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Beverage consumption patterns in a new market economy

Abstract: Beverage consumption reflects consumer behavior shaped by social and economic factors. Observations of beverage consumption patterns provide unique insights of interest to many decision-makers, from the marketers and distributors to public health experts. We apply count data modeling technique to data on beverage consumption frequencies and show the importance of selecting the appropriate model. The models are estimated using survey data collected from more than 2,000 households in Bulgaria. Results from nested and non-nested tests and the ability to predict zero observations suggested that the zero-inflated Poisson with heterogeneity and negative binomial models performed best. Only results of these models are discussed leading to the overall conclusion that age, employment, education and income are the core characteristics of each beverage consuming group, while gender and household characteristics such as the number of adults in the family or the presence of children together with the religion and the geographical location helped to fine tune the profile of beverage consumers.

Keywords: survey data, consumption frequency, count data model, zero-inflated models, negative binomial models.

JEL codes: D12.

1. Introduction

A fundamental change in the economic and political system results in a cascade of changes, each calling for major adjustment on the part of all members of a society. The transition from a centrally planned economic system controlling the distribution and consumption of goods and services to a system based on markets as an allocative mechanism represents such a fundamental change. Individual responses to changes vary. The nature of the experienced change affects the system of values and preferences, and emerging preferences are reflected in consumption choices.

In this paper we investigate factors influencing beverage choice in Bulgaria using consumption frequency data. Bulgaria has undergone a major transition from a consumption-restricting centrally planned system emphasizing heavy industry growth to an economy based on the market mechanism. Liberalization of the economy led to a rapid increase in the variety of food items available, including beverages. The pattern of beverage consumption captures phenomena associated with the dramatic socio-economic change induced by transformation of the country's political and economic system. Depending on the type of beverage, the profile developed by the consumer is expected to mirror several different trends that may occur simultaneously but are difficult to discern. Trends reflect lifestyle changes, uncertainties brought about by structural transformation of the economy and employment insecurity, concerns about adequate nutrition, or changes in consumption resulting from varying incomes. Beverage consumption choices provide a synthetic measure of societal reaction to a major change in the socio-economic environment and allow multiple recommendations ranging from specific marketing strategies to nutrition implications and public health concerns to be made. The deliberate purpose of this study is to investigate beverage consumption in an economy subjected to a major transformation affecting the population. Factors affecting the individual beverage consumption frequencies were analyzed. Specifically, we distinguish among eight beverage categories and examine demographic, economic, and geographic factors responsible for frequency of their consumption. The eight beverage categories are milk, coffee, tea, soft drinks, lemonade, beer, wine, and spirits.

Nutritional concerns are reflected in the profiles of milk consumers, while soft drink consumption offers an immediate and relatively inexpensive way to demonstrate a fashionable lifestyle. Liberalization of trade and investment led to a rapid development of the soft drink market, and foreign and domestic manufacturers supply a variety of soft drinks. Black tea has been commonly available for years, but choices of brands and flavors increased during the 1990s. Lemonade was widely consumed prior to adoption of a market economy. Coffee is the most common hot beverage, and the Bulgarian coffee market has experienced a major growth in recent years.

Transition changed the structured and regulated lives of Bulgarians, and increased fears of unemployment because many industries in Bulgaria proved to be unable to compete on world markets and closed many plants. It has been observed that in stressful situations some increase in alcohol consumption occurs (Cooper et al., 1995; Peirce et al., 1996). Increased alcohol intake can negatively affect health of individuals and cause a loss of productivity. Earlier studies suggested that the most educated Bulgarian experienced a decline in health larger than that of the less educated (Wnuk-Lipinski, 1990). The disproportional decline was attributed to greater sensitivity and feelings of frustration on the part of the highly educated. We will examine, among other associations, the link between the educational attainment level and the frequency of consumption of various alcoholic beverages.

The available data are self-reported records of beverage consumption frequency. The integer nature of the data calls for an appropriate estimation technique. A count-data model is suitable, but within the family of count-data models a specific, more accurate alternative may be preferred to others. If the results are to be used for the purpose of developing a policy, the degree of model robustness matters. We apply four different count-data models to show the relevancy of selecting a proper model. Selection of the best performing model is based on the penalized consistent Akaike Information Criteria (CAIC), Vuong test and the ability of the model to predict beverage choices made by consumers.

2. Econometric models

We adopt the standard demand model in which an individual maximizes his utility subject to a budget constraint. The goods entered in the individual's budget are indivisible and consumed in multiples of some basic unit (Pudney, 1989). We also assume that the choice of each beverage product, q_1 is a nonnegative integer. In principle, each individual chooses q_1 as well as the quantity of a vector of other goods, $\mathbf{q_2}$, some point in a given time. Furthermore, we don't know whether the individual has other beverage products or a subset of them on his choice set for $\mathbf{q_2}$ because the way it is defined, e.g., composite goods.

Let the individual's utility function be

$$u = V(q_1, q_2; \beta), \tag{1}$$

where $q_1 \in I$ is the quantity of the beverage in question, where I is the set of {0, 1, 2, . . .}, $\mathbf{q_2}$ is the quantity vector for all other goods and $\boldsymbol{\beta}$ is a vector of unobservable preferences shift variables. Each individual maximizes

$$\begin{aligned} &\max_{q_1 \in I, q_2} \left\{ V(q_1, q_2; \beta) \mid P \cdot Q = p_1 q_1 + p_2 q_2 = Y \right\} = \\ &= \max_{q_1 \in I} \left\{ \max \left[V(q_1, q_2; \beta) \mid p'_2\, q_2 = Y - p_1 q_1 \right] \right\} = \\ &= \max_{q_1 \in I} \left\{ H\left[q_1, \frac{p_2}{(Y - p_1 q_1)} \right]; \beta \right\}, \end{aligned} \tag{2}$$

where P is the vector of prices and divided into p_1, the price of the beverage in question, q_1, and $\mathbf{p_2}$, a vector of prices of all other goods, $\mathbf{q_2}$, Y is income, and H is the indirect utility. Usually detailed information on $\mathbf{q_2}$ is unavailable in cross-section studies and thus the utility must be defined as a function of the quantity of the beverage in question, its price, aggregate price ($\mathbf{p}_2$) for other consumption good $\mathbf{q}_2$ and income. In such a case, the individual's discrete choice problem is defined as

$$\max_{q_1 \in I} \left\{ V\left[q_1, \frac{(Y - p_1 q_1)}{p_2} \right]; \beta \right\}, \tag{3}$$

where $\mathbf{P}_2$ is the price aggregate for a composite good $\mathbf{q}_2$.

Prices of individual beverages are not available, but due to the competitive nature of the economy, likely show little variation in retail outlets where they are purchased most often. Therefore, the assumption of equal prices across individuals is plausible and they are captured in the constant term in the equation. Morever, regional variables are included because these variables may also serve as proxies for regional price variations as well as social behaviour differences.(Su and Yen, 2000). The objective functions defined in equations (2) and (3) depend on the integer value of q_1 as the unique characteristics distinguishing each j (j =1, 2, ...) alternative corresponding to quantities $\mathbf{q}^j$ =0, 1, 2, ... units of good q_1. In this case, the individual will make a decision by comparing the utilities which give him the highest satisfaction u^1=V(0, y $\mathbf{P}_2$; β), u^2 =V(0, (y-p_1) $\mathbf{P}_2$; β) etc. It is worth noting that some of the elements of $\mathbf{q}^j$ will not vary across individuals and other elements may vary because they are not specific to alternative j. V(.;.) is known to all individual and all alternatives displaying all common properties of a utility function for every estimable $\boldsymbol{\beta}$ (Pudney, 1989).

The discrete non-negative nature of the beverage consumption frequency-dependent variable suggests the use of the simple Poisson count data model. Let y_i, i = 1, ..., N represent the discrete beverage consumption frequency and x_i be a (k x 1) vector of independent variables. In the benchmark model, we assume

$$f(y_i \mid x_i) = \frac{\lambda_i^{y_i} \exp(-\lambda_i)}{y_i!} \, y_i = 1, 2, \ldots, \tag{4}$$

with λ_i = mean (y_i|x_i) = variance (y_i|x_i). Setting a common specification for the mean parameter as λ_i = exp($x_i\boldsymbol{\beta}$), where the exponential form ensures non-negativity of counts and $\boldsymbol{\beta}$ is a vector of unknown parameter estimates, yields the compound Poisson regression model. The benchmark model has the restrictive assumption equalizing the conditional mean of each count-dependent variable with its corresponding conditional variance. However, in most economic applications, empirical count data are characterized by the presence of overdispersion: the conditional variance exceeds the conditional mean. Unobserved heterogeneity and positive contagion are main sources of overdispersion (McCullagh and Nelder, 1989). In addition, another frequently encountered issue in consumption studies is a relatively higher frequency of zero observations (Gurmu and Trivedi, 1996; 1997; 1998). Thus, the compound Poisson model is not appropriate for data with a large portion of new observations and the potential presence of overdispersion.

