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COFFEE IN CHINA: MARKET TREND AND CONSUMER DEMAND

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COFFEE IN CHINA: MARKET TREND AND CONSUMER DEMAND

THESIS

A thesis submitted in partial fulfillment of the
requirements for the degree of Master of Science in
Agricultural Economics in the
College of Agriculture, Food and Environment
at the University of Kentucky

By

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Lexington, Kentucky

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Lexington, Kentucky

2016

ABSTRACT OF THESIS

COFFEE IN CHINA: MARKET TREND AND CONSUMER DEMAND

Although it remains a tea consuming nation, both production and consumption of coffee in China has been increasing at double-digit rates and is not expected to slow down (International Coffee Organization (ICO), 2015). With investments and upward trends in production and rapid increases in consumption of coffee in China it is important for producers and retailers of the bean[1] in China to understand the new Chinese coffee consumer. Using survey data from Wuhan, China we help understand the Chinese coffee consumer by explaining their consumption using standard OLS regression. Results show that whether or not consumers make/brew their own coffee, how long consumers have been consuming coffee regularly, the size of the coffee cup most often purchased and individuals' prediction of their coffee consumption in the following year are all important in explaining Chinese coffee consumption. We suggest for long-run success, that Chinese coffee producers and retailers in China focus on the quality of their coffee bean.

KEYWORDS: Consumption, Coffee, China, Wuhan, OLS

Jesse Wayne Mattingly

April 27, 2016

[1] 'bean' refers to coffee

COFFEE IN CHINA: MARKET TREND AND CONSUMER DEMAND

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April 27, 2016

To my loving parents, Ron and Diane Mattingly of Louisville, Kentucky

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1.1 Research Motivation

1.1.1 What is coffee?

Coffee starts off as a seed which stays in a coffee nursery off-farm for approximately 6 months. Afterwards, the coffee plant faces the world and is planted in the farm of which it will not begin to harvest until 3 years later. During the 3 years, the coffee plant develops green berries on its branches of which turn into the color red when ripe come harvest time. After harvest the berries are processed depending on preference, as many techniques are practiced, and multiple layers of skin are removed. Underneath the multiple layers of skin sits two beans per berry. Eventually the beans are roasted, grinded and brewed to become the final product; liquid coffee in a cup.

Summarizing the entire process of coffee up to the final product is an understatement of the hard work that is put into the beloved commodity at the roots. While after the initial 3 years coffee trees begin to harvest after every 1 year, new (baby) coffee trees are always being planted in the farm. With that, coffee farmers always have a number of trees of which they are investing labor, money and time into during a 3 years' time. The decision to grow coffee is risky because during the duration of 3 years, coffee plants can too commonly be diagnosed with illnesses such as coffee leaf rust and coffee berry borer diseases: These diseases can harm harvest to a point in which 3 years of labor, money and time put into these plants is wasted. This loss is more severe compared to an investment of resources for only 1 year. Furthermore, like farmers of other crops/animals, coffee growers face price risk. It can be concluded that the decision to grow coffee is not elementary, and must consider the market scenario. This thesis

contributes to understanding the coffee market by examining the consumers in an upcoming country in the international coffee business-China.[2]

1.1.2 Coffee, a New Concept in the Traditional Tea Consuming China

Although it remains a tea consuming nation, both production and consumption of coffee in China has been increasing at double-digit rates and is not expected to slow down (ICO, 2015). Figure 5 and Figure 6 show coffee production and coffee consumption in China, respectively. Of particular interest, according to ICO (2015), estimates show China now harvests more coffee than Kenya and Tanzania together, and consumes more of the black bean than Australia.[3] With the Chinese economy growing, more citizens of China have disposable income, and demand for coffee in China has correspondingly increased (ICO, 2015). According to Sgarro (2015) coffee retailers are taking advantage of the trend with Starbucks currently operating 1500 of their stores in China, with plans to double that number by the year 2019. Starbucks is not alone, with Costa, McDonald's McCafe and Kentucky Fried Chicken (KFC) also planning to expand their coffee products in China (Sgarro, 2015).

While coffee growing is most known to be in Latin America and countries in eastern Africa, some are surprised when hearing that coffee is also grown in China. ICO (2015) said that majority of coffee production in China is in the Yunnan province where Arabica[4] coffee is grown, with the island Hainan and the province Fujian growing the

2 Explanation for 'what is coffee?' is based on Jesse Mattingly's experience working on Leito Lezcano's coffee farm in Santa Clara, Panamá, Chiriquí Province. This farm grows organic Arabica coffee.

3 'black bean' refers to coffee, as coffee turns into a dark brownish/black color after roasting

4 Arabica coffee is grown 1000-2000 meters above sea level in misty-type climates with shade trees protecting coffee trees from direct sunlight, which is undesired for Arabica. Arabica contains mild amounts of caffeine and encompasses desirable flavors such as

remaining proportion of (Robusta[5]) coffee. ICO (2015) continued by saying most interesting is that coffee production in China has been noticeably increasing in the past twenty years: Particularly, in this same twenty-year span, production has been approximately doubling every 5 years. ICO (2015) said this trend is due mostly to public and private investments in coffee production in China: These investments were implemented due to the price of tea dropping, allowing coffee to become noticeably more profitable. With further investment plans being announced, production is expected to continue increasing over the next 10 years (ICO, 2015). Now with a stable price and external support, farmers in China will need to better understand the domestic market for their beans.

China is quickly becoming a large coffee-consuming country. ICO (2015) said the rapid increase of coffee consumption in China, particularly from the years 2004/05 to 2013/14 can be compared to a similar trend that occurred in Japan from the years 1964/65 to 1973/74 (see Figure 1). ICO (2015) said that during the two respective 10-year time periods China and Japan's coffee consumption grew at similar rates. Furthermore, ICO (2015) note that the significant rise in coffee consumption in Japan continued while peaking in the mid-2000s when it became the world's fourth largest coffee consumer. For Japan, it took 30-40 years total to become a recognizable coffee consumer and become the world's fourth largest coffee consumer (ICO, 2015). China on the other hand,

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citrus, chocolate, earthy, etc. which make it overall a good quality coffee, desired for taste.

5 Robusta coffee is lower in quality versus Arabica, and is inferior in general. It is grown on farms at sea level with direct sunlight. Typically Robusta is mixed with a small proportion of Arabica coffee to produce your lower grade Folgers and Maxwell-type coffees. The Arabica gives the (majority) Robusta an aroma to make the coffee taste 'good enough'.

still in the premature stages of coffee development, is only in the first 10 years of Japan's full 30-40 year span, with projections to move past the U.S. and Brazil as the world's largest coffee consumer by the year 2020 (ICO, 2015; McKibbens, 2013). Moving forward, Japan is old news with interest shifting towards China in the Eastern Hemisphere.

Coffee consumption in China (2004/05 to 2013/14) compared to Japan (1964/65 to 1973/74)

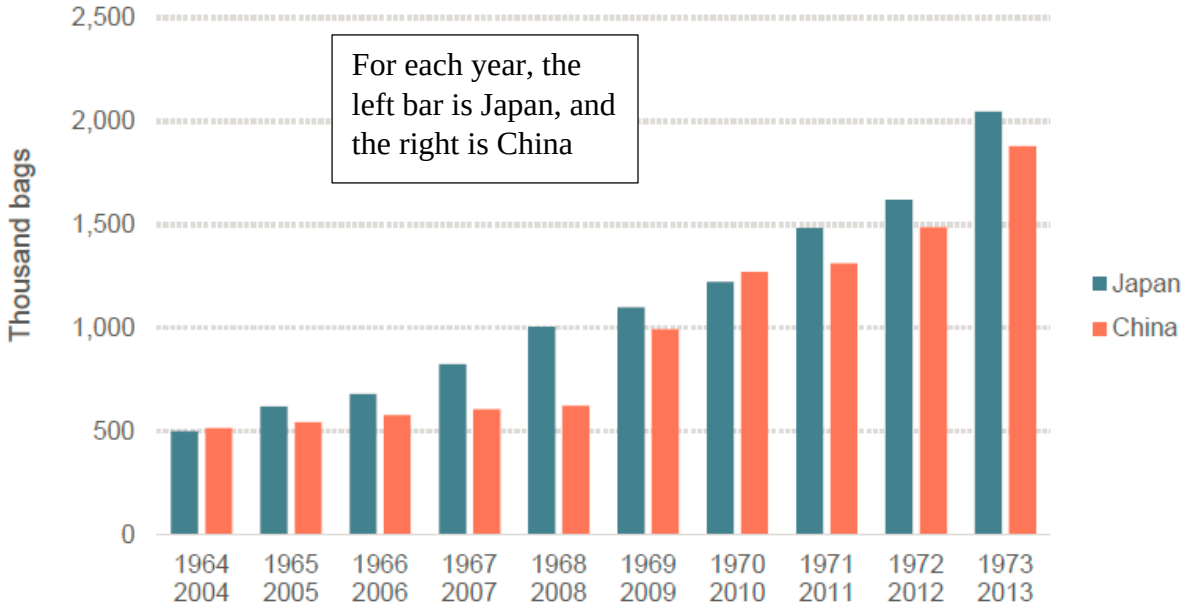

Figure 1: Coffee Consumption in China and Japan

Figure 1. Coffee consumption in China (2004/05 to 2013/14) compared to Japan (1964/65 to 1973/74). Copyright 2016 by International Coffee Organization (ICO). Reprinted with Permission.

With investments and upward trends in production and rapid increases in consumption of coffee it is important for producers and retailers of the bean in China to understand the new Chinese coffee consumer. Given such information, coffee farmers in China could make a more informed decision as to whether they want to mainly focus their attention on the international market or sell domestically. With the decision to grow coffee being very risky, farmers benefit from knowing as much information about the

market as possible, including consumers. For example, farmers knowing that Chinese coffee consumption is not influenced by country-of-origin gives them a potential opportunity to sell domestically, where international regulations and tariffs can be avoided. For retailers, such research provides them with direct suggestions as to how to better market their coffee in-store within China. With direct contact with consumers, retailers benefit the most with information on Chinese coffee consumption behavior with hopes of improving current profit and with an insight as to what will make them successful in the future in China.

1.2 Objective and Outline of Paper

This study uses survey data from Wuhan, China to explain Chinese coffee consumption. Our efforts are centered on providing an understanding of Chinese coffee consumers, with most relevance in assisting coffee retailers in marketing their product in China, and with providing an additional motivation for farmers in China to grow coffee.

This paper will proceed with the remaining sections, in order: In Chapter 2 we will talk about the background of the study by going into the movements in coffee production and consumption worldwide and in China, and why Wuhan was selected to be the sample that represents China; We then make a note of relevant literature pertaining to our research in Chapter 3 with reference to the role of coffee production, the role of coffee price and consumption and past studies on household beverage consumption; Chapter 4 goes into the data collection process, design of survey and the descriptive statistics of our sample; In Chapter 5 we layout the theoretical framework, discuss missing data in our sample and the use of multiple imputation and introduce our empirical model implemented; Chapter 6 provides the regression results with interpretations and explanations; Chapter 7 concludes while making implications and

discussing limitations and future research of our study; and lastly, the references and appendices follow.

CHAPTER 2 BACKGROUND

2.1 Movements in Coffee Production and Consumption Worldwide

According to United States Department of Agriculture (USDA) Foreign Agricultural Service (FAS) (2015), going into 2015/16, world production and consumption of coffee is expected to rise from 2014/15 crop year numbers. USDA FAS (2015) said that Brazil, Vietnam, Colombia and Indonesia are currently the top 4 largest producers of coffee. USDA FAS (2015) note that while Brazil is predicted to decrease supply by 4.9 million bags of Robusta and Arabica (combined) due to unfavorable weather conditions, Indonesia, Honduras and Vietnam plan on picking up the slack in the world market. USDA FAS (2015) continued by saying that Indonesia and Honduras are projected to increase production by 1.8 million and 900 thousand bags, respectively, marking highest supply in history for the two countries. Furthermore, USDA FAS (2015) note that Vietnam is expected to increase their supply by 1.9 million bags. With coffee leaf rust resistant trees being planted into farms replacing disease effected ones and with favorable weather conditions, Colombia's coffee output is expected to increase and settle at 13.4 million bags total (USDA FAS, 2015).

According to USDA FAS (2015) worldwide exports and consumption is projected to rise to the highest levels in history: While exports in Brazil are expected to decrease by 3.1 million bags, this number is estimated to increase by 6.3 million, 150 thousand, and 400 thousand bags in Vietnam, Colombia, and Indonesia, respectively (USDA FAS, 2015). Furthermore, imports in the world's two largest coffee importing regions, the U.S.

and European Union, is expected to increase by 500 and 400 thousand bags, respectively (USDA FAS, 2015).

From the years 1994-2014, compared to China, we can see that Brazil and Vietnam experienced similar sharp rises in coffee production, overall (see Figure 2). Figure 4 supports these trends, looking at corresponding exports. These increases in output could be explained by technological advancement; for example, the development and implementation of pest/disease resistant seeds, and farm machinery (for Robusta farms).[6] But the reader should also note the variation of production annually, more noticeably with Brazil and at a smaller scale with Vietnam. These variations in output could be explained by weather changes affecting the crop both negatively and positively. This gives China, which has just recently moved to the big stage with regard to coffee production, an opportunity to gain market share on the world market, especially if continued investments and favorable weather conditions exist. China has potential to push its way through the coffee production market of 'old' producer countries (Brazil, Vietnam, Colombia and Indonesia). With China still in the development stages of coffee production, in the short run it will act more as a supplement, and not major game changer in the World market.

Looking at Figure 3 we can see that consumption of coffee in Japan slowly grew over the last 21 years. Due to the scaling of Figure 3 it appears that consumption in Japan has been inactive going back to the year 1994, but consumption in Japan was 1521 thousand 60kg bags more in the year 2014 versus 1994. So although Japan is 'old news',

[6] Robusta, unlike Arabica, is grown at sea level where machinery such as tractors can be used. Arabica is grown at about 1000-2000 meters above sea level, therefore most machinery such as tractors cannot be used, and most work is done by hand.

as previously stated, consumption continues to rise. In the well-known coffee consumption regions of the world, the European Union and the United States, consumption has also risen. Particularly, consumption was 4798 and 6435 thousand 60 kg bags more in the EU and U.S., respectively, in the year 2014 versus 1994. This is surprising, given that countries in the European Union and also the U.S. were already big coffee consumers prior to 1994. Figure 4 mirrors these trends, looking at imports. With coffee consumption rising in the European Union and U.S. as well, there is a possible market for coffee produced in the People's Republic of China (P.R.C.). With that, we assume it will take some time, at least 10 years, for the world to recognize and respect coffee grown in China. Also, because they are working on improving quality, Chinese coffee is still inferior, especially compared to higher grade and specialty coffees in the international market. Even when Chinese coffee begins to earn a higher grade and move into the specialty coffee arena, we expect there to be lags with regard to global coffee consumer response: In other words, it will take time for consumers to become convinced that good coffee comes from China. China needs to build a solid reputation for coffee production, and this will take consistency and marketing efforts over the years.

