Using In-Home Scanner Data to Analyze Beverage Purchasing Patterns of Chinese

Urban Households

by

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Thesis submitted in partial fulfillment of
the requirements for the degree of
Master of Science in the Duke Global Health Institute
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2015

<u>ABSTRACT</u>

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Abstract

Background: Due to recent rapid economic development, China has seen changes in what foods households are purchasing as well as the general health of the population. In the United States and other high-income countries, in-home scanner programs allow consumer packaged goods companies to measure household level grocery store food purchases and analyze trends of certain food categories while also linking to demographic information of the purchaser. Since few similar research has been conducted in China, especially with beverages, this study aims to examine beverage purchasing patterns among urban households in China across different demographics. Using the results, the study hopes to initiate conversations about what, if any, opportunities exist for health policy to intervene for a healthier Chinese population.

Methods: Secondary data analysis was conducted using scanner data to quantitatively analyze the beverage purchasing patterns among urban households in China from 2011-2013. Scanner data were acquired by Research Triangle Institute (RTI) from Kantar Worldpanel (Kantar Group) and provided for this study. Data were collected from four income levels in 24 provinces/municipalities from a panel of 40,000 Chinese households.

Results: Sugar-Sweetened Beverages (SSB) made up 74% of the total volume of beverages, with the majority of the SSB volume coming from Juice Drinks (29%), Carbonated Soft Drinks (CSD) (21%), and Ready-To-Drink (RTD) Tea (19%). Between

income groups, higher income households purchased significantly higher volumes of RTD Coffee (p<0.0001), 100% Juice (p=0.01), Functional Drinks (p<0.0001), Juice Drinks (p=0.01), RTD Tea (p=0.02), and CSD (p=0.03) than their lower income counterparts. Coastal provinces had lower beverage price points and higher purchasing amounts than interior provinces. Total and per household purchase volumes of Functional Drinks, Juice Drinks, 100% Juice, Packaged Water, and RTD Coffee increased annually, but only the volume increases of Functional Drinks (p=0.004) and RTD Coffee (p=0.006) were statistically significant between 2011 and 2013, while Soybean Milk decreased significantly (p<0.0001). Per household purchase volumes of CSD, Juice Drinks, and 100% Juice all peaked during the busiest holiday season, the Chinese New Year, while Packaged Water and RTD Tea peaked during the second biggest season, National Week.

Conclusions: Because of the majority of beverage volume purchased being SSB, the significance of higher income households purchasing certain SSB more, the volume of certain SSB increasing every year, and the patterns of purchasing volume based on geography and certain periods of the year, creative health policies and campaigns should be addressed now in China to address the growing trends that other countries have seen linking SSB consumption to obesity, diabetes, and cardiovascular disease. Future research should examine whether front-of-package labeling, SSB taxes, advertisement restrictions, regulations around schools, and nutrition education campaigns could reduce SSB purchases in China.

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1. Introduction

1.1 The Changing Economy and Landscape

With rapid development and foreign investment, more and more multi-national food and beverage companies have entered China to cater to a growing consumer base. For example, since Coca-Cola reentered China in 1979, the company has invested more than $5 billion in the country, including $3 billion from 2009-2011 and a total of 43 plants (Coca-Cola, 2013). Similarly, fast food chain restaurants that offer inexpensive sugar sweetened beverages (SSB), have grown tremendously over the past decades. McDonald's entered with one store in 1990 and now aims to open 4,000 by 2017, while Yum! Brands, which owns Kentucky Fried Chicken and Pizza Hut, went from one store in 1987 to 6,900 total restaurants presently (I.-C. Chen, 2014; Jargon, 2015). Even domestic brands, such as Hangzhou Wahaha Group, a large soda and beverage company, has seen large growths and increased production in the past decades, with 60 factories across the country and sales of $13.3 billion in 2012 (Freifelder, 2015; M. Wei, 2012). Rapid development in urban areas have also brought about large-chain grocery stores, distribution and access of vast arrays of packaged beverages, and new decision making experiences for consumers on what and how much to buy (Singer, 2010; G. Yang et al., 2013). From international megastores such as Wal-Mart to national supermarket chains, large-chain convenience stores, and vending machines, consumers have increasing opportunities to buy different types of packaged beverages of domestic and

international brands (C. Chen, 1995; Singer, 2010; F. Y. Zhai et al., 2014).

Simultaneous with economic growth, China has experienced the largest flow of rural to urban migration in the world (K. H. Zhang & Song, 2003). In the past 30 years, the urban population in China has more than tripled (G. Yang et al., 2013). Economic development, widening income inequality between rural and urban populations, reduction of arable land, and the need for urban workforce have all encouraged people throughout China to migrate to urban cities (Pannell, 2002; K. H. Zhang & Song, 2003). *In-situ* urbanization, or rural areas developing into urban classification, have also flourished, with these residents making up one half of the 440 million people since 1979 that account for urban growth, with the other half being rural to urban migrants (K. Chan, 2013). The number of urban residents in China is expected to continue growing, with 48-50% of the total Chinese population projected to live in urban areas by 2020 and over 60% by 2030 (J. Chen, 2007).

1.2 Nutrition Transition and Beverage Behavior

Not only have the developmental landscape and demographics of the country been shifting, but also the consumption behaviors of Chinese people (Astrup, Dyerberg, Selleck, & Stender, 2008; C. Chen, 1995). As the economy grew, Chinese income and social mobility increased, creating a nutrition transition away from a traditional Chinese diet of primarily cereals, vegetables, and little processed foods to a Westernized diet characterized by high energy dense foods and higher intake of sugar-rich beverages

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(Astrup et al., 2008; F. Zhai et al., 2009). While boiled tap water and hot tea are still

traditionally consumed, increased concerns over food safety and contamination along

with more disposable income and busier lifestyles have driven the popularity of bottled

water and other convenient, Ready-To-Drink (RTD) beverages (Baker & Friel, 2014; C.

Chen, 1995; Griffiths; Jing, 2011). Consumers understand that packaged beverages, such

as juices and bottled water with health claims, cost more partly because they are

convenient and have higher-quality ingredients, which they are willing and are now

able to afford (Euromonitor, 2015).

As the world has opened up to China, taste preferences have also shifted, as

consumers have a curiosity to explore new international products or twists on familiar

flavors (Griffiths). Young urban residents, in particular, are drawn to the international

appeal of foreign brands, made popular by the increased amount of Westernized TV

programming and food advertisements (C. Chen, 1995; Parvanta et al., 2010; Singer,

2010). In fact, food and drinks were the most advertised TV products to all audiences in

2004 (Y. B. Zhang & Harwood, 2004). Together with salty chips, soft drinks made up

more than 80% of all food product commercials in China, compared to around 30% in

the United States (Ji & McNeal, 2001) . Along with TV, over the past 10 to 15 years,

mobile media, internet, digital and social media have all become marketing platforms

that have been utilized with a growing digitally connected Chinese user base, especially

the post 1980 and 1990's generation that depend on the Internet to create communities

and bonds (Graylin, 2015; L. Zhang, 2011). Coca-Cola, for example, implemented a campaign in the summer of 2014 putting famous Chinese song lyrics on their label for users to scan and upload to social media, creating a brand experience that helped consumers to express and connect emotionally with the help of Coca-Cola's products (Lightfoot, 2014).

1.3 Chinese Health Outcomes and Their Potential Linkage to Sugar-Sweetened Beverages

Coincidentally enough during this development, as Chinese consumers have greater access to packaged foods and beverages, the prevalence of overweight and obesity, along with diet-related non-communicable diseases (NCD) have all risen in adults and children (Y. Wang, Mi, Shan, Wang, & Ge, 2007; G. Yang et al., 2013). Amongst adults, obesity prevalence increased from 2.9% to 11.8% among men and 4.6% to 11.0% among women from 1991 to 2011 (Mi et al., 2015). The prevalence of obese and overweight adults combined has even reached over 50% in Beijing according to the National Nutrition and Health Survey conducted in 2002 (Y. Wang et al., 2007). Similarly, obesity rates amongst Chinese children to age 7 have increased steadily from 0.9% in 1986, to 2.0% in 1996, and 7.2% in 2006, while the number of overweight children have increased from 4.2% in 1996 to 19.8% in 2006 (Ma et al., 2005; S. Wei, Ju, Li, & Wei, 2011). In regards to type 2 diabetes, the prevalence has increased from about 1% in the 1980s, to 5.5% in 2001, 9.7% in 2008, and 11.6% in 2010 (J. N. Chan, Malik, Jia, & et al., 2009; Gu et al., 2003; Xu, Wang, He, & et al., 2013; W. Yang et al., 2010).

There have been many studies that positively associate SSB consumption to risks of increased body weight, obesity, diabetes, and other diet-related maladies in various populations around the world (V. Malik, Schulze, & Hu, 2006; V. S. Malik et al., 2010; Mirmiran, Yuzbashian, Asghari, Hosseinpour-Niazi, & Azizi, 2015; Singh et al., 2015; Vartanian, Schwartz, & Brownell, 2007). Singh's model estimated that worldwide, there were around 184,000 deaths a year in 2010 due to SSB consumption, with 133,000 coming from diabetes, 45,000 from cardiovascular disease, and 6,450 from cancer (Singh et al., 2015). There have been similar results in Chinese studies linking SSB consumption to weight gain, but mainly focusing on children which have similar but different risk factors of being overweight than adults. Compared to regular milk drinkers, Chinese children aged 6-13 who regularly drank SSB instead had significantly higher body mass indexes (BMI), waist circumferences, and prevalence of obesity and abdominal obesity (Shang et al., 2012). Another study found that among junior high students in Beijing, those with high consumption levels of SSB (multiple times a day or week) were 2.6 times more likely to be obese and overweight compared to those that had low SSB intake levels (less than twice a week) (Jia et al., 2012). There have been fewer studies done with Chinese adults, although one study found that working-age women in Hong Kong that had frequent intakes of SSB (two or more a day) had significantly higher BMI, waist, and hip circumferences than women with less frequent intakes (less than twice a day) (Ko et al., 2010).