To account for the unobserved heterogeneity and excess of zeros in the model, we use a zero-inflated variant of the standard Poisson and negative binomial count data models. The zeros may come from two different data-generating processes. The first zero-generating process results from the pervasive abstention decision in which an individual does not have an inherent preference about the beverages. The second zero-generating process follows the usual corner solutions in the underlying count data distribution. The high consumption frequency of zeros is thus accounted for by introducing an extra probability mass at zero, say with the probability π and reducing the probability mass for other non-zero frequencies with probability 1 – π.

The link between the economic decision and statistical analysis for the probability mass at zero is that the binary binomial procedure addresses the abstention decision, while the standard count data analyzes the corner solution along with positive counts. Because zeros are not a certainty in the event count model (i.e., zeros are assumed to occur only if the corner solutions are present in the standard count models or otherwise), the compound count data model is not truncated at zero. Thus, cases which make the transition to the standard count stage may nevertheless have zero counts; crossing the hurdle in zero-inflated count data models does not guarantee a positive realization of beverage consumption frequencies. To specify the zero-inflated Poisson (ZIP I) and the zero-inflated negative binomial (ZINB) models, let

$$\pi_i = F(\tau\beta' x_i) \text{ for the zero-inflated tau } (\tau), \tag{5}$$

where F(.) is either the cumulative normal probability, Φ(.), for the probit or the cumulative logistic probability, ∧(.), for the logit model, τ will be subsequently outlined. Let $f(.)$ denote either the Poisson (λ_i) or the negative binomial ($\lambda_{i,}$ θ) probability density function, then the probability density function of observing a count, y_i, is

$$\Pr(y_i) = (1 - \pi_i)f(y_i) + 1\,(y_i = 0)\,\pi_i. \tag{6}$$

The zero-inflated Poisson (λ_i) and negative binomial ($\lambda_{i,}$ α) probability density functions are, respectively

$$\Pr(y_i) = \begin{cases} \pi_i + (1-\pi_i)e^{-\lambda_i} & y_i = 0 \\ (1-\pi_i)\dfrac{e^{-\lambda_i}\lambda_i^{y_1}}{y_i!} & y_1 = 1,2,3,\ldots \end{cases}, \tag{7}$$

$$\Pr(y_i) = \begin{cases} \pi_i + (1-\pi_i)\left(\dfrac{1}{1+\alpha\lambda_i}\right)^{\frac{1}{\alpha}} & y_i = 0 \\ (1-\pi_i)\dfrac{\Gamma\left(y_i+\frac{1}{\alpha}\right)}{y!\Gamma\left(\frac{1}{\alpha}\right)}\left(\dfrac{1}{1+\alpha\lambda}\right)^{\frac{1}{\alpha}}\left(\dfrac{\alpha\lambda_i}{1+\alpha\lambda_i}\right)^{y_i} & y_i = 1,2,3,\ldots \end{cases}, \tag{8}$$

where Γ and α are the gamma function and the dispersion parameter, respectively.

And the corresponding log-likelihood is

$$Log\ L = \sum\nolimits_i \log\left[\Pr(y_i)\right]. \tag{9}$$

An important distinction of the Poisson with normal heterogeneity model (ZIP II) is that the log-likelihood is maximized by numerical integration using the Hermite quadrature method to obtain parameter estimates since the heterogeneity term introduced into $\lambda = x'\beta+\varepsilon$ (Greene, 2002; 2002).

The model is a mixture of observations from two independent sources. They may either result from the compound Poisson and negative binomial distributions with probability (1 − π) or occur independently by the extra probability π in underlying binomial distribution (logit or probit). For this model, the expected mean and variance of the zero-inflated model is then

$$\begin{aligned} E(y_i) &= (1-\pi_i)\lambda_i, \\ Var(y_i)_{ZIP} &= (1-\pi_i)(1+\pi_i\lambda_i)\lambda_i, \\ Var(y_i)_{ZINB} &= (1-\pi_i)\left[1+\lambda_i(\alpha+\pi_i)\right]\lambda_i. \end{aligned} \tag{10}$$

The expected conditional mean of the ZIP I, ZIP II and ZINB models are equal to each other. The dispersion parameter, α, determines the shape of the negative binomial distribution. As α tends to zero, the conditional negative binomial in the inflated model tends to a Poisson compound distribution. Thus, the ZINB is nested within the ZIP I when α tends to zero. The nice thing about testing the null hypothesis $\alpha=0$ is the simultaneous testing whether the ZINB reduces to ZIP I and if it does not then it shows the presence of overdispersion. As α increases, the conditional negative binomial model becomes more skewed with a heavier tail and observing higher probability of a zero consumption of the product. Notice when π is one, the distribution is a probability mass at zero compared to when π is zero, the probability distribution becomes strictly compound count. The restriction $\pi = 0$ is not a simple parametric restriction because it depends on the covariates. When π does not depend on the covariates then a simple score test developed can be applied to see whether the zero-inflated reduces to its compound version. However, when it depends on the covariates and to make $\pi = 0$, it is necessary for some parameter needed to be $+\infty$ or $-\infty$. Therefore, the zero-inflated Poisson is not nested within either the Poisson or the negative binomial models. We use Vuong (1989) test distinguishing non-Poissonness due to the overdispersion of the negative binomial model (Greene, 2002; 2003). We use a Likelihood Ratio (LR) and the penalized consistent Akaike Information Criterion (CAIC) log-likelihood to discriminate among variants of nested zero-inflated models (e.g., ZIP I versus other zero-inflated models such as the zero-inflated negative binomial (ZINB) and the zero-inflated Poisson with heterogeneity (ZIP II)). The ZIP II is nested within ZIP I when the variance, σ^2, is equal to zero. The preferred model has the lowest value in the CAIC test. For the use of a regression model, Lambert (1992) considers

$$\lambda_i = \exp(X_i\beta) \quad \text{and} \quad \left(\frac{\pi_i}{1-\pi_i}\right) = \exp(Z_i\gamma), \tag{11}$$

where X_i and Z_i are the observable vectors of two different covariate sets and β and γ are vectors of unknown parameter estimates. The basic assumption implied in the zero-inflated model is that the two sets of covariates in both the Poisson or negative binomial and the binary logit models may or may not coincide. However, when the same set of exogenous variables is used in both models, then more parsimonious models can be developed by assuming that linear predictors from both models are related in some way. Indeed, no economic theory shows a guideline for what set of variables should be included in each of the models (Su and Yen, 2000). We, therefore, use the same set of variables and thus the zero-inflated-tau count data models (ZIP I (τ), ZIP II (τ), ZINB (τ)) are deemed appropriate when the same set of variables coincides in both probability and frequency models. The simplest model is the zero-inflated Poisson-tau, ZIP I (τ), which is a multiplicative function of the covariates used to explain the standard count

$$\lambda_i = \exp(X_i\beta) \quad \text{and} \quad \left(\frac{\pi_i}{1-\pi_i}\right) = \exp(\tau X_i\beta), \tag{12}$$

where tau, τ, is a scalar parameter and implies that $\pi_i = (1+\lambda_i^{-\tau})^{-1}$. Individuals at the corner solutions may display the same preferences as those who are already users of a beverage as compared to individuals who do not derive an inherent utility from the product at all. Thus, specific merits of zero-inflated count models are their ability to combine the effects of individuals who are both at the corner solutions and users on the count density function while identifying a different probability function for the effects of those individuals who are assumed to be abstentionists. If the sub-segment of abstentionists is ignored, the model resembles a Tobit-type censoring count data technique. This inherent feature differentiates zero-inflated count models from their rival, the standard hurdle count models, which assumes that observations at the corner solution and observations of those who do not have any desire to consume a product come from the same data-generating process.

3. Data

The data are from a survey of Bulgarian households collected in May 1997. Following a pretest, the Bulgarian National Statistical Service distributed questionnaires to a panel of 2,500 households scattered throughout the country. The survey instrument was hand-delivered and responses were gathered by enumerators four weeks later, yielding 2,133 completed questionnaires. Questions inquired, among others, about daily, weekly and monthly consumption frequencies of many food items, including eight beverages. A series of questions requested information about demographic characteristics of the respondent and other household members. In addition, respondents shared details about their education level, household income, and employment status.