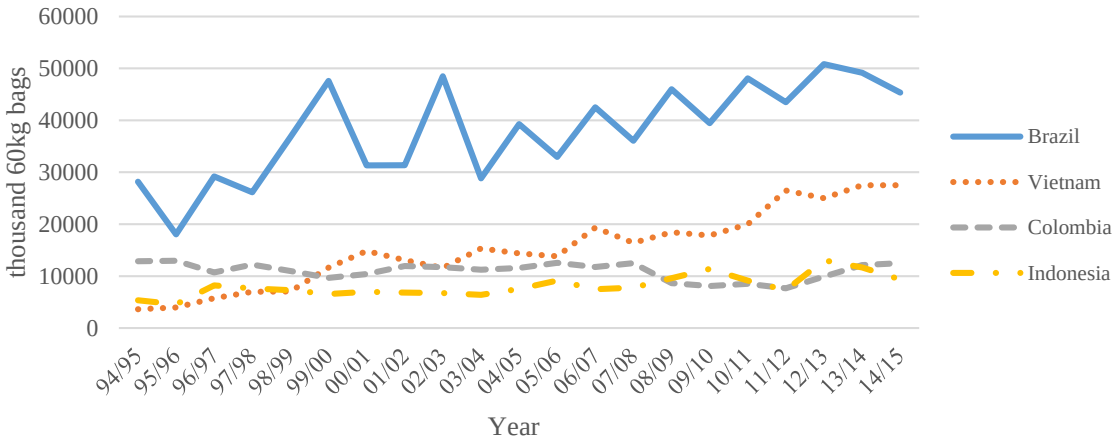

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Figure 2: World Coffee Production

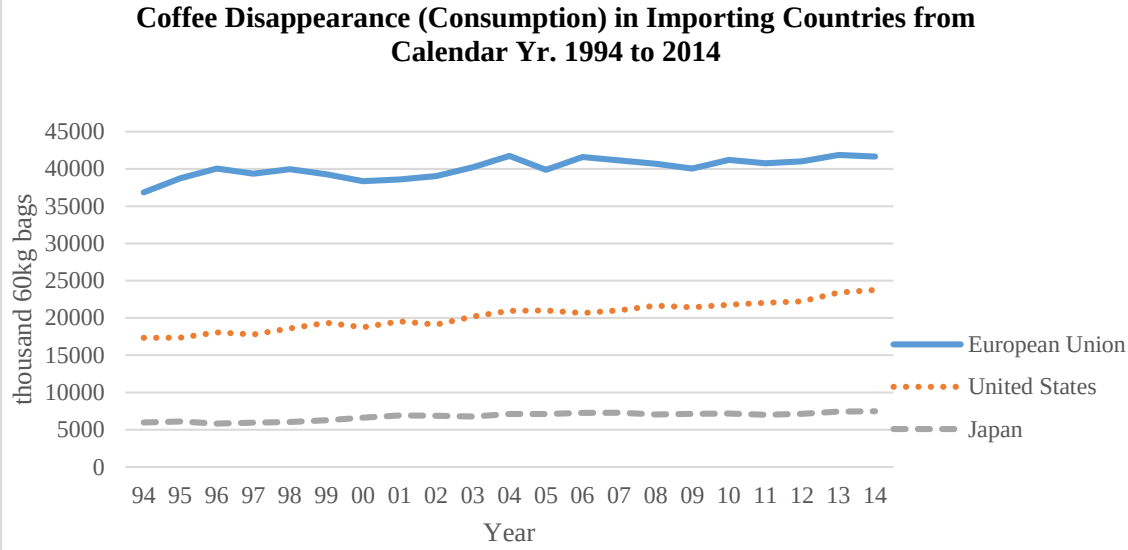

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Figure 3: World Coffee Consumption

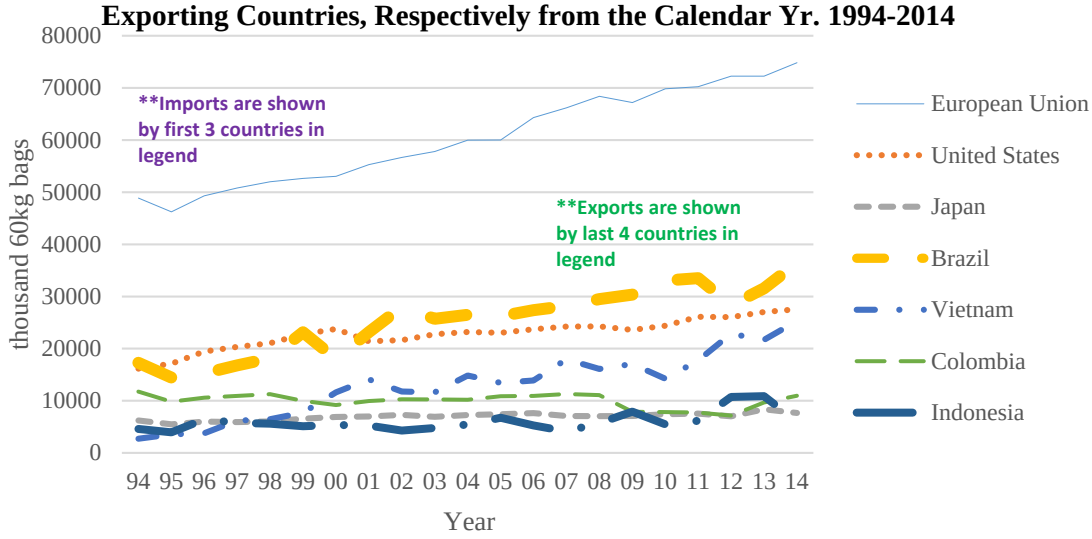

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Figure 4: World Coffee Imports and Exports

2.2 Movements in Coffee Production and Consumption in China

ICO (2015) said that while surprisingly coffee has been grown in China since the late 1800s, the time at which the bean was inherited from a French missionary, one should note that production in the country did not gain recognition until the year 1988. ICO (2015) note that 1988 was the year that the Chinese Government, in collaboration with the United Nations Development Programme and the World Bank, decided to make investments in coffee production, making the bean a more highly prioritized crop in China. In addition, according to ICO (2015), at the same time, outsiders such as Nestlé contributed, investing money in the P.R.C. As previously mentioned by ICO (2015), coffee production within the country dominates in the Yunnan province where Arabica is grown. ICO (2015) continued by saying the Yunnan province exhibits geographical characteristics that make it an ideal place to grow Arabica: It exhibits mountainous areas with an average elevation of about 2000 meters along with a misty climate, making it an ideal place to grow Arabica (ICO, 2015). Arabica needs to be grown at a high elevation,

between about 1000-2000 meters above sea-level with tropical weather and shade trees. Also, with the large-sized Yunnan, showing an area of 394000 km2, there is potential for an expansion of coffee production in the province (ICO, 2015).

According to ICO (2015), going into the year 2015 China became the 14th biggest producer of the black bean worldwide, moving up the list 16 spots over the previous 10 years of time. As we mentioned in the Introduction, the trend in rapid coffee production in China is not expected to slow down any time soon with continued investments in the crop: With an aim towards soil improvement, construction of research institutions and extension-like services to coffee farmers, the Coffee Association of Yunnan has recently proposed plans to invest $480 million in coffee, which would increase the amount of land used for farming the crop and its yield (ICO, 2015). Furthermore, ICO (2015) note that in the last couple of years Nestlé has provided funds to run a regional coffee center in the country, along with Starbucks implementing extension-like programs with coffee farmers aimed at introducing the planting of new varieties and overall increasing the quality of the bean. These investments are coming in at a time when the overall quality of the bean produced in China is not high (ICO, 2015).

According to ICO (2015), at the current state, the quality of coffee produced in China is not high enough to be labeled as specialty coffee, yet is too high to be directly purchased by Chinese consumers. Perhaps, this implies that majority of Chinese consumers are not knowledgeable about coffee, not being able to differentiate between different levels of quality and therefore are not willing to pay a higher price for increased quality. ICO (2015) said that coffee farmers in the P.R.C. are beginning to plant more of the Typica and Bourbon varieties of Arabica, which receive a higher price versus the

traditionally grown Catimor, also a variety of Arabica. It is suggested that growers are making this move because, domestically, disposable incomes are rising and recognition and demand of higher quality coffee is slowly increasing, along with there already being a market for higher-grade coffee outside of China (ICO, 2015).

According to ICO (2015), although the per capita number is low, by the end of 2014 China became the 17th largest consumer of coffee, with consumption increasing by 16% annually since 2004. ICO (2015) continued by saying it is estimated that per capita consumption in the city (2 kilograms in Hong Kong) is significantly higher versus the 83 grams estimated for the whole country. As ICO (2015) note, 2kg is not far away from the per capita rates of 4.9kg and 4.4kg in the European Union and U.S., respectively. Although it is important to look at consumption in both rural and urban areas, we would expect coffee consumption to rise rapidly and flourish in the city. ICO (2015) said that in the Chinese coffee market instant coffee currently makes up 98% and 99% of the retail sales by value and volume, respectively, but freshly grinded coffee is being demanded at a higher rate of which the rising number of coffee shops are promoting. This trend supports the claim that consumers typically upgrade to a higher quality good as disposable incomes grow (ICO, 2015).

Furthermore, according to ICO (2015), coffee imports in China have been noticeably increasing over the years, at an annual rate of 15% from the years 2004-2014 (see Figure 7). ICO (2015) said that from 2009-2014 majority of the coffee imported (on average 69%) was of green (unprocessed) form, although some of it could be processed into instant coffee at later stages. ICO (2015) continued by saying that China has been noticeably exporting more coffee over the years, with exports increasing twenty-fold

from the years 1994/95-2013/14. Chinese consumers are shifting their preference away from Robusta towards Arabica, and looking at Figure 7 beginning in the year 2012/13 consumption of coffee produced domestically seems to be increasing with imports increasing and exports decreasing simultaneously. This potentially explains the recent investments made by international coffee companies to improve the quality and increase the production of Arabica coffee in China, giving the Chinese market "specifically targeted blends and products" (ICO, 2015, p. 8).[7] This allows the Nestlés and Starbucks to grow and sell their product in one domestic market. In other words, if more of the coffee being produced in China is being sold domestically, then perhaps less of the total amount of coffee grown in China is being exported. If simultaneously, consumption of coffee in China is rising, domestic coffee will not be able to keep up with demand, therefore causing coffee imports to increase.

7 The reader should take caution when using import and export numbers to understand what is happening in the Chinese coffee market. One should not assume imports=domestic consumption and exports=domestic production. Ourselves and the references we are referring to only point to such figures to provide suggestions as to how producers and consumers are currently behaving.

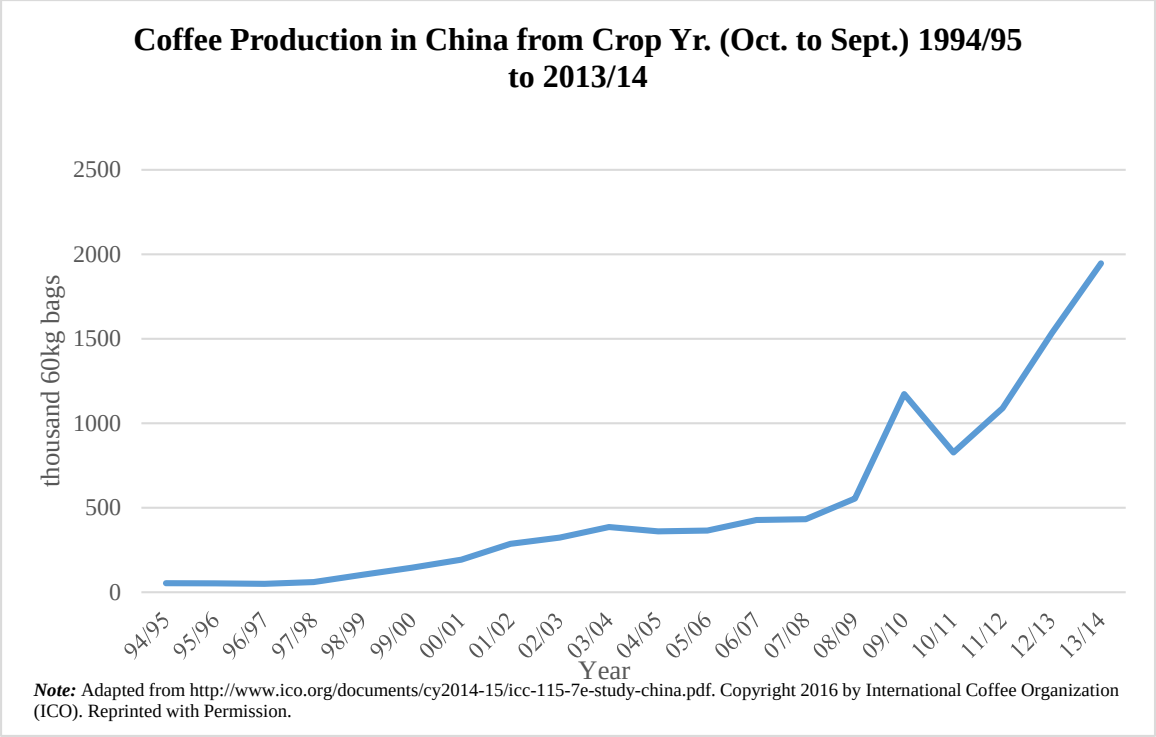

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Figure 5: Coffee Production in China

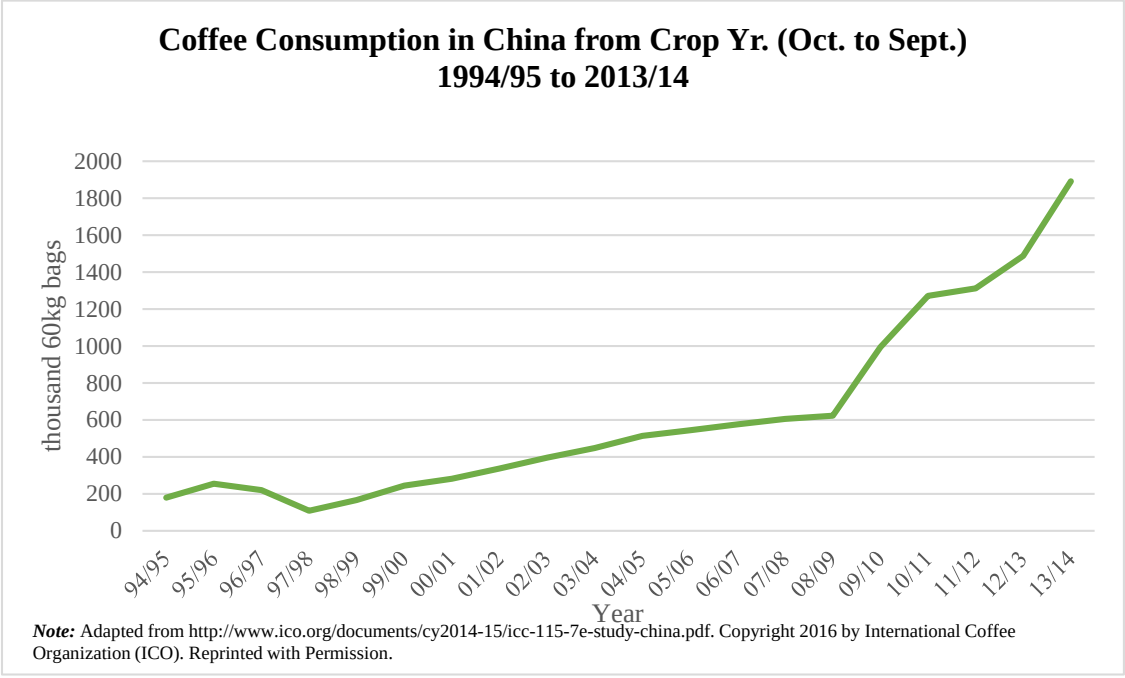

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Figure 6: Coffee Consumption in China

