9%, as it did with vegetable juices, followed by the Northeast and Mountain regions. The regions where 100% fruit juice prices increase are West South Central, West North Central and Mid-Atlantic. In 2012, 100% fruit juice prices are highest in the Mid Atlantic, West South Central and Mountain regions. The Northeast, East South Central and West North Central have the lowest prices for the 100% fruit juice subcategory.

With respect to the fruit drink category, nearly every region exhibits a slight decrease in price of between 0.3% and 1.5%. Prices in the Pacific region are an exception and decrease by a higher level of 5.3%. In 2012, the two regions with the highest mean fruit drink prices are the Mid Atlantic and Northeast. The lowest fruit drink

prices are in the Mountain and West South Central, which is also one of the regions with the lowest prices for 100% fruit juices and vegetable juices in 2012.

**Conclusions:**

This pricing analysis provides useful insight for firms operating in the beverage industry when developing their business strategies and competitiveness analyses. This is also relevant insight for understanding consumers' willingness to pay for certain products and the convenience of one store type versus another, as well as the impact on the consumer of differences in prices. Regionally, we see both similarities and differences in the trends of mean prices across subcategories. The Pacific region exhibits the greatest decrease in prices for vegetable juices, 100% fruit juices and fruit drinks, as well as considerable decreases in the super-premium subcategory. In 2012, it is the second highest-priced region for vegetable juices, whereas it is the lowest-priced for super-premium juices and has the median value for fruit drinks across the nine regions. Mean prices in the Northeast in 2012, by contrast, are the lowest for both vegetable and 100% juices and second-lowest for super-premium juices, whereas they are the highest for fruit drinks.

These pricing characteristics generate additional questions for future research to respond to, such as the extent to which consumers are aware of the higher prices associated with super-premium juices or convenience store products on a per unit of volume basis and whether these prices are driving their purchasing decisions (versus selecting based on container size or the price per unit purchased). An additional future research area would be to determine what combination of supply and demand factors is driving these differences in regional prices and at what respective magnitudes. A third

area would be to evaluate the correlation of socio-economic and demographic variables such as income levels, education attainment, and race of consumers to differences in prices paid for the same products, controlling for the channel they are being sold in and the geographic location of the store. This would help explain whether income levels were correlated to price levels and whether lower income individuals were paying higher or lower prices, and in turn, the impact of that on their living standard. This may require more precise geographic designations beyond the county-level.

**Table B-1. Summary statistics for price variable, by subcategory, 2007-2012**

| Subcategory | Mean | Median | Standard Deviation | Min | Max |
|---|---|---|---|---|---|
| **Fruit drink** | | | | | |
| 2007 | 0.040 | 0.038 | 0.012 | 0.014 | 0.114 |
| 2008 | 0.276 | 0.038 | 0.012 | 0.014 | 0.122 |
| 2009 | 0.042 | 0.039 | 0.013 | 0.002 | 0.266 |
| 2010 | 0.041 | 0.038 | 0.013 | 0.011 | 0.298 |
| 2011 | 0.040 | 0.037 | 0.012 | 0.006 | 0.165 |
| 2012 | 0.039 | 0.037 | 0.012 | 0.000 | 0.125 |
| **100% Fruit Juice** | | | | | |
| 2007 | 0.055 | 0.054 | 0.017 | 0.009 | 0.311 |
| 2008 | 0.057 | 0.054 | 0.018 | 0.016 | 0.307 |
| 2009 | 0.057 | 0.054 | 0.019 | 0.019 | 0.423 |
| 2010 | 0.055 | 0.051 | 0.020 | 0.003 | 0.230 |
| 2011 | 0.056 | 0.052 | 0.019 | 0.004 | 0.260 |
| 2012 | 0.062 | 0.058 | 0.017 | 0.002 | 0.400 |
| **Super-premium** | | | | | |
| 2007 | 0.195 | 0.192 | 0.031 | 0.001 | 0.463 |
| 2008 | 0.204 | 0.206 | 0.032 | 0.020 | 0.424 |
| 2009 | 0.213 | 0.216 | 0.036 | 0.001 | 0.408 |
| 2010 | 0.208 | 0.208 | 0.041 | 0.001 | 0.398 |
| 2011 | 0.194 | 0.190 | 0.040 | 0.001 | 0.390 |
| 2012 | 0.183 | 0.182 | 0.035 | 0.001 | 0.379 |
| **Vegetable** | | | | | |
| 2007 | 0.073 | 0.068 | 0.027 | 0.008 | 0.225 |
| 2008 | 0.069 | 0.065 | 0.027 | 0.006 | 0.417 |
| 2009 | 0.071 | 0.066 | 0.027 | 0.000 | 0.391 |
| 2010 | 0.068 | 0.063 | 0.027 | 0.000 | 0.297 |
| 2011 | 0.067 | 0.061 | 0.026 | 0.000 | 0.302 |
| 2012 | 0.063 | 0.058 | 0.023 | 0.000 | 0.236 |

[a] Prices are calculated using projected, national sales figures.

