The Effect of Income on Health Choices: Alcohol Use

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This paper investigates the relation between household income level and individual alcohol consumption behavior. Previous research is inconclusive regarding this relation. We explore this issue through the lens of time preference. Our model considers income as a budget constraint of today as well as a component of future utility, and those with lower income discount future utility more heavily. Data from Behavioral Risk Factor Surveillance System (BRFSS) are tested utilizing a multinomial Logit method and two drinking behaviors, frequency of alcohol consumption and frequency of excessive alcohol consumption, are estimated. The results show that alcohol consumption frequency positively correlates to income, but excessive alcohol use mostly occurs among lower income population. In general, these findings support the hypothesis that low income individuals are more likely to make poor choices with regard to future health, since they discount future utility relatively heavily.

Key words: health choices, income, alcohol consumption.

Introduction

The overall health of the population depends on many health behaviors including smoking, alcohol consumption and diet. The field of agricultural economics has examined these behaviors, investigating how consumers make choices related to their health. One important determinant of health-related choices is household income: a low-income household might not be able to afford healthy food, which is usually more expensive. Previous studies have found that low income populations appear to choose more unhealthy diets, such as lower consumption of fruits and vegetables, higher smoking rates, less physical activity, and excessive alcohol consumption. For example, Park et al. (1996) find that the demand of low-income households for agricultural products is more responsive to a marginal change in income than that of other households. Evidence presented by Stewart et al. (2003) suggests that poor households spend less on fruits and vegetables than other households; however, as income rises, they are unlikely to increase the consumption of fruits or vegetables. Thus, there are factors other than affordability affecting their choices.

Interestingly, while household income often appears to limit the consumption of healthy food, it tends to increase smoking behavior. In other words, low income groups smoke more than high income groups. However, at first, this result is counter-intuitive, since low-income households have less disposable income after their basic needs are met. One explanation for this finding is related to the idea of time preference. Briefly, the benefit of future good health appears to be valued less by those with low income, and hence they discount their future health more heavily. Becker et al. (1988) presents a consumer choice model of rational addiction and time preference. This model implies that when faced with a trade-off between long-term health and an immediate pleasure that might cause the detriment of their health, consumers who discount the future more tend to select immediate pleasure, even though rationality suggests that individuals are planning to maximize utility over their entire life span. Higher earnings increase the future cost of consuming an unhealthy addictive good, since its negative effects on productivity would cause a greater loss in future earnings and thus lifetime income.

Our study explores the relation between household income level and individual consumption choice on a particular addictive good, alcohol. The effect of income on alcohol consumption seems to be more complex than that on smoking, since a moderate alcohol intake may have health benefits. However, as consumption of alcohol becomes excessive, it damages health. We expect that excessive alcohol consumption behavior negatively correlates with income level.

There have been several studies discussing the relation between household income and individual consumption choices regarding another addictive good, cigarettes. Binkley (2010) suggests that generally, the probability of starting smoking decreases as income increases, whereas the rate of quitting increases. The study of Scharff et al. (2011) finds time preferences are correlated with smoking behavior. Specifically, they find that smokers have a higher rate of time preference compared to nonsmokers, which means that smokers value present pleasure more and discount future utility more heavily.

In this study, similar to Binkley's work, we examine whether alcohol consumption can be explained by differences in time preferences by income level. Ettner (1996) finds that individuals with higher income significantly exhibit greater alcohol intake; however, increasing disposable income does not reduce alcohol consumption and behaviors. Similarly, Cerdá et al. (2011) point out that people with lower lifetime income are more likely to appear with lower drinking levels. They examine the data from the Panel Study of Income Dynamics (PSID) with 6,729 respondents aged 18-59 in 1996. However, in their study in the next year with 3,111 respondents aged 30-44, the authors find the opposite result: higher income is associated with higher odds of moderate drinking relative to abstinence or alcoholism. Since increasing income is claimed to indicate a weaker time preference, or weighing future utility more heavily, this outcome is consistent with the discussion from Keough et al. (2010). They find that a present time perspective is positively related to self-reported alcohol use, whereas a future time perspective implies less frequent alcohol consumption.

Aside from the role of income in determining individual alcohol consumption, researchers have examined various other factors that might contribute to the decision of alcohol use. For example, Droomers et al. (1999) find that excessive alcohol consumption is more common among less educated groups. Wilsnack et al. (2000) report gender differences in alcohol use; the rate of heavy drinking is higher in men than in women. Herd (1990) finds evidence of ethnicity effects. For example, despite the similar proportions of abstainers and abusers for blacks and for whites, their determinants are not the same. Moreover, the effect of income varies by race. Heavier drinking is associated with high income only among whites.

This paper explores how individual alcohol consumption is affected by household income, after controlling for other psychological and demographic features. It focuses on drinking and binge drinking behavior of more than 1,700,000 individuals who are interviewed from 2001 to 2010. The study aims to provide a descriptive comparison along with explanatory models of alcohol use among the population according to annual household income, age, educational background, marital status, and health condition, with the emphasis on the first factor. The latter part of analysis employs a multinomial Logit approach to construct the models, and the empirical study shows consistent results with theoretical predictions. Ambiguities from previous research are resolved to some extent.