Table 1 shows descriptive statistics of all items found to be relevant to the study. Consumption frequencies and individual characteristics have been expressed as variables, which are included in the empirical models. The majority of respondents were females, a fairly typical occurrence in food consumption studies. This is also consistent with the respondents who were primarily in charge of meal preparation in the family. Respondents who were the primarily food shopper in the family were mix of gender. The average age is relatively high, but Bulgaria's population is characterized by a stable population with a large segment of retirees. The average income level reflects a compression of incomes that resulted from the need to balance the government budget and freeing of prices. Furthermore, periods of inflationary fiscal policies, resulting from inconsistencies in the implementation of economic reforms, further depressed incomes prior to 1997. The low number of children per household reflects the general demographic trend, suggesting a declining population size. In contrast, the relatively large number of adults in each household is reflected in the high average age and reflects the frequent occurrence of multi-generational families. A high number of respondents were from married households and reported at least a high school level of educational attainment. Also, two out of five respondents were employed, still a high percentage given the large share of pensioners and increasing incidence of unemployment.

Patterns of beverage consumption are influenced by the religious background of the respondent. Although the majority declared themselves as Christians, about six percent classified themselves as Muslims. Religious background plays a role in food consumption and can influence the consumption of alcoholic beverages. Finally, the region where the respondent resided could influence beverage consumption because of climatic or cultural reasons. Respondents from the metropolitan region were likely to be more exposed to the new beverages, leading the rest of the population in changing beverage consumption patterns. It is not unusual for large, highly urbanized areas to differ distinctly from small towns or rural areas in consumption of foods, including the incidence of beverage consumption.

The consumption frequency of beverages differed across eight beverages considered in this study. Some consumption frequency indicate a wide variation across respondents, e.g., soft drink consumption. Also, alcoholic beverage consumption frequency was highly variable. However, as stated earlier, reasons for the observed variation in, for example, soft drinks versus alcoholic beverages, are dissimilar and likely result from different motives for consuming each type of beverage.

4. Results

Each equation was estimated using four techniques. The purpose was to verify the usefulness of all techniques in an empirical study based on the data set that contains a large number of zeros, i.e., respondents who did not report the consumption of a specific beverage. Table 2 shows the results of nested and non-nested tests of model performance as a series of pair-wise comparisons. A careful indiction for the preferred model shows that the ZIP II model is of the choice for milk, tea and spirits beverages. The ZINB model fits best to coffee and soft drink beverages. All three models, ZIP II, negative binomial and ZINB remain equal for lemonade and wine beverages and the ZIP II and ZINB were not distinguishable for beer beverage. The models gaining equal weights for beverages were further distinguished by the power of zero observations predictions. In doing so, we credit the model which has the more power of the zero observations prediction than the other models. In this case, the ZINB was determined for lemonade and wine beverages whereas the ZIP II was chosen for beer beverage frequency consumption. Results discussed in the following sections refer to the ZINB for coffee, soft drink, lemonade, and wine beverages and the ZIP II for milk, tea, beer, and spirits beverages.

4.1. Milk

Milk product consumption in Bulgaria increased from 80 kg in 1952 to 193 kg in 1989 (Bresch, 1999), but the milk production declined after 1990. Milk consumption frequency was positively influenced by the age-squared, cooker, number of adults in household, employment, marital status, and negatively influenced by the income, age, shopper, number of children in household, gender and education of respondents (Table 4). Muslims are more likely and Christians are less likely to consume milk than other religious group. People residing in southern, coastal, and northern regions are less likely to consume milk than the people residing in metropolitan area. This result can be as expected because people residing in the metropolitan area may have more excess to markets selling varieties of milk such as skim and non-fat milk and it could be associated with the location of high-value farm production near large accessible urban centers. These results may further indicate the price differences in regions. A metropolitan area may have higher prices than all other regions. Because reduced-fat milk was one of a few items subject to government pricing guidelines, its price was not expected to be a barrier to consumption. This result is in line with consumption trends observed in Western societies, where milk consumption has either stagnated or declined and the only major change has been shares in the volume consumed according to the fat content (Bunch, 1985).

This contradicts the observed tendency of declining ability to digest milk with advanced age, but supports the observation that older consumers, especially those living off fixed incomes (e.g., pensions or disability payments), might substitute milk for other animal protein sources. Assuming that most of the respondents who were primarily in charge of family cooking are female, the sign for that variable is consistent with that of gender variable. In other words, females are more likely to consume milk than males. Respondents from married households consumed milk more frequently than those from other households. This suggests that although respondents may not have consumed milk when children were present in the household, they were still more likely to drink milk if married. Less frequent consumption of milk by the highly educated reflects a different food consumption pattern. Despite expectations that education would improve knowledge of nutrition and the role of milk in a diet, highly educated Bulgarians choose to drink milk less often than those with less education. Also, those employed consumed milk more frequently than those without obligations resulting from having a job. A plausible explanation is that those without jobs either had their own cow or bartered, doing odd jobs in exchange for milk. The latter situation was more likely in villages where, after the collapse of the state farm system, many Bulgarians took advantage of having access to grazing land, allowing ownership of a cow.

4.2. Hot beverages

Two beverages served hot in Bulgaria are considered in this study. Coffee appears to be the preferred hot beverage, but tea is commonly available and inexpensive. After the adoption of a market economy, the variety of coffee and tea brands and flavors noticeably increased. Both tea and coffee contain caffeine, although in different amounts. Adverse effects of heavy caffeine consumption on human health and the feeling of well-being are a concern (Snel and Lorist, 1997). However, moderate coffee drinking also has been found to improve some measures of job performance (Streufert et al., 1997). Black tea has been implicated in cancer chemoprevention (Dreosti, Wargovich and Yang, 1997; Hakim et al., 2000) and may protect against coronary heart disease and stroke due to antioxidant vitamins and flavonoids (Hertog et al., 1995; Keli et al., 1996). Tea ingestion has been reported to improve alertness and information processing capacity (Hindmarch et al., 1998). The amount of caffeine consumed by a typical Bulgarian consumer is expected to have a more therapeutic rather than detrimental health effect because the average monthly consumption frequencies indicated that coffee was consumed about once a day, while tea consumption was infrequent.

Coffee. Income, education, the number of adults in a household, and full time employment positively influenced the frequency of coffee consumption. Income is important as it affects purchase frequency of coffee, which is more expensive than tea in Bulgaria. The significance of income in coffee consumption was expected because many households experienced a decrease in real incomes and likely consumed coffee with a lower frequency than prior to the transition. The more adults in the household, the higher the consumption frequency. Clearly, households with several adults have a different consumption pattern, possibly pool resources for coffee purchase, and exercise their preference for coffee more often than households with fewer adults. Respondents with more education are likely follow a different consumption pattern and have a different lifestyle leading to a higher coffee consumption frequency than those with less education. Full-time employees reported drinking coffee more often than others. Psychosocial job environment may be conducive to coffee consumption. Other studies have revealed that those who experienced high job demands drank coffee more often on days they felt distressed (Steptoe and Wardle, 1999).

Several variables negatively influenced the dependent variable. A large number of children in the household negatively influenced coffee consumption frequency, but was statistically insignificant. There were no gender differences in the frequency of coffee consumption. Excessive coffee consumption during pregnancy has been linked to health problems (Torfs and Christianson, 2000) of the newborns, but the average reported frequency was far below that implicated in causing any harm.

Tea. An increased tea consumption frequency was expected as respondents were advancing in age or had a higher level of educational attainment (Table 4). Older consumers may prefer tea because it contains less caffeine, often blamed for its relation to well being. Tea consumption has been reported to lead to improvement of blood circulation in people suffering from coronary heart disease (Hertog et al., 1993; Duffy et al., 2001), most common among the elderly. Highly educated consumers search for variety and choose tea as an alternative hot beverage. Education has been linked to demand for food variety in previous studies in Western economies and economies in transition. Furthermore, tea consumers are more likely to be females than males. Gender difference supports findings of improved mood among women who drank tea and enjoyed high social acceptance at work (Steptoe and Wardle, 1999). Although a large dosage of caffeine from tea, among other beverages, is not recommended (Food Standards Agency, 2001), the consumption frequency of tea in our study was generally very limited. Respondents identifying themselves as Muslims consumed tea more often than those of other religions or non-believers, while residents in the Northern region tended to drink tea less often than those in other regions. These confirmed differences in tea consumption suggest that religious or regional preferences in beverage consumption frequency exist and should be recognized by marketers.