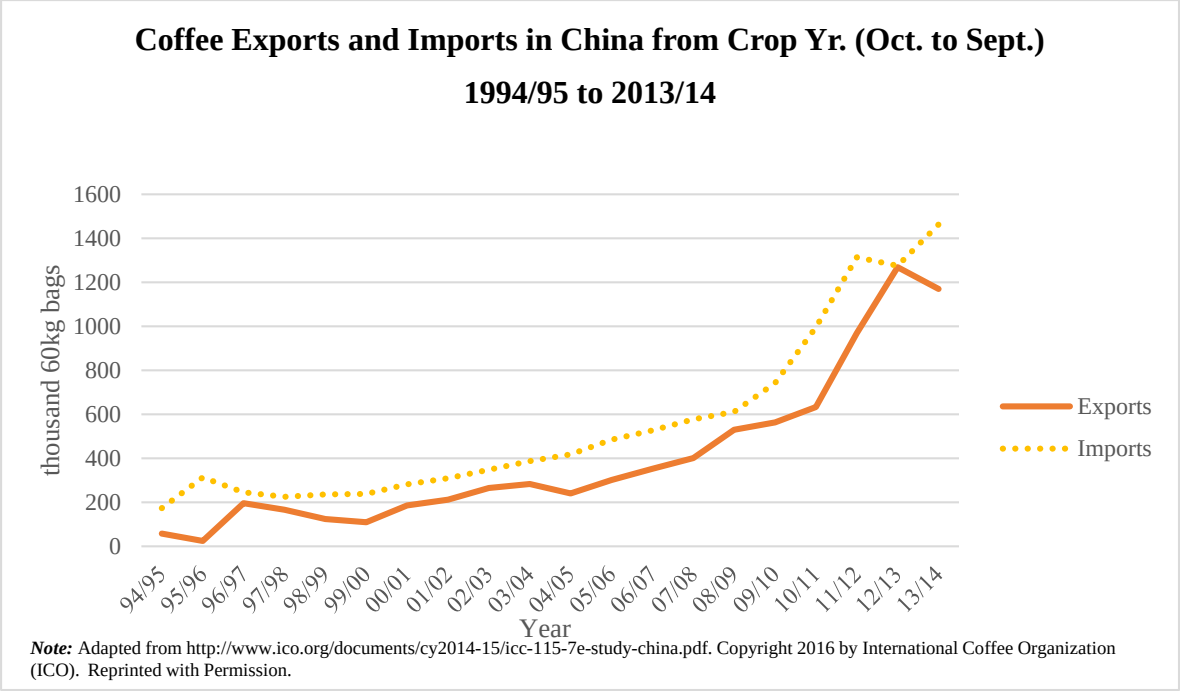

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Figure 7: Coffee Exports and Imports in China

2.3 Why Wuhan was Selected

The sample used in this study is from a survey conducted in the city Wuhan (Yang, Hu, Mupandawana, & Liu, 2012). The city was chosen after weighing different factors. Surveying in China's countryside where coffee is not nearly as commonly consumed as in the city may leave the sample size to be too small; and typically consumers in the richer cities set new consumer trends from the beginning in China, also potentially representing inflated incomes compared to their counterparts (Yang et al., 2012). While on the list of the top 10 most populous cities in China, Wuhan is an average city in terms of household income and food and beverage consumption (Yang et al., 2012). With that, although less internationally recognized and developed versus cities in China such as Beijing and Shanghai, Wuhan serves as the "political, economic, financial, cultural, educational, and transportation" hub in central China, which allows it to be a suitable location to survey average and representative Chinese consumers (Yang et al.,

2012, p. 24, 25). It is of greater interest to study the consumers who will take longer to respond to the coffee boom. Understanding these consumers is of particular interest to retailers who must make efforts to market their product to such consumers who have not fully adopted the trend (Yang et al., 2012).

CHAPTER 3: LITERATURE REVIEW

3.1 Role of Coffee Production

Individuals have touched on a wide array of topics in coffee production. Proceeding are articles focusing strictly on production-side coffee. Winter-Nelson and Temu (2005) looked at the influence that relative prices and transaction costs have on the amount of chemical inputs used by coffee farmers in Tanzania to understand why input use is low in the country. Wilson and Wilson (2014) examined the characteristics that determine the price of un-roasted coffee at high-valued coffee auctions with special implications aimed at informing farmers of the bean what they can do to get a better price. Blackman, Albers, Ávalos-Sartorio and Murphy (2008) looked to see what determines whether or not a coffee farm has trees, which are used for shade and provide environmental benefits, cut down or maintained by using a sample from Mexico.

Additional studies have looked production-side economics. Weber (2012) studied 'social learning' in an economics context, by seeing if one farmer (of a group of farmers) initiating pruning, which is necessary in coffee farming to improve output but yet is an investment that takes 2 years to see the benefit, persuades others farmers in the group to take the same action. Vedenov, Houston an Cardenas (2007) looked at what drives production efficiency on coffee farms up and down by using a sample from Mexico. Fafchamps and Hill (2005) investigated what motivates coffee farmers to sell at their farm versus traveling to and selling at the market where in contrast they bare a

transportation cost. While the papers above provide value to the coffee literature, they look primarily at coffee production. In contrast, our paper looks primarily at the coffee consumer with heavy marketing implications, although we still provide valuable information to coffee producers, especially in China.

3.2 Role of Coffee Price and Consumption

Some coffee research in the past has looked directly at coffee price: Ubilava (2012) looked at how weather events, particularly the El Niño Southern Oscillation (ENSO) affects coffee prices. Lee and Gomez (2013) looked at price transmission, specifically how the end of the coffee export quota system affects international-to-retail coffee price transmission in the developed countries of France, Germany and the U.S. A similar study by Li and Saghaian (2013) investigated what happens to the price of coffee as it moves from the farm to the wholesaler both in the present and future time. An almost identical study conducted a couple of years later by Li and Saghaian (2015) studied price as it moves from the farm to the wholesaler with strong implications as to if these trends reflect certain advantages of middle-men in the chain. Donnet, Weatherspoon and Hoehn (2008) used hedonic price analysis to see what factors contribute to the price of specialty coffees.

Past studies, including Yang, Qing, Hu and Liu (2013), Yang et al. (2012) and Qing, Hu and Liu (2014), have evaluated the coffee market in China, particularly in the city Wuhan, but such efforts focused on consumer Willingness to Pay (WTP). Our study contributes to the existing literature by directly looking at coffee consumption in Wuhan, with implications to the whole Chinese market. Rather than evaluating a hypothetical number such as WTP, we look at actual behavior (i.e. actual number of ounces coffee consumed as our dependent variable). To our investigation, no others have researched

our topic, particularly looking at the Chinese market. We add to the existing coffee literature by giving individuals in the coffee market chain information as to what factors drive consumption up and down in China.

3.3 Past Studies on Household Beverage Consumption

In the recent years, economic studies on coffee consumption are scarce, with no literature on this subject found within the past 10 years. The latest research on coffee consumption comes from Houston, Santillan and Marlowe (2003) and Galarraga and Markandya (2004), and these studies focused on mature coffee consuming countries. Houston et al. (2003) looked at US. Consumption of coffee by estimating demand equations for Colombian milds, Mexican (including other milds) and Brazilian coffee. The authors found that for Mexican coffee, its own price is significant and inelastic; also the price of Colombian coffee and the dummy variable representing whether or not the International Coffee Agreement was active are positively and negatively significant, respectively in the Mexican coffee demand equation (Houston et al., 2003). Glarraga and Markandya (2004) first implemented Hedonic analysis to see how much fair trade and organic coffee influence price and then used these results in a Quantity Based Demand System and Almost Ideal Demand System to study demand for fair trade and organic coffee in the United Kingdom. The authors found that holding all else constant, fair trade/organic traits will increase the price of average quality coffee by 11.26%, and that consumers are more price sensitive to fair trade versus regular coffee (Galarraga & Markandya, 2004).

In general, there has been little research on household beverage consumption going back 10 years. Reed and Levedahl (2010) estimated an Almost Ideal Demand System model and found that the degree to which Supplement Nutrition Assistance

Program (SNAP) affected the U.S. market food demand is less than what previous researchers have found by using nonlinear aggregation instead of linear aggregation. Zhen, Wohlgenant, Karns and Kaufman (2011) estimated an almost ideal demand system model while considering habit formation to examine demand for sugar-sweetened beverages in the U.S. Zhen et al. (2011) found that a half-cent per ounce tax on sugar drinks will cause consumption of these beverages to decrease slightly for both high and low income groups of people, although the decline is sharper for high income individuals who are more likely to substitute as a result of a price increase. Furthermore, they concluded that certain individuals do become addicted to these types of drinks and because of that consumers will overall decrease consumption more in the long-run versus the short-run (Zhen et al., 2011). In other words, consumers do not significantly decrease consumption in the short-run because they are addicted to the sugar beverage and cannot adjust immediately, but eventually substitute to other beverages in the long-run due to the price increase (Zhen et al., 2011).

Barrett and Brzozowski (2012) estimated a fixed effects model to see if expenditures on nondurable grocery items such as food decreases once individuals retire, and if so why. Using panel data from Australia, the authors found that grocery expenditures do decrease as people retire, but only with ones who had to retire earlier than expected due to health reasons or because of losing their job (Barrett & Brzozawski, 2012). Zheng, McLaughlin and Kaiser (2013) ran simulations using theoretical models with results from a survey, a far different approach than what we use, to determine what happens to food and beverage demand as a result of a change in sales or excise tax in the U.S. Most interestingly, they found that the degree of impact of a tax change on food or

beverage demand "mainly depends on the nature of the tax change, the degree to which consumers rely on SNAP benefits, the degree of underreaction to tax for consumers, the existence of a prior sales tax, the degree of consumers' misperception of tax status, and the publicity of the tax change" (Zheng et al., 2013, p. 721).

Zhen, Finkelstein, Nonnemaker, Karns and Todd (2014) analyzed the effects of sugar-sweetened beverage taxes on the demand for food and beverages in the U.S. Zhen et al. (2014) used a Censored Exact Affine Stone Index incomplete demand system to find that a half-cent per ounce tax is estimated to decrease total calorie consumption of the 23 food and beverages chosen to observe in study, but consumers shift to other foods of that group and sodium & fat consumption increases. Particularly, they discovered that low-income household calorie intake as a result of the tax decreases more compared to high-income households (Zhen et al., 2014). Klerman, Bartlett, Wilde and Olsho (2014) estimated a regression model with control variables using weighted Least Squares to examine the effect of the USDA's Healthy Incentives Pilot (HIP) program on fruit & vegetable consumption amongst SNAP receivers in the U.S. They found that 4-6 months after the program was initiated, average fruit and vegetable consumption was 0.22 cup-equivalents (Klerman et al., 2014).

To conclude, past literature has covered 5 topics:

(1) They have concentrated on research questions aimed at coffee producers directly;

(2) Looked directly at coffee price;

(3) Studied coffee consumption but is over 10 years old, using different empirical/modeling techniques versus the more direct OLS regression we use;

(4) Studied (hypothetical) WTP for coffee;

(5) Researched household beverage consumption, but not with coffee.

Based on our investigation, our study is the first within the past 10 years to look directly at coffee consumption in China.

CHAPTER 4: DATA

4.1 Data Collection

Our cross-sectional data are derived from a survey conducted in the P.R.C. in the city Wuhan during the duration of October and November, 2008 (Yang et al., 2012). Full data for 564 coffee drinkers total were successfully collected by students and professors from a university in Wuhan (Yang et al., 2012). Surveys were randomly collected in coffee shops and cafes where coffee is primarily sold and of which coffee consumers are expected to travel (Yang et al., 2012). Furthermore, because instant coffee from brands such as Nestlé is popular in China, citizens were also randomly approached to fill out our questionnaire outside of supermarkets where this product is commonly sold (Yang et al., 2012). Efforts were made to minimize sampling bias by gathering data on different days (and times of) the Monday-Sunday week (Yang et al., 2012). Also, we worked towards minimizing hypothetical bias by coordinating a trial run of our survey to receive feedback and make appropriate revisions (Yang et al., 2012). In approaching individuals to fill out our survey, we used general language, not referring to a specific brand or product-type so the consumers would be self-motivated to participate with no bias for or against a particular coffee product (Yang et al., 2012).

4.2 Design of Survey

There are 3 main parts of the survey: The first asks consumers about their coffee consumption behavior such as if they made/brewed coffee themselves in the previous

months, what part of the world the coffee they consume comes from, the preferred flavor of the coffee they drink, etc. The second part of the survey evaluated the individuals' WTP for coffee. Lastly, the third portion of the survey asks basic demographic information. The survey was designed to take approximately 10 minutes to finish (Yang, Qing, Hu & Liu, 2014).

4.3 Descriptive Statistics

While descriptive statistics do not have the power to predict nor provide statistically significant results (such as by modeling), such information still gives those in the coffee chain ideas about the coffee market scenario in China. Below lies a brief summary of the descriptive statistics of our sample, specifically for our discrete/dummy variables (refer to Table 1):

Majority, 68.79% of the total consumers in our sample bought brewed coffee in the past month. This tells us that most of the individuals in our sample are (at least) beginning to consistently buy and consume coffee. A total of 72.5% of the participants in our study made/brewed at least one cup of coffee themselves last month. This tells us that not only are Chinese consumers showing signs of consistency in coffee drinking, but also that they are perhaps either increasing consumption and want to save money by brewing their own coffee or are beginning to develop a passion for coffee drinking. Majority, 66.23% of our sample, most often buy brewed coffee at the coffee shop. This number gives valuable information to those in the coffee chain as to where majority of Chinese consumers go to buy coffee. With this information, marketing efforts can be made accordingly to lure consumers to or away from coffee shops for their coffee in a form of competition.

Majority, 68.16% of the consumers in our sample who make/brew their own coffee buy their ingredients for their homemade coffee at the grocery store. This information could be useful to coffee shops who also sell ingredients for brewing coffee at home. They may increase their marketing efforts to lure more consumers towards the coffee shop, not grocery store for ingredients. Most individuals in our study (43.95%) drink coffee produced in South America. But most of the other consumers also drink coffee from China (26.44%) and Europe (20.48%). This provides coffee producers and retailers in South America, but also Europe and China with a hint as to where they stand with regard to market share with Chinese consumers.