Theoretical model

It is assumed that individuals make consumption decisions to maximize their lifetime aggregate utility,

$$\mathrm{V} = \sum_{\mathrm{t}=0}^{\mathrm{T}} \beta^{\mathrm{t}}(I_t)\mathrm{U_t}(\mathrm{C_t}),$$

where β^{t} is the discount factor at time t within the current period in which consumption decision is made. The term of β^{t} is assumed to increase with income level I_t, so that $\beta^{\mathrm{t}'}(I_t) > 0$. A smaller β^{t} suggests a heavier discounting of future utility, and consequently a stronger current time preference; and vice versa.

U_t is the utility in period t determined by the consumption of goods C_t in that period. More specifically, C_t can be decomposed into the consumption of ordinary goods c_t, which provide utility without having any potential negative effects, as well as consumption of x_t that contributes to current utility but will do harm to health cumulatively, such as cigarettes and alcohol. Thus, $U_t = U_t(c_t, x_t)$.

Since x_t culminates in a long-run negative effect, the utility in t+1 will be further reduced by an additional term $\int_0^t f(x_t)dt$， where $f(x_t)$ measures how the consumption of x in each period reduces health and utility in the next period, with $f'(x_t) < 0$ and $f(0) = 1$. In this paper, we explore how income is allocated between c_t and x_t in the current period; we are not interested in how consumption decisions are made in future periods. Therefore, while $U_t = U_t(c_t, x_t)$, the utility in future periods could be modeled as depending solely on expected income, which is assumed to be a function of the income today, $U_{t+1} = U_{t+1}(g(I_t))$. I_t is today's income, and $g'(I_t) > 0$. To simplify our model, we make the lifetime only two periods: a current period 0 and a future period 1. Finally, the individual's lifetime utility aggregation is expressed as:

$$U = U_0(c_0, x_0) + \beta(I_0)f(x_0)U_1(g(I_0))$$

We focus on two decisions in the first period: whether to consume alcohol and, if so, whether to consume "excessive" amount of alcohol. Incomes, prices, and preferences are assumed to be fixed within that period. We follow the model in Binkley (2010) to determine the optimal level of alcohol consumption by comparing the utilities with different quantities of consumption. If D is the difference in lifetime utilities under two different consumption levels, and x_0' denotes a smaller quantity of the good x_0 , then

$$D = \left[U_0(c_0, x_0) + \beta(I_0)f(x_0)U_1\left(g(I_0)\right)\right] - \left[U_0(c_0, x_0') + \beta(I_0)f(x_0')U_1\left(g(I_0)\right)\right]$$

$$= [U_0(c_0, x_0) - U_0(c_0, x_0')] + \beta(I_0)U_1\left(g(I_0)\right)[\, f(x_0) - f(\, x_0')]$$

$$= D_0 + D_1$$

D_0 is the utility gained in the current period with higher consumption of x , and D_1 represents the utility loss in the future due to higher x intake in the first period. D_1 has a negative sign. Obviously, if the absolute value of D_1 exceeds D_0, $D < 0$. In other words, the utility improvement today is canceled out by the health effect in the future, and rational individuals will choose less and even no consumption of x. The comparison of D_0 and D_1 is a key focus.

Now, we illustrate how income determines the values of D_0 and D_1. To begin with, it is straightforward that the absolute value of D_1 is increased with $U_1(g(I_0))$, since $f(x_0) - f(x_0')$ is negative and β is positive. Hence, a higher I_0 implies both a higher β and a higher $g(I_0)$ and consequently a larger U_1. Increased income is associated with a greater magnitude of effect from D_1. Next, we need to examine how D_0 relates to income. The standard consumer theory demonstrates that an individual chooses his consumption where the marginal utility of that good is greater than or equal to its price times the marginal utility of income. Income has a decreasing marginal utility, and the price is fixed from our assumption. As a result, an individual will accept a good for a smaller marginal utility and thus a larger quantity when income increases. D_0 increases accordingly.

Because a higher income leads to both an increase in D_0 and a larger absolute value of D_1, whether the current utility improvement compensates for the negative future health effect needs further discussion to ascertain whether extra x will be consumed. The relative strengths of the two competing components of the net effect vary over the income distribution. As discussed before, the influence of D_1 tends to be minor at low incomes. D_0 plays a dominant role among low income households since a small increase in income enhances their ability to purchase more x. Individuals with low income have $D > 0$ and are more likely to consume x. Conversely, high income individuals will have $D < 0$ and are less willing to consume a good that damages health. This comes from the fact that high income households are less constrained by expenditure budgets, so the effect of D_0 is not powerful. Meanwhile, the impact of D_1

turns out to be larger as income increases, for the reason that high income population is more concerned about healthy issues and future utilities.

The model predicts that the consumption of potentially unhealthy goods will decrease as income escalates. More generally, the quantity purchased increases with income if affordability is main focus, and shrinks when health grows to be the major consideration. The example that is analyzed in this paper is the consumption of alcohol.

Data

The data for this study comes from the 2001-2010 Behavioral Risk Factor Surveillance System (BRFSS), which is a telephone survey tracking health conditions and risk behaviors in the United States yearly since 1984. This survey comprises only respondents 18 and older. We use data starting from 2001 since questions concerning alcohol consumption were optional prior to that year. Two sets of multinomial choice models are estimated; these models are described in the next section. In the first model, the dependent variable represents how many days the respondent had at least one alcohol drink during the past 30 days. It measures the frequency of regular alcohol consumption. The original responses are counted as specific numbers of days per month; in this analysis, we sort them into seven categories: "none", "once per month", "twice per month", "up to once per week", "up to twice per week", "up to every other day", and "up to every day" – which are labeled as 0-6, respectively. The categorization is employed to escape some insignificant results due to a limit sample size of some groups[1]. In the second model, the dependent variable is the number of days of binge drinking during the past 30 days, where binge drinking is defined as having at least 5 drinks in one day for a man and 4 for a woman[2]. This model assesses the frequency of excessive alcohol consumption. The original responses and the categorization of

[1] Before the categorization, some groups (0 day, 1 day, 2 days, 3 days, 4 days) have hundreds of thousands of observations, while other groups (11 days, 13 days, 17 days, 19 days, 22 days, 23 days) have only hundreds of observations. The regression results on the small groups are reported to be insignificant. The categorization provides seven groups with more equivalent observations, from the smallest of approximately 170,000 to the largest of 397,068.