4.3. Non-carbonated and carbonated beverages

Consumption of non-carbonated (still) and carbonated beverages has been rapidly growing world-wide. In Bulgaria, the average soft drink consumption was relatively low (Table 1) but highly variable, suggesting that a small percentage of people consume soft drinks often. The consumer profile allows marketers to target their promotion and advertising efforts and also provides public health officials with guidelines concerning a segment of the population that may develop health problems associated with high sugar consumption.

The soft drinks consumed include commercially manufactured products and home-made drinks such as lemonade. Although homemade drinks are inexpensive, they do not enjoy the same image as branded soft drinks, which are a part of the new, trendy lifestyle among young Bulgarians. The low production cost of most soft drinks, combined with a growing demand, offers exceptional earning opportunities for manufacturers, distributors, and retailers. Furthermore, the long, hot summers in many parts of Bulgaria are conducive to high soft drink consumption.

Lemonade. The number of children and adults positively influenced the consumption frequency (Table 4). Lemonade can be purchased, but it can be easily prepared at home and, therefore, income may have no significant effect on lemonade consumption. Males or married respondents were more likely than females or those who were not married to drink lemonade more often. It appears that lemonade was more likely prepared in married households, but at the request of husbands or children. The number of children also positively influenced the consumption of lemonade by respondents, suggesting that it was a family-type beverage. It is possible that some lemonade was prepared using ingredients specifically purchased for making it. Distributors and retailers, if aware of the strong association between lemonade drinking frequency and family households, may develop marketing strategies encouraging increased lemonade consumption. Respondents identifying themselves as Christians also consumed lemonade more often than non-Christians. The lack of regional differences in lemonade consumption suggests that there is no need for regionally differentiated marketing strategies.

Soft drinks. Results indicate that income, the number of adults in a household, employment, and education drove soft drink consumption frequency (Table 4). These factors are consistent with expectations and the observed behavior in western economies, with one exception. It appears that the number of adults was more relevant than the number of children in the household for consumption frequency of this category. Although one could associate the presence of children as the reason for soft drink purchases, according to survey results, only adult household members significantly affected the consumption frequency. Because the age variable had a negative effect, soft drinks were consumed by the younger generation, likely motivated by the trendy image of soft drink consumption. Married respondents consumed such beverages less often than unmarried respondents. Furthermore, residents in all but the Metropolitan region consumed soft drinks infrequently. This strong regional effect results from the access of metropolitan region residents to soft drinks, exposure to promotional and advertising campaigns, and the preference of foreign companies to target large, urban centers at the onset of entering a new market.

4.4. Alcoholic beverages

Information on consumption of alcoholic beverages was expected to reflect an increased stress associated with transition to the new socio-economic system in general and uncertainties associated with employment in particular. Public health experts argued that if macroeconomic policies led to unemployment which, in turn, promoted alcohol use, then indirect costs measured in the loss of health, premature death and crime may require a policy change (Ettner, 1997). Studies from post-industrial economies suggest that unemployment reduces alcohol consumption and attribute this reduction to decrease in incomes (Ettner, 1997; Claussen and Aasland, 1993). However, involuntary unemployment had a mixed effect (Ettner, 1997). Results of estimating the consumption frequency of beer, wine and spirits help to identify population segments likely to consume each of the three alcoholic beverages, providing information not only for alcohol manufacturers and distributors, but also public policymakers.

In a rare study of alcohol demand in a centrally-planned economy during the pre-transition period, Florkowski and McNamara (1992) showed that income had a significant influence on the consumption of spirits and the observed shortage of spirits had a significant dampening effect on consumption. Anecdotal evidence, however, indicated that prolonged shortages led to illegal alcohol production and the official consumption figures may have been underestimated. Such local conditions as accessibility to alcoholic beverages stemming from the legality of production of alcohol suggest that the self-reported consumption frequency may more accurately reflect consumption patterns than the official sales figures. In Bulgaria, production of beer and wine for home use is permitted.

Beer. Age of the respondent was the only significant variable that negatively affected the beer consumption frequency (Table 4). Older respondents were less often consuming beer, possibly because it was not widely available throughout their lives until very recently when the economic liberalization led to increased production and improved quality of beer. Income and employment positively influenced beer consumption frequency, suggesting that as incomes increase, many will drink beer more often. The positive influence of employment may be associated with a lack of supervision and the limited alcohol content of beer, making it more acceptable to drink on the job in contrast to drinking other alcoholic beverages. These attitudes seem to coincide with two household characteristics that stimulate beer consumption frequency, i.e., the number of adults and marital status. Beer was consumed more often when more adults lived together or in married households as compared to households with few adults or residents not married. Socializing and low alcohol content of beer may help explain these positive relationships. Males more often consumed beer than females, a trend observed in many other countries and characteristic of the ways of socializing typical of this gender. The more frequent consumption of beer in the Coastal region than other regions results possibly from the location of a traditionally well known brewery in that region, making quality beer more accessible to residents of this region.

Wine. Wine consumption frequency declined with age and the level of education (Table 4). Decreasing alcohol consumption frequency with advancing age was expected. Feelings of well-being and possible health implications lead to less consumption. The negative effect of education on wine consumption suggests a likely country-specific effect. Domestic wines are well known but do not offer variety often sought by highly educated consumers. Also, the quality of domestic Bulgarian wines varies, while the best quality wines are exported and less often available for domestic consumption. The more children in the household, the lower the wine consumption frequency. This may be a positive development from the standpoint of public health.

However, those who were employed, married or males consumed wine more often than those not employed, not married or who were females. Reasons behind the observed consumption patterns are likely similar to those responsible for beer consumption. Also, respondents identifying themselves as Muslim or Christian were more likely to drink wine more often than those of other religions or non-believers. Among regions, residents of the Northern and Coastal regions consumed wine more often than those from the Metropolitan or Southern regions. Some of the premier commercial wineries are located in those regions, but the increased consumption frequency may result also from deeper traditions of making wine in general and reflects drinking of home-made wine. Noticeably, the income effect was statistically insignificant in this equation, supporting the notion that some wine may have been home-made and, therefore, the income effect was neutralized.

Spirits. Respondents with high incomes, high levels of educational attainment, working full time or male consumed spirits more often than their counterparts. Liquor tends to be expensive because of the imposed excise tax and, therefore, the positive income effect was expected. Also, males are generally more likely to consume beverages with high alcohol content. The effect of education was not expected, but it may result from a variety-seeking behavior. Employment, which led to more frequent consumption of spirits, likely reflects the style of socializing with co-workers. Note that, in general, the consumption of spirits was very low, suggesting that this type of alcohol was consumed on special occasions. Muslim respondents were less likely to consume spirits than respondents of other religious affiliations. Older respondents were less likely than those of younger age to drink spirits. Advancing age leads to less frequent consumption of alcohol in general, a trend supported by results of this study. Finally, regional differences were confirmed, indicating that spirits were less often consumed in Coastal and Northern regions compared to Metropolitan and Southern regions.

5. Implications

Although the consumption frequency data of the beverages measures the number of times a respondent consumes a beverage, it lacks a perfect measure for the consumption quantity. However, when the lack of the consumption quantity exists, the frequency data may be an alternative way to look for individual behaviors affecting the beverage consumption. Many researchers have begun to use count data model in modifying the pattern of consumption where the dependent variable is an integer (Moon et al., 1999; 2001). Examination of beverage consumption patterns was done using the count data procedure. Among the four approaches tested, the zero-inflated Poisson with heterogeneity and negative binomial models performed consistently better than other models. Without comprehensive testing, other models might have been selected, given the statistical significance test of individual coefficients. For example, in the case of milk consumption, the ZIP I model showed all coefficients as significant, while the preferred ZINB version did not confirm these results. In general, the ZIPs an ZINB models differed in terms of statistical significance and, sometimes, the direction of the effect. Differences occurred with greater frequency for coefficients accounting for regional and religious characteristics, followed by respondent demographic features such as gender, presence of children and number of adults. No differences were detected in terms of age or employment effects, while income and education influences differed in single cases.

From the standpoint of developing a marketing plan or public health messages, identified differences across various models are very important. They suggest that not all factors are equally important and that some of the essential variations are related to the location, religious beliefs, and the family unit living within a single household. Income, age and education affected beverage consumption frequencies in a similar manner, regardless of the applied modeling technique. These characteristics may establish core profiles of each beverage consumption group, while factors which differed in their influence enable to differentiation among groups.