Majority, 41.07% of consumers drink coffee with creamer or milk and sugar. This suggests that Chinese consumers are not adapted to black (no milk and/or sugar) coffee, which may be too bitter for them. With that, if Chinese consumers are adding cream and sugar they most likely cannot tell the difference between 'good' and 'bad' coffee.[8] In the short run, the farmers and retailers of the lower grade Robusta may gain market share and take advantage of the unexperienced Chinese coffee consumers. But as experience grows, we expect quality to prevail in the future, and Arabica coffee to dominate in the Chinese playing field. Majority of those in our sample have been consuming coffee regularly for 0-5 years (54.68%), while a lot of the others (35.6%) are irregular consumers. This supplements the fact that China is a new consumer of coffee, and therefore there is much room for aggressive marketing behavior and profit gains in

[8] Sugar and/or cream mask the full taste of pure (black) coffee, along with unwanted bitterness associated with lower-grade coffees. Therefore adding sugar or cream to coffee makes it more difficult to detect the aromas and flavors present in higher-grade coffee, the same items professional coffee tasters look for. Examples of flavors include citrus, chocolate and earthy.

the traditional tea consuming nation. The size of the cup of coffee most often purchased is medium (55.9%) for consumers in our model. With such information and holding other factors constant, retailers may raise the price of their medium cup of coffee to increase profit, assuming this is the most desired amount of coffee per sitting.

About 1/3, or 34.86% of those in our sample expect their consumption of coffee next year to at least increase some. With more Chinese people assumed to begin drinking coffee in the future along with about 1/3 of current consumers expected to increase consumption, such numbers back up the notion that the Chinese coffee market will only expand in the upcoming years. A lot of consumers in our sample have consumed fair trade or organic coffee, or Chinese domestic coffee. This suggests that Chinese consumers are at least interested in coffee portrayed as assisting coffee farmers or specialty coffee, and also gives hope to Chinese coffee growers looking to tap into their home country's market. Furthermore, on the downside, majority of the consumers in our sample almost know nothing about fair trade and organic coffee. This gives marketers of such types of coffee a hint as to the amount of future efforts needed to promote their product(s) in China.

We have nearly a 50/50 representation of females and males in our sample. A total of 52.1% of our sample are students which supports, not concludes, the notion that most coffee consumers in China are younger in age. Most people in our sample are employed in either management or education/medical field, which supports the notion that most Chinese coffee consumers are white-collared workers. Majority of the participants in our sample are not married and do not have children at home, which is expected if most of the coffee consumers in China are younger in age. Of additional

interest, most people in our sample did not leave comments at the end of our survey, which loosely hints that Chinese coffee consumers are not knowledgeable enough about coffee to stimulate questions regarding the black bean. Following discrete/dummy variables is a summary of the descriptive statistics of continuous variables (refer to Table 2):

The mean total ounces coffee consumed per normal week in our sample is 38.91. This is about three 12oz cups of coffee, which is impressive given that China is new to consuming coffee. This is our dependent variable. This variable was derived by using data from four questions in our survey which asked consumers: For a normal week, how many cups of x-large, large, medium and small size coffee do you consume, respectively. We used cup sizes from Starbucks as a benchmark, where x-large cup size=20 fl. oz., large cup size=16 fl. oz., medium cup size=12 fl. oz., and small cup size=8 fl. oz. in our calculation. We multiplied each respective cup size from Starbucks (in fl. oz.) by the response in the four respective questions in the survey and then summed total ounces for each cup size for each consumer to give us the final total consumption of coffee per normal week (in fl. oz.) for each consumer. This calculation allows us to look at total consumption directly as one variable, which is more interesting than analyzing each respective cup size individually.

The mean age of people in our sample is about 24 which again directly supports the notion that majority of Chinese coffee consumers are younger in age. The mean income per month is almost 6000 RMB, which is about how much a faculty member who

has just received their PhD in Wuhan, China makes.[9] Although, not near the highest income made in China, 6000 RMB/month is without a doubt enough to make causal coffee purchases, holding purchasing behavior of other luxury products constant. The mean number of years of schooling of the participants in our study is about 16 years which is roughly the amount of time in school necessary to complete a Bachelor's degree. This is expected if we already know that most Chinese coffee consumers are white-collared workers, although of course education is not the only factor that determines whether an individual is white-collared or not. The mean household size is about 3. Although most of our participants are not married nor have children at home, we conclude the reason mean household size is about 3 is because our mean age is about 24: Most 24 year-olds in China are still living at home with their parents.

The mean price paid for most often purchased cup size of coffee is 22.09 RMB. This number, about 3.18 US$, represents the actual amount paid for coffee (THE WORLD BANK IBRD • IDA, 2016). With specialty coffee on average being higher in price versus lower grade coffee, there seems to be a future market for specialty coffee growers and retailers in China. With $3.18 being about the same price you would pay for a specialty cup of coffee in some regions of the U.S., such information sends a message to producers and retailers of coffee that some Chinese consumers pay a relatively high price for a cup of coffee. The mean estimated price for a medium cup of coffee for those whose most often purchased size is not medium is 21.24 RMB (about $3.06) (THE WORLD BANK IBRD • IDA, 2016). This number reflects consumers' knowledge of

9 RMB is the currency of China. The exchange rate in 2008 was 6.95: This is 6.95 RMB per U.S. dollar (THE WORLD BANK IBRD • IDA, 2016). All RMB to U.S. dollar conversions are based on this 2008 exchange rate in this thesis.

coffee prices in China. This estimate does not necessarily represent the price Chinese consumers believe is deserved for a medium cup of coffee, rather the price they note based on previous coffee purchases, the health of the economy, futures prices, etc. Such information tells retailers of coffee in China whether or not Chinese consumers are able to appropriately estimate the price of a cup of coffee, and correspondingly know what factors go into determining the price of a cup of coffee. This knowledge of Chinese consumers allows retailers to adjust price where themselves as well as producers receive a respectable price.

Table 1: Descriptive Statistics for Dummies (before Multiple Imputation)

Variable: Aone

Dummy[10]	**Dummy Description**	**Frequency**[11]	**Percent**
brew	Bought brewed coffee in the past month	388	68.79
nobrew	Didn't buy coffee in the past month	176	31.21

Variable: Atwo

Dummy	**Dummy Description**	**Frequency**	**Percent**
myself	Made/brewed at least one cup of coffee myself last month	406	72.50
notme	Didn't make/brew at least one cup coffee myself last month	154	27.50

[12]Frequency Missing = 4

10 Each listed 'Dummy' was created from its original classification variable shown above each chart after 'Variable:'

11 For each chart, 'Frequency' represents the number of participants who answered the response shown as the (created) dummy, with its corresponding 'Percent' out of the total sample size N = 564.

12 For each chart, 'Frequency Missing' shows how many observations (out of N=564) have missing values for each original classification variable

Table 1: Descriptive Statistics for Dummies (before Multiple Imputation) (resumed)

Variable: Athree

Dummy	Dummy Description	Frequency	Percent
coffeeShop	Most often buy brewed coffee at the coffee shop	353	66.23
rest	Most often buy brewed coffee at restaurant	84	15.76
work	Normally don't buy brewed coffee but work provides	38	7.13
oth	Most often buy brewed coffee at place(s) not listed	58	10.88

Frequency Missing = 31

Variable: Afour

Dummy	Dummy Description	Frequency	Percent
cofsho	Normally buy ingredients at coffee shop (if made/brew coffee)	92	17.13
groc	Normally buy ingredients at reg. grocery (if made/brew coffee)	366	68.16
spec	Normally buy ingredients at specialty food store (if made/brew coffee)	47	8.75
else	Normally buy ingredients at place(s) not listed (if made/brew coffee)	24	4.47
cg	Normally buy ingredients at coffee shop and reg. grocery (if made/brew coffee)	3	0.56
cs	Normally buy ingredients at coffee shop and specialty food store (if made/brew coffee)	1	0.19
co	Normally buy ingredients at coffee shop and place(s) not listed (if made/brew coffee)	1	0.19
cgs	Normally buy ingredients at coffee shop, reg. grocery & specialty food store (if made/brew coffee)	3	0.56

Frequency Missing = 27

Table 1: Descriptive Statistics for Dummies (before Multiple Imputation) (resumed)

Variable: Afive

Dummy	Dummy Description	Frequency	Percent
Samer	For coffee consumed most often, produced in S. America	236	43.95
eur	For coffee consumed most often, produced in Europe	110	20.48
chin	For coffee consumed most often, produced in China	142	26.44
outside	For coffee consumed most often, produced in place(s) not listed	40	7.45
Se	For coffee consumed most often, produced in S. America & Europe	2	0.37
Sc	For coffee consumed most often, produced in S. America & China	4	0.74
ec	For coffee consumed most often, produced in Europe & China	1	0.19
cho	For coffee consumed most often, produced in China & place(s) not listed	1	0.19
Sec	For coffee consumed most often, produced in S. America, Europe & China	1	0.19

Frequency Missing = 27

Table 1: Descriptive Statistics for Dummies (before Multiple Imputation) (resumed)

Variable: Asix

Dummy	Dummy Description	Frequency	Percent
blackSug	For coffee consumed most often, is reg. black w/ sugar only flavor	106	19.52
milkSug	For coffee consumed most often, is reg. w/ creamer or milk & sugar flavor	223	41.07
special	For coffee consumed most often, is specialty (e.g. latte, capucinno) flavor	182	33.52
other	For coffee consumed most often, is flavor not listed	22	4.05
bm	For coffee consumed most often, is reg. black w/ sugar only and reg. w/ creamer or milk & sugar flavor	1	0.18
bs	For coffee consumed most often, is reg. black w/ sugar only and specialty flavor	3	0.55
ms	For coffee consumed most often, is reg. w/ creamer or milk & sugar and specialty flavor	6	1.10

Frequency Missing = 21

Variable: Asevencmb

Dummy	Dummy Description	Frequency	Percent
lessonefiveyr	Been consuming coffee regularly for 0-5 yrs.	298	54.68
fivetenyr	Been consuming coffee regularly for 5-10 yrs.	42	7.71
overtenyr	Been consuming coffee regularly for > 10 yrs.	11	2.02
irreg	Consume coffee irregularly	194	35.60

Frequency Missing = 19

Table 1: Descriptive Statistics for Dummies (before Multiple Imputation) (resumed)

Variable: A9a

Dummy	Dummy Description	Frequency	Percent
xlarge	Size of cup MOST OFTEN purchased is x-large	24	4.64
large	Size of cup MOST OFTEN purchased is large	97	18.76
med	Size of cup MOST OFTEN purchased is medium	289	55.90
small	Size of cup MOST OFTEN purchased is small	86	16.63
lm	Size of cup MOST OFTEN purchased is large & medium	1	0.19
meds	Size of cup MOST OFTEN purchased is medium & small	1	0.19
lms	Size of cup MOST OFTEN purchased is large, medium & small	4	0.77
xlms	Size of cup MOST OFTEN purchased is x-large, large, medium & small	15	2.90

Frequency Missing = 47

Variable: Atencmb

Dummy	Dummy Description	Frequency	Percent
incals	Predict consumption of coffee next yr. to at least incr. some	190	34.86
same	Predict consumption of coffee next yr. to be about the same as this yr.	294	53.94
decsome	Predict consumption of coffee next yr. to decr. some	50	9.17
decdras	Predict consumption of coffee next yr. to decr. drastically	11	2.02

Frequency Missing = 19

Table 1: Descriptive Statistics for Dummies (before Multiple Imputation) (resumed)

Variable: Aelevencmb

Dummy	Dummy Description	Frequency	Percent
FTorg	Have consumed fair trade or organic coffee	231	52.86
dom	Have consumed Chinese domestic coffee	190	43.48
FTo	Have consumed fair trade & organic coffee	4	0.92
FTd	Have consumed fair trade & Chinese domestic coffee	4	0.92
od	Have consumed organic and Chinese domestic coffee	7	1.60
Fod	Have consumed fair trade, organic & Chinese domestic coffee	1	0.23

Frequency Missing = 127

Variable: Atwelve

Dummy	Dummy Description	Frequency	Percent
alot	Know a lot about fair trade coffee	16	2.95
some	Know some about fair trade coffee	171	31.49
noth	Almost know nothing about fair trade coffee	356	65.56

Frequency Missing = 21

Variable: Athirteen

Dummy	Dummy Description	Frequency	Percent
kalot	Know a lot about organic coffee	22	4.04
ksome	Know some about organic coffee	226	41.54
knoth	Almost know nothing about organic coffee	296	54.41

Frequency Missing = 20

Variable: Male

Dummy	Dummy Description	Frequency	Percent
male	Male	326	59.27
female	Female	224	40.73

Frequency Missing = 14

Table 1: Descriptive Statistics for Dummies (before Multiple Imputation) (resumed)

Variable: Employonecmb

Dummy	Dummy Description	Frequency	Percent
partful	At least part-time employed	228	41.68
ret	Retired	1	0.18
noj	No job	11	2.01
home	Home maker	10	1.83
stud	Student	285	52.10
notlisted	Employ status not listed	12	2.19

Frequency Missing = 17

Table 1: Descriptive Statistics for Dummies (before Multiple Imputation) (resumed)

Variable: Jobone

Dummy	Dummy Description	Frequency	Percent
ser	At least part time employed & in service	51	13.28
sales	At least part time employed & in sales	40	10.42
const	At least part time employed & in construction	15	3.91
manu	At least part time employed & in manufacturing	14	3.65
min	At least part time employed & in mining	1	0.26
agff	At least part time employed & in ag/fishery/forest	0	0
edumed	At least part time employed & in edu/medical	81	21.09
mana	At least part time employed & in management	108	28.13
trans	At least part time employed & in transportation	8	2.08
maint	At least part time employed & in maintenance	4	1.04
off	At least part time employed & in office wrk.	26	6.77
mili	At least part time employed & in military	2	0.52
oddjob	At least part time employed & in job not listed	31	8.07
salc	At least part time employed & in sales & construction	1	0.26
ssm	At least part time employed & in service, sales and management	1	0.26
manao	At least part time employed & in management & office wrk.	1	0.26

Frequency Missing = 180

Variable: Child

Dummy	Dummy Description	Frequency	Percent
children	Have children at home	86	15.99
nochildren	Don’t have children at home	452	84.01

Frequency Missing=26

Table 1: Descriptive Statistics for Dummies (before Multiple Imputation) (resumed)

Variable: Marry

Dummy	Dummy Description	Frequency	Percent
married	Married	91	17.60
notmarried	Not married	426	82.40

Frequency Missing = 47

Variable: Commnum

Dummy	Dummy Description	Frequency	Percent
Nocom	Didn't write comments in survey	527	93.44
com	Wrote comments in survey	37	6.56

Source: This table was manually re-created in Word via SAS output

Table 2: Continuous Variables (before Multiple Imputation)

Variable	Variable Description	N	Mean	Std. Deviation	Min.	Max.
totconsm	Dependent Variable: Total ounces coffee consumed per normal week	465	38.91	43.84	8	416
Age	Age of Consumer (# yrs.)	546	24.36	5.87	7	54
IncomeCtn	Income/mo (RMB)	512	5947.27	4539.15	500	17500
EduoneCtn	Yrs. Schooling	552	15.94	1.79	6	22
Size	Household size (# heads)	534	3.10	1.10	1	10
A9b	Corresponding price paid for most often purchased cup size (RMB)	492	22.09	12.07	0	100
A9c	If most often purchased size is not medium, your estimated price for medium cup (RMB)	209	21.24	10.50	1	75

Source: This table was manually re-created in Word via SAS output

CHAPTER 5: METHODOLOGY

5.1 Theoretical Framework

The neoclassical consumption model serves as theory behind our applied work. The basic ideas behind the neoclassical consumption model are as follows: An individual derives utility from consuming in the present and future time and furthermore faces two budget constraints (Jones, 2009):

(1) $$c_{today} = y_{today} - (f_{future} - f_{today})$$

(2) $$c_{future} = y_{future} + (1 + R)f_{future}$$

Where c_{today} and c_{future} represent consumption today and in the future, respectively; y_{today} and y_{future} are labor income today and in the future, respectively; f_{today} and f_{future} are financial wealth today and in the future, respectively; $(f_{future} - f_{today})$ represents an individual's future savings (p. 3); (1 + R) represents interest earned on financial wealth in the future (Jones, 2009, p. 3); In equation (2), a given individual spends all their income and wealth, for it is the 'end of life' (future) (Jones, 2009, p. 3).