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1.4 In-Home Scanner Data as a Valid Method for Analyzing Purchasing Patterns

Understanding exactly what consumers are purchasing is an important first step for any population and diet-related health analysis to take place. In the United States and other high-income countries such as the United Kingdom and France, in-home scanning of grocery purchases using handheld scanners has proven to be an effective method for measuring purchasing patterns at household level (Stevens, Bryant, Wang, Borja, & Bentley, 2011). Universal Product Code (UPC) scanners allow households to record what they purchase from stores by simply scanning the barcodes of the product. Not only are home-scanners easy to use and non-intrusive, they also have an accuracy of 95.6% compared with manual line-item food inventory (Weinstein, Phillips, MacLeod, Arsenault, & Ferris, 2006). Existing scanner data, such as the Nielsen Homescan (The Nielsen Co.) contains information about food products with a UPC that a household purchases, along with socio-demographic information and sampling weights. With this data, specific purchasing trends can be gleaned from specific populations. For example, Ng et al. found that 73% of the total volume of foods purchased over four years by 40,000 and 55,000 nationally representative US households contained caloric sweeteners (Ng, Slining, & Popkin, 2012).

1.5 Research Aims

In China, very limited research has been done using scanner data to quantitatively assess the purchasing patterns in urban households, especially with

regards to beverages. For a country experiencing nationwide economic boom, changing food and beverage consumption behaviors, and increasing NCD rates, analyzing beverage purchase information allows for significant opportunities to assess any health concerning patterns with the general population or with certain demographics. These analyses can be invaluable information for policy makers and other public health experts to identify key problem areas in nutrition and to begin generating strategies for a healthier China. Thus, this research has the following four aims:

1. To examine consumer beverage purchasing patterns, particularly SSB, among urban households across China.

2. To examine beverage purchasing patterns among various income levels of urban households in China.

    Hypothesis: Lower income households purchase significantly more SSB per household than higher income households.

3. To examine beverage purchasing patterns and price among coastal and interior provinces and municipalities in China both with and without respect to income level.

    Hypothesis: Coastal provinces and municipalities purchase more beverages per household than the interior.

4. To examine three-year beverage purchasing trends from 2011 to 2013 among urban households across China.

Hypothesis: Per household volume rates of purchasing increase significantly

from 2011 to 2013 for most all SSB.

2. Methods

2.1 Study Design

This study was comprised of secondary data analysis using scanner data to quantitatively analyze the beverage purchasing patterns among urban households across 24 Chinese provinces and municipalities. Scanner data were acquired by Research Triangle Institute (RTI) from Kantar, a transnational consumer measurement company similar to Nielsen, and provided for this study. Dr. Chen Zhen, Associate Professor of Agricultural and Applied Economics at the University of Georgia at Athens and a former economist at RTI, was the primary liaison for data management.

2.2 Participants

The participants in this study were households that submitted their beverage purchasing information to Kantar's household scanner data program—the Kantar Worldpanel. In total, there were 40,000 households represented by 4 different income levels (<3,000 RMB/month, 3001-5000 RMB/month, 5001-7000 RMB/month, and >7,000 RMB/month) and from urban areas across 24 provinces and municipalities in China. The data used in this study has been aggregated from the 40,000 household-level data and weighted by Kantar to be representative of the urban population in the 24 provinces and municipalities based on census totals. The four municipalities and 20 provinces are part of the first tier of administrative divisions in China directly under the central

government. Table 1 lists all the municipalities and provinces sampled. A map of the

provinces and municipalities sampled in this study is included in Appendix A.

Table 1: The 24 provinces and municipalities and number of households sampled.

Province/ Municipalities(*)	Chinese Name	Households Sampled
BEI JING*	北京	2000
SHANG HAI *	上海	2000
CHONG QING*	重庆	650
TIAN JIN*	天津	1000
AN HUI	安徽	1250
FU JIAN	福建	1150
GUANG DONG	广东	4620
GUANG XI	广西	1170
GUI ZHOU	贵州	800
HE BEI	河北	1260
HEI LONG JIANG	黑龙江	1220
HE NAN	河南	1840
HU BEI	湖北	1750
HU NAN	湖南	1150
JIANG SU	江苏	2860
JIANG XI	江西	870
JI LIN	吉林	810
LIAO NING	辽宁	2430
SHAAN XI	陕西	1230
SHAN DONG	山东	2610
SHAN XI	山西	810
SI CHUAN	四川	2860
YUN NAN	云南	1330
ZHE JIANG	浙江	2330
Total		**40000**

2.3 Procedures

When a household agrees to be part of the program, a barcode scanner is mailed to the participant. They are then instructed on how to scan their purchases by scanning the barcode of every product they buy from the store. In addition to purchase information sent to Kantar's data center in Beijing by households through the Internet, Kantar also collects the demographic information of the household. By complying with Kantar's scanning protocol, households earn points that can be used to redeem products such as consumer electronics that the Worldpanel does not track. This is done to avoid the reward program interfering with households' purchase decisions on products Kantar tracks.

Data was collected over 3 years (2011-2013) and each year was divided into 13, 4-week periods. Information collected for each period included the barcode of the beverage purchased, the income level, province, purchase volume and expenditure. Diet indicator and juice content percentage were obtained from Kantar's UPC description. Barcode level nutrition information including calories was obtained separately from other sources including Datamonitor's Product Launch Analytics database and www.taobao.com by RTI's summer intern.

IRB was applied for but since the study was considered as research with non-human subjects with only de-identified, secondary data analysis used, IRB approval was exempted.

2.4 Measures

Beverages were classified into seven different categories: Carbonated Soft Drinks (CSD), Functional Drinks, Juice, Packaged Water, Ready-To-Drink Coffee (RTD Coffee), Ready-To-Drink Tea (RTD Tea), and Soybean Milk. Functional Drinks include all energy, vitamin, and sports drinks. Juice was separated further into two categories by the researcher into Juice Drinks and 100% Juice, giving a total of eight different beverage categories.

Scanner data measured barcode-level information on purchase volume and expenditure. The volume and expenditure were aggregated and projected by UPC, province, period, and income level using Kantar's survey weights. All beverage purchasing information was separated into its appropriate category. Per household volume and expenditure was obtained by dividing aggregate data by province-, income- or time-specific population. This was done to prevent false comparisons between income groups and provinces with different population amounts as well as annual population growth. Volume of beverages was measured by liters. Expenditure was measured in the Chinese national currency, the RMB. Price was calculated by dividing total expenditure by total purchase volume to get RMB/liter.

Provinces and municipalities were grouped into being either interior or coastal. Ten of the 24 provinces and municipalities used in this study are on the coast, which include Beijing, Fujian, Guangdong, Hebei, Jiangsu, Liaoning, Shandong, Shanghai,

Tianjin, and Zhejiang. Historically, coastal provinces have been viewed as more economically flourishing due to geographical location to shipping lines and trading ease, and for this reason, have been separated and analyzed comparatively in the literature and similarly for this study (Fleisher & Chen, 1997; Fujita & Hu, 2001).

Barcode level nutrition information had information on whether the product was diet, meaning labeled as diet, having no sugar, or total calories were zero. It also included information on the percent of juice as stated in the product's description. Using related SSB studies (Han & Powell, 2013) and the FDA's proposed definition for nutrition labeling revisions (FDA, 2014b), SSB was defined as any non-diet, non-alcoholic beverage with added sugars, which are sugars that are added during processing or packaged as such, and include sugars (free, mono- and disaccharides), syrups, naturally occurring sugars, and other caloric sweeteners. Sugar alcohols such as Xylitol were not included in the SSB definition. Neither were beverages that were 100% juice since they contained no added sugars, unlike Juice Drinks. Thus, intrinsically, 100% Juice and Packaged Water were not considered SSB.

2.5 Analysis

All raw beverage data was collected in Excel spreadsheets (Microsoft). Data that had no UPC and diet information were considered missing data and thus removed (accounted for less than 5% of total beverage volume). Data was aggregated, merged, and analyzed using Stata 13.0 (StataCorp). For the aims with ANOVA tests, a log scale

was first applied to per household purchase volume to remove skewness and then a critical alpha probability of <0.5 was used to determine significance.

Specifically, for Aim 1, total unique barcodes purchased, total volume purchased, and volume market share percentages were calculated for all beverage categories. The same information was calculated with regards to SSB, along with how much of the total volume purchased was considered SSB volume.

For Aim 2, per household purchase volume was calculated for each income group for all beverage categories. A two-way ANOVA test was performed for each category and significance was measured between income groups.

For Aim 3, both total purchase volume and total expenditure were analyzed for each province and municipality. Per household purchase volume and price was calculated for each province and municipality, and then aggregated into either the coastal or interior group. Per household purchase volume was also plotted against price for each province and municipality to obtain a spatial understanding of price-demand relationships. These calculations and procedures were done for each beverage category.

For Aim 4, total purchase volume of each beverage category was first measured for each year (2011, 2012, 2013). Next, two-way ANOVA tests were performed to test for significant differences in per household purchase volumes between years. To get another perspective of each beverage category's purchasing trends throughout the three-year period, per household purchase volume was measured for each of the 13 4-week

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periods for each of the three years. This information was then plotted to determine

visual pattern trends.

A table summarizing each aim's measure and analysis is shown below (Table 2).

Table 2: Summary of measures and analysis for each research aim.