Older consumers are a potentially lucrative group of buyers for milk products. Health concerns, including adequate calcium intake, may improve sales, especially because no gender differences were identified, while women are more likely than men to suffer bone loss. Marital status positively influenced milk consumption frequency, suggesting these respondents who are either primarily shoppers or in charge of cooking in the family are more likely to purchase milk, but also supporting the general finding of traditional attitudes towards health maintenance within family households (Watson, 1995). In our study, the traditional view of the family and its views seems to be more responsible than the education-based knowledge of nutrition for milk consumption.

Coffee consumption increased in Bulgaria between 1997 and 2001 by about 28 percent, reaching 1.9 kg per capita (Anonymous, 2002), placing Bulgaria among the top ten growth markets. This growth is consistent with the strong preference for coffee found in our survey. Improving incomes probably increased the demand for coffee, and the trend towards increased consumption was strengthened by an increased consumption frequency, education and full time employment. The strong preference for coffee in Bulgaria is a country-specific phenomenon because, compared to other countries in the region, the relative share of food expenses of 58 percent in a household budget is very high (Kolev, 2002). Assuming continuous growth in income, coffee consumption is likely to increase, creating new opportunities for coffee exporters as well as for domestic roasters, distributors, and retailers. This increase in activity in the coffee market in Bulgaria may call for policy changes due to the link between coffee consumption and health (Ming et al., 1995). Although moderate consumption appears to benefit drinkers, excessive consumption may aggravate the existing health condition. In sharp contrast to coffee consumption, despite the beneficial effects of tea, its consumption is small in Bulgaria and likely to increase slowly. Increased incomes are unlikely to increase consumption frequencies and tea marketers may focus on older consumers, females, or the highly educated as potential buyers. Given the already infrequent tea consumption among respondents in the survey, the small growth rate will only marginally increase the volume sold. However, increased promotion of health benefits of tea may change the observed trend.

Soft drink consumption frequency can be expected to increase due to a strong positive income effect. Such a response in Bulgaria will be consistent with a worldwide increase in consumption of soft drinks. Results showed that soft drink consumption frequency was adversely affected by age of respondent. Such a relationship was found for American consumers in the early 1980s (Wood, 1983). According to our survey, consumption was particularly high in the Metropolitan region, but improvements in distribution probably made soft drinks more accessible throughout the country. The soft drink market, which includes a mix of domestic and international companies, remains very competitive, registering a high volume growth with only a moderate growth in sales value. Consequently, soft drinks have become available to a wider group of consumers, leading to potential for developments observed in other countries where soft drinks replace nutritionally more desirable beverages (Moyer and Mayell, 1981). From the public health standpoint, the growing consumption of soft drinks in Bulgaria may aggravate the existing problems of maintaining proper body weight, lowering calcium intake by replacing milk, and treating chronic diseases induced by improper diet. In contrast to soft drinks, lemonade consumption is unlikely to grow in response to rising incomes. Manufacturers of dry ingredients for homemade lemonade can expect increased consumption frequency in households with children, among female consumers, and in households with many adults. Three characteristics driving the consumption of most other beverages, i.e., employment, education and income, lacked any significant effect in the case of lemonade.

Earlier studies concluded that unemployment in Eastern Europe can be expected to be more damaging to health than in Western Europe because of the severe decline in incomes during transition to a market-oriented economy, coping mechanisms impaired by lower incomes, increased feelings of uncertainty and underdeveloped civil institutions (Watson, 1995). According to our results, employment led to an increased consumption of all alcoholic beverages (Table 4). Despite the low average consumption frequencies, the link between employment and alcohol consumption may call for increased monitoring of the trend. Further investigations may distinguish between occupation and the frequency of consumption of different types of alcoholic beverages. The importance of a respondent's family may discourage consumption of spirits. Gender differences in consumption frequency of all alcoholic beverages were found in this study. Men always drink more often than women and gender effects of different alcoholic beverages vary (Epstein, 1989), but the results of our study also support earlier findings showing that men differ from women in using alcohol in times of stress and the alcohol tension reducing effect on men (McNair, 1996; Cooper et al., 1997). Four characteristics stimulating alcohol intake, i.e., gender, employment, income, and number of many adults in the respondent's family, provide guidelines for alcohol manufacturers and distributors. From the public health standpoint, results seem to support a correlation with high incidence of stroke and heart diseases among Bulgarian men (Bresch, 1999), despite sometimes inconclusive evidence of linkages between alcohol consumption and health complications. Furthermore, residents of the Metropolitan region revealed divergent preferences for beverages not evident among those living in other parts of the country.

Table 1. Descriptive statistics of variables

Variable	Definition	Mean	Standard deviation	% of respondents not drinking the beverage
Dependent variable				
Milk	Monthly frequency consumption	21.7823	21.60	6.23
Coffee	Monthly frequency consumption	28.4514	30.85	25.96
Tea	Monthly frequency consumption	11.0648	15.02	22.37
Soft drink	Monthly frequency consumption	9.0837	26.18	62.68
Lemonade	Monthly frequency consumption	8.4738	15.78	25.96
Beer	Monthly frequency `consumption	5.4434	10.18	39.71
Wine	Monthly frequency consumption	2.7992	7.55	54.96
Spirits	Monthly frequency consumption	.4514	2.97	85.60
Individual characteristics				
Gender	1 = male	0.3288	0.47	
Age	Age in years	0.5237	0.1686	
Income	Monthly household income, in Leva	1.6831	1.02	
Shopper	1= If the individual is the primary food shopper in family	0.6856	0.4644	
Cooker	1=If the individual is the primarily in charge of meal preparation in family	0.6702	0.4703	
Number of children in household	Actual numbers	0.5755	0.86	
Number of adults in household	Actual numbers	2.2800	1.09	
Married	1 = Married	0.6263	0.48	
Education	1 = High school and above	0.6353	0.48	
Employment	1 = employed	0.4086	0.49	
Religion				
Christian	1= Christian	0.9138	0.28	
Muslim	1 = Muslim	0.0608	0.24	
Other	1 = Other than Christian or Muslim	0.0254	0.16	
Region				
Metropolitan	1= Metropolitan Area	0.2531	0.43	
South	1= South	0.3149	0.46	
Coastal	1= Coastal	0.1320	0.34	
North	1= North	0.3000	0.46	

Note: N = 2007 and number in parentheses are the percentage of zero counts and age is scaled by 100.

Table 2. Nested and non-nested test results of count data model performance

	Milk		Coffee		Tea		Soft drink	
Models Tested	Nested[a]	Non-nested[b]	Nested[a]	Non-nested[b]	Nested[a]	Non-nested[b]	Nested[a]	Non-nested[b]
ZIP I vs Standard Poisson		10.58		18.16		19.09		14.51
ZIP I vs Negbin		−28.49		−22.34		−20.73		−14.25
ZIP I vs ZIP II	24,595.00		17,801.95		14,110.65		13,652.28	
ZIP I vs ZINB	24,373.55		17,997.66		13,830.73		14,516.44	
ZIP II vs Standard Poisson		31.62		29.69		26.31		16.32
ZIP II vs Negbin		5.45		4.11		10.38		−11.05
ZIP II vs ZINB		5.56		−4.36		10.51		−11.58
ZINB vs Standard Poisson		30.92		29.47		26.28		16.33
ZINB vs Negbin		1.16		11.78		2.72		5.53
	Lemonade		Beer		Wine		Spirits	
	Nested[a]	Non-nested[b]	Nested[a]	Non-nested[b]	Nested[a]	Non-nested[b]	Nested[a]	Non-nested[b]
ZIP I vs Standard Poisson		15.08		14.27		11.32		3.39
ZIP I vs Negbin		−14.28		−12.47		−11.05		−3.52
ZIP I vs ZIP II	14,580.87		7,926.80		5,459.26		1,251.36	
ZIP I vs ZINB	14,601.73		7,926.80		5,492.34		1,145.59	
ZIP II vs Standard Poisson		16.46		15.04		12.63		3.79
ZIP II vs Negbin		−0.59		3.06		−1.11		5.67
ZIP II vs ZINB		−0.63		−1.17		−1.18		4.45
ZINB vs Standard Poisson		16.44		15.08		12.64		3.67
ZINB vs Negbin		0.52		5.55		0.36		−0.26

[a] LR test. LR= −2(Log-Likelihood of ZIP I-Log-Likelihood of ZIP II) and LR=-2(Log-Likelihood of ZIP I-Log-Likelihood of ZINB) distributed as χ^2 with number of restrictions imposed as degree of freedom. The consistent Akaike information criterion: CAIC=-2(Log-Likelihood)+(number of free parameters)*(Log(N)+1), where N is the number of observations. The CAIC is consistent with the LR test and both the ZIP II and ZINB models outperform the ZIP I model since the disparities between th log-likelihood value of the ZIP II and ZIP I and between the log-likelihood value of the ZINB and ZIP I are enormous for each corresponding beverage .