Equations (1) and (2) are combined, and the individual is required to decide their level of consumption given the intertemporal budget constraint (Jones, 2009):

(3) $$c_{today} + \frac{c_{future}}{1+R} = f_{today} + y_{today} + \frac{y_{future}}{1+R}$$

Conceptually,

present value of consumption = financial wealth + human wealth

With financial wealth + human wealth = total wealth

Equation (3) says that the individual has the choice to either save for the end of life or "borrow against" their "future labor income" (Jones, 2009, p. 4). Furthermore it is assumed that the consumer maximizes their utility given their budget constraint (Jones, 2009, p. 5):

(4) $$\max_{c_{today}, c_{future}} U = u(c_{today}) + \beta u(c_{future}) \text{ subject to}$$

$$c_{today} + \frac{c_{future}}{1+R} = \bar{W}$$

Where U = Utility, where diminishing marginal utility is experienced as consumption increases; $u(c_{today})$ is the number of utils obtained from consumption 'today';

$u(c_{future})$ is the number of utils obtained from consumption in the 'future'; β represents a value which serves as the weight that an individual places on today versus the future (Jones, 2009, p. 4, p. 5): In other words, it represents if a certain amount of utils is more preferred today, in the future, or equally in both periods of time (Jones, 2009, p. 4). $\bar{W}$ represents total wealth already mathematically and conceptually defined above (Jones, 2009, p. 5; all equations above (1)-(4) were re-created but represent exact equations from Jones, 2009).

5.2 Missing Data and Multiple Imputation

For 3 different variables, 'Aelevencmb', 'A9c' and 'Jobone', over 20% of the observations out of the total 564 in our sample had missing data: These 3 variables were potential candidates for being independent variables. Furthermore, more than 10% of observations had missing data for our dependent variable 'totconsm', total ounces of coffee consumed per normal week. Given the severity of missing data for the 3 independent variables mentioned, it is unreasonable to delete the incomplete rows of data or to replace missing values with the mean/median for continuous/classification variables (Hu, 2014): A more robust method must handle the problem (Hu, 2014). In considering the severity of missing data for the dependent variable, one must not conclude that it is random without evidence (Hu, 2014). When the missing data problem is as severe as what we experienced multiple imputation is debated as being the best way to deal with the problem for both independent and dependent variables, especially in survey data (Hu, 2014).

5.2.1 What is Multiple Imputation?

According to SAS (n.d.), "Instead of filling in a single value for each missing value, multiple imputation replaces each missing value with a set of plausible values that

represent the uncertainty about the right value to impute (Rubin 1976, 1987). The multiply imputed data sets are then analyzed by using standard procedures for complete data and combining the results from these analyses" (Overview: MI Procedure, para. 4). SAS (n.d.) says that "Multiple imputation does not attempt to estimate each missing value through simulated values, but rather to represent a random sample of the missing values. This process results in valid statistical inferences that properly reflect the uncertainty due to missing values; for example, valid confidence intervals for parameters" (Overview: MI Procedure, para. 5). There are 3 main events that occur in the process of Multiple Imputation (SAS, n.d.): First; "The missing data are filled in m times to generate m complete data sets" (SAS, n.d., Overview: MI Procedure, para. 6). Second, empirical results are given via each m dataset after specifying an empirical model (SAS, n.d.). Third and lastly, the empirical results for each m dataset are merged to leave the analyst with one set of results (SAS, n.d.)

5.2.2 How we Utilized Multiple Imputation

For our data, SAS ® was used to perform multiple imputation: First, m=5 complete datasets were developed using the proc mi command. After obtaining the m=5 complete datasets, each were used to build a model and to be analyzed using the proc surveyreg command. Lastly regression results for each m=5 complete datasets were merged using the proc mianalyze command. Our data exhibit a non-monotone missing data pattern. Based on this pattern of missing data, Fully conditional specification (FCS) discriminant function methods was specified for our nominal classification variables; FCS logistic regression was specified for our ordinal classification variables; and lastly, FCS predicted mean matching was specified for our continuous variables.

5.3 Empirical Model

Some consumption analysis studies (looking at consumption as the dependent variable), such as McCracken and Brandt (1987), use the tobit model to account for the cases involving 'zero consumption'. Zero consumption meaning that there are individuals who do not consume the relevant good, in our case coffee (McCracken & Brandt, 1987). When zero consumption exists and one uses OLS, the resulting estimates would be biased and inconsistent (McCracken & Brandt, 1987). With our study, we surveyed coffee consumers only. So if there were responses indicating coffee consumption was 'zero', the consumer clearly either misunderstood the question or simply did not answer the question. With only N=17 observations doing this, we treated the value of zero for these individuals as missing and used OLS regression with robust errors.

Below is our model specification used in analysis:

$$\text{totconsm} = \phi_0 + \phi_{\text{brew}}\,\text{brew} + \phi_{\text{myself}}\text{myself} + \phi_{\text{coffeeShop}}\,\text{coffeeShop} + \phi_{\text{Samer}}\,\text{Samer} + \phi_{\text{eur}}\,\text{eur} + \phi_{\text{chin}}\,\text{chin} + \phi_{\text{lessonefiveyr}}\,\text{lessonefiveyr} + \phi_{\text{fivetenyr}}\,\text{fivetenyr} + \phi_{\text{overtenyr}}\,\text{overtenyr} + \phi_{\text{xlarge}}\,\text{xlarge} + \phi_{\text{large}}\,\text{large} + \phi_{\text{med}}\,\text{med} + \phi_{\text{incals}}\,\text{incals} + \phi_{\text{same}}\,\text{same} + \phi_{\text{male}}\,\text{male} + \phi_{\text{Age}}\,\text{Age} + \phi_{\text{IncomeCtn}}\,\text{IncomeCtn} + \phi_{\text{EduoneCtn}}\,\text{EduoneCtn} + \phi_{\text{partful}}\,\text{partful} + \phi_{\text{Size}}\,\text{Size} + \phi_{\text{children}}\,\text{children} + \phi_{\text{married}}\,\text{married} + \varepsilon$$

The description for each variable in the model may be found in the descriptive statistics tables (see Table 1 and Table 2).

CHAPTER 6: RESULTS

6.1 OLS Regression Results and Interpretations

Table 3 gives the regression results. Below is a breakdown of each variable, with an explanation of results and interpretations if statistically significant.

The coefficient for the variable ‘brew’ which asked consumers if they bought brewed coffee the past month is not statistically significant. The reason behind insignificance could be the fact that many consumers could be ‘seasonal’ coffee drinkers; meaning they could have just bought one brewed coffee last month on a day where per se they needed to work overtime at work and needed caffeine. This characteristic clearly would not be decisive in the total amount of ounces of coffee consumed per week, which is our dependent variable.

The variable ‘myself’ represents the questions which asked consumers whether or not they made/brewed at least one cup of coffee themselves last month. The coefficient for this variable was statistically significant at the 10% level. ‘myself’ is the response of consumers who did make/brew at least one cup of coffee themselves last month. Ceteris paribus, consumers who made/brewed at least one cup of coffee themselves the past month drink 10.26 ounces of coffee per week more than the consumers who did not. The significance of the coefficient for this variable supports our hypothesis, which says that consumers who make/brew their own coffee likely are more than causal coffee drinkers versus consumers who do not make/brew their own coffee: They are able to save money by making/brewing their own coffee and therefore likely consume more coffee versus the latter consumers.

The variable ‘coffeeShop’ is the dummy representing the question which asks consumers where they most often buy brewed coffee. ‘coffeeShop’ represents the response of consumers who most often buy brewed coffee at the coffee shop. The coefficient for this variable is not statistically significant. The base represents those who most often buy brewed coffee at the restaurant, normally don’t buy brewed coffee but

their work provides, and most often buy brewed coffee at places(s) not listed in the survey. The coefficient for coffeeShop variable not being statistically significant tells us that perhaps consumers with preferences for different locations to buy brewed coffee share similar enough characteristics. It could be that these consumers go to the locations for coffee most convenient for them. Perhaps they all consume similar amounts of coffee but the difference is that for one person, it is more convenient to buy coffee at a restaurant near work versus traveling to a coffee shop farther away.

The variables 'Samer', 'eur' and 'china' are dummies representing the question which asks consumers where the coffee that they consume the most often is produced. 'Samer', 'eur' and 'china' represent the response of consumers whose coffee they consume the most often is produced in South America, Europe and China, respectively. The coefficients for these three variables are not statistically significant. We conclude that the reason why consumers of coffee from these three regions of the world do not drink a different amount of coffee than those who drink coffee from other regions in the world (our base) is simply because these characteristics must represent preference solely (i.e. taste). Such conclusion says that consumers purchase coffee from a specific region of the world based on factors such as reputation and perhaps quality, but drink the same amount of coffee as those who purchase from other parts of the globe, holding everything else constant. Information from such variables may be important in explaining how much money coffee consumers in China spend on coffee, as we expect price to vary with coffees from different regions of the world, but not coffee consumption.

The variable 'lessonefiveyr' is a dummy representing the question which asks consumers how long they have been consuming coffee regularly (e.g. every day or week).

This variable reflects the response of consumers who have been consuming coffee regularly for 0-5 years. The coefficient for this variable is not statistically significant. The omitted category is for those consumers who have not been consuming coffee regularly. Consumers of this category likely represent beginner coffee drinkers, and if anything they are increasing their coffee consumption. With results being insignificant, perhaps compared to irregular consumers, individuals who have been drinking coffee for a short time are still also experimenting with coffee and acquiring a taste for it, causing no movement in consumption.

The variable 'fivetenyr' is a dummy representing the question which asks consumers how long they have been consuming coffee regularly (e.g. every day or week). This variable reflects the response of consumers who have been consuming coffee regularly for 5-10 years. The coefficient for this variable is statistically significant at the 10% level. Ceteris paribus, consumers who have been consuming coffee regularly for 5-10 years drink 18.61 ounces of coffee per week more than those who drink coffee irregularly. The significance of the coefficient for this variable supports our hypothesis that coffee drinkers at this level of maturity have acquired a taste for coffee and clearly like it, furthermore increasing their consumption of it because of the taste and also because they may need to increase productivity due to work/business demands. Therefore, they drink more coffee than irregular consumers, our base.

The variable 'overtenyr' is a dummy representing the question which asks consumers how long they have been consuming coffee regularly (e.g. every day or week). This variable reflects the response of consumers who have been consuming coffee regularly for over 10 years. The coefficient for this variable is statistically significant at

the 10% level. Ceteris paribus, consumers who have been consuming coffee regularly for over 10 years drink 15.67 ounces of coffee per week more than those who drink coffee irregularly. This variable represents the 'most mature' coffee drinkers who have been consuming coffee for the longest. The significance supports our hypothesis that coffee drinkers who have been consuming coffee for the longest time will certainly consume more coffee than irregular consumers, but not as much more than those who have been consuming coffee for 5-10 years:[13] We conclude the reason why being that diminishing marginal consumption comes into play past 10 years of coffee consumption. These consumers enjoy coffee just as much as the ones who have been consuming coffee for 5-10 years, but come to a peak, or rather a comfortable, satisfying and furthermore healthy level of consumption which is lower than the 5-10 year consumers: This is holding everything else constant.

The variable 'xlarge' is a dummy for the question that asks individuals what the size is of the cup of the coffee they purchase the most. 'xlarge' is the response of x-large as the size of the most often purchased cup of coffee. The coefficient for this variable is statistically significant at the 10% level. Ceteris paribus, consumers who mostly purchase x-large sized coffee drink 27.13 ounces of coffee per week more than those who mostly drink out of purely small sized cups or combinations of different sizes. This significance supports our hypothesis that individuals who drink out of x-large cups drink more coffee than those who drink out of small coffee cups. Although those who drink out of small coffee cups could drink just as much, if not more than x-large drinkers by purchasing additional small cups, we assume that making many purchases of small cups

13 See results for variable 'fivetenyr' in above paragraph.

versus 1-2 x-large cups is inefficient and also more costly. Typically retailers offer 'deals' where larger cup sizes are marginally less costly in quantity versus your smaller cups sizes. Those who drink out of x-large cups are the ones who consume more coffee, and therefore are acting rationally by purchasing the x-large cup.

The variable 'large' is a dummy for the question that asks individuals what the size is of the cup of the coffee they purchase the most. 'large' is the response of large as the size of the most often purchased cup of coffee. The coefficient for this variable is not statistically significant. This means that those who consume large coffee cups do not drink more or less coffee than those who drink out of small cups. Unlike the case of the variable 'xlarge' above, the large size may not be marginally less costly enough in quantity versus smaller cup sizes. So in this situation some consumers purchase the small cup size: With a small cup size, the coffee doesn't get cold too soon and no coffee is wasted if (on abnormal days) consumers decide to drink slightly less. In the case of either cup size, the same amount of coffee is consumed per week.

The variable 'med' is a dummy for the question that asks individuals what the size is of the cup of the coffee they purchase the most. 'med' is the response of medium as the size of the most often purchased cup of coffee. The coefficient for this variable is not statistically significant. The conclusion is that consumers who consume medium sized coffee cups do not drink more or less coffee than those who drink out of small cups. We give the same reasoning for these results as we do with the variable 'large' above. The additional amount of coffee that can be purchased with medium sized cups is at about the same per unit price as coffee with small sized cups, so the consumer is indifferent between the two.

The variable ‘incals’ is a dummy representing the question which asks consumers to predict their consumption of coffee for the following year. ‘incals’ is the response of consumption to at least increase some the following year. The coefficient for this variable is not statistically significant. This means that those who predict their consumption of coffee to at least increase some the next year do not consume more or less than those who predict their consumption of coffee to at least decrease some. We conclude the reason behind these results is the simple fact that the consumers were asked to predict. Predictions do not always reflect actual behavior. Some may predict consumption to go down because of temporary feelings of health concerns that too much caffeine is not good. Furthermore, others may predict consumption to increase if, per se, they feel as if they will have more work to do in their job/career the following year, requiring more caffeine to keep up with the pace. Either way, these two types of consumers enjoy coffee equally, and currently drink the same amount.