	Aim	Variables Analyzed	How Created	Stat. Test Used	Analysis Output
1	Summary statistics and SSB prevalence	barcode (Universal Product Code/UPC), volume (liter)	included in data collection	none	total unique barcodes and volume purchased, volume share, total SSB barcodes and SSB volume saturation within each category
2	Purchasing differences between income groups	per household (HH) purchase volume based off income group (liter)	total purchase volume for given income group divided by final HH pop. for given income group	ANOVA	per HH purchase volume amounts for each income group, ANOVA significance tests between income groups
3	Price and purchase volumes for 24 provinces/ municipalit-ies (P/M)	price (RMB/liter)	total expenditure for given P/M divided by total purchase volume for given P/M	none	price for each P/M, and interior and coastal P/M
		per HH purchase volume based off P/M (liter)	total purchase volume for given P/M divided by final HH pop. for given P/M	none	per HH purchase volume amounts for each P/M, and interior and coastal P/M with respects to income level
4	Purchasing differences between years and periods	per HH purchase volume based off year (liter)	total purchase volume in given year divided by total HH pop. in given year	ANOVA	per HH purchase volume amounts in each year, ANOVA significance tests between years
		per HH purchase volume based off period (liter)	total purchase volume in given period divided by total HH pop. in given period	none	graphical illustration of per HH purchase volume over periods

3. Results

3.1 Aim 1: Beverage Purchasing Patterns as a Whole and as SSB

Out of the total volume of beverages that were purchased, Juice Drinks, Packaged Water, CSD, and RTD Tea had the largest volumes purchased out of the eight categories, and in turn, the largest volume shares of 29.5%, 23.0%, 20.7%, and 18.9% respectively. Functional Drinks, Soybean Milk, 100% Juice, and RTD Coffee had the lowest volumes purchased and lowest total volume shares of 4.2%, 1.6%, 1.5%, and 0.6% respectively. Juice Drinks also made up the largest number of unique barcodes that were purchased (14,021) which represents the total number of different types of products sold, while RTD Coffee had the least number of unique barcodes purchased (349) (Table 3).

In terms of SSB for each category, percentages of unique barcodes considered SSB made up the overwhelming majority of total unique barcodes purchased for each beverage category, ranging from 97% (CSD) to 99.5% (Functional Drinks and Soybean Milk). Accordingly, purchase volumes of SSB also made up the overwhelming majority of total volume purchased for each beverage category. 100% of total Functional Drink volume purchased were SSB, followed by 99.9%, 98.6%, 98.6%, 98.5%, and 97.8% for RTD Coffee, Juice Drinks, CSD, RTD Tea, and Soybean Milk respectively. Thus for these six categories, practically all the volume purchased were considered SSB (Table 3).

Table 3: Total barcodes purchased, volumes purchased, percent shares, and equivalent relative information for SSB for all beverage categories.

Category	Total Unique Barcodes Purchased	Total Volume Purchased (per 1 million liters)	Percent of Total Volume Market Share	Total Unique Barcodes Purchased that are SSB	Percent of Unique Barcodes that are SSB	Total SSB Volume Purchased (per 1 million liters)	Percent of Total Volume that are SSB
Juice Drinks	14021	7984.8	29.5%	13753	98.1%	7869.5	98.6%
Packaged Water	2986	6226.3	23.0%	0	0.0%	0.0	0.0%
Carbonated Soft Drinks	4455	5595.5	20.7%	4321	97.0%	5519.6	98.6%
Ready-To-Drink Tea	3012	5112.9	18.9%	2955	98.1%	5038.6	98.5%
Functional Drinks	852	1147.8	4.2%	848	99.5%	1147.4	100.0%
Soybean Milk	2074	436.9	1.6%	2064	99.5%	427.3	97.8%
100% Juice	1195	405.0	1.5%	0	0.0%	0.0	0.0%
Ready-To-Drink Coffee	349	149.8	0.6%	347	99.4%	149.6	99.9%
Total	**28944**	**27059.1**	**100.0%**	**24288**	**83.9%**	**20152.0**	**74.5%**

As a whole, SSB volume represented 74% of the total volume of beverages purchased. Within total SSB volume, the SSB beverages with the largest volume share were Juice Drinks (39%), CSD (27%), and RTD Tea (25%). The lower volume shares were from Functional Drinks (6%), Soybean Milk (2%), and RTD Coffee (1%) (Figure 1).
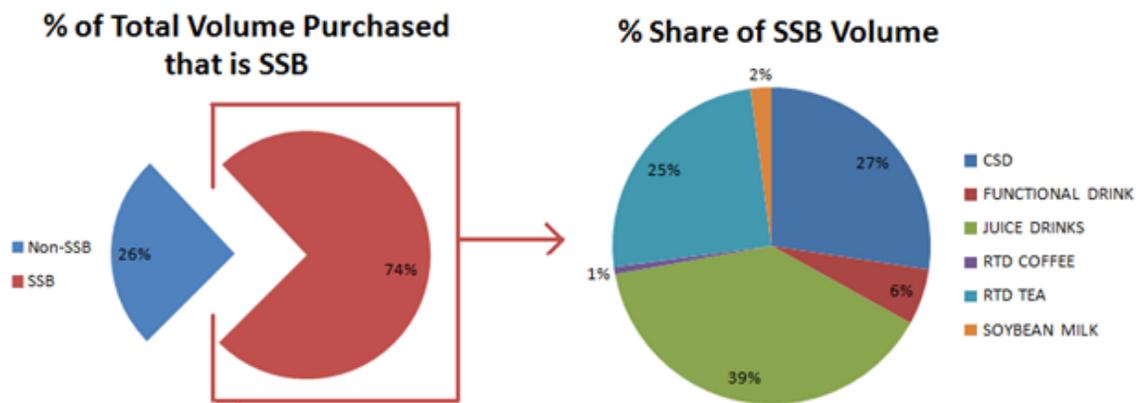
Figure 1: Percent volume breakdown of SSB and the corresponding volume share of different beverages within SSB.

3.2 Aim 2: Beverage Purchasing Patterns and Income Level

Per household purchase volumes show that for all beverage categories, the highest income group (>7,000 RMB/month) purchased more than the next lowest income group (5001-7000 RMB/month), which purchased more than the next lowest (3001-5000 RMB/month), which purchased more than the lowest income group (<3000 RMB/month). The only exception was the Juice Drinks category, with the second highest income group purchasing more than the highest income group (Table 4).

Table 4: Per household (HH) purchase volumes for each income group, for each beverage category

Category	Total Volume Purchased per HH for INCOME<3000 RMB (liters)	Total Volume Purchased per HH for INCOME 3001-5000 RMB (liters)	Total Volume Purchased per HH for INCOME 5001-7000 RMB (liters)	Total Volume Purchased per HH for INCOME>7000 RMB (liters)
Juice Drinks	40.9	50.5	56.9	54.7
Packaged Water	33.6	35.9	42.8	46.8
Carbonated Soft Drinks	27.8	32.6	40.6	40.9
Ready-To-Drink Tea	23.0	28.8	36.1	40.2
Functional Drinks	4.9	6.1	8.3	9.3
Soybean Milk	0.9	1.4	2.9	5.1
100% Juice	1.4	1.7	2.9	3.9
Ready-To-Drink Coffee	0.4	0.6	1.0	1.6
Total	**133.0**	**157.6**	**191.5**	**202.5**

In terms of actual significance between per household volume between income groups, the ANOVA tests show that there was a significant difference between the lowest income group and the highest income group for the following beverages: RTD Coffee ($p<0.0001$), 100% Juice ($p=0.01$), Functional Drinks ($p<0.0001$), Juice Drinks ($p=0.01$), RTD Tea ($p=0.02$), and CSD ($p=0.03$). There was also a significant difference between the lowest income group and the second-highest income group (5001-7000RMB/month) for RTD Coffee ($p=0.02$), Functional Drinks ($p<0.0001$), Juice Drinks ($p=0.01$), RTD Tea ($p=0.02$), Soybean Milk ($p=0.43$), and CSD ($p=0.01$) (Table 5).

Table 5: ANOVA tests to determine significance of per household purchase volume between income groups, comparing Income <3000RMB as the referent group.

		Coefficient	Standard Error	P-value	95% Confidence Interval
Juice Drinks	Income 3001-5000RMB	41.1	1.1	0.16	(35.0, 48.2)
	Income 5001-7000RMB	41.3	1.1	0.01	(35.1, 48.5)
	Income >7000RMB	41.2	1.1	0.01	(35.1, 48.4)
Packaged Water	Income 3001-5000RMB	33.9	1.1	0.50	(28.2, 40.8)
	Income 5001-7000RMB	34.1	1.1	0.07	(28.3, 41.0)
	Income >7000RMB	34.1	1.1	0.08	(28.3, 41.0)
Carbonated Soft Drinks	Income 3001-5000RMB	29.3	1.1	0.27	(24.7, 34.8)
	Income 5001-7000RMB	29.5	1.1	0.01	(24.9, 35.1)
	Income >7000RMB	29.5	1.1	0.03	(24.8, 35.0)
Ready-To-Drink Tea	Income 3001-5000RMB	25.5	1.1	0.22	(21.1, 30.9)
	Income 5001-7000RMB	25.7	1.1	0.02	(21.2, 31.2)
	Income >7000RMB	25.7	1.1	0.02	(21.2, 31.1)
Functional Drinks	Income 3001-5000RMB	6.3	1.1	0.12	(5.3, 7.4)
	Income 5001-7000RMB	6.6	1.1	0.00	(5.6, 7.9)
	Income >7000RMB	6.7	1.1	0.00	(5.6, 8.0)
Soybean Milk	Income 3001-5000RMB	1.8	1.5	0.81	(0.9, 3.8)
	Income 5001-7000RMB	2.1	1.5	0.43	(1.0, 4.4)
	Income >7000RMB	2.0	1.5	0.55	(0.9, 4.2)
100% Juice	Income 3001-5000RMB	2.2	1.4	0.52	(1.3, 3.9)
	Income 5001-7000RMB	2.9	1.4	0.05	(1.6, 5.1)
	Income >7000RMB	3.3	1.4	0.01	(1.8, 5.8)
Ready-To-Drink Coffee	Income 3001-5000RMB	1.7	1.3	0.24	(1.0, 2.8)
	Income 5001-7000RMB	2.2	1.3	0.02	(1.3, 3.7)
	Income >7000RMB	2.7	1.3	0.00	(1.6, 4.6)

3.3 Aim 3: Beverage Purchasing Patterns, Province, and Price

Coastal provinces and municipalities combined had higher per household purchase volumes than interior provinces and municipalities combined for all beverage categories. For all categories except Juice Drinks and Packaged Water, the coastal group also had lower price points than the interior group (Table 6). A spatial illustration of per household purchase volume and price comparison for each province and municipality and beverage category is given in Appendix B with the average price for each beverage represented by a red horizontal line.