**Table B-2. Mean prices per unit of volume ($/ounce), mean volume per item purchased (ounces), and mean prices per item purchased ($), per channel, 2007-2012**

| | Convenience | | | Drug | | | Grocery | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | Mean price per ounce | Mean price per item purchased | Mean volume per item purchased | Mean price per ounce | Mean price per item purchased | Mean volume per item purchased | Mean price per ounce | Mean price per item purchased | Mean volume per item purchased |
| 2007 | 0.070 | 1.815 | 26.070 | 0.053 | 1.883 | 35.734 | 0.043 | 2.646 | 61.289 |
| 2008 | 0.073 | 1.825 | 25.040 | 0.053 | 1.923 | 36.052 | 0.043 | 2.610 | 60.714 |
| 2009 | 0.073 | 1.843 | 25.194 | 0.056 | 2.036 | 36.122 | 0.042 | 2.592 | 61.025 |
| 2010 | 0.076 | 1.887 | 24.828 | 0.055 | 1.931 | 35.336 | 0.041 | 2.439 | 59.436 |
| 2011 | 0.075 | 1.868 | 24.767 | 0.053 | 1.766 | 33.327 | 0.041 | 2.348 | 57.010 |
| 2012 | 0.077 | 1.931 | 25.094 | 0.054 | 1.729 | 32.181 | 0.042 | 2.356 | 56.714 |

| Liquor | | | Mass Merchandiser | | |
|---|---|---|---|---|---|
| Mean price per ounce | Mean price per item purchased | Mean volume per item purchased | Mean price per ounce | Mean price per item purchased | Mean volume per item purchased |
| 0.079 | 2.621 | 33.128 | 0.035 | 2.171 | 61.435 |
| 0.081 | 2.684 | 33.178 | 0.036 | 2.172 | 60.135 |
| 0.084 | 2.744 | 32.518 | 0.037 | 2.239 | 60.752 |
| 0.083 | 2.761 | 33.369 | 0.037 | 2.231 | 61.069 |
| 0.086 | 2.916 | 33.712 | 0.037 | 2.201 | 58.798 |
| 0.087 | 2.935 | 33.893 | 0.039 | 2.224 | 56.627 |

**Table B-3. Mean prices per unit of volume ($/ounce), by subcategory, by channel, 2007 2012**

| Subcategory Name | Year | Convenience | Drug | Grocery | Liquor | Mass Merchandiser |
|---|---|---|---|---|---|---|
| Fruit Drink | 2007 | 0.064 | 0.047 | 0.034 | 0.075 | 0.031 |
| | 2008 | 0.066 | 0.048 | 0.033 | 0.076 | 0.031 |
| | 2009 | 0.064 | 0.051 | 0.034 | 0.080 | 0.032 |
| | 2010 | 0.067 | 0.050 | 0.033 | 0.078 | 0.032 |
| | 2011 | 0.066 | 0.048 | 0.033 | 0.082 | 0.032 |
| | 2012 | 0.066 | 0.047 | 0.033 | 0.080 | 0.033 |
| 100% Fruit Juice | 2007 | 0.085 | 0.064 | 0.052 | 0.083 | 0.047 |
| | 2008 | 0.092 | 0.065 | 0.052 | 0.086 | 0.048 |
| | 2009 | 0.098 | 0.065 | 0.049 | 0.089 | 0.047 |
| | 2010 | 0.103 | 0.061 | 0.047 | 0.088 | 0.046 |
| | 2011 | 0.102 | 0.063 | 0.050 | 0.092 | 0.048 |
| | 2012 | 0.104 | 0.070 | 0.051 | 0.094 | 0.051 |
| Super-premium | 2007 | 0.225 | 0.212 | 0.182 | N/A | 0.195 |
| | 2008 | 0.226 | 0.224 | 0.180 | N/A | 0.193 |
| | 2009 | 0.223 | 0.241 | 0.177 | N/A | 0.187 |
| | 2010 | 0.222 | 0.243 | 0.165 | N/A | 0.167 |
| | 2011 | 0.213 | 0.232 | 0.155 | N/A | 0.157 |
| | 2012 | 0.219 | 0.216 | 0.151 | N/A | 0.149 |
| Vegetable | 2007 | 0.131 | 0.097 | 0.067 | 0.098 | 0.054 |
| | 2008 | 0.138 | 0.079 | 0.068 | 0.096 | 0.056 |
| | 2009 | 0.146 | 0.079 | 0.067 | 0.099 | 0.058 |
| | 2010 | 0.148 | 0.073 | 0.064 | 0.099 | 0.056 |
| | 2011 | 0.145 | 0.073 | 0.060 | 0.112 | 0.056 |
| | 2012 | 0.135 | 0.065 | 0.058 | 0.122 | 0.055 |