The variable ‘same’ is a dummy representing the question which asks consumers to predict their consumption of coffee for the following year. ‘same’ is the response of consumption to be about the same the following year as it was in the current year. The coefficient for this variable is statistically significant at the 10% level. Ceteris paribus, consumers who predict their consumption of coffee the following year to be about the same as the current year drink 9.10 ounces of coffee per week more than those who predict consumption to at least decrease some the next year. This means that individuals who predict their coffee consumption to be about the same the following year as it was in the current year drink more coffee than those who predict their consumption of coffee to at least decrease some the next year. This supports our hypothesis that those who

essentially do not expect coffee consumption to change the next year drink more coffee than those who expect consumption to at least decrease some the next year. Those who do not expect a change likely are certain that they like coffee and consume more than the ones who expect a decrease in consumption who are probably experimenting with coffee and do not yet know if they like it enough to drink as much as the 'certain' ones.

The variable 'male' is the dummy for the question that asks consumers of their gender. 'male' represents those who are male. The coefficient for this variable is not statistically significant. This shows that Chinese males and females consume the same amount of coffee. Such results tell a story that says males and females in China have similar lifestyles when it comes down to coffee. For example, perhaps both the male and female work the same amount of hours per week requiring equal amounts of caffeine. This is assuming, ceteris paribus, that coffee consumption reflects lifestyle. Also, since most of the Chinese consumers are younger, curiosity of coffee in the tea consuming nation could be dominating any gender effect. In other words, perhaps in the future males and females in China will consume coffee differently, but for now both genders are more interested in just trying the product.

The variable 'Age' is the continuous variable representing the age of the coffee consumer taking the survey. The coefficient for this variable is not statistically significant. We strongly suggest the reason behind the insignificance is the fact that the mean age of our sample is young. In other words, there is not enough variation in our sample to show the significance of age. Nevertheless, the notion that most Chinese coffee consumers are younger also explains why the mean age in our sample is also 'young'.

The variable ‘IncomeCtn’ is the continuous variable representing the income per month of each coffee consumer in the survey. The coefficient for this variable is not statistically significant. We conclude that the reason the coefficient for income is not significant in explaining total coffee consumption is because the price of coffee in China is expensive to a point where only individuals with higher income can afford to make coffee purchases. In other words, there is not enough variation in the income of individuals who have the money to buy coffee in China. Majority of the people who buy coffee in China are presumably white collared individuals.

The variable ‘EduoneCtn’ is the continuous variable representing number of years of education each person has in the survey. The coefficient for this variable is not statistically significant. We conclude the reason for this result is that higher education does not necessarily educate people about the culture and action of coffee drinking nor does it individually determine the ability of Chinese consumers to afford the expensive cup of coffee. It is suggested that the value of education is more in giving people the power to obtain a job/career more desirable to them. Education perhaps can better explain matters such as job/career success and social welfare, than coffee consumption.

The variable ‘partful’ is the dummy variable for the question which asks individuals their employment status. ‘partful’ is for those who are at least part-time employed. The coefficient for this variable is not statistically significant. This result tells us that citizens of all employment status’ in China value coffee and the benefits of, equally. Ceteris paribus, those of all job types will treat coffee consumption the same, and it is likely that each job-type requires the same benefits of coffee. In other words,

students, part-time workers, full-time workers, etc. all need caffeine to get through the day and all drink coffee if they like the taste.

The variable ‘Size’ is the continuous variable for the question which asks consumers how many people (number of heads) they have in their household. The coefficient for this variable is not statistically significant. This result tells us that coffee consumption is individually motivated. Also, it can be concluded that consumers drink coffee for factors such as taste and social status, not the situation at home.

The variable ‘children’ is the dummy for the question which asks consumers if they have children at home. ‘children’ is for those who do have children at home. The coefficient for this variable is not statistically significant. We conclude that having children does not affect lifestyle choices such as coffee consumption. Although presumably those who have children live more busy lifestyles than those who don’t, requiring more energy, which coffee provides, these same individuals likely were already at a comfortable and mature coffee consumption level prior to having kids.

The variable ‘married’ is the dummy for the question which asks consumers if they are married. ‘married’ is for those who are married. The coefficient for this variable is not statistically significant. We conclude that individuals likely experiment with coffee drinking earlier in their life, prior to becoming married, especially in the Chinese context where most of the coffee consumers indeed are younger, where the life changes associated with becoming married are not enough to change coffee consumption. In other words, similar to the conclusions for the variable representing those with/without children above, consumers in China are already at a comfortable coffee drinking level

prior to becoming married, and if consumption were to change marginal utility would come into play and likely go against the consumer.

Table 3: OLS Regression Results

Variable	Variable Description	Coefficient (Std. Error)
intercept	Intercept	47.794809 (35.728406)
brew	Dummy: Bought brewed coffee in last month	4.073237 (4.620225)
myself	Dummy: Made/brewed at least one cup coffee myself last month	10.256909* (5.380338)
coffeeShop	Dummy: Most often buy brewed coffee at coffee shop	-6.392972 (4.835918)
Samer	Dummy: For coffee consumed most often, produced in S. America	-6.435741 (7.902852)
eur	Dummy: For coffee consumed most often, produced in Europe	-8.159594 (7.482084)
chin	Dummy: For coffee consumed most often, produced in China	-5.676947 (9.015233)
lessonefiveyr	Dummy: Been consuming coffee regularly for 0-5 yrs	3.764777 (4.250846)
fivetenyr	Dummy: Been consuming coffee regularly for 5-10 yrs	18.605568* (9.570908)
overtenyr	Dummy: Been consuming coffee regularly for > 10 yrs	15.668486* (9.329567)

Table 3 OLS Regression Results (resumed)

xlarge	Dummy: Size of cup MOST OFTEN purchased is x-large	27.134022* (15.931192)
large	Dummy: Size of cup MOST OFTEN purchased is large	11.854528 (7.176665)
med	Dummy: Size of cup MOST OFTEN purchased is medium	7.155656 (4.485632)
incals	Dummy: Predict consumption of coffee next yr to at least incr some	6.494210 (4.888469)
same	Dummy: Predict consumption of coffee next yr to be about same as this yr	9.103240* (4.961253)
male	Dummy: Male	-5.678988 (5.186042)
Age	Continuous: Age of consumer (# yrs)	-0.061218 (0.482820)
IncomeCtn	Continuous: Income/mo	0.000136 (0.000482)
EduoneCtn	Continuous: yrs schooling	-1.590128 (1.896495)
partful	Dummy: At least part-timed employed	4.774983 (4.843329)
Size	Continuous: Household size (# heads)	-0.436115 (1.449852)
children	Dummy: Have children at home	1.489224 (6.304063)
married	Dummy: Married	11.556057 (9.904223)
Avg. Ajd.- R^2 = 0.059		

***, ** and * indicates significance at the 1%, 5% and 10% significance levels, respectively

Source: This table was manually re-created in Word via SAS output

CHAPTER 7: CONCLUSION

7.1 Implications

With investments and upward trends in production and rapid increases in consumption of coffee in China it is important for producers and retailers of the bean to

understand the new Chinese coffee consumer. This study uses survey data from Wuhan, China to explain Chinese coffee consumption. Specifically, we answer the question as to what drives the number of ounces per week of coffee consumed by Chinese consumers. Our efforts are centered on providing an understanding of Chinese coffee consumers, with most relevance in assisting coffee retailers in marketing their product in China, and with providing additional information for farmers in China who are growing or plan to grow coffee. Based on our investigation, our study is the first within the past 10 years to look directly at coffee consumption in China. Using OLS regression, we find that whether or not consumers make/brew their own coffee, how long consumers have been consuming coffee regularly, the size of the coffee cup most often purchased and individuals' prediction of their coffee consumption in the following year are all important in explaining total ounces of coffee consumed per normal week. Our results provide us with a summary which describes Chinese coffee consumers, below:

Consumers who make/brew their own coffee likely are more than causal coffee drinkers versus consumers who do not make/brew their own coffee: They are able to save money by making/brewing their own coffee and therefore consume more coffee versus the latter consumers. Retailers should focus more on selling ingredients and tools to brew coffee versus brewed coffee itself. This gives coffee shops in China a motivation to begin selling raw (un-brewed) coffee and tools to brew coffee if they have not yet done so. These marketing efforts not only provide convenience and cost advantages for consumers, but also a hobby and a gained interest in the art of coffee making. Creating a new culture of coffee making in the tea consuming China would without a doubt add to the success of coffee retailers and producers. Furthermore, retailers should make sure

their non-brewed coffee is at a competitive price where profits are achieved but also where consumers can see cost advantages of brewing their own coffee versus buying brewed coffee. This introduction of 'coffee culture' would surely increase consumption of not only home-brewed but also in-store brewed coffee. Chinese coffee growers may consider processing, packaging and selling their own product directly on-farm versus going through a middle-man if there are cost advantages.

Ceteris paribus, coffee drinkers who have been consuming coffee for the longest time (> 10 years) consume more coffee than irregular consumers, but not as much more than those who have been consuming coffee for 5-10 years: We conclude the reason why being that diminishing marginal utility comes into play past 10 years of coffee consumption. These consumers enjoy coffee just as much as the ones who have been consuming coffee for 5-10 years, but come to a peak, or rather a comfortable, satisfying and furthermore healthy level of consumption which is (ceteris paribus) lower than the 5-10 year consumers. This information tells producers and retailers of coffee that quality and a corresponding higher price may prevail in the future in China. In other words, the most mature coffee drinkers in China likely begin to realize the difference between the high and low quality coffee after drinking coffee for many years: In this case they may begin drinking coffee more for the taste of it, but also drink less. With lower quantity and higher taste preferences, coffee of higher quality and price is most successful in the long run.

Individuals who drink out of x-large cups drink more coffee than those who drink out of small coffee cups more often. Although this sounds like common sense, actually it is not. Consumers of smaller cup sizes could drink just as much, if not more

than the x-large cup consumers if they drink multiple of the smaller cup sizes. This tells retailers that they should more heavily promote their larger cup sizes by implementing marketing efforts such as offering larger cup sizes at prices marginally competitive. For example, coffee shops could set higher than average prices for their smaller cup sizes while setting prices not significantly higher than the smaller cup sizes for the larger cup sizes. In this scenario many consumers will purchase the larger cup size because it is not much more expensive than the smaller cup sizes. Holding the price elasticity constant, the overall result may be an increased profit.

Those who do not expect a change in their consumption of coffee the following year likely are certain that they like coffee and consume more than the ones who expect a decrease in consumption who are also probably experimenting with coffee and do not yet know if they like it enough to drink as much as the 'certain' ones. This tells retailers in China that they need to do a better job of promoting coffee to beginner drinkers of the bean in a way in which consumers will enjoy it more quickly. This could mean that retailers need to offer enough coffee products which contain added ingredients which take away the (what Chinese consumers call) bitter taste of black coffee, such as sugar, cream or other enhancing flavors. As time moves forward, these beginner coffee drinkers may slowly begin to acquire a taste for pure (black) coffee.

Country-of-origin for the coffee most consumed by Chinese consumers showed to have no importance in explaining consumption. This gives coffee growers in China a reason to increase production and put majority of efforts in selling domestically where no significant shipping costs and no tariffs are experienced. Major cost advantages can be gained by Chinese coffee farmers if China's coffee consumers have no preference for

where coffee was produced. Also, retailers can gain cost advantages by buying coffee grown in China and selling it in-store. Gender was not significant in explaining coffee consumption. This tells advertisers that they do not need to be sensitive as far as what gender they display in coffee ads in China. More focus should be on the coffee itself.

To end, based on results, we think that producers and retailers of coffee in China should concentrate on quality. While overall, Chinese consumers are currently new to drinking coffee and cannot differentiate between the lower and higher quality coffee, as time progresses preferences may change. This comes after the culture of coffee making and drinking continues to evolve in China, especially from Western influences and an acquired taste for black coffee. With an acquired taste for black coffee along with information in the media, consumers will likely begin to notice the difference between the higher and lower quality coffees. With disposable incomes in China expected to continue increasing, Chinese consumers may begin to demand (and be able to afford) higher quality coffee. To conclude, we suggest that Chinese producers and retailers may make profits with lower grade coffee in China in the short-run, but the higher quality coffee prevails in the long-run.

7.2 Limitations and Future Research

While this study provides valuable information about the new Chinese coffee consumer, there were limitations in our investigation. Our data are from the year 2008: Although, these data are from a year during the time Chinese coffee consumption was rapidly increasing, they are older. Future research will have more recent data, and possibly compare those data to our survey conducted in 2008 to see of any changes in behavior of the Chinese coffee consumer. Although our cross-sectional data provided a solid answer to our research question, panel data is always superior in terms of

explanatory power. Future research, with sufficient resources, could attempt to collect panel data and explain coffee consumption over time in China. Furthermore, with enough resources future analysis could collect scanner data to supplement survey data. Unlike scanner data, survey data provides personal (demographic) data whereas unlike survey data, scanner data gathers information regarding actual coffee consumption behavior. Although our sample city, Wuhan is a good representation of the average citizen of the P.R.C., it is better to have additional data from other cities in China. With enough resources, future research could collect coffee consumption data from multiple cities in China.