[2] One drink is calculated as one third of a 40 ounce beer or a cocktail drink with 1 shot.

the dependent variable values are the same as the first model. Our final estimation sample has 1,719,271 observations on the drinking frequency model and 1,376,525 observations on the binge drinking frequency model when restricted to those without missing data in the estimation variables. In both models, the middle category "up to once per week" (category 3) is chosen as the base outcome category.

This analysis includes a broad set of independent variables. First, we include annual household income as a potential factor in alcohol consumption. Examining income by year, we find income increases slightly over the ten years overall, with a drop around 2008 – the height of the economic recession – and recovers after that. However, the BRFSS data measures household income in intervals, making it impractical to deflate the income level over time. It should be noted that the empirical results might be a bit biased in view of this fact. Other demographic variables are also considered as explanatory variables, including age, race, gender, educational attainment, employment, marital status, and the presence of children in family.

There are eight income variables, each representing an income interval; the dummy variable indicates whether an individual fits in this interval or not. The same applies to educational attainment, employment and marital status which have 3, 8, and 4 variables, respectively. Other than income and demographic variables, factors included in this study measure the number of men and women in the household, as well as self-reported physical health and mental health conditions. These factors are assumed to influence individual risk behaviors and consequently are included in this alcohol consumption analysis.

Descriptive statistics for the full sample are presented in Table 1. The average drinking frequency is less than 3, which means consuming alcohol no more than once per week among the whole sample. The mean of binge drinking frequency is 0.58, indicating that excessive amounts of alcohol are consumed less than once per month. Physical and mental health conditions are measured by the self-reported number of unhealthy days in one month; thus, a higher value implies a worse physical or mental health.

There are a few caveats to remember. First, there are approximately 12% more female respondents than male respondents in our sample; therefore, the sample is not fully randomly representative of the entire population. Second, only a very small percentage of the observations are reported to be Hispanic or Latino. Third, more observations are allocated in the high income intervals relative to the population. Each of these may create biased regression results.

Table 2 and Table 3 give the independent variable means for each of the two dependent variables by category. Individuals reporting more days of regular alcohol consumption in a month appear to have a larger number of men and a smaller number of women in the household, are less likely to be Hispanic or Latino or have children in the household, and have better self-reported health conditions both physically and mentally. Low income groups tend to have fewer drinking days, while higher income groups have more days consuming alcohol per month. The same situation occurs for educational attainment that the number of drinking days is small among low educated groups, and becomes greater in high educated population. However, binge drinking tells a very different story. While the trends of the number of men, women and children in the household stays unchanged, more individuals with lower income and less education are observed with more days of excessive alcohol consumption; also, they appear to suffer more from health problems. The first two lines of Table 3 reveal that for individuals who consume alcohol up to every other day, they only have excessive alcohol consumption up to once per month; for those consuming alcohol up to every day, binge drinking occurs more than once per month, but still less than twice per month.

Figure 1 exhibits the comparison between drinking frequency and binge drinking frequency across all eight income groups, which is the focus of this study. It is straightforward that the average drinking days increase with income, whereas the binge drinking frequency exhibits the opposite trend. Other relations will be investigated and discussed in the latter part of the paper.

Empirical methodology

According to the standard neoclassical theory of consumer utility maximization, assume that an individual has preferences over his health and alcohol consumption, while health condition and the length of life are affected by drinking behavior. To determine the optimal frequency and quantity of alcohol consumption, the individual maximizes utility taking a set of factors into account, including his income level, his current health situation, the family structure (the number of males and females, and the presence of children) and so forth. We are particularly interested in whether income level significantly relates to alcohol consumption. Based on the theoretical discussion before, a reasonable expectation is that low income would contribute to higher alcohol consumption, whether through higher drinking frequency or higher alcohol consumption each time, or both.

We investigate this relation empirically by employing a multinomial Logit model. A multinomial Logit model predicts consumer choice utilizing a logistic regression, with the underlying assumption that the independent variables are alternative-invariant, which means they vary over the individuals but do not vary over alternatives. In the context of this study, there are two types of consumer choices: the frequency of alcohol consumption (Model 1) and the frequency of excessive alcohol consumption, or binge drinking (Model 2). It is assumed that individual's drinking behavior is primarily influenced by his income, physical and psychological condition, family structure, and demographic factors. These factors differ across observations but are constant within each individual. Further computations on various explanatory characteristics also provide marginal values for each determinant.

The two separate estimations have different dependent variables (frequency of alcohol consumption; frequency of binge drinking) but the same explanatory variables and same empirical specification, which is as follows:

$$p_{ij} = p(y_i = j) = \frac{e^{(w_i' \gamma_j)}}{\sum_{k=1}^{m} e^{(w_i' \gamma_k)}}$$

where p is the probability that an individual i choosing a frequency j, y is the dependent variable having 7 values from 0 to 6, w is a matrix of independent variables which includes annual household income, age, race, gender, educational attainment, employment, marital status, the presence of children in family, the number of men and women in the family, and self-reported physical health and mental health situations. γ is the matrix of regressor coefficients.