In terms of actual average prices of each beverage, RTD Coffee was the most expensive (14.33 RMB/liter), followed by 100% Juice (13.56 RMB/liter), Functional Drinks (8.83 RMB/liter), Juice Drinks (7.84 RMB/liter), Soybean Milk (7.43 RMB/liter), RTD Tea (6.34 RMB/liter), CSD (4.19 RMB/liter), and Packaged Water (2.33 RMB/liter) (Table 6).

Table 6: Average per household (HH) purchase volume and price for interior, coastal, and all provinces and municipalities

Category	Average per HH Purchase Volume (liters)			Average Price (RMB/liter)		
	Interior	Coastal	All	Interior	Coastal	All
Juice Drinks	51.3	53.3	52.3	7.68	8.00	7.84
Packaged Water	36.5	45.1	40.8	2.31	2.35	2.33
CSD	32.3	41.1	36.6	4.30	4.11	4.19
Ready-To-Drink Tea	29.2	37.8	33.5	6.59	6.16	6.34
Functional Drinks	6.7	8.3	7.5	8.99	8.69	8.83
Soybean Milk	0.7	5.1	2.9	8.55	7.28	7.43
100% Juice	1.6	3.7	2.7	13.75	13.47	13.56
Ready-To-Drink Coffee	0.4	1.6	1.0	16.65	13.70	14.33

Looking at both income and province, coastal provinces also purchased more volume per household between each income level and for every beverage category compared to the interior group. The only exception was with Juice Drinks for the 5,001-7,000 RMB/month group, as interior averages were higher than coastal averages. (Table 7).

Table 7: Per household (HH) purchase volume (liters) for coastal and interior provinces and municipalities within each income level

Category	Interior Provinces and Municipalities				Coastal Provinces and Municipalities			
	Per HH Pur. Vol. for income <3000 RMB	Per HH Pur. Vol. for income 3001-5000 RMB	Per HH Pur. Vol. for income 5001-7000 RMB	Per HH Pur. Vol. for income >7000 RMB	Per HH Pur. Vol. for income <3000 RMB	Per HH Pur. Vol. for income 3001-5000 RMB	Per HH Pur. Vol. for income 5001-7000 RMB	Per HH Pur. Vol. for income >7000 RMB
Juice Drinks	39.4	46.8	60.7	54.8	49.4	55.1	57.2	62.6
Packaged Water	34.3	36.5	42.4	40.2	51.0	42.1	48.1	52.6
Carbonated Soft Drinks	26.1	30.5	40.2	35.6	43.3	41.2	44.8	46.6
Ready-To-Drink Tea	23.7	27.4	33.4	32.3	41.5	37.9	40.0	42.5
Functional Drinks	5.1	5.9	8.3	8.4	6.5	7.2	8.4	9.9
Soybean Milk	0.7	0.6	0.7	0.7	4.3	3.6	4.6	4.8
100% Juice	1.0	1.2	2.2	2.3	3.4	3.7	4.2	5.8
Ready-To-Drink Coffee	0.3	0.3	0.5	0.6	2.3	1.5	1.8	2.1

3.4 Aim 4: Beverage Purchasing Patterns and Time Periods

By year (2011, 2012, 2013), Functional Drinks, Juice Drinks, 100% Juice, Packaged Water, and RTD Coffee had a per household purchase volume that increased every year. CSD and RTD Tea fluctuated up and down, while Soybean Milk was the only beverage that had a continuous negative trend in per household purchase volume (Table 8).

Table 8: Per household (HH) purchase volume for years 2011, 2012, and 2013.

Category	Total Volume Purchased per HH for Year 2011 (liters)	Total Volume Purchased per HH for Year 2012 (liters)	Total Volume Purchased per HH for Year 2013 (liters)
Juice Drinks	17.7	17.8	18.1
Packaged Water	13.3	14.1	14.4
Carbonated Soft Drinks	13.2	12.2	12.3
Ready-To-Drink Tea	11.6	10.7	12.0
Functional Drinks	2.1	2.5	3.1
100% Juice	0.9	0.9	0.9
Soybean Milk	1.1	1.0	0.9
Ready-To-Drink Coffee	0.3	0.3	0.4

In terms of actual significant differences, the ANOVA tests show that only Functional Drinks ($p=0.004$) and RTD Coffee ($p=0.006$) had significant per household purchase volume increases between 2011 and 2013. Soybean Milk, meanwhile, had per household purchase volume that significantly decreased ($p<0.0001$) from 2011 to 2013 (Table 9).

Table 9: ANOVA tests to determine significance of per household purchase volume between years, comparing year 2011 as the referent group.

		Coefficient	Standard Error	P-value	95% Confidence Interval
Juice Drinks	2012	2.3	2.2	0.91	(1.8, 2.9)
	2013	2.3	2.2	0.88	(1.8, 2.9)
Packaged Water	2012	2.0	2.4	0.76	(1.4, 2.8)
	2013	2.0	2.4	0.67	(1.4, 2.8)
Carbonated Soft Drinks	2012	1.9	2.2	0.62	(1.5, 2.4)
	2013	1.9	2.2	0.57	(1.5, 2.4)
Ready-To-Drink Tea	2012	1.8	2.3	0.74	(1.3, 2.3)
	2013	1.9	2.3	0.80	(1.4, 2.5)
Functional Drinks	2012	1.4	2.2	0.14	(1.1, 1.8)
	2013	1.6	2.2	0.01	(1.3, 2.1)
Soybean Milk	2012	1.0	2.1	0.00	(0.9, 1.0)
	2013	0.9	2.1	0.00	(0.8, 0.9)
100% Juice	2012	1.1	2.3	0.69	(0.8, 1.5)
	2013	1.1	2.3	0.64	(0.8, 1.5)
Ready-To-Drink Coffee	2012	1.1	2.1	0.06	(1.0, 1.3)
	2013	1.2	2.1	0.01	(1.1-1.3)

By period, CSD and Juice Drinks had per household volumes that peaked substantially between periods 1-3 for each year, which so happens to be the same time as the month-long festivities of Chinese New Year (usually celebrated late January to late February depending on the equivalent lunar date). Packaged Water and RTD Tea peaked substantially at period 8 for each year, which is the same time that China's

second biggest holiday season, National Week, takes place. 100% Juice peaked slightly

during periods 1-3, but stayed relatively flat during other periods, while Functional

Drinks, RTD Coffee and Soybean Milk remained relatively flat and consistent during all
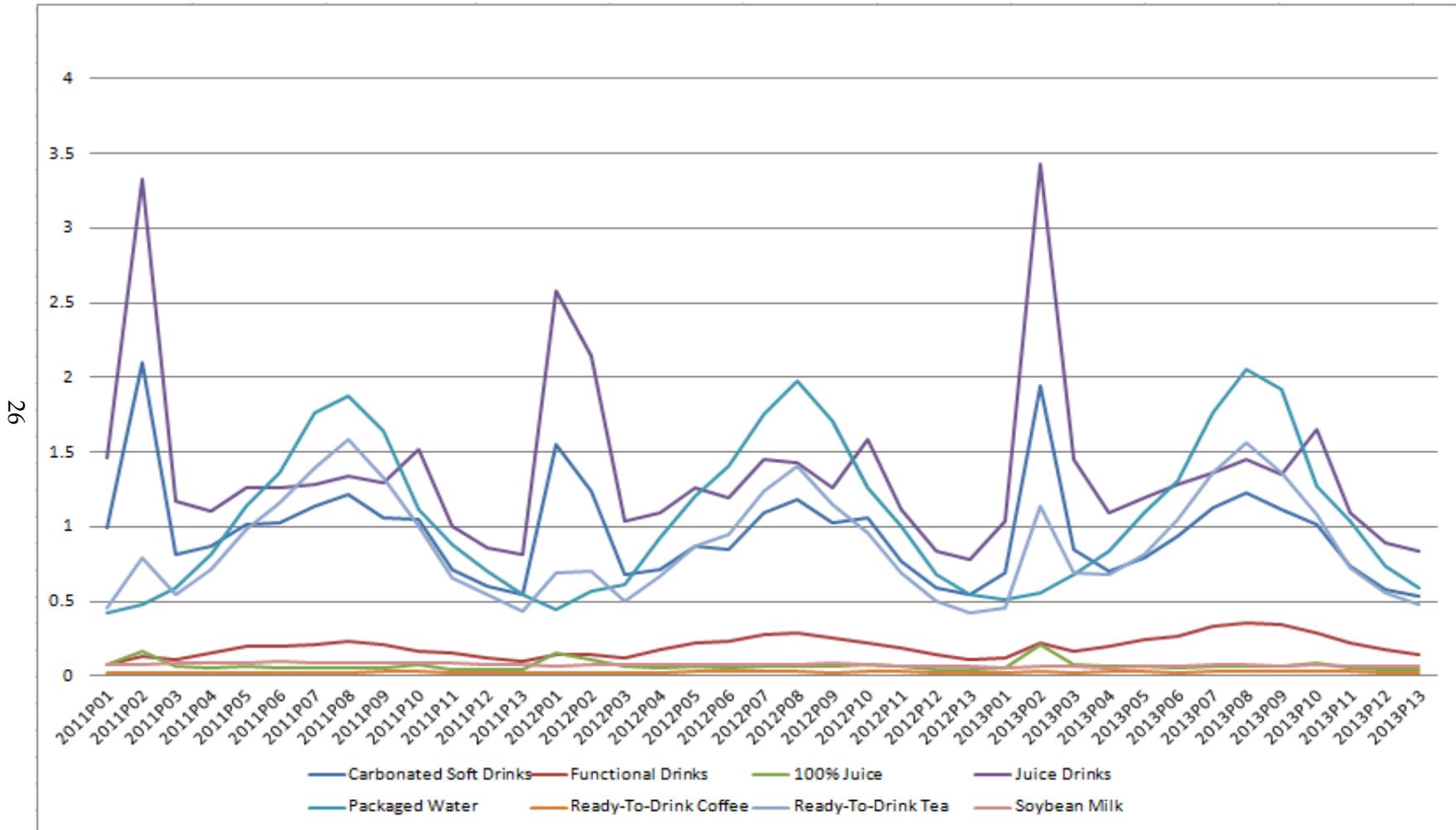
periods for each year (Figure 2).