[b] Vuong test, $V = \frac{\sqrt{n}\bar{m}}{s_m}$, where $m_i = Log\left[\frac{f_1(y_i)}{f_2(y_i)}\right]$, $f_1(.)$ and $f_2(.)$ are densities for the competing models, and m bar and s_m are the sample mean and standard deviation for the sample of m_is. Asymptotically, the V statistic is distributed as standard normal, so the computed value is comparable with the critical value from the standard normal distribution.

Table 3. Actual vs. predicted zero observations using four count data modeling techniques

	Milk			Coffee			Tea			Soft drink		
Model	Actual	Predicted	Prediction[a]	Actual	Predicted	Prediction[a]	Actual	Predicted	Prediction[a]	Actual	Predicted	Prediction[a]
ZIP I	125	136	Over	521	526	Over	449	447	Under	1258	1193	Under
ZIP II	125	131	Over	521	433	Under	449	453	Over	1258	1102	Under
Negbin	125	79	Under	521	15	Under	449	55	Under	1258	90	Under
ZINB	125	122	Under	521	444	Under	449	444	Under	1258	1233	Under
	Lemonade			Beer			Wine			Spirits		
	Actual	Predicted	Prediction[a]	Actual	Predicted	Prediction[a]	Actual	Predicted	Prediction[a]	Actual	Predicted	Prediction[a]
ZIP I	521	520	Under (≅ Equal)	797	688	Under	1,103	1,045	Under	1,718	1609	Under
ZIP II	521	545	Over	797	783	Under	1,103	1,155	Over	1,718	1736	Over
Negbin	521	79	Under	797	204	Under	1,103	388	Under	1,718	1682	Under
ZINB	521	531	Under	797	737	Under	1,103	1,084	Under	1,718	1815	Over

[a] Prediction shows whether the predicted zero observations are over or under estimated compared to the actual zero observations in the sample. Interestingly, all zero-inflated count models have a nice prediction about zero observations as compared to the compound count data model, negative binomial model.

Table 4. Parameter estimates for beverage consumption frequencies from zero-inflated count data models

	Milk				Coffee			
Variable	ZIP[a] Model I	ZIP[a] Model II	Negbin[a]	ZINB[a]	ZIP[a] Model I	ZIP[a] Model II	Negbin[a]	ZINB[a]
Constant	2.6214[d]	2.9964[d]	2.368[d]	2.4121[d]	3.6670[d]	2.7587[d]	3.2097[d]	3.5158[d]
	(155.786)	(27.037)	(8.169)	(7.920)	(279.202)	(40.308)	(8.244)	(11.789)
Income	.0496[d]	−0.0090	.0450[b]	0.0425[b]	0.0499[d]	.0253[d]	0.0809[c]	0.0611[c]
	(44.580)	(−1.465)	(1.796)	(1.720)	(43.793)	(4.277)	(2.306)	(2.078)
Age	−0.1076[d]	−0.0099	−0.0744	−0.0858	−0.0079[d]	1.4823[d]	−1.1298	−0.4786
	(−2.454)	(−0.038)	(−0.079)	(−0.089)	(−0.172)	(−6.572)	(−0.929)	(−0.543)
Age-Squared	0.6703[d]	0.0557	0.7588	0.7476	−1.3307[d]	−3.8138	−0.8710	−1.0531
	(15.951)	(0.224)	(0.814)	(0.769)	(28.301)	(−16.174)	(−0.743)	(−1.340)
Shopper	0.0169[d]	−0.0046	−0.0031	−0.0065	−0.0214[d]	−0.0418	0.0039	−0.0177
	(5.531)	(−0.263)	(−0.046)	(−0.091)	(−6.599)	(−2.345)	(0.042)	(−0.249)
Cooker	−0.0581[d]	0.0241	−0.0251	−0.0219	0.0108[d]	−0.0513	0.0692	0.0290
	(−14.297)	(0.984)	(0.299)	(−0.257)	(2.683)	(−2.340)	(0.565)	(0.338)
# of Children	.0002	−0.0043	0.0175	0.0166	0.0040[d]	−0.0017[d]	0.0657	0.0359
in household	(.101)	(−0.355)	(0.506)	(0.465)	(2.715)	(−0.228)	(1.412)	(1.004)
# of Adults in	.0334[d]	0.0048	0.0371	0.0364	0.0238[d]	0.0786[d]	0.1263[d]	0.0709[d]
household	(26.155)	(0.595)	(1.416)	(1.272)	(20.076)	(12.879)	(3.559)	(2.861)
Employment	−.0929[d]	0.0206	−0.0974	−0.0941	0.2216[d]	0.3688[d]	0.3870[d]	0.2902[d]
	(−30.615)	(1.069)	(−1.569)	(−1.482)	(82.451)	(26.582)	(4.825)	(4.631)
Marital status	.2363[d]	0.0041	0.2410[d]	0.2342[d]	0.0502[d]	0.0203[d]	0.0933	0.0682
	(82.364)	(0.239)	(4.138)	(3.858)	(17.763)	(1.389)	(1.176)	(1.207)
Gender	−0.0474[d]	−0.0095	−0.0622	−0.0620	−0.0010	−0.0665[d]	0.0590	0.0135
	(−12.984)	(−0.416)	(−0.866)	(−0.848)	(−0.295)	(−3.858)	(0.567)	(0.190
Education	−0.1854[d]	−0.6263[d]	−0.1828[d]	−0.1806[d]	0.2085[d]	0.4315[d]	0.6194[d]	0.3862[d]
	(−68.792)	(−35.325)	(−3.099)	(−2.938)	(66.211)	(23.358)	(7.587)	(6.573)
Religion								
Muslim	0.5666[d]	0.0253[d]	0.7235[d]	0.7028[d]	−0.2148[d]	0.0689[d]	−0.0907	−0.1322
	(46.133)	(7.739)	(4.003)	(3.500)	(−25.669)	(1.487)	(−0.363)	(−.684)

Christian	0.3406[d]	−0.0253	0.4504[d]	0.4384[d]	−0.1591[d]	−0.0167[d]	−0.3355	−0.2321
	(29.833)	(−0.304)	(2.882)	(2.610)	(−21.600)	(−0.407)	(−1.550)	(−1.372)
Region								
Southern	−0.0373[d]	−0.0079	−0.0302	−0.0269	−0.0379[d]	0.0494[d]	−0.1905[c]	−0.0958
	(−12.144)	(−0.442)	(−0.467)	(−0.400)	(−12.265)	(3.292)	(−2.123)	(−1.323)
Coastal	−0.2347[d]	−0.0400[b]	−0.1996[c]	−0.1887[c]	−0.2039[d]	−0.1916[d]	−0.1837	−0.1901[c]
	(−59.484)	(−1.653)	(−2.444)	(−2.278)	(−52.231)	(−9.279)	(−1.627)	(−2.266)
Northern	−0.2406[d]	−0.0013	−0.2066[d]	−0.1970[d]	−0.1250[d]	−0.0586[d]	−0.1742[b]	−0.1440[c]
	(−74.821)	(−0.064)	(−3.175)	(−2.920)	(−39.549)	(−3.771	(−1.902)	(−2.068)
Alpha			1.0669[d]	0.9832[d]			2.0301[d]	0.7314[d]
			(31.363)	(41.253)			(28.306)	(27.053)
Tau	−0.8741[d]	−0.6261[d]		−1.2953[d]	−0.3376[d]	−0.2799[d]		−0.3934[d]
	(−29.37)	(−30.375)		(−12.584)	(−20.609)	(−22.181)		(−18.016)
Sigma		0.95633				0.8062		
		(102.981)				(106.091)		
Log-Likelihood	−20322.89	−8025.39	−8139.20	−8136.11	−16570.17	−7669.1940	−7807.37	−7571.3380