One set of coefficients will be normalized to 0 as the base outcome, and the coefficients of other alternatives are interpreted in reference to it. In comparison to the base alternative, a positive coefficient value indicates that an increase in the independent variable makes the selection of that drinking option more likely, while a negative coefficient suggests it is less likely.

However, the degree of effect cannot be interpreted by this coefficient. To investigate the marginal effect of a variation of a determinant on the probability of choice on a particular alcohol consumption alternative, an additional calculation is utilized as

$$\frac{\partial p_{ij}}{\partial w_i} = p_{ij}(\gamma_j - \overline{\gamma_i})$$

Given an independent variable, γ_j is its coefficient of selecting the drinking frequency j, while $\overline{\gamma_i}$ is the average value of all the coefficients to different consumer choices for a particular individual i in one model. The marginal effects are not necessarily consistent in sign to the coefficient estimates, and the marginal effects of each explanatory variable on the different dependent alternatives will sum up to zero.

Empirical Results and Discussion

This section reports four sets of estimates: the estimation coefficients and marginal effects for drinking frequency and binge drinking frequency. The estimation results for the multinomial models for drinking frequency (Model 1) are presented in Table 4. Individuals with annual household income less than $20,000 have a higher probability of low drinking frequency as well as a lower probability of high

drinking frequency, while those with income higher than $20,000 are more likely to drink more frequently. Generally, an increasing number of adults in the household (whether females or males) will result in lower drinking frequency. An exception is that more men in the household is associated with a higher probability of daily consumption. Having children also reduces the drinking frequency. Reporting a worse physical health condition makes people less likely to drink occasionally, while reporting a worse mental condition contributes to more frequent alcohol consumption. Being male correlates negatively with low drinking frequency and relates positively with high drinking frequency. The married population and less educated groups consume alcohol less frequently.

Table 5 provides the regression coefficients for binge drinking frequency (Model 2). Low income groups (Income1, Income2 & Income 3) show a significantly positive relation with the extremely high binge frequency that taking excessive alcohol up to every day (Category 6), while the high income groups (Income 5-8) report a negative effect. Unlike drinking frequency, an increasing number of men in the household significantly leads to higher frequency of excessive alcohol consumption. Worse mental condition also increases binge drinking frequency. Lack of marriage and education are associated with higher frequency of binge drinking.

To summarize, the probability of drinking frequency increases with income (Model 1), but the probability of binge drinking decreases (Model 2). The first result does not entirely support the prediction from the theoretical model, but this divergence may be reasonable because unlike smoking, moderate drinking may be beneficial to health. Moderate alcohol intake causes a small increase in high density lipoprotein (HDL) cholesterol and prevents platelets in the blood from clot formation[3]. Thus, this finding is consistent with our assumption that people with higher income have lower time preference. Additionally, higher income is usually linked to higher social status, which often requires more social activities involving alcohol consumption. The second finding supports our hypothesis that low income

[3] American Heart Association, http://www.heart.org/HEARTORG/GettingHealthy/NutritionCenter/Alcoholic-Beverages-and-Cardiovascular-Disease_UCM_305864_Article.jsp

individuals discount expected future utility and hence diminish the cost of reduced longevity. Therefore, the consumption of a good in harmful amounts for a low income person tends to be greater.

Educational attainment affects alcohol consumption in a similar way to income. This can be easily interpreted by the same mechanism that education raises the possibility of future utility because education is an investment in human capital (Becker et al, 1977). Individuals who do not have a spouse are associated with more frequent alcohol and excessive alcohol consumption. Causality is difficult to establish because marriage friction might lead one to indulge in alcohol; on the other hand, an unorganized life habit like unrestrained alcohol consumption could be a potential determinant in spousal loss. However, the examination of the "never married" groups demonstrates that the absence of a spouse will encourage people to both consume alcohol and binge drink at a higher frequency. Employment status is not observed to influence the alcohol consumption behavior.

We do find evidence of gender effects. Males are at all times consuming alcohol more frequently than females. The presence of children in a household has an opposite effect, reducing not only drinking but also binge drinking frequency. People who have children are concerned about providing them with a stable family atmosphere and thus control their alcohol consumption.

Self-reported physical health condition and mental health condition function differently. With worse physical health, people consume less alcohol; perhaps they pay more attention to living healthy. Conversely, worse psychological condition increases alcohol consumption. Age presents a U-shaped pattern for both drinking frequency and excessive alcohol consumption. Drinking and binge drinking frequencies are both more likely to occur at the endpoints. This may attribute to the fact that college students consume alcohol frequently, and drinking helps the old to get rid of the loneliness in life. Race does not appear to influence alcohol consumption.

Table 6 and Table 7 exhibits the marginal effects for both models, indicating the magnitudes of the effects for each explanatory factor on drinking frequency and binge drinking frequency. An important

principle should be noticed is that the significance of the marginal effects can be applied only after the significance of the coefficients are verified. In other words, the significance of marginal effects is based on the significance of coefficients; if a variable has an insignificant coefficient, the significance of its marginal effect makes no sense.