Figure 2: Per household purchase volumes (liters) for each period (2011P01 – 2013P13) for all beverage categories.

4. Discussion

Juice Drinks, Packaged Water, CSD, and RTD Tea were the big four beverages that represented the majority of all beverage volume purchased. Besides Packaged Water, they also represented the majority of SSB volume purchased. Along with Functional Drinks, Soybean Milk, and RTD Coffee, these six categories individually had a miniscule total purchase volume that were non-SSB, as SSB made up the overwhelming percentage of total volume purchased for each of these categories. This means that consumers hardly purchased any diet options, but rather purchased added sugar options, essentially demonstrating that these six categories can practically all be considered SSB. Between income groups, all categories except Packaged Water and Soybean Milk had significant differences in per household purchase volume with the highest income group purchasing more than the lowest income group. RTD Coffee was the most expensive beverage followed by 100% Juice, Functional Drinks, Juice Drinks, Soybean Milk, RTD Tea, CSD, and Packaged Water. Coastal provinces and municipalities had a higher per household purchase volume and lower price than the inland group for all categories, irrespective of income level. Yearly, nearly all categories increased annually but only Functional Drinks and RTD Coffee had significant per household purchase volume increases from 2011 to 2013, while Soybean Milk decreased significantly. By period, per household purchase volumes of CSD and Juice Drinks peaked during periods 1-3, around the same time as the Chinese New Year festivities.

Packaged Water and RTD Tea, meanwhile, peaked during period 8, the same time as National Week.

The large volume purchases of CSD, Juice Drinks, and RTD Tea, along with the rising purchase rates of RTD Coffee and Functional Drinks demonstrate how popular SSB categories are. This growing SSB use is consistent with other large developing countries that have experienced changing consumption behavior due to economic development and increased wealth (Cabrera Escobar, Veerman, Tollman, Bertram, & Hofman, 2013; Rehm, Matte, Van Wye, Young, & Frieden, 2008). While CSD have been in the public health spotlight as the major culprit of global obesity (James & Kerr, 2005), Juice Drinks and RTD Tea are emerging and significant SSB markets in China as well and should not be overlooked. Juice Drinks are cheaper than 100% Juice, but just as refreshing, sweet, and marketed with nutritional claims that consumers are now willing and able to spend more on for health (Euromonitor, 2015). Tea, on the other hand, has been cultivated and drunk for thousands of years in China, but due to mass commercialization and the demand for familiar flavors that are convenient and affordable, RTD Tea has become a popular and growing beverage category as evidenced by the two biggest tea brands in China, Wong Lo Kat and Jiaduobao, which grew a combined $1.5 billion in 2013 (Arthur, 2014; Griffiths).

Functional Drink and RTD Coffee purchases are significantly growing annually in China as well. These energy-boosting, non-traditional drinks may be appealing to a

younger, busier population in China, seeking more Western preferences and looking for value added products (C. Chen, 1995; Singer, 2010). Fittingly, coffee culture has grown recently in China, namely because of Westernization and more successful, overseas Chinese returning home with newly acquired coffee tastes (Duggan, 2015). This might also explain why this study found that higher income households purchased significantly more RTD Coffee than the lowest income household. Functional Drinks, also purchased significantly more by higher income households, increased in purchase volume significantly from 2011 to 2013 as well. This trend matches the rising popularity globally of the energy and sports drink market. The US, for example, saw a 6.7% increase of sales from 2012 to 2013, while globally, the compound annual growth rate is expected to grow over 10% by 2016 ("Energy Drinks Market - Global Industry Size, Share, Trends, Analysis and Forecasts 2012-2018," 2015; Wong, 2013). As Chinese consumers are becoming more aware about health and fitness benefits, the presence of these sports and energy drinks, including the Chinese market leader Red Bull (Hong Niu), is a trend that will only keep growing in China("Energy Drinks Market in China," 2015; Hennessy, 2013). Soybean Milk, meanwhile, has a declining per household volume amount annually. One explanation is that Soybean Milk, a traditional beverage consumed while hot, is readily available and made fresh by street vendors, thus untraceable by a barcode scanner. Another explanation is the decreasing popularity of the traditional beverage, especially if Functional Drinks and RTD Coffee are more

marketable to a busier, younger generation influenced heavily by Western culture (C. Chen, 1995; Singer, 2010).

The finding that the highest income groups purchased more SSB than the lowest income group in China is in contrast to the hypothesis and what other studies have shown with other populations. In the United States, one study showed that individuals from households with low socioeconomic status (SES) had increased likelihoods of being frequent soda consumers (Rehm et al., 2008), while another linked low-income children and low-income adults to be more likely heavy consumers of SSB compared to their higher-income counterparts (Han & Powell, 2013). Even a study done with urban Chinese students showed that children from low-income families from six different provinces were more prone to becoming regular SSB drinkers (Shang et al., 2012). Their explanations for lower SES individuals consuming more SSB include lack of nutrition knowledge and the relative low cost of SSB (Duan, 2009; Han & Powell, 2013). Although these studies evaluated consumption and not purchasing, related but separate measures, and also specified children as the participants, the results seem to depict an opposite pattern from what this study found. This study showed that higher income households purchased significantly more categories with SSB including CSD, RTD Tea, RTD Coffee, Functional Drinks, and Juice Drinks. This may be due to the price of some of these beverages being more expensive, including RTD Coffee and Functional Drinks, that would allow higher income households to purchase more. Price also varies from coastal

to interior, with the coastal group having cheaper prices except for Juice Drinks, which might explain variation between study results. Thus, households living in the coastal group might facilitate more purchasing compared to households in the interior group, no matter if they fall under the lowest income group or the highest. This study's results also illustrated that for some beverages, especially for the three most purchased SSB, CSD, Juice Drinks, and RTD Tea, the difference between per household purchase volumes of high and low income levels is smaller amongst coastal groups than interior groups. This means that purchasing power is more equal between income levels if the household is from the coast versus the interior. The geographical differences in cost are probably due to the logistics of shipping being cheaper to coastal provinces than to inland provinces and a higher density of manufacturing plants that are located in the coastal provinces (OECD 2000).

The two biggest holiday seasons throughout the year also explain the reason why certain beverages have peaked volume purchases. Chinese New Year, the largest holiday in China, has a strong impact on purchasing decisions. Chinese New Year dinner, the first night of celebration, involves families from all over China reuniting to share a feast together along with plenty of beverages, including novel, value products such as CSD, 100% Juice, and Juice Drinks that family members bring over to share. The culture of buying and gift giving during Chinese New Year is a strong reason why these beverages might have higher purchasing volumes during this time. Also, CSD and Juice

Drinks are not considered as low quality as they might be perceived in Western

countries, but on the contrary, a status symbol showing prestige and a thoughtful

gesture to share as a gift (Griffiths). The second biggest holiday season, National Week,

may explain the reason why Packaged Water and RTD Tea purchase volume peak

during Period 8. During this weeklong holiday, people young and old take advantage

of the long break to spend time outdoors and travel to different places to enjoy the late

summer weather. A traditional and popular activity to do during this holiday is to hike

mountains, which explains why Packaged Water and RTD Tea purchase volume peak

during Period 8 since both beverages can be used to stay hydrated. Both of these are

relatively cheap as well compared to Functional Drinks. Food safety and quality are

other reasons why Packaged Water is purchased heavily, as consumers want a safe,

reliable, and quality source of water, especially amid concerns over pollution and

contamination (Jing, 2011).

4.1 Implications for policy and practice

Clearly, SSB have a strong and growing presence in China, as evidenced by the

74% total volume share of all purchased beverages, the percent share of SSB represented

in each category, and the increased volume purchasing rates of certain SSB yearly.