[a] Prices are calculated using projected, national sales figure

**Table B-4. 2007 and 2012 mean prices ($/ounce) and % changes, by subcategory and by the 9 census regions**

| Fruit Drink | | | |
|---|---|---|---|
| **Region Name** | **2007 Price** | **2012 Price** | **% change 2007-2012** |
| West South Central | 0.0320 | 0.0320 | 0.1% |
| Mountain | 0.0329 | 0.0324 | -1.3% |
| East South Central | 0.0328 | 0.0325 | -1.0% |
| South Atlantic | 0.0332 | 0.0329 | -1.0% |
| Pacific | 0.0348 | 0.0329 | -5.3% |
| East North Central | 0.0335 | 0.0330 | -1.5% |
| West North Central | 0.0359 | 0.0357 | -0.5% |
| Mid Atlantic | 0.0369 | 0.0364 | -1.2% |
| Northeast | 0.0366 | 0.0365 | -0.3% |

| Super-premium | | | |
|---|---|---|---|
| **Region Name** | **2007 Price** | **2012 Price** | **% change 2007-2012** |
| Pacific | 0.1807 | 0.1496 | -17.2% |
| Northeast | 0.1661 | 0.1502 | -9.6% |
| South Atlantic | 0.1854 | 0.1510 | -18.5% |
| East South Central | 0.1977 | 0.1516 | -23.3% |
| East North Central | 0.1906 | 0.1526 | -20.0% |
| Mid Atlantic | 0.1798 | 0.1539 | -14.4% |
| West South Central | 0.1883 | 0.1557 | -17.3% |
| Mountain | 0.1839 | 0.1573 | -14.5% |
| West North Central | 0.1931 | 0.1692 | -12.4% |

| 100% Fruit Juice | | | |
|---|---|---|---|
| **Region Name** | **2007 Price** | **2012 Price** | **% change 2007-2012** |
| Northeast | 0.0496 | 0.0484 | -2.3% |
| East South Central | 0.0506 | 0.0497 | -1.6% |
| West North Central | 0.0494 | 0.0497 | 0.6% |
| East North Central | 0.0514 | 0.0505 | -1.7% |
| South Atlantic | 0.0516 | 0.0518 | 0.4% |
| Pacific | 0.0548 | 0.0521 | -4.9% |
| Mid Atlantic | 0.0520 | 0.0523 | 0.5% |
| West South Central | 0.0505 | 0.0524 | 3.7% |
| Mountain | 0.0540 | 0.0529 | -2.0% |

| Vegetable | | | |
|---|---|---|---|
| **Region Name** | **2007 Price** | **2012 Price** | **% change 2007-2012** |
| Northeast | 0.0624 | 0.0540 | -13.4% |
| East South Central | 0.0604 | 0.0555 | -8.1% |
| South Atlantic | 0.0659 | 0.0561 | -14.8% |
| Mid Atlantic | 0.0655 | 0.0565 | -13.7% |
| East North Central | 0.0636 | 0.0571 | -10.2% |
| West North Central | 0.0588 | 0.0574 | -2.4% |
| West South Central | 0.0679 | 0.0591 | -13.1% |
| Pacific | 0.0778 | 0.0624 | -19.8% |
| Mountain | 0.0716 | 0.0632 | -11.7% |

[a] Pricing are based on sales figure that are not weighted to represent national-level projections.