Appendix A: Codes used in SAS® software

```
/*09/14/2015; codes for thesis for 2008 Wuhan*/
/*this code is good*/
proc import /*data from external file, excel;*/
out=wuhan /*what you want to call data, not data file name itself*/
datafile="E:\2008WuhanUse.xlsx"
dbms=excel replace; /*replace=overwrites an exiting SAS data*/
getnames=yes; /*use first row as variable name*/
run;

/*dummy coding all classification variables; these codes match up with
below proc format code; this code is good*/
data wuhan;
set wuhan;
if Aone=1 then yes=1; else yes=0;
if Aone=0 then no=1; else no=0;

if Atwo=1 then yess=1; else yess=0;
if Atwo=0 then noo=1; else noo=0;

if Athree=1 then coffeeShop=1; else coffeeShop=0;
if Athree=2 then rest=1; else rest=0;
if Athree=3 then work=1; else work=0;
if Athree=4 then oth=1; else oth=0;

if Afour=1 then cofsho=1; else cofsho=0;
if Afour=2 then groc=1; else groc=0;
if Afour=3 then spec=1; else spec=0;
if Afour=4 then othh=1; else othh=0;
if Afour=12 then cg=1; else cg=0;
if Afour=13 then cs=1; else cs=0;
if Afour=14 then co=1; else co=0;
if Afour=123 then cgs=1; else cgs=0;

if Afive=1 then Samer=1; else Samer=0;
if Afive=2 then eur=1; else eur=0;
if Afive=3 then chin=1; else chin=0;
if Afive=4 then othhh=1; else othhh=0;
if Afive=12 then Se=1; else Se=0;
if Afive=13 then Sc=1; else Sc=0;
if Afive=23 then ec=1; else ec=0;
if Afive=34 then cho=1; else cho=0;
if Afive=123 then Sec=1; else Sec=0;

if Asix=1 then blackSug=1; else blackSug=0;
if Asix=2 then milkSug=1; else milkSug=0;
if Asix=3 then special=1; else special=0;
if Asix=4 then other=1; else other=0;
if Asix=12 then bm=1; else bm=0;
if Asix=13 then bs=1; else bs=0;
if Asix=23 then ms=1; else ms=0;
```

```
if Asevencmb=1 then lessonefiveyr=1; else lessonefiveyr=0;
if Asevencmb=3 then fivetenyr=1; else fivetenyr=0;
if Asevencmb=4 then overtenyr=1; else overtenyr=0;
if Asevencmb=5 then irreg=1; else irreg=0;

if A9a=1 then xlarge=1; else xlarge=0;
if A9a=2 then large=1; else large=0;
if A9a=3 then med=1; else med=0;
if A9a=4 then small=1; else small=0;
if A9a=23 then lm=1; else lm=0;
if A9a=34 then meds=1; else meds=0;
if A9a=234 then lms=1; else lms=0;
if A9a=1234 then xlms=1; else xlms=0;

if Atencmb=1 then incals=1; else incals=0;
if Atencmb=3 then same=1; else same=0;
if Atencmb=4 then decsome=1; else decsome=0;
if Atencmb=5 then decdras=1; else decdras=0;

if Aelevencmb=1 then FTorg=1; else FTorg=0;
if Aelevencmb=3 then dom=1; else dom=0;
if Aelevencmb=12 then FTo=1; else FTo=0;
if Aelevencmb=13 then FTd=1; else FTd=0;
if Aelevencmb=23 then od=1; else od=0;
if Aelevencmb=123 then Fod=1; else Fod=0;

if Atwelve=1 then alot=1; else alot=0;
if Atwelve=2 then some=1; else some=0;
if Atwelve=3 then noth=1; else noth=0;

if Athirteen=1 then kalot=1; else kalot=0;
if Athirteen=2 then ksome=1; else ksome=0;
if Athirteen=3 then knoth=1; else knoth=0;

if Male=1 then yesss=1; else yesss=0;
if Male=0 then female=1; else female=0;

if Employonecmb=1 then partful=1; else partful=0;
if Employonecmb=3 then ret=1; else ret=0;
if Employonecmb=4 then noj=1; else noj=0;
if Employonecmb=5 then home=1; else home=0;
if Employonecmb=6 then stud=1; else stud=0;
if Employonecmb=7 then othhhhh=1; else othhhhh=0;

if Jobone=1 then ser=1; else ser=0;
if Jobone=2 then sales=1; else sales=0;
if Jobone=3 then const=1; else const=0;
if Jobone=4 then manu=1; else manu=0;
if Jobone=5 then min=1; else min=0;
if Jobone=6 then agff=1; else agff=0;
if Jobone=7 then edumed=1; else edumed=0;
if Jobone=8 then mana=1; else mana=0;
if Jobone=9 then trans=1; else trans=0;
if Jobone=10 then maint=1; else maint=0;
if Jobone=11 then off=1; else off=0;
if Jobone=12 then mili=1; else mili=0;
if Jobone=13 then othhhhhh=1; else othhhhhh=0;
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```
if Jobone=23 then salc=1; else salc=0;
if Jobone=128 then ssm=1; else ssm=0;
if Jobone=811 then manao=1; else manao=0;

if Child=1 then yessss=1; else yessss=0;
if Child=0 then nooo=1; else nooo=0;

if Marry=1 then yesssss=1; else yesssss=0;
if Marry=0 then noooo=1; else noooo=0;

if Commnum=1 then nocom=1; else nocom=0;
if Commnum=2 then com=1; else com=0;
run;

/*checking dummy coding to see if done correctly*/
/*Everything was done correctly; this code is good*/
proc freq data=wuhan;
tables Aone*yes*no/list;
run;

proc freq data=wuhan;
tables Atwo*yess*noo/list;
run;

proc freq data=wuhan;
tables Athree*coffeeShop*rest*work*oth/list;
run;

proc freq data=wuhan;
tables Afour*cofsho*groc*spec*othh*cg*cs*co*cgs/list;
run;

proc freq data=wuhan;
tables Afive*Samer*eur*chin*othhh*Se*Sc*ec*cho*Sec/list;
run;

proc freq data=wuhan;
tables Asix*blackSug*milkSug*special*other*bm*bs*ms/list;
run;

proc freq data=wuhan;
tables Asevencmb*lessonefiveyr*fivetenyr*overtenyr*irreg/list;
run;

proc freq data=wuhan;
tables A9a*xlarge*large*med*small*lm*meds*lms*xlms/list;
run;

proc freq data=wuhan;
tables Atencmb*incals*same*decsome*decdras/list;
run;

proc freq data=wuhan;
tables Aelevencmb*FTorg*dom*FTo*FTd*od*Fod/list;
run;

proc freq data=wuhan;
```

```
tables Atwelve*alot*some*noth/list;
run;

proc freq data=wuhan;
tables Athirteen*kalot*ksome*knoth/list;
run;

proc freq data=wuhan;
tables Male*yesss*female/list;
run;

proc freq data=wuhan;
tables Employonecmb*partful*ret*noj*home*stud*othhhhh/list;
run;

proc freq data=wuhan;
tables
Jobone*ser*sales*const*manu*min*agff*edumed*mana*trans*maint*off*mili*o
thhhhhh*salc*ssm*manao/list;
run;

proc freq data=wuhan;
tables Child*yessss*nooo/list;
run;

proc freq data=wuhan;
tables Marry*yesssss*noooo/list;
run;

proc freq data=wuhan;
tables Commnum*nocom*com/list;
run;

/*need to create 'counter' for proc surveyreg; this code is good*/
data wuhan;
set wuhan;
counter=_n_;
run;

/*all codes below are ready to run; I created these codes on 12/15/2015;
this code is good*/
data wuhan;
set wuhan;
Sizesq=Size**2;
run;

data wuhan;
set wuhan;
EduoneCtnsq=EduoneCtn**2;
run;

data wuhan;
set wuhan;
IncomeCtnsq=IncomeCtn**2;
run;

data wuhan;
```

```
set wuhan;
Agesq=Age**2;
run;

/*creating lables for variables (so audience knows exactly which each
variable is); this code is good*/
DATA wuhan;
SET wuhan;
LABEL OID="Identifier of each observation"
Version="Version number of survey"
Location="Survey location"
Date="Survey date"
Time="Time of day survey conducted"
Aone="Buy brewed coffee in past month?"
Atwo="Make/brew at least one cup of coffee yourself last month?"
Athree="Where you most often buy your brewed coffee?"
Afour="If made/brew coffee where do you normally buy ingredients?"
Afive="For coffee consumed most often, where is produced?"
Asix="For coffee consumed most often, what's flavor?"
Aseven="How long been consuming coffee regularly? na"
A8a="for normal week, # cups x-large coffee you consume?"

A8b="for normal week, # cups large coffee you consume?"
A8c="for normal week, # cups medium coffee you consume?"
A8d="for normal week, # cups small coffee you consume?"
A8aoz="var A8a in ounces"
A8boz="var A8b in ounces"
A8coz="var A8c in ounces"
A8doz="var A8d in ounces"
totconsm="total ounces coffee consumed per normal week"
A9a="size of cup you MOST OFTEN purchase?"
A9b="Corresponding price you recall paid for most often purchased cup
size?"

A9c="if most often purchased size not medium, your estimated price of
medium cup?"

Aten="how predict your consumption of coffee next yr? na"

Aeleven="you ever consumed fair trade/organic/Chinese domestic coffee?
na"

Atwelve="how familiar with fair trade coffee?"

Athirteen="how familiar with organic coffee?"

Male="Gender"
Age="Age of consumer(# yrs)"
Income="Income/mo non-continuous"
Eduone="yrs schooling non-continuous"
Employone="Employment status na"
Jobone="if at least part time the nature of your job?"

Size="household size (# heads)"
Child="Have children at home?"
Marry="Married?"
```

```
yes="Bought brewed coffee in past month"
no="Didn't buy brewed coffee in past month"

yess="Made/brewed at least one cup coffee myself last month"
noo="Didn't make/brew at least one cup coffee myself last month"

coffeeShop="most often buy brewed coffee at coffee shop"
rest="most often buy brewed coffee at restaurant"
work="normally don't buy brewed coffee but work provides"
oth="most often buy brewed coffee at place(s) not listed"

cofsho="normally buy ingredients at coffee shop (if made/brew coffee)"
groc="normally buy ingredients at reg grocery (if made/brew coffee)"
spec="normally buy ingredients at specialty food store (if made/brew
coffee)"
othh="normally buy ingredients at place(s) not listed (if made/brew
coffee)"
cg="normally buy ingredients at coffee shop & reg grocery (if made/brew
coffee)"
cs="normally buy ingredients at coffee shop & specialty food store (if
made/brew coffee)"
co="normally buy ingredients at coffee shop & place(s) not listed (if
made/brew coffee)"
cgs="normally buy ingredients at coffee shop, reg grocery & specialty
food store (if made/brew coffee)"

Samer="for coffee consumed most often, produced in S.America"
eur="for coffee consumed most often, produced in Europe"
chin="for coffee consumed most often, produced in China"
othhh="for coffee consumed most often, produced in place(s) not listed"
Se="for coffee consumed most often, produced in S.America & Europe"
Sc="for coffee consumed most often, produced in S.America & China"
ec="for coffee consumed most often, produced in Europe & China"
cho="for coffee consumed most often, produced in China & place(s) not
listed"
Sec="for coffee consumed most often, produced in S.America, Europe &
China"

blackSug="for coffee consumed most often, is reg black w/sugar only
flavor"
milkSug="for coffee consumed most often, is reg w/creamer or milk &
sugar flavor"
special="for coffee consumed most often, is specialty (e.g.latte,
capucinno) flavor"
other="for coffee consumed most often, is flavor not listed"
bm="for coffee consumed most often, is reg black w/sugar only and reg
w/creamer or milk & sugar flavor"
bs="for coffee consumed most often, is reg black w/sugar only and
specialty flavor"
ms="for coffee consumed most often, is reg w/creamer or milk & sugar
and specialty flavor"

lessonefiveyr="been consuming coffee regularly for 0-5 yrs"
fivetenyr="been consuming coffee regularly for 5-10 yrs"
overtenyr="been consuming coffee regularly for > 10 yrs"
irreg="Consume coffee irregularly"
```

```
xlarge="size of cup MOST OFTEN purchased is x-large"
large="size of cup MOST OFTEN purchased is large"
med="size of cup MOST OFTEN purchased is medium"
small="size of cup MOST OFTEN purchased is small"
lm="size of cup MOST OFTEN purchased is large & medium"
meds="size of cup MOST OFTEN purchased is medium & small"
lms="size of cup MOST OFTEN purchased is large, medium & small"
xlms="size of cup MOST OFTEN purchased is x-large, large, medium &
small"

incals="predict consumption of coffee next yr to at least incr some"
same="predict consumption of coffee next yr to be about same as this
yr"
decsome="predict consumption of coffee next yr to decr some"
decdras="predict consumption of coffee next yr to decr drastically"

FTorg="have consumed fair trade or organic coffee"
dom="have consumed Chinese domestic coffee"
FTo="have consumed fair trade & organic coffee"
FTd="have consumed fair trade & Chinese domestic coffee"
od="have consumed organic and Chinese domestic coffee"
Fod="have consumed fair trade, organic & Chinese domestic coffee"

alot="know a lot about fair trade coffee"
some="know some about fair trade coffee"
noth="almost know nothing about fair trade coffee"

kalot="know a lot about organic coffee"
ksome="know some about organic coffee"
knoth="almost know nothing about organic coffee"

yesss="Male"
female="Female"

partful="at least part-time employed"
ret="retired"
noj="no job"
home="home maker"
stud="student"
othhhhh="employ status not listed"

ser="at least part time employed & in service"
sales="at least part time employed & in sales"
const="at least part time employed & in construction"
manu="at least part time employed & in manufacturing"
min="at least part time employed & in mining"
agff="at least part time employed & in ag/fishery/forest"
edumed="at least part time employed & in edu/med"
mana="at least part time employed & in management"
trans="at least part time employed & in transportation"
maint="at least part time employed & in maintenance"
off="at least part time employed & in office wrk"
mili="at least part time employed & in military"
othhhhhh="at least part time employed & in job not listed"
salc="at least part time employed & in sales & construction"
ssm="at least part time employed & in service, sales and management"
manao="at least part time employed & in management & office wrk"
```

```
yessss="Have children at home"
nooo="Don't have children at home"

yesssss="Married"
noooo="Not married"

nocom="Didn't write comments in survey"
com="Wrote comments in survey"

Atencmb="how predict your consumption of coffee next yr?"
IncomeCtn="Income/mo"
EduoneCtn="yrs schooling"
Employonecmb="Employment status"
Commnum="comments given by participants"
Asevencmb="How long been consuming coffee regularly?"
Aelevencmb="you ever consumed fair trade/organic/Chinese domestic
coffee?"
Sizesq="household size (# heads) squared"
EduoneCtnsq="yrs schooling squared"
IncomeCtnsq="Income/mo squared"
Agesq="Age of consumer(# yrs) squared"

counter="only to run surveyreg";
RUN;

/*checking to see if above code worked; this code is good; the above
code DID work*/
PROC CONTENTS DATA=wuhan;
RUN;

/*this code is good*/
proc means data=wuhan;
run;

/*MIS; I'm checking the missing data pattern; for these data, there is
a non-monotone missing pattern; this code is good*/
proc mi data=wuhan nimpute=0;
var Aone Atwo Athree Afour Afive Asix Aseven totconsm A9a A9b A9c Aten
Aeleven Atwelve Athirteen Male Age Income Eduone Employone Jobone Size
Child Marry;
ods select misspattern;
run;

/*MI c; this code is good */
proc mi data=wuhan seed=518 out=miwuhan;
class Aone Atwo Athree Afour Afive Asix Aelevencmb Male Jobone Child
Marry Employonecmb Commnum Asevencmb A9a Atwelve Athirteen Atencmb;
fcs discrim(Aone Atwo Athree Afour Afive Asix Aelevencmb Male Jobone
Child Marry Employonecmb Commnum/CLASSEFFECTS=INCLUDE)
logistic(Asevencmb A9a Atwelve Athirteen Atencmb) regpmm(totconsm A9b
A9c Age Size IncomeCtn EduoneCtn Sizesq EduoneCtnsq IncomeCtnsq Agesq);
var Aone Atwo Athree Afour Afive Asix totconsm A9a A9b A9c Atwelve
Athirteen Male Age Jobone Size Child Marry Atencmb IncomeCtn EduoneCtn
Employonecmb Commnum Asevencmb Aelevencmb Sizesq EduoneCtnsq
IncomeCtnsq Agesq;
run;
```

```
/*this code is good*/
proc means data=miwuhan;
run;

/*this code is good*/
proc print data=miwuhan;
run;

/*proc surveyreg cc; analysis on official empirical model using proc