Various countries, regional governments, and NGO's such as the Institute of Medicine

have imposed or advocated national and local regulations to combat the growing trends

of SSB and obesity, including a "Soda Tax" that increases the cost of the soda or SSB at

the point-of-sale (Mytton, Clarke, & Rayner, 2012; Powell, Chriqui, Khan, Wada, &

Chaloupka, 2013). The added cost is meant to deter consumers from buying SSB as

much and as frequently, and the tax revenue generated can be used in other programs to

encourage healthier diets and prevent obesity (Sturm, Powell, Chriqui, & Chaloupka,

2010; Y. C. Wang, Coxson, Shen, Goldman, & Bibbins-Domingo, 2012). Numerous

studies have been conducted showing that a soda tax is beneficial and can reduce

obesity rates (Cabrera Escobar et al., 2013). In 2014, Mexico passed a soda tax that

charged one peso per liter (roughly 10%) to soda and other SSB. Already, preliminary

results reported by the University of North Carolina Chapel Hill Food Research

Program have shown positive results with a 6% average decline in taxed purchases and

a 4% increase in un-taxed beverages, especially bottled water (Hollingsworth, 2015;

Stern, Piernas, Barquera, Rivera, & Popkin, 2014). Other experts suggest a stricter

volume-based tax, such as a penny-per-ounce sugar tax, and claim that a tax would need

to be at least 20% to have significant impacts on purchase change and health (Mytton et

al., 2012; Y. C. Wang et al., 2012). Berkeley, California, the first city ever in the US to

pass a soda tax in 2015, charges distributors an additional one cent per ounce (roughly

20%) for sugary drinks from soda, to energy drinks, to coffee drinks and sweetened tea.

The excise tax is meant to raise the price before the point of purchase so that consumers

are more aware, and indeed it has in Berkeley after three months of implementation

(Falbe, Rojas, Grummon, & Madsen, 2015). Berkeley's tax has also raised $116,000 of

revenue so far and is on target to reach $1.2 million by the end of year, which will be

allocated to school cooking and gardening programs as well as possibly bringing

educational and nutritional campaigns to marginalized communities (Dugdale, 2015).

China currently has no such policies encouraging lower SSB consumption but could

consider a SSB-related tax. Since other non-soda beverages contributed heavily to the

SSB purchase volume and growth in China, particularly RTD Tea, Juice Drinks,

Functional Drinks, and RTD Coffee, taxes should be implemented with these categories

in mind as well.

Opponents of a soda tax claim that the tax is regressive, affecting poorer

households more since a uniform tax rate will disproportionately impinge them greater.

However, proponents claim that obesity and diabetes rates also disproportionately affect

the poor, who have less resources to prevent and treat these diseases (Y. C. Wang et al.,

2012). Another argument against the tax is the availability of healthier options.

Packaged water is prevalent, but not free, so it would be important for China to allocate

a portion of a soda tax revenue, as well as other utilizing other funds, to invest in

strengthening drinking water infrastructure and ensure that everyone has access to safe

piped water (Cabrera Escobar et al., 2013).

Another area for obesity policy is in restricting advertisement and marketing of

unhealthy foods and beverages, as recommended by the World Health Organization

(WHO, 2006). Currently in China, there are few restrictions on advertisement and

marketing campaigns directed towards children. Some countries place restrictions for

beverage commercials including what, when, and how advertisements are presented.

Meanwhile on the retail side, improved nutritional labeling has been shown to be an

important strategy for healthier purchasing (Tao, Li, Lo, Tang, & Wang, 2011). In the

US, the FDA has encouraged manufacturers to include calorie count and sugar amount

in a prominent font and size on the front of the label so that consumers can easily see the

nutrient contents (FDA, 2014a). China could manage similar marketing and retail

regulations by restricting how certain products are advertised, especially towards

children, as well as enacting a national measure that could regulate and govern what

and how nutrition labels should look like. Currently, standards exist, but the labeling

rates are low and poorly enforced (Tao et al., 2011).

Since students are high targets and consumers of SSB, managing environments

by decreasing unhealthy beverages while increasing healthier options are other

strategies to curb SSB consumption rates.   Tactics to improve "environmental choices"

have been done in the USA, by replacing CSD in vending machines with 100% fruit

juices and water, removing SSB from cafeterias, and placing a ban of unhealthy products

a certain distance away from the school grounds, or zoning (Lustig, Schmidt, & Brindis,

2012). One study sampled US middle schools and found that for states that ban all SSB

in schools, there was a reduction of in-school access and purchasing of SSB, even though

overall consumption outside of school did not decrease (Taber, Chriqui, Powell, &

Chaloupka, 2012). China has no such regulations currently and should consider creating laws to restrict SSB in schools and around schools.

Finally, with caffeinated beverages such as RTD Coffee and Functional Drinks increasing in popularity, targeting a growing generation of busy working class professionals should be the aim of educational SSB campaigns, especially in urban areas around the coast where purchase volume is higher. And because certain categories and SSB tend to peak during Chinese New Year season and National Week, more energy on educational campaigns should be focused during these times. Heightened educational awareness can encourage consumers to buy less Juice Drinks, CSD, and RTD Tea during these peak purchasing seasons and persuade consumers to buy healthier alternatives, such as diet options or just water.

4.2 Implications for further research

This study hopes to provide a basis for SSB trends among urban households in China. Other research can analyze price elasticity of certain beverage purchasing amount and price to see if a "Soda Tax" would be viable, and if so, how a tax would look.

4.3 Study strengths and limitations

Study strengths include a large sample size (40,000 households) represented in urban areas of all provinces across China. The sheer range of beverage purchasing

information that was collected and analyzed has not been done before in China to the author's knowledge.

The study has some limitations however. First, purchase volume is only reflected on a per household measure, but no information was included on the size of the household, thus preventing any insight on per capita purchasing. Neither was included the age range of the households, whether households consisted of infants, to teenagers, to elderly adults. Other potentially helpful and interesting demographic information such as household education levels was not part of the survey data. Second, rural and suburban households were not included in the study, which make up almost half of the total Chinese population. Thus, analysis and trends did not reflect those populations. Third, beverages fell into either SSB or non-SSB, meaning even beverages with small amounts of added sugar were placed into the SSB category. Although creating dichotomous categories exaggerates the scope of SSB, it is even more implausible to demarcate at what exact sugar amount should be considered SSB or not. Furthermore, complete nutritional and ingredient information was not available for all beverages. Some nutritional information, such as grams of sugar, were included for some, but other only included information on whether the beverage was diet (0 grams of sugar) or not diet (> 0 grams of sugar). 100% juices could also potentially have high sugar amounts (from grape juice, for example), but still not be considered a SSB because they are 100% juice. Fourth, there could have been bias on how households report what

they purchased, especially if the beverage bought is deemed less socially desirable.

Finally, the study deals only with the purchasing of beverages, not actual consumption.

Thus, participants could have only consumed a portion of what they purchased, while

other households could have consumed everything they purchased.

5. Conclusion

Whether through more income, increased access, media and marketing, or shifting lifestyle and taste preferences, China's changing economy has also brought about changes in beverage purchasing behavior. In particular, SSB represent a 74% volume share in total Chinese purchases and make up the overwhelming total volume percentage in nearly every beverage category. Out of all the SSB volume, Fruit Drinks, CSD, and RTD Tea were purchased the most, probably because they are affordable, convenient, safe, and flavorful. The volume of these beverages are also increasing annually, with Functional Drinks and RTD Coffee increasing significantly, probably to keep pace with the busy urban lifestyles, Western acculturation, and changing palettes. Geography, seasonality and major holidays also affect purchasing behavior.

As China shifts its beverage preferences towards easily accessible and affordable SSB, policy and regulations should be discussed and implemented now to control the growing presence of these beverages and the health results associated with SSB. An excise tax on SSB could be beneficial towards curbing SSB purchase rates and should be researched in greater detail. Furthermore, restrictions on advertisements to children, regulations on what is offered around schools, and legislation around front-of-label packaging should be discussed and implemented as well. Through a multi-armed approach, China can see a reduction and eventual decrease of SSB purchase rates, while taking a stand for the health of its people and being a world leader for healthy change.
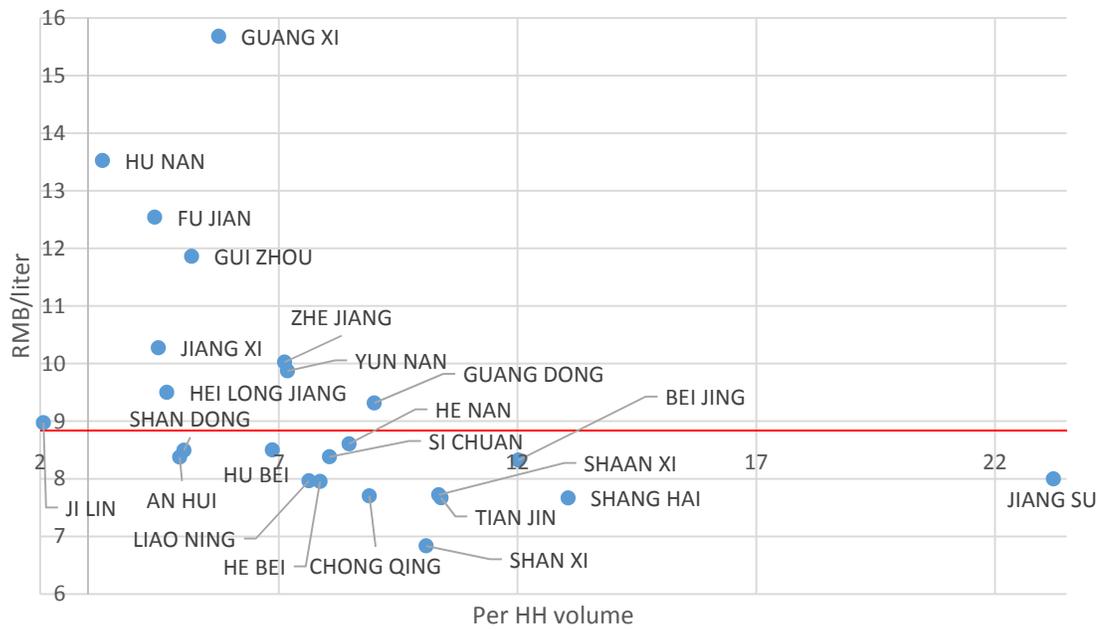
Appendix A