	Tea				Soft drink			
Variable	ZIP[a] Model I	ZIP[a] Model II	Negbin[a]	ZINB[a]	ZIP[a] Model I	ZIP[a] Model II	Negbin[a]	ZINB[a]
Constant	1.8534[d]	1.9310[d]	1.3987[d]	1.5753[d]	2.0083[d]	0.8096[d]	0.2876	1.0167[c]
	(68.540)	(11.845)	(3.626)	(4.184)	(49.224)	(4.405)	(0.347)	(1.969)
Income	−.0274[d]	−0.0041	−0.0397	−0.0381	0.1001[d]	0.1531[d]	0.2038[d]	0.1886[d]
	(−12.881)	(−0.341)	(−1.194)	(−1.221)	(61.050)	(14.952)	(3.116)	(4.202)
Age	.8764[d]	0.0548	1.2472	1.1970	0.5695[d]	−0.2178	0.9115	0.2994
	(10.767)	(0.116)	(0.968)	(0.973)	(8.650)	(−0.483)	(0.358)	(0.175)
Age-Squared	−0.0196	−0.0384	−0.1743	−0.2075	−0.7957[d]	−0.4026	−2.0305	−1.3240
	(−0.248)	(−0.086)	(−0.137)	(−0.168)	(−11.700)	(−0.880)	(−0.817)	(−0.816)
Shopper	0.0693[d]	0.0263	0.0847	0.0736	−0.0015	−0.0940[d]	−0.3661[c]	−0.2302[c]
	(13.341)	(0.839)	(0.954)	(0.917)	(−0.273)	(−2.717)	(−2.025)	(−2.136)
Cooker	0.0879[d]	0.0229	0.500	0.0452	0.0285[d]	0.1384[d]	0.5267[c]	0.3655[c]
	(12.564)	(0.535)	(0.429)	(0.432)	(4.377)	(3.486)	(2.212)	(2.369)

# of Children in household	−.0351[d]	−0.0095	−0.0236	−0.0207	−0.0595[d]	−0.0862[d]	−0.0793	−0.0677
	(−13.126)	(−0.552)	(−0.513)	(−0.505)	(−22.560)	(−4.947)	(−0.837)	(−1.087)
# of Adults in household	.0525[d]	−0.0037	0.0629[b]	0.0577[b]	0.0393[d]	0.0448[d]	0.171[c]	0.1359[d]
	(25.632)	(−0.310)	(1.723)	(1.717)	(19.182)	(3.105)	(2.127)	(2.716)
Employment	−0.0011	−0.0284	−0.0090	−0.0150	−0.0718[d]	0.0556[c]	0.3653[c]	0.2975[d]
	(−0.218)	(−0.955)	(−0.106)	(−0.192)	(−16.387)	(1.962)	(2.135)	(2.833)
Marital status	.0281[d]	0.0041	0.0273	0.0262	−0.2617[d]	−0.2822[d]	−0.342[c]	−0.2741[d]
	(6.014)	(0.145)	(0.340)	(0.354)	(−60.851)	(−10.199)	(−2.040)	(−2.744)
Gender	−.0420[d]	0.0426	−0.0963	−0.0882	0.2152[d]	0.2924[d]	0.3366	0.2967[c]
	(−6.699)	(1.054)	(−0.939)	(−0.957)	(47.160)	(9.371)	(1.637)	(2.193)
Education	.1931[d]	−0.0175	0.1962[c]	0.1807[c]	0.7130[d]	1.2147[d]	1.1789[d]	0.9838[d]
	(41.035)	(−0.628)	(2.476)	(2.422)	(107.092)	(40.549)	(7.786)	(11.154)
Religion								
Muslim	.5029[d]	0.8805[d]	0.5929[c]	0.5494[c]	0.7565[d]	0.6527[d]	0.8697[b]	0.2391
	(26.458)	(7.866)	(2.439)	(2.042)	(19.809)	(4.338)	(1.665)	(1.131)
Christian	.0501[d]	−0.0056	0.0744	0.0648	0.4109[d]	0.6339[d]	0.7060	0.3110
	(2.797)	(−0.052)	(0.351)	(0.281)	(13.715)	(4.361)	(1.644)	(1.639)
Region								
Southern	−.0689[d]	0.0208	0.0639	0.0700	−0.8281[d]	−0.7503[d]	−1.0878[d]	−0.8714[d]
	(−13.461)	(0.679)	(0.720)	(0.863)	(−191.270)	(−23.542)	(−6.066)	(−6.680)
Coastal	−.0445[d]	0.0382	0.0712	0.0795	−0.7199[d]	−0.8917[d]	−1.1369[d]	−0.9684[d]
	(−6.586)	(0.891)	(0.643)	(0.707)	(−115.587)	(−22.044)	(−5.081)	(−6.254)
Northern	−.1039[d]	0.0078	−0.1307	−0.1229	−0.8719[d]	−1.4704[d]	−1.9103[d]	−1.6066[d]
	(−19.699)	(0.253)	(−1.464)	(−1.574)	(−158.906)	(−44.783)	(−10.342)	(−12.991)
Alpha			1.9293[d]	1.440[d]			7.3398[d]	6.1175[d]
			(29.146)	(31.120)			(21.696)	(49.340)
Tau	−.4784[d]	−0.4758[d]		−.8956[d]	.1717[d]	0.0001		−1.3292[d]
	(−23.172)	(−20.262)		(−16.678)	(9.804)	(0.001)		(−9.817)
Sigma		1.3105				0.7337[d]		
		(66.985)				(95.41)		
Log-Likelihood	−13516.38	−6461.06	−6613.73	−6601.02	−10926..51	−4100.37	−3694.03	−3668.29

	Lemonade				Beer			
Variable	ZIP[a] Model I	ZIP[a] Model II	Negbin[a]	ZINB[a]	ZIP[a] Model I	ZIP[a] Model II	Negbin[a]	ZINB[a]
Constant	2.6757[d]	1.3782[d]	1.8142[d]	1.8042[d]	0.7577[d]	0.1281	−0.3378	−0.0765
	(109.462)	(9.637)	(4.548)	(5.004)	(19.140)	(0.633)	(−0.761)	(−0.220)
Income	0.0103[d]	−0.0169	0.0057	0.0068	0.1016[d]	0.0494[d]	0.1067[d]	0.1062[d]
	(5.148)	(−1.799)	(0.156)	(0.183)	(36.049)	(3.236)	(2.621)	(3.179)
Age	−2.8290[d]	−1.6760[d]	−2.2425[b]	−2.1848[b]	2.7936[d]	4.6628[d]	3.3796[c]	2.9011[c]
	(−33.236)	(−3.636)	(−1.692)	(−1.863)	(19.259)	(6.980)	(2.198)	(2.527)
Age-Squared	1.6618[d]	0.0526	0.9032	0.8312	−3.8217[d]	−7.0045[d]	−5.6938[d]	−4.6972[d]
	(19.038)	(0.111)	(0.691)	(0.749)	(−25.493)	(−10.482)	(−3.731)	(−4.239)
Shopper	0.0616[d]	0.0455	0.1223	0.1175	−0.0954[d]	−0.0438	−0.1644	−0.1298[d]
	(10.352)	(1.423)	(1.213)	(1.126)	(−11.725)	(−1.011)	(−1.598)	(−4.239)
Cooker	−0.0569[d]	0.0672	0.0412	0.0494	0.2261[d]	0.0257	0.3628[d]	0.2694[c]
	(−7.443)	(1.732)	(0.317)	(0.409)	(22.074)	(0.440)	(2.757)	(2.522)
# of Children in household	0.0372[d]	0.1047[d]	0.0883[b]	0.0888[b]	0.0610[d]	−0.0070	0.0442	0.0574
	(14.652)	(7.591)	(1.884)	(1.748)	(19.070)	(−0.436)	(0.905)	(1.392)
# of Adults in household	0.0658[d]	0.1199[d]	0.0846[d]	0.0831[c]	0.0317[d]	0.0723[d]	0.1259[d]	0.1066[d]
	(28.747)	(10.575)	(2.277)	(2.241)	(10.558)	(5.239)	(3.154)	(3.351)
Employment	−0.1581[d]	0.1133[d]	−0.0860	−0.0816	−0.0167[c]	0.0195	0.007	0.0642
	(−7.443)	(4.262)	(−0.966)	(−0.951)	(−2.418)	(0.534)	(0.007)	(0.912)
Marital status	0.3313[d]	0.2575[d]	0.3246[d]	0.3211[d]	0.1552[d]	0.1579[d]	0.4376[d]	0.3335[d]
	(56.110)	(8.276)	(3.867)	(3.967)	(19.738)	(3.756)	(4.926)	(5.103)
Gender	0.1489[d]	0.2805[d]	0.2805[d]	0.2782[d]	0.8210[d]	0.8694[d]	1.3780[d]	1.1972[d]
	(23.739)	(9.098)	(2.622)	(3.256)	(91.431)	(19.089)	(12.499)	(14.204)
Education	0.2201[d]	−0.0495	0.0856	0.0606	0.1691[d]	0.0648	0.1068	0.0652
	(41.167)	(−1.721)	(0.966)	(0.763)	(21.098)	(1.622)	(1.112)	(0.912)
Religion								
Muslim	−0.2168[d]	0.3621[d]	0.2545	0.2665	−0.3020[d]	−0.5027[d]	−0.1225	−0.0708
	(−12.954)	(3.900)	(0.982)	(1.240)	(11.278)	(−3.513)	(−0.431)	(−0.309)
Christian	0.1610[d]	0.4354[d]	0.3863[b]	0.3964[c]	0.0378[b]	−0.0870	0.2524	0.2732
	(12.628)	(6.022)	(1.731)	(2.252)	(1.732)	(−0.720)	(1.036)	(1.382)