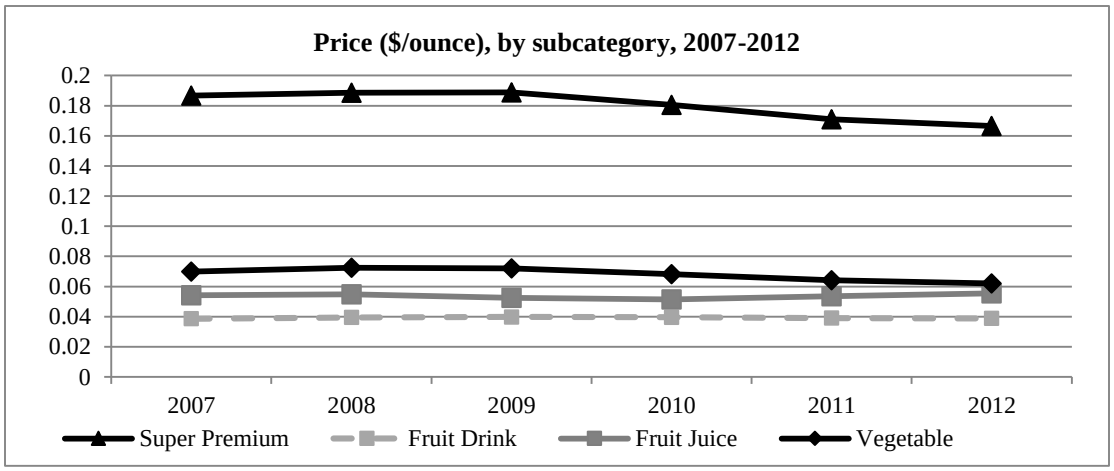


**Figure B-1.** Mean prices ($/ounce), by subcategory, 2007-2012
Note: Mean prices represented in figure are based on prices calculated using projected, national sales figures