Provinces (in black) and municipalities (in red) used in this study. Other small provinces (Gansu, Hainan, Qinghai), special administrative regions (Hong Kong, Macau), autonomous regions (Inner Mongolia, Tibet, Xinjiang, Ningxia), and islands around the South China Sea were not included in study. Map adapted from www.travelchinaguide.com

Appendix B

Juice Drinks

Packaged Water

Carbonated Soft Drinks

Ready-To-Drink Tea
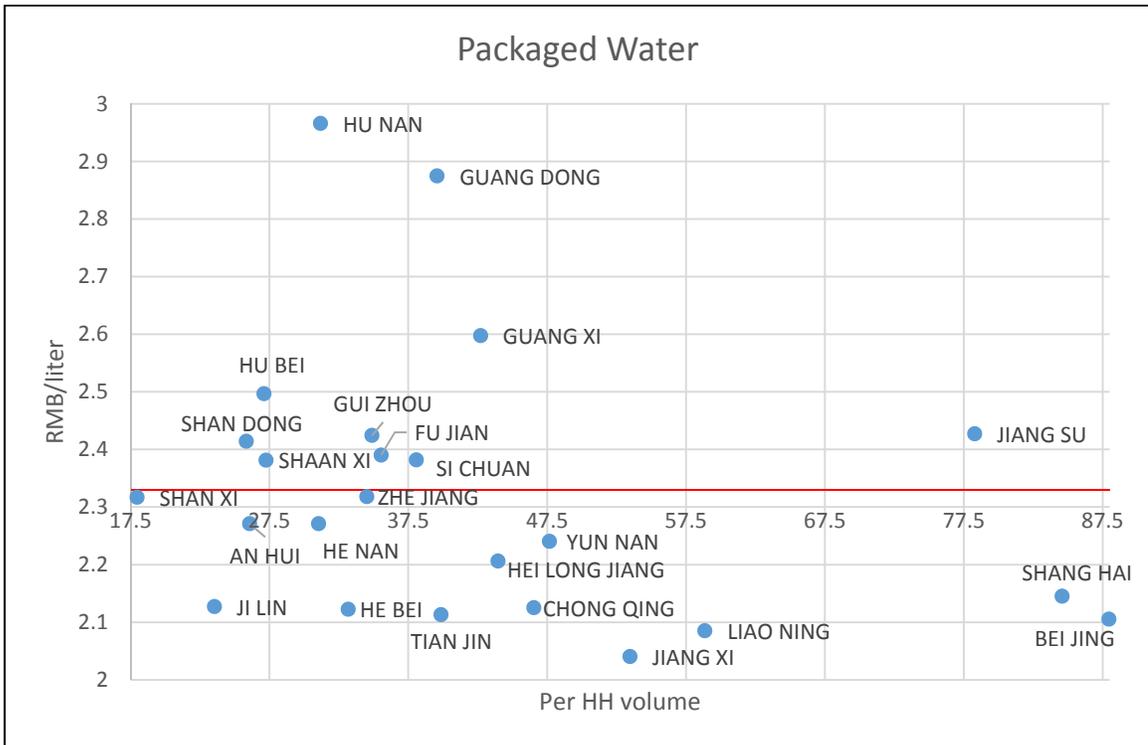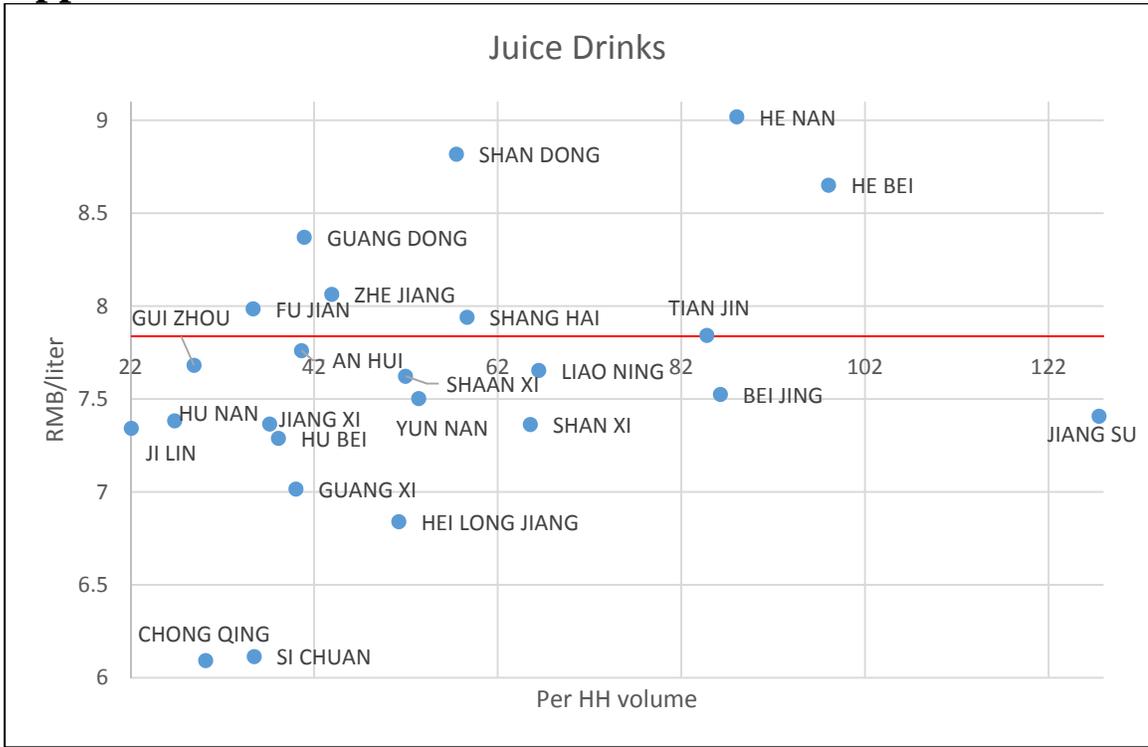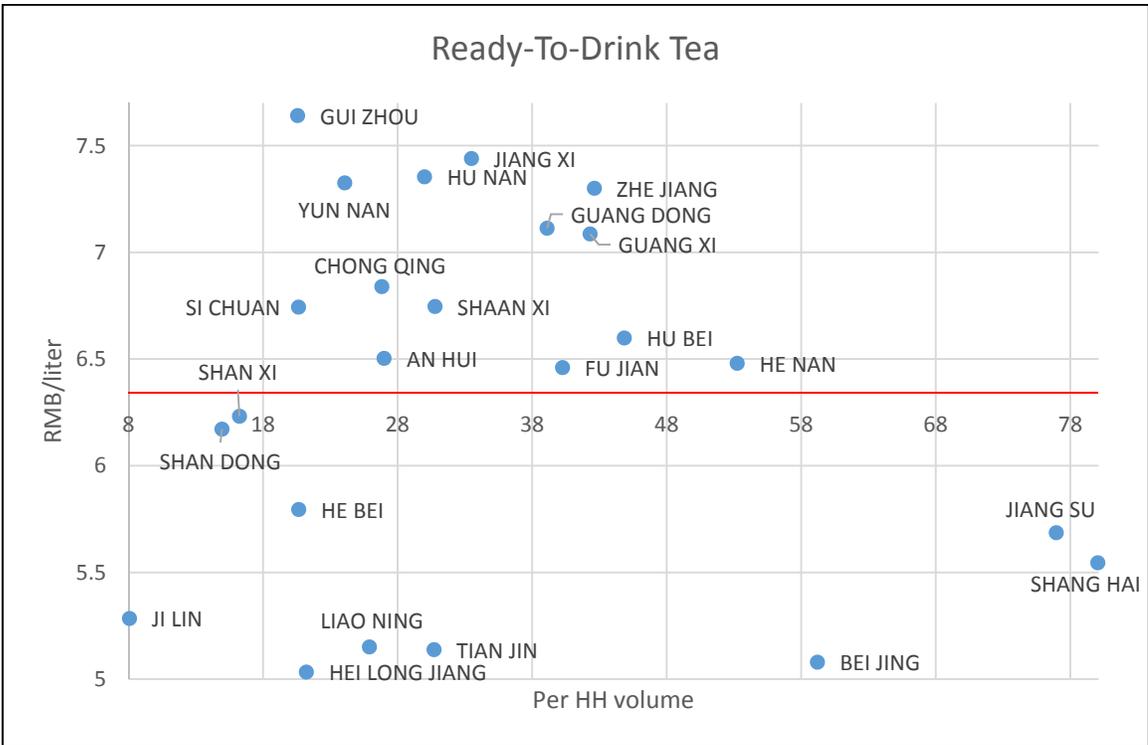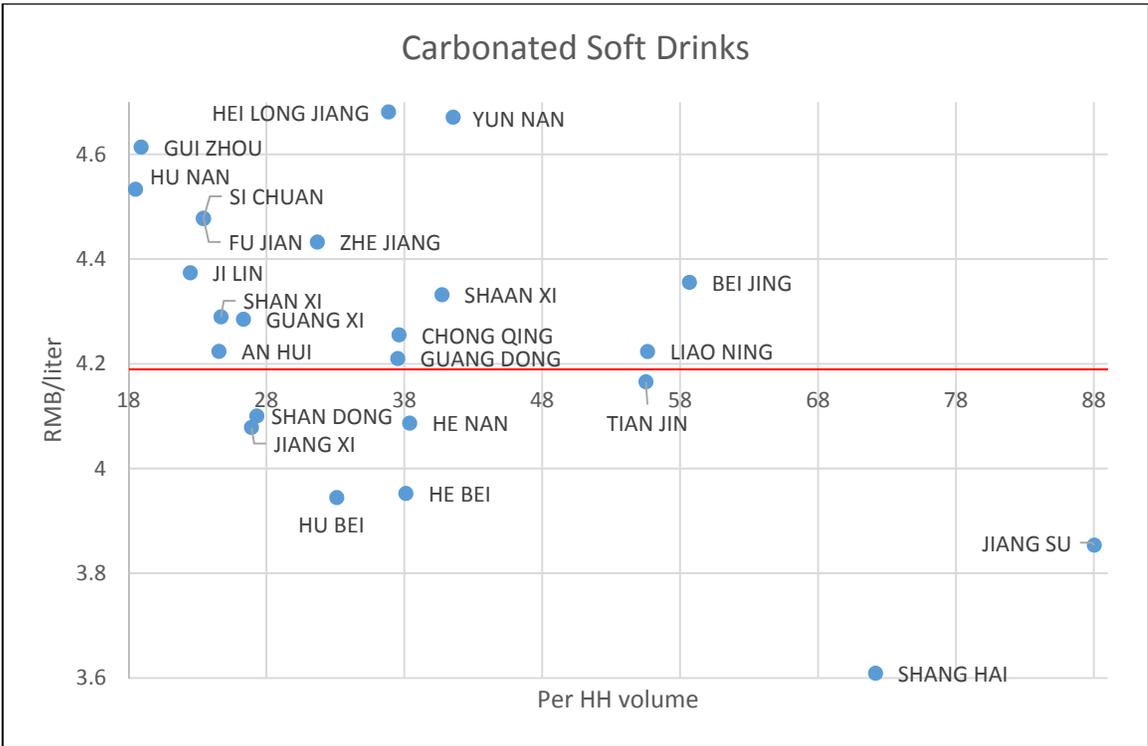
Functional Drinks