surveyreg; this is using dummy variables; this code is good*/
proc surveyreg data=miwuhan;
cluster counter; /*good*/
model totconsm=yes yess coffeeShop Samer eur chin lessonefiveyr
fivetenyr overtenyr xlarge large med A9b incals same FTorg dom yesss
Age IncomeCtn EduoneCtn partful Size yessss yesssss Sizesq EduoneCtnsq
IncomeCtnsq Agesq/I;/*good*/
by _Imputation_;
ods output ParameterEstimates=parmse
                  InvXPX=xtxinv
                  FitStatistics=fs; /*good*/
run;/*good*/

/*proc surveyreg cc; 12/17/2015 in evening with Wuyang dropping squared
terms only; analysis on official empirical model using proc surveyreg;
this is using dummy variables; this code is good*/
proc surveyreg data=miwuhan;
cluster counter; /*good*/
model totconsm=yes yess coffeeShop Samer eur chin lessonefiveyr
fivetenyr overtenyr xlarge large med A9b incals same FTorg dom yesss
Age IncomeCtn EduoneCtn partful Size yessss yesssss/I;/*good*/
by _Imputation_;
ods output ParameterEstimates=parmse
                  InvXPX=xtxinv
                  FitStatistics=fs; /*good*/
run;/*good*/

/*proc surveyreg cc; 12/17/2015 in evening with Wuyang dropping squared
terms plus 'A9b' and 'FTorg'; analysis on official empirical model
using proc surveyreg; this is using dummy variables; this code is
good*/
proc surveyreg data=miwuhan;
cluster counter; /*good*/
model totconsm=yes yess coffeeShop Samer eur chin lessonefiveyr
fivetenyr overtenyr xlarge large med incals same dom yesss Age
IncomeCtn EduoneCtn partful Size yessss yesssss/I;/*good*/
by _Imputation_;
ods output ParameterEstimates=parmse
                  InvXPX=xtxinv
                  FitStatistics=fs; /*good*/
run;/*good*/

/*proc surveyreg cc; FINAL MODEL AS OF END OF 12/17/2015;12/17/2015 in
evening with Wuyang dropping squared terms plus 'A9b' and 'FTorg' plus
'dom'; analysis on official empirical model using proc surveyreg; this
is using dummy variables; this code is good*/
proc surveyreg data=miwuhan;
```

```
cluster counter; /*good*/
model totconsm=yes yess coffeeShop Samer eur chin lessonefiveyr
fivetenyr overtenyr xlarge large med incals same yesss Age IncomeCtn
EduoneCtn partful Size yessss yesssss/I;/*good*/
by _Imputation_;
ods output ParameterEstimates=parmse
                  InvXPX=xtxinv
                  FitStatistics=fs; /*good*/
run;/*good*/

/*testing the validity of above model (final model as of end of
12/17/2015); this code is good; ALL CODES BELOW ARE FOR MANUALLY
CONDUCTING RESET TEST*/
proc reg data=miwuhan;
model totconsm=yes yess coffeeShop Samer eur chin lessonefiveyr
fivetenyr overtenyr xlarge large med incals same yesss Age IncomeCtn
EduoneCtn partful Size yessss yesssss/acov;
output out=reset r=resd p=yhat;
by _Imputation_;
run;

/*this code is good*/
proc print data=reset;
run;

/*this code is good*/
data reset;
set reset;
p2=yhat*yhat;
p3=yhat*yhat*yhat;
p4=yhat*yhat*yhat*yhat;
run;

/*this code is good*/
proc reg data=reset;
model totconsm=yes yess coffeeShop Samer eur chin lessonefiveyr
fivetenyr overtenyr xlarge large med incals same yesss Age IncomeCtn
EduoneCtn partful Size yessss yesssss p2 p3 p4/acov;
test p2=p3=p4=0;
by _Imputation_;
run;

/*this code is good*/
proc reg data=reset;
model totconsm=yes yess coffeeShop Samer eur chin lessonefiveyr
fivetenyr overtenyr xlarge large med incals same yesss Age IncomeCtn
EduoneCtn partful Size yessss yesssss p2/acov;
test p2=0;
by _Imputation_;
run;

/*this code is good*/
proc reg data=reset;
model totconsm=yes yess coffeeShop Samer eur chin lessonefiveyr
fivetenyr overtenyr xlarge large med incals same yesss Age IncomeCtn
EduoneCtn partful Size yessss yesssss p2 p3/acov;
test p2=p3=0;
```

```
by _Imputation_;
run;

/*END OF MANUAL RESET TEST CODES*/

/*testing for multicollinearity using 'collin' on final model as of end
of 12/17/2015; this code is good*/
proc reg data=miwuhan;
model totconsm=yes yess coffeeShop Samer eur chin lessonefiveyr
fivetenyr overtenyr xlarge large med incals same yesss Age IncomeCtn
EduoneCtn partful Size yessss yesssss/acov collin;
by _Imputation_;
run;

/*testing for multicollinearity using 'vif' on final model as of end of
12/17/2015;this code is good*/
proc reg data=miwuhan;
model totconsm=yes yess coffeeShop Samer eur chin lessonefiveyr
fivetenyr overtenyr xlarge large med incals same yesss Age IncomeCtn
EduoneCtn partful Size yessss yesssss/acov vif;
by _Imputation_;
run;

/*testing for autocorrelation using Durbin-Watson test on final model
as of end of 12/17/2015; this code is good*/
proc reg data=miwuhan;
model totconsm=yes yess coffeeShop Samer eur chin lessonefiveyr
fivetenyr overtenyr xlarge large med incals same yesss Age IncomeCtn
EduoneCtn partful Size yessss yesssss/acov dwprob;
by _Imputation_;
run;

/*checking output from 'proc surveyreg cc'*/
/*all codes below are good*/
proc print data=parmse;
run;

proc print data=xtxinv;
run;

proc print data=fs;
run;

/*proc mianalyze b; this code matches up with 'proc surveyreg cc; FINAL
MODEL AS OF END OF 12/17/2015....'; this code is good*/
proc mianalyze parms=parmse xpxi=xtxinv;
modeleffects intercept yes yess coffeeShop Samer eur chin lessonefiveyr
fivetenyr overtenyr xlarge large med incals same yesss Age IncomeCtn
EduoneCtn partful Size yessss yesssss; /*good*/
run;

/*proc means sigg 1; for (only) variables in model via 'proc surveyreg
cc; FINAL MODEL AS OF END OF 12/17/2015....'; this code is good*/
proc means data=wuhan;
VAR totconsm yes yess coffeeShop Samer eur chin lessonefiveyr fivetenyr
overtenyr xlarge large med incals same yesss Age IncomeCtn EduoneCtn
partful Size yessss yesssss;
```

```
run;

/*proc means sigg 2; for (only) variables in model via 'proc surveyreg
cc; FINAL MODEL AS OF END OF 12/17/2015....' after Multiple Imputation;
this code is good*/
proc means data=miwuhan;
VAR totconsm yes yess coffeeShop Samer eur chin lessonefiveyr fivetenyr
overtenyr xlarge large med incals same yesss Age IncomeCtn EduoneCtn
partful Size yessss yesssss;
run;

/*testing something; this code is ready to run; from these results I
should be able to
test for multicollinearity, autocorrelation, etc. via proc reg using
multiply imputed data sets*/
proc reg data=miwuhan outest=mlyzwuh covout;
model totconsm=lessyr onefiveyr fivetenyr overtenyr xlarge large med
small lm meds lms A9b Age least secleast thirdleast fourthleast
fifthleast sixthleast six nine ele twel thirt fourt sixt ninet tt part
full ret noj home stud Size yessss nooo yess noo/acov collin vif dwprob;
by _Imputation_;
run;

/*-----APPENDIX------*/
/*formating classification variables for proc mi (and) proceeding;
this code is good*/
proc format;
value Aone 1="yes"
           0="no";
value Atwo 1="yess"
           0="noo";
value Athree 1="coffeeShop"
             2="rest"
               3="work"
               4="oth";
value Afour 1="cofsho"
            2="groc"
              3="spec"
              4="oth"
                12="cg"
                13="cs"
                14="co"
                123="cgs";
value Afive 1="Samer"
              2="eur"
              3="chin"
              4="oth"
                12="Se"
                13="Sc"
                23="ec"
                34="cho"
                123="Sec";
value Asix 1="blackSug"
           2="milkSug"
           3="special"
           4="other"
               12="bm"
```

```
                13="bs"
                23="ms";
value Aseven 1="lessyr"
             2="onefiveyr"
             3="fivetenyr"
             4="overtenyr"
             5="irreg";
value A9a 1="xlarge"
          2="large"
          3="med"
          4="small"
              23="lm"
              34="meds"
              234="lms"
              1234="xlms";
value Aten 1="inclot"
           2="incsome"
           3="same"
           4="decsome"
           5="decdras";
value Aeleven 1="FT"
              2="org"
              3="dom"
                    12="FTo"
                    13="FTd"
                    23="od"
                    123="Fod";
value Atwelve 1="alot"
              2="some"
              3="noth";
value Athirteen 1="kalot"
                2="ksome"
                3="knoth";
value Male 1="yesss"
           0="female";
value Income 1="least"
             2="secleast"
             3="thirdleast"
             4="fourthleast"
             5="fifthleast"
             6="sixthleast"
             7="seventhleast";
value Eduone 1="six"
             2="nine"
             3="ele"
             4="twel"
             5="thirt"
             6="fourt"
             7="sixt"
             8="ninet"
             9="tt"
             10="oth";
value Employone 1="part"
                2="full"
                3="ret"
                4="noj"
                5="home"
```

```
                6="stud"
                7="oth";
value Jobone 1="ser"
             2="sales"
             3="const"
             4="manu"
             5="min"
             6="agff"
             7="edumed"
             8="mana"
             9="trans"
             10="maint"
             11="off"
             12="mili"
             13="oth"
                   23="salc"
                   128="ssm"
                   811="manao";
value Child 1="yessss"
            0="nooo";
value Marry 1="yesssss"
            0="noooo";
run;
options fmtsearch=(work);

/*MI a; I can use this MI method for these data given my non-monotone
missing pattern; I am continuing to use regpmm
for continuous variables because I assume normality is slightly
disturbed and I am impressed of this method;
start off by not setting minimums, maximums and rounding; as result, I
have various warning messages;*/
proc mi data=wuhan seed=407 out=miwuhan;
class Aone Atwo Athree Afour Afive Asix Aeleven Male Employone Jobone
Child Marry Aseven A9a Aten Atwelve Athirteen Income Eduone;
fcs discrim(Aone Atwo Athree Afour Afive Asix Aeleven Male Employone
Jobone Child Marry) logistic(Aseven A9a Aten Atwelve Athirteen Income
Eduone) regpmm(totconsm A9b A9c Age Size);
var Aone Atwo Athree Afour Afive Asix Aseven totconsm A9a A9b A9c Aten
Aeleven Atwelve Athirteen Male Age Income Eduone Employone Jobone Size
Child Marry;
run;

/*testing something; do not use this code*/
proc import /*data from external file, excel*/
out=testwuhan /*what you want to call data, not data file name itself*/
datafile="E:\test_Wuhan.xlsx"
dbms=excel replace; /*replace=overwrites an exiting SAS data*/
getnames=yes; /*use first row as variable name*/
run;

proc means data=testwuhan;
run;

/*ONLY looking to see if labels of variables shows up in regression
results; this model is ONLY to test for this*/
proc reg data=wuhan;
model Age=noooo manao ssm;
```

```
run;

/*MI b; adding CLASSEFFECTS=INCLUDE to 'MI a' to fcs discrim to use
class variables as covariates (what I want)
and to get rid of warning messages; I got rid of CLASSEFFECTS= WARNING
message but have one new ERROR message(s);
but I was still able to obtain results; this code is good */
proc mi data=wuhan seed=407 out=miwuhan;
class Aone Atwo Athree Afour Afive Asix Aeleven Male Employone Jobone
Child Marry Aseven A9a Aten Atwelve Athirteen Income Eduone;
fcs discrim(Aone Atwo Athree Afour Afive Asix Aeleven Male Employone
Jobone Child Marry/CLASSEFFECTS=INCLUDE) logistic(Aseven A9a Aten
Atwelve Athirteen Income Eduone) regpmm(totconsm A9b A9c Age Size);
var Aone Atwo Athree Afour Afive Asix Aseven totconsm A9a A9b A9c Aten
Aeleven Atwelve Athirteen Male Age Income Eduone Employone Jobone Size
Child Marry;
run;

/*proc surveyreg aa analysis on official empirical model using proc
surveyreg; this code is ready to run; this is using proc format*/
proc surveyreg data=miwuhan;
cluster counter; /*good*/
CLASS Aseven A9a Income Eduone Employone Child Atwo;
model totconsm=Aseven A9a A9b Age Income Eduone Employone Size Child
Atwo/SOLUTION I;/*good*/
by _Imputation_;
ods output ParameterEstimates=parmse
                 InvXPX=xtxinv
                 FitStatistics=fs; /*good*/
run;/*good*/

/*proc surveyreg bb analysis on official empirical model using proc
surveyreg; this code is ready to run; this is using dummy variables;
this code is good*/
proc surveyreg data=miwuhan;
cluster counter; /*good*/
model totconsm=lessyr onefiveyr fivetenyr overtenyr xlarge large med
small lm meds lms A9b Age least secleast thirdleast fourthleast
fifthleast sixthleast six nine ele twel thirt fourt sixt ninet part
full ret noj home stud Size yessss yess/SOLUTION I;/*good*/
by _Imputation_;
ods output ParameterEstimates=parmse
                 InvXPX=xtxinv
                 FitStatistics=fs; /*good*/
run;/*good*/

/*proc mianalyze a; this code is good*/
proc mianalyze parms=parmse xpxi=xtxinv;
modeleffects intercept lessyr onefiveyr fivetenyr overtenyr xlarge
large med small lm meds lms A9b Age least secleast thirdleast
fourthleast fifthleast sixthleast six nine ele twel thirt fourt sixt
ninet part full ret noj home stud Size yessss yess; /*good*/
run;
/*this code is good*/
proc print data=wuhan;
run;
```

```
/*this code is good*/
ods rtf file='miwuhanF.rtf';
proc means data=miwuhan;
run;
ods rtf close;

/*proc means for (only) variables in model via 'proc surveyreg bb';
this code is good*/
proc means data=wuhan;
VAR totconsm Aseven A9a A9b Age Income Eduone Employone Size Child Atwo
lessyr onefiveyr fivetenyr overtenyr xlarge large med small lm meds lms
least secleast thirdleast fourthleast fifthleast sixthleast six nine
ele twel thirt fourt sixt ninet part full ret noj home stud yessss yess;
run;

/*proc means for (only) variables in model via 'proc surveyreg bb'
after Multiple Imputation; this code is good*/
proc means data=miwuhan;
VAR totconsm Aseven A9a A9b Age Income Eduone Employone Size Child Atwo
lessyr onefiveyr fivetenyr overtenyr xlarge large med small lm meds lms
least secleast thirdleast fourthleast fifthleast sixthleast six nine
ele twel thirt fourt sixt ninet part full ret noj home stud yessss yess;
run;

/*proc mianalyze b; this code is good*/
ods rtf file='emp.rtf';
proc mianalyze parms=parmse xpxi=xtxinv;
modeleffects intercept yes yess coffeeShop cofsho groc Samer eur chin
lessyr onefiveyr fivetenyr overtenyr xlarge large med A9b incals same
FT org dom yesss Age IncomeCtn EduoneCtn partful Size yessss yesssss
nocom; /*good*/
run;
ods rtf close;

/*proc means sigg 2; for (only) variables in model via 'proc surveyreg
cc' after Multiple Imputation; this code is good*/
ods rtf file='sig.rtf';
proc means data=miwuhan;
VAR totconsm yes yess coffeeShop cofsho groc Samer eur chin lessyr
onefiveyr fivetenyr overtenyr xlarge large med A9b incals same FT org
dom yesss Age IncomeCtn EduoneCtn partful Size yessss yesssss nocom;
run;
ods rtf close;
```
(Goodnight, 2016)

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