Annual household income of less than $10,000 decreases the probability of drinking up to every day by 2.84%, while promotes non-drinking by 10.87%. At the same time, it slightly enhances the probability of every day binge drinking by 0.18%, but diminishes non-binge drinking by 1.35% among those who do drink. Annual household income higher than $75,000 makes one 7.81% more likely to consume alcohol daily, while it lowers the probability of consuming excessive alcohol approximately every day by 0.17%. Meanwhile, those people are 17.71% less likely to consume no alcohol at all. The comparison between Table 6 and Table 7 reveals that the scale of effects is generally greater on drinking behavior than on binge drinking behavior.

Though the results of the empirical estimation substantially support the theoretical setup, limitations leave room for future exploration. First, our estimation assumes that the rates of time preference are affected only by income, but it is probably not the case in reality. Becker et al. (1997) have argued that time preference rate is endogenous and is associated with income, education and other personal information. Accordingly, the determinants of time preference rates can be diverse. Additionally, under the consideration of lifelong aggregate utility, the application of one single year's income is less demonstrative than an index that can represent the income trend over several years. Our result is desirable based on the assumption that most of individuals will have a stable income variation during the lifetime; consequently, the income of one particular year is able to partly carry their expectation. Nevertheless, future studies aiming at a larger range of years of income information would be beneficial to obtain more precise outcomes.

In addition, the significance levels of the second model are weak. Our data has the characteristic that the number of observations of each category is not equally distributed, which might affect the regression significance. We keep this categorization to follow the format of the first model; nonetheless, there is space for future research to modify the data and model setup so as to increase the prediction precision.

Conclusion

In recent years, health choices as they relate to food purchases have attracted a lot of attention. Determinants that affect consumer decision are a main focus among agricultural economists. Alcohol consumption is one example of health-related food decisions that consumers make. Alcohol can provide health benefits when consumed moderately, but it can also be additive, excessive intake will potentially do harm to the human body. In this study, we are interested in the relation between income and alcohol consumption, and what that implies about time preference. We investigate how the household income level influences the quantity and frequency of drinking for individuals.

Based on the medical finding that heavy drinking will hurt health, our hypothesis is that people who consume above a certain threshold of alcohol will face a potential loss of lifetime aggregate utility. A rational consumer has to balance his choice between current utility from drinking and the disutility caused by impending health damage. Individuals with stronger time preference, which is a present time perspective and means more heavily discounting the future, place more weight on current utility; those with future time perspective value future utility more and are willing to sacrifice the present utility of drinking to maintain better health in future. The cost of utility loss increases as income increases, since utility depends in part on income. Hence, a higher income makes binge drinking less likely to occur, while a lower income may lead to excessive alcohol consumption.

We estimate two multinomial Logit regressions for alcohol consumption and excessive alcohol consumption, employing the data from the 2001-2010 Behavior Risk Factor Surveillance System (BRFSS). Empirical results are mostly consistent with theoretical findings. Moderate alcohol

consumption is positively correlated with household income, probably due to the fact that higher income usually indicates a higher social status, which may require activities involving alcohol consumption. Meanwhile, moderate alcohol intake is beneficial to health. Nonetheless, excessive alcohol use decreases as income increases. This is a strong signal that the low income group discounts expected future utility and thus cuts back the cost of reduced longevity. Educational attainment affects alcohol consumption in a similar mechanism. Being male enhances the probability of binge drinking while the presence of children in household decreases the frequency of binge drinking. Our study also introduces self-reported physical and mental health condition as explanatory variables in both models. Better psychological condition significantly reduces the probability of excessive alcohol consumption; conversely, better physical health increases the binge drinking frequency.

This study analyzes the relation of income and alcohol consumption from a new perspective, and empirically supports the discussion of time preference proposed by previous researches. A prime advantage of this paper is that it estimates the models utilizing a sample of over 1,700,000 observations. Compared with estimation of only thousands of observations, this study better describes the whole population and indicates a more precise policy implication. However, shortcomings remain for further exploration. Our assumption of time preference rate only includes the consideration of income level, but it may be affected by various factors far more than this. Future study incorporating the endogeneity of time preference should yield a better prediction. Since we are considering the lifelong aggregate utility, another modification could be obtained by replacing one single year's income with an index that can carry the income information of a larger range of years.

Table1. Sample Descriptive Statistics (N=1,719,271)				
Variable	*Mean*	*SD*	*Min.*	*Max.*
Drinking Frequency	2.76	2.09	0	6
Binge Drinking Frequency	0.58	1.25	0	6
Number of Men in Household	0.88	0.59	0	16
Number of Women in Household	0.98	0.52	0	15
Physical Unhealthy Days Per Month	3.18	7.45	0	30
Mental Unhealthy Days Per Month	3.19	7.26	0	30
Age	49.67	16.06	18	99
Hispanic or Latino	0.06	0.25	0	1
Children Presence in Household	0.36	0.48	0	1
Male	0.44	0.50	0	1
Income1: <$10,000	0.04	0.20	0	1
income2: $10,000-$14,999	0.04	0.21	0	1
income3: $15,000-$19,999	0.06	0.24	0	1
income4: $20,000-$24,999 (Reference)	0.09	0.28	0	1
income5: $25,000-$34,999	0.13	0.33	0	1
income6: $35,000-$49,999	0.17	0.38	0	1
income7: $50,000-$74,999	0.18	0.39	0	1
income8: >$75,000	0.28	0.45	0	1
Widowed, Separated, Divorced	0.25	0.43	0	1
Never Married	0.14	0.34	0	1
Married (Reference)	0.58	0.49	0	1
Unmarried Couple	0.03	0.17	0	1
High School and Below	0.34	0.47	0	1
Some College (Reference)	0.27	0.45	0	1
College Graduate and Above	0.39	0.49	0	1
Employed for Wages	0.55	0.50	0	1
Self-employed	0.10	0.30	0	1
Short-time Unemployed	0.02	0.13	0	1
Long-time Unemployed	0.03	0.16	0	1
Homemaker	0.06	0.24	0	1
Student	0.02	0.14	0	1
Retired	0.19	0.39	0	1
Unable to work (Reference)	0.04	0.19	0	1