100% Juice

Soybean Milk

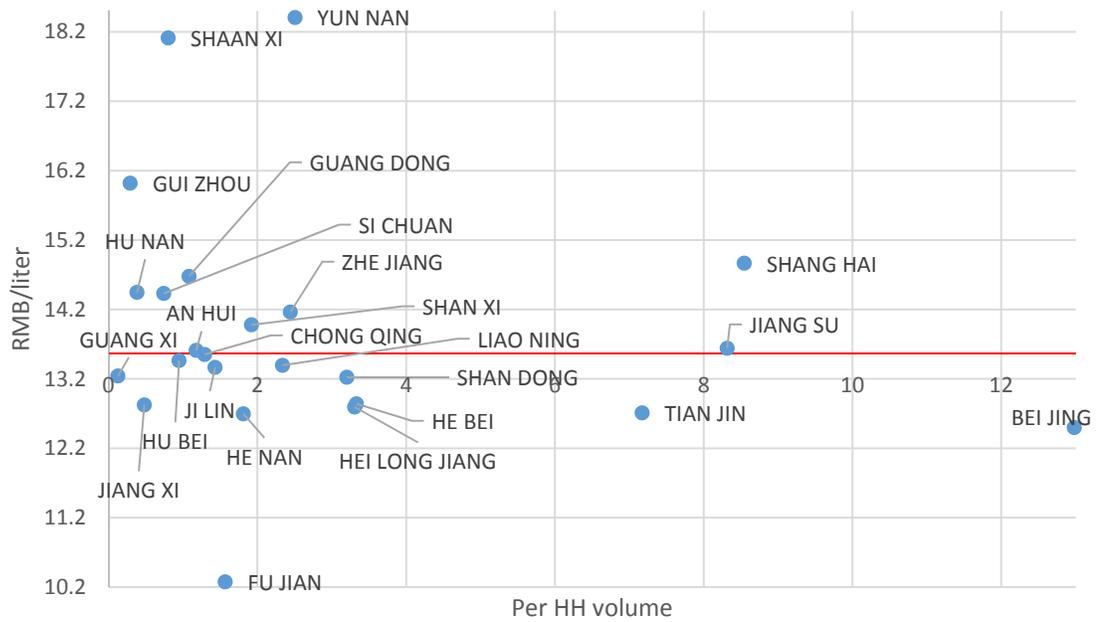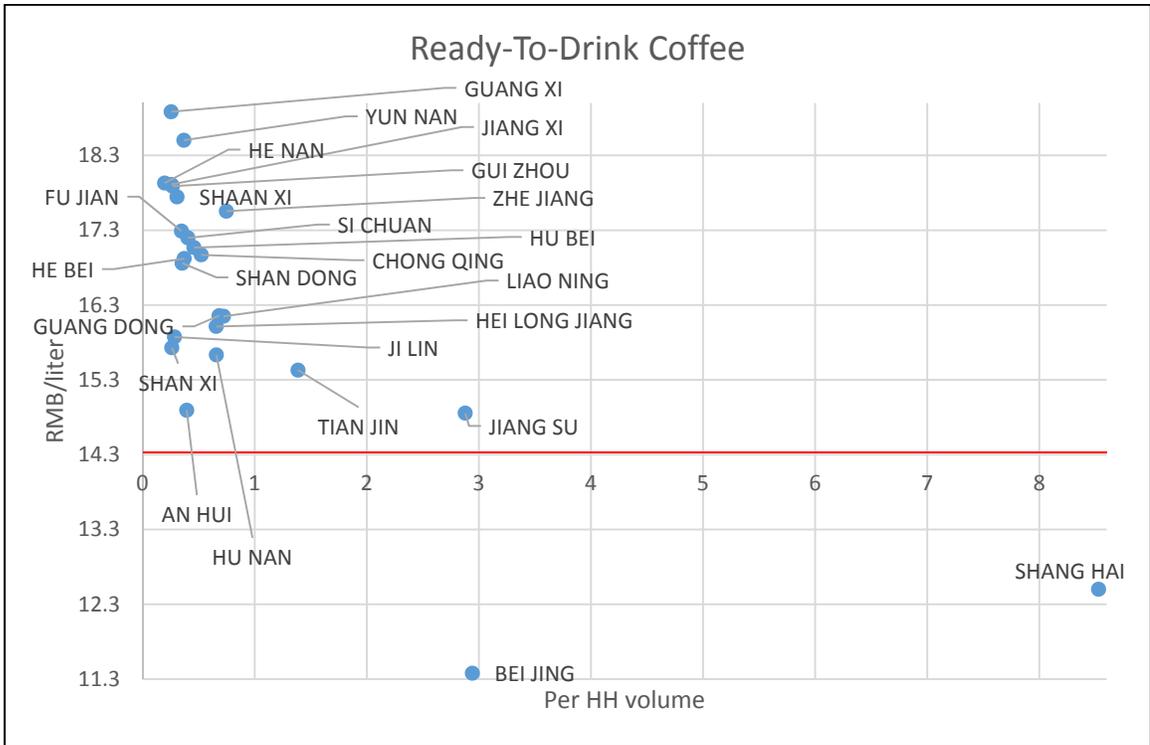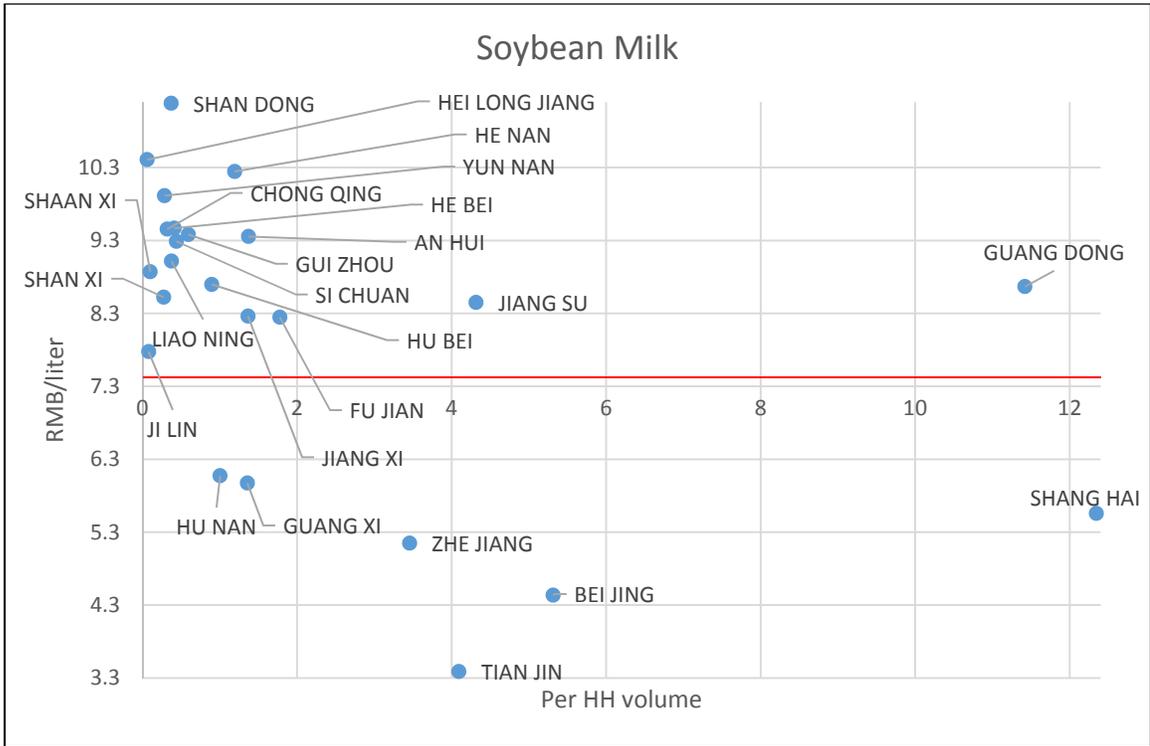Ready-To-Drink Coffee

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