Region								
Southern	−0.0550[d]	0.0439	0.0927	0.1105	−0.0729[d]	0.0769[c]	−0.0836	−0.1198
	(−10.836)	(1.733)	(0.992)	(1.391)	(−9.734)	(2.215)	(−0.835)	(−1.605)
Coastal	−0.0557[d]	0.0392	0.0891	0.1124	0.2693[d]	0.0976[c]	0.3114[c]	0.2681[d]
	(−9.083)	(1.260)	(0.762)	(1.040)	(32.863)	(2.387)	(2.472)	(2.659)
Northern	−0.1012[d]	0.1325[d]	0.0546	0.0792	−0.0883[d]	0.0831[c]	−0.0279	0.0102
	(−18.086)	(4.771)	(0.571)	(0.963)	(−11.261)	(2.023)	(−0.268)	(0.128)
Alpha			2.1442[d]	2.1095[d]			2.3334[d]	1.9497[d]
			(28.515)	(43.567)			(24.548)	(30.761)
Tau	−0.4558[d]	−.5144[d]		−2.5649[d]	−0.3328[d]	−.6213[d]		−1.6634[d]
	(−20.549)	(−20.225)		(−4.076)	(−12.988)	(−14.330)		(−10.127)
Sigma		1.0500[d]				1.1405[d]		
		(92.330)				(68.570)		
Log-Likelihood	−13221.31	−5930.87	−5920.90	−5920.44	−8757.21	−4778.10	−4823.02	−4793.81

	Wine				Spirits			
Variable	ZIP[a] Model I	ZIP[a] Model II	Negbin[a]	ZINB[a]	ZIP[a] Model I	ZIP[a] Model II	Negbin[a]	ZINB[a]
Constant	0.5230[d]	−2.5963[d]	−1.1860[c]	−0.5970[d]	−2.4263[d]	−2.9691[d]	−3.0284[d]	−0.6403[c]
	(8.223)	(−8.529)	(−2.070)	(−4.466)	(−9.616)	(−3.582)	(−3.325)	(−2.186)
Income	−0.0370[d]	0.0041	0.0465	−0.0042	0.0930[d]	0.2382[d]	0.1590[c]	0.1074[d]
	(−6.953)	(0.160)	(0.867)	(−0.385)	(5.705)	(3.212)	(2.108)	(4.057)
Age	2.9506[d]	4.7501[d]	3.2838[b]	0.0745	5.9955[d]	−1.0705	5.0317	0.5484
	(13.959)	(4.525)	(1.689)	(0.134)	(6.134)	(−0.295)	(1.430)	(0.546)
Age-Squared	−3.5706[d]	−6.0158[d]	−4.9296[c]	−0.6340	−8.5038[d]	−1.8462	−8.0577[c]	−1.7273
	(−17.538)	(−5.990)	(−2.563)	(−1.198)	(−7.662)	(−0.473)	(−2.168)	(−1.612)
Shopper	0.2582[d]	0.1718[d]	0.1973	−0.0691[b]	0.7106[d]	0.5714[c]	0.1227	−0.0299
	(27.894)	(3.861)	(1.562)	(−1.921)	(15.577)	(2.551)	(0.494)	(−0.431)
Cooker	−0.0952[d]	0.2418[d]	−0.0530	0.1612[c]	−0.6210[d]	−0.2639	−0.2555	0.0082
	(−7.379)	(4.256)	(−0.350)	(2.337)	(−16.356)	(−1.333)	(−0.985)	(0.101)
# of Children in household	−0.0549[d]	−0.0211	−0.1028	−0.1080[d]	0.1119[d]	0.0417	0.0056	−0.0191
	(−9.161)	(−0.771)	(−1.565)	(−3.839)	(4.537)	(0.466)	(0.060)	(−0.693)

# of Adults in household	−0.0662[d] (−13.558)	0.091[d] (2.962)	0.0045 (0.085)	0.0327[b] (1.947)	0.0402[b] (1.734)	0.1211 (1.487)	0.0928 (1.106)	0.0626[d] (2.639)
Employment	0.0164 (1.616)	−0.1604[d] (−3.414)	0.2015 (1.612)	0.2238[d] (3.950)	0.7431[d] (15.303)	0.8776[d] (4.306)	0.6731[d] (3.467)	0.3732[d] (5.745)
Marital status	0.3911[d] (32.603)	0.5495[d] (10.184)	0.5612[d] (4.895)	0.2485[d] (4.875)	−0.4508[d] (−8.824)	−0.6049[d] (−3.388)	−0.0889 (−0.455)	−0.0926[b] (−1.691)
Gender	0.4549[d] (35.922)	0.6745[d] (13.156)	0.9702[d] (7.210)	0.8705[d] (10.625)	0.8829[d] (22.558)	0.8053[d] (4.449)	0.7400[d] (3.380)	0.3040[d] (4.071)
Education	−0.6257[d] (−63.954)	−0.1457[d] (−3.079)	−0.5717[d] (−4.491)	−0.1142[d] (−3.167)	2.2718[d] (20.897)	1.4547[d] (5.857)	1.4242[d] (5.770)	0.5373[d] (6.046)
Religion								
Muslim	−0.0098 (−0.255)	0.3537[b] (1.911)	−0.0817 (−0.218)	0.4671[d] (4.813)	1.1933[d] (10.966)	−0.7679[b] (−1.800)	−0.0246 (−0.042)	−0.3992[c] (−2.093)
Christian	0.3232[d] (10.173)	1.2440[d] (7.721)	0.7278[c] (2.327)	0.8031[d] (8.156)	−0.9348[d] (−15.862)	−1.1242[d] (−4.100)	−0.4255 (−0.902)	−0.1764 (−1.132)
Region								
Southern	0.1509[d] (9.411)	0.2916[d] (3.827)	0.1600 (1.211)	−0.0287 (−1.622)	−0.4989[d] (−11.089)	−0.1064 (−0.544)	0.0373 (0.175)	0.0642 (1.143)
Coastal	0.5293[d] (31.147)	0.5741[d] (6.850)	0.7468[d] (4.556)	0.5195[d] (6.338)	−0.5293[d] (−5.503)	−0.2954 (−1.077)	−0.6394[c] (−2.264)	−0.2228[d] (−2.750)
Northern	0.9644[d] (64.866)	0.6940[d] (9.849)	1.1804[d] (8.499)	0.9122[d] (11.775)	−0.6776[d] (−10.617)	−0.6743[d] (−2.969)	−0.6281[d] (−2.627)	−0.2665[d] (−3.851)
Alpha			3.7531[d] (21.895)	3.7241[d] (46.562)			6.6562[d] (11.264)	3.7773[d] (11.768)
Tau	.0424 (1.566)	−.5625[d] (−8.097)		−21.4890[d] (−2.895)	0.4833[d] (5.866)	1.2402[d] (2.627)		−2.3164[d] (−5.963)
Sigma		1.2795[d] (57.849)				1.6546[d] (25.991)		
Log-Likelihood	−6264.17	−3534.5350	−3521.06	−3518.00	−1757.02	−1131.34	−1182.02	−1184.23

[a] ZIP I stands for the zero-inflated Poisson model; ZIP II stands for the zero-inflated Poisson model with heterogeneity; Negbin stands for compound negative binomial model; and ZINB stands for the zero-inflated negative binomial, [b] Significant at α=.10, [c] Significant at α=.05 and [d] Significant at α=.01.

Note: t-values in parentheses.

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