Table2. Explanatory Variable Means for Drinking Frequency Categories (N=1,719,271)							
Drinking Frequency	***0***	***1***	***2***	***3***	***4***	***5***	***6***
Binge Drinking Frequency	0.00	0.10	0.17	0.38	0.66	0.92	1.24
Number of Men in Household	0.81	0.85	0.86	0.89	0.92	0.94	0.94
Number of Women in Household	1.03	1.04	1.02	0.99	0.96	0.93	0.89
Physical Unhealthy Days Per Month	4.95	3.40	2.90	2.63	2.39	2.45	2.71
Mental Unhealthy Days Per Month	3.76	3.49	3.24	2.96	2.87	2.95	2.86
Age	50.78	48.4	47.33	47.94	47.26	48.64	55.5
Hispanic or Latino	0.09	0.08	0.07	0.07	0.05	0.04	0.03
Children Presence in Household	0.37	0.42	0.42	0.39	0.37	0.34	0.24
Male	0.33	0.34	0.37	0.43	0.49	0.55	0.60
Income1: <$10,000	0.09	0.04	0.03	0.03	0.02	0.02	0.02
income2: $10,000-$14,999	0.09	0.05	0.04	0.03	0.03	0.03	0.03
income3: $15,000-$19,999	0.11	0.07	0.06	0.05	0.04	0.04	0.04
income4: $20,000-$24,999 (Reference)	0.12	0.10	0.08	0.08	0.07	0.06	0.07
income5: $25,000-$34,999	0.16	0.14	0.13	0.12	0.11	0.10	0.11
income6: $35,000-$49,999	0.17	0.18	0.18	0.17	0.16	0.16	0.16
income7: $50,000-$74,999	0.14	0.19	0.20	0.20	0.20	0.20	0.19
income8: >$75,000	0.12	0.24	0.29	0.32	0.37	0.39	0.38
Widowed, Separated, Divorced	0.31	0.25	0.24	0.23	0.22	0.22	0.25
Never Married	0.13	0.14	0.14	0.15	0.16	0.15	0.10
Married (Reference)	0.55	0.58	0.59	0.59	0.59	0.60	0.61
Unmarried Couple	0.02	0.03	0.03	0.03	0.03	0.04	0.03
High School and Below	0.49	0.36	0.32	0.30	0.27	0.25	0.27
Some College (Reference)	0.27	0.30	0.30	0.28	0.27	0.26	0.25
College Graduate and Above	0.24	0.34	0.38	0.42	0.46	0.49	0.48
Employed for Wages	0.46	0.57	0.60	0.60	0.61	0.58	0.47
Self-employed	0.08	0.09	0.09	0.10	0.11	0.13	0.14
Short-time Unemployed	0.02	0.02	0.02	0.02	0.01	0.01	0.01
Long-time Unemployed	0.03	0.03	0.03	0.03	0.03	0.03	0.02
Homemaker	0.10	0.07	0.06	0.05	0.05	0.04	0.04
Student	0.02	0.02	0.02	0.02	0.02	0.02	0.01
Retired	0.22	0.16	0.15	0.15	0.14	0.17	0.29
Unable to work (Reference)	0.08	0.04	0.03	0.02	0.02	0.02	0.02

Table3. Explanatory Variable Means for Binge Drinking Frequency Categories (N=1,376,525)							
Binge Drinking Frequency	***0***	***1***	***2***	***3***	***4***	***5***	***6***
Number of Men in Household	0.87	0.95	0.98	1.00	1.05	1.08	1.09
Number of Women in Household	0.98	0.96	0.93	0.91	0.88	0.84	0.74
Physical Unhealthy Days Per Month	2.77	2.46	2.47	2.62	2.69	3.14	4.69
Mental Unhealthy Days Per Month	2.81	3.40	3.52	3.79	4.10	5.02	6.27
Age	51.31	42.87	43.37	43.27	42.52	42.36	47.97
Hispanic or Latino	0.05	0.07	0.07	0.08	0.07	0.06	0.05
Children Presence in Household	0.35	0.45	0.41	0.39	0.36	0.33	0.26
Male	0.42	0.53	0.59	0.63	0.67	0.72	0.80
Income1: <$10,000	0.03	0.03	0.03	0.04	0.04	0.05	0.07
income2: $10,000-$14,999	0.03	0.03	0.04	0.04	0.04	0.05	0.06
income3: $15,000-$19,999	0.05	0.05	0.06	0.06	0.06	0.07	0.09
income4: $20,000-$24,999 (Reference)	0.07	0.07	0.08	0.08	0.08	0.09	0.10
income5: $25,000-$34,999	0.12	0.11	0.12	0.13	0.12	0.13	0.14
income6: $35,000-$49,999	0.17	0.17	0.17	0.17	0.17	0.18	0.18
income7: $50,000-$74,999	0.20	0.19	0.19	0.19	0.19	0.18	0.16
income8: >$75,000	0.34	0.33	0.31	0.29	0.29	0.26	0.19
Widowed, Separated, Divorced	0.24	0.20	0.21	0.22	0.22	0.23	0.32
Never Married	0.12	0.19	0.20	0.22	0.26	0.28	0.21
Married (Reference)	0.61	0.57	0.54	0.51	0.48	0.43	0.42
Unmarried Couple	0.03	0.05	0.05	0.05	0.05	0.05	0.05
High School and Below	0.28	0.32	0.35	0.39	0.39	0.42	0.50
Some College (Reference)	0.27	0.28	0.28	0.28	0.29	0.30	0.28
College Graduate and Above	0.45	0.40	0.36	0.33	0.33	0.28	0.22
Employed for Wages	0.55	0.66	0.64	0.64	0.64	0.60	0.50
Self-employed	0.11	0.11	0.12	0.12	0.12	0.13	0.14
Short-time Unemployed	0.01	0.02	0.02	0.02	0.02	0.02	0.04
Long-time Unemployed	0.02	0.03	0.04	0.04	0.04	0.05	0.05
Homemaker	0.06	0.04	0.04	0.03	0.03	0.02	0.02
Student	0.02	0.03	0.03	0.03	0.04	0.04	0.02
Retired	0.21	0.08	0.10	0.09	0.09	0.10	0.17
Unable to work (Reference)	0.02	0.02	0.02	0.03	0.03	0.04	0.06