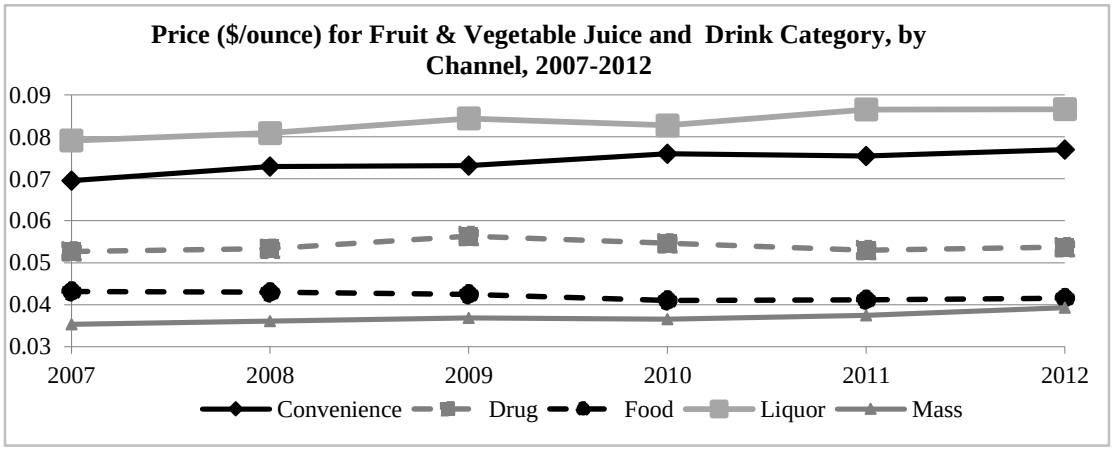


**Figure B-2.** Mean prices ($/ounce) for the overall fruit & vegetable juice and drink category, by channel, 2007-2012

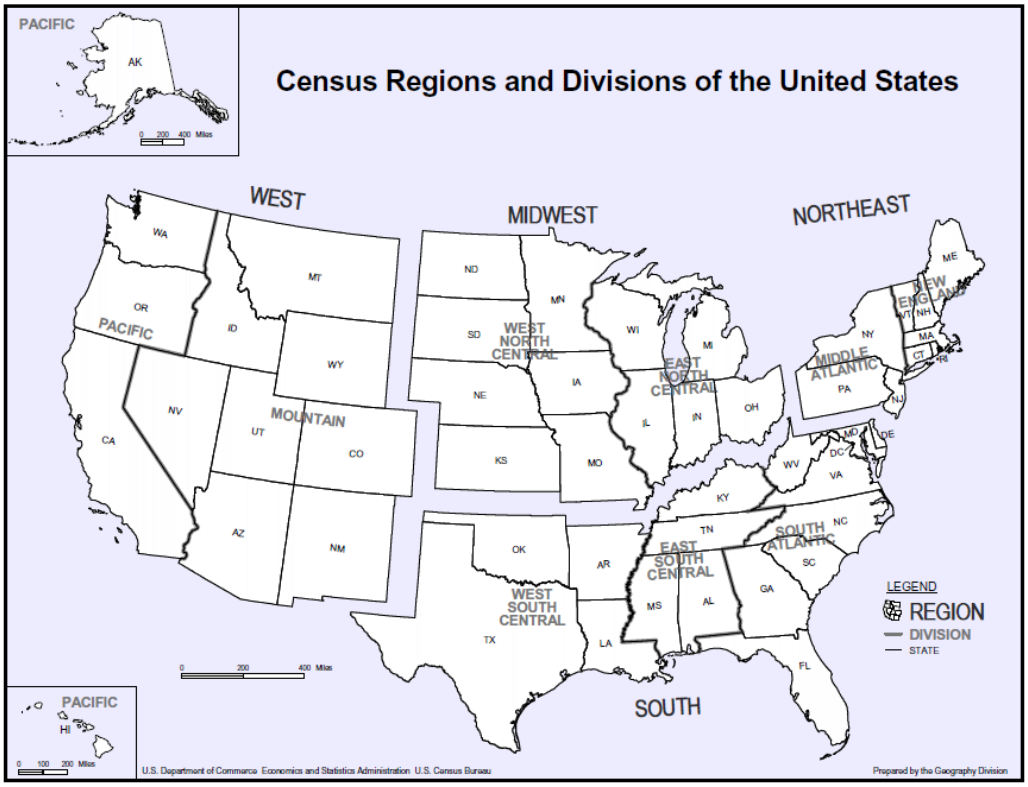


**Figure B-3. US Department of Commerce and Census Bureau regions used for analysis of differences in prices**

**Source:** http://www2.census.gov/geo/pdfs/maps-data/maps/reference/us_regdiv.pdf

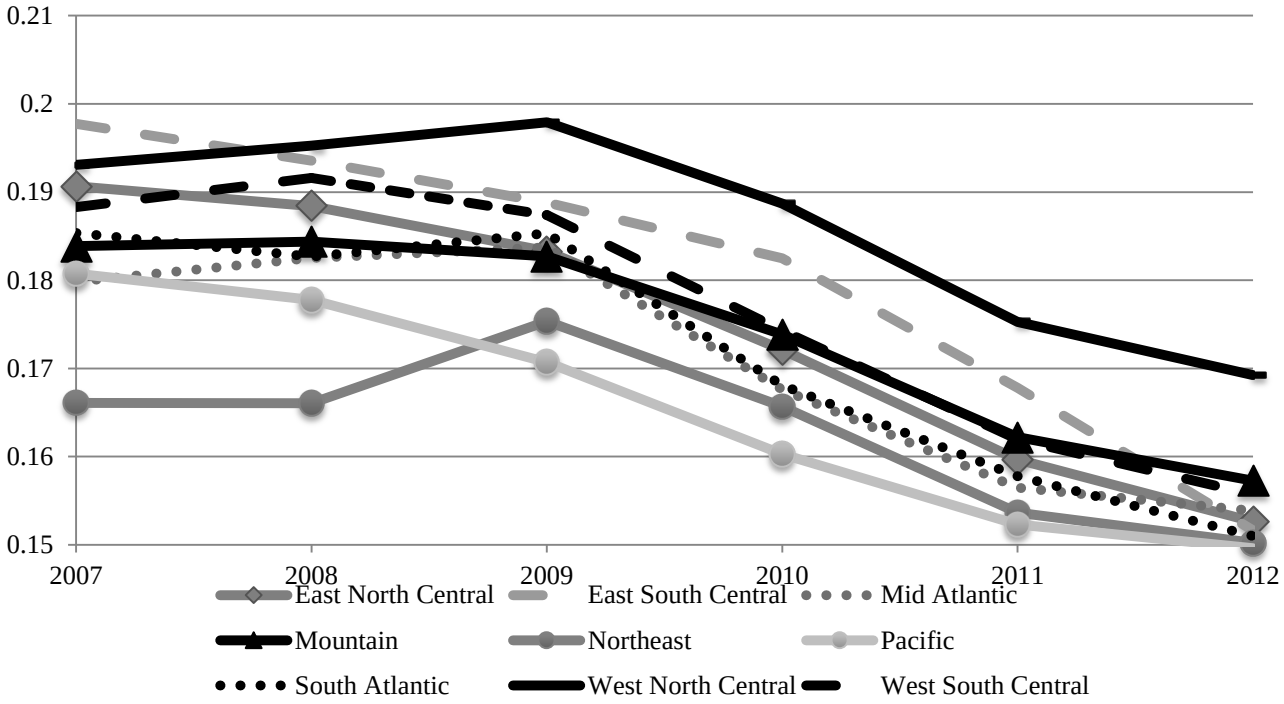


**Figure B-4. Super-premium subcategory mean prices ($/ounce), by the 9 census regions, 2007-2012**
Note: Prices represented in figure are based on sales figure that are not weighted to represent national-level projections