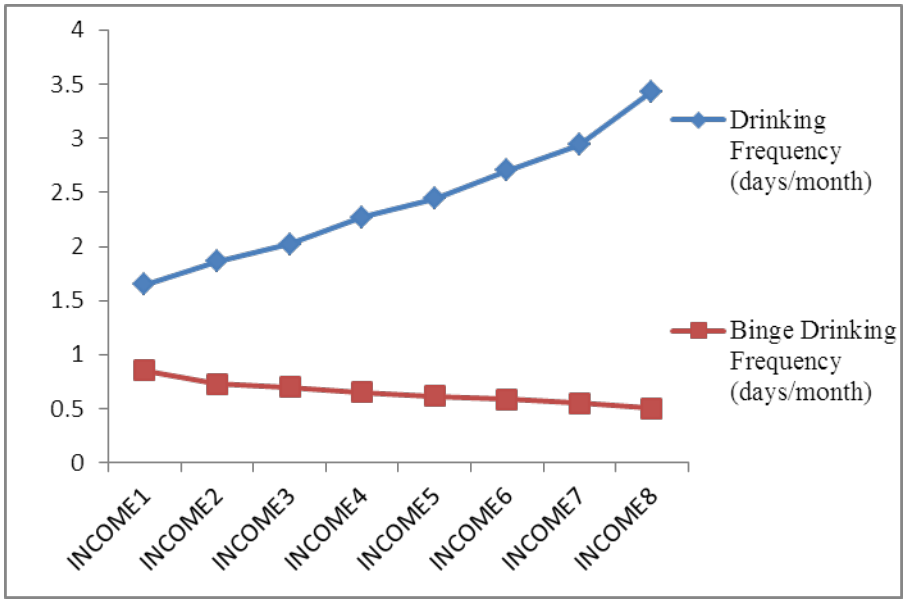

Figure1: Drinking and Binge Drinking Days per Month across Incomes

Table4. Multinomial Logit Estimation Results for Drinking Frequency (Model 1)						
Drinking Frequency	**0**	**1**	**2**	**4**	**5**	**6**
Number of Men in Household	0.055*	0.053*	0.008	-0.002	-0.014*	0.026*
Number of Women in Household	0.074*	0.056*	0.022*	-0.036*	-0.047*	-0.085*
Physical Unhealthy Days Per Month	0.018*	0.008*	0.004*	-0.002*	-0.002*	-0.004*
Mental Unhealthy Days Per Month	-0.007*	0.001*	0.001	0.002*	0.008*	0.015*
Age	0.005*	0.004*	-0.002*	-0.004*	-0.001*	0.025*
Hispanic or Latino	-0.021*	0.099*	-0.058*	-0.279*	-0.476*	-0.575*
Children Presence in Household	0.149*	0.165*	0.102*	-0.121*	-0.195*	-0.305*
Male	-0.360*	-0.395*	-0.258*	0.225*	0.442*	0.636*
Income1: <$10,000	0.631*	0.100*	0.012	-0.005	-0.016	-0.082*
income2: $10,000-$14,999	0.432*	0.102*	0.056*	-0.010	0.006	-0.073*
income3: $15,000-$19,999	0.269*	0.051*	0.043*	-0.016	-0.010	-0.032*
income5: $25,000-$34,999	-0.151*	-0.052*	0.006	0.022	0.046*	0.025*
income6: $35,000-$49,999	-0.444*	-0.135*	-0.020	0.071*	0.110*	0.105*
income7: $50,000-$74,999	-0.787*	-0.238*	-0.045*	0.121*	0.173*	0.171*
income8: >$75,000	-1.421*	-0.488*	-0.170*	0.239*	0.357*	0.358*
Widowed, Separated, Divorced	-0.305*	-0.119*	-0.056*	0.061*	0.073*	0.013
Never Married	-0.388*	-0.125*	-0.066*	0.085*	0.038*	-0.018
Unmarried Couple	-0.664*	-0.149*	-0.067*	0.127*	0.246*	0.378*
High School and Below	0.259*	0.043*	-0.010	-0.038*	-0.094*	-0.048*
College Graduate and Above	-0.143*	-0.157*	-0.094*	0.097*	0.128*	0.157*
Employed for Wages	-0.354*	-0.141*	-0.075*	0.081*	0.067*	0.079*
Self-employed	-0.440*	-0.248*	-0.121*	0.142*	0.259*	0.385*
Short-time Unemployed	-0.574*	-0.125*	-0.078*	0.141*	0.153*	0.303*
Long-time Unemployed	-0.630*	-0.191*	-0.125*	0.121*	0.188*	0.275*
Homemaker	0.060*	-0.127*	-0.083*	0.094*	0.143*	0.297*
Student	-0.369*	-0.179*	-0.091*	0.104*	0.102*	0.080*
Retired	-0.235*	-0.192*	-0.072*	0.077*	0..180*	0.309*
Intercept	0.627*	-0.135*	-0.242*	-0.437*	-1.074*	-2.101*
R-squared	0.048					

(Category 3 is the base outcome category; the asterisk denotes significance at the 10% level.)

Table5. Multinomial Logit Estimation Results for Binge Drinking Frequency (Model 2)						
Binge Drinking Frequency	**0**	**1**	**2**	**4**	**5**	**6**
Number of Men in Household	-0.030*	-0.039*	- 0.009	0.058*	0.067*	0.110*
Number of Women in Household	-0.025*	-0.025*	- 0.016	- 0.023	- 0.016	-0.050*
Physical Unhealthy Days Per Month	0.003*	0.001	- 0.002	0.001	0.003*	0.011*
Mental Unhealthy Days Per Month	-0.014*	-0.007*	-0.004*	0.006*	0.016*	0.026*
Age	0.036*	-0.002*	- 0.000	-0.004*	-0.006*	0.013*
Hispanic or Latino	-0.072*	-0.002	-0.082*	-0.179*	-0.382*	-0.462*
Children Presence in Household	0.232*	0.164*	0.076*	-0.084*	-0.166*	-0.253*
Male	-0.874*	-0.365*	-0.160*	0.176*	0.393*	0.823*
Income1: <$10,000	-0.075*	-0.007*	- 0.045	0.061*	0.070	0.181*
income2: $10,000-$14,999	-0.061*	-0.035	-0.032*	0.033*	0.080*	0.048
income3: $15,000-$19,999	0.018	0.030	0.012	0.043	0.060*	0.118*
income5: $25,000-$34,999	0.014*	-0.005	- 0.033	0.003	0.037	-0.055*
income6: $35,000-$49,999	- 0.003	-0.003	- 0.033	0.034	0.096*	-0.073*
income7: $50,000-$74,999	- 0.035	-0.009	- 0.040	0.044	0.053	-0.161*
income8: >$75,000	-0.074*	0.019	0.003	0.099*	0.078*	-0.313*
Widowed, Separated, Divorced	-0.326*	-0.159*	-0.062*	0.084*	0.189*	0.274*
Never Married	-0.299*	-0.242*	-0.104*	0.135*	0.240*	0.104*
Unmarried Couple	-0.370*	-0.175*	-0.109*	- 0.005	0.085*	0.207*
High School and Below	-0.279*	-0.150*	-0.072*	0.003	0.008	0.137*
College Graduate and Above	0.337*	0.184*	0.081*	- 0.032	-0.178*	-0.280*
Employed for Wages	-0.195*	-0.095*	- 0.069	0.077	- 0.087	-0.113*
Self-employed	-0.208*	-0.119*	- 0.032	0.089	0.060	0.106*
Short-time Unemployed	-0.250*	-0.117*	- 0.035	0.094	0.069	0.276*
Long-time Unemployed	-0.303*	-0.172*	- 0.079	0.095	0.099	0.044
Homemaker	- 0.013	-0.105*	- 0.049	0.037	0.003	0.138
Student	- 0.016	-0.045	0.003	0.171*	0.032	0.310*
Retired	- 0.053	-0.096*	- 0.017	0.132*	0.131*	0.126*
Intercept	1.899*	1.219*	0.378	-0.576*	-1.339*	-2.667*
R-squared			0.0564			

(Category 3 is the base outcome category; the asterisk denotes significance at the 10% level.)

Table6. Multinomial Logit Marginal Effects for Drinking Frequency (%)							
Drinking Frequency	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Number of Men in Household	0.63*	0.46*	-0.14*	-0.40*	-0.29*	-0.33*	0.07
Number of Women in Household	1.27*	0.75*	0.23*	-0.05	-0.52*	-0.47*	-1.21*
Physical Unhealthy Days Per Month	0.26*	0.06*	0	-0.07*	-0.08*	-0.06*	-0.11*
Mental Unhealthy Days Per Month	-0.16*	-0.02*	-0.02*	-0.04*	0	0.05*	0.18*
Age	0.01*	0	-0.07*	-0.08*	-0.11*	-0.05*	0.29*
Hispanic or Latino	2.18*	3.65*	0.93*	2.92*	-1.80*	-2.81*	-5.07*
Children Presence in Household	2.92*	2.54*	1.32*	0.26*	-1.43*	-1.70*	-3.91*
Male	-6.56*	-5.60*	-3.09*	-0.45*	2.73*	4.08*	8.88*
Income1: <$10,000	10.87*	-0.60*	-1.42*	-2.70*	-1.89*	-1.43*	-2.84*
income2: $10,000-$14,999	6.87*	0.03	-0.49*	-1.91*	-1.41*	-0.86*	-2.23*
income3: $15,000-$19,999	4.12*	-0.08	-0.16	-1.11*	-0.96*	-0.62*	-1.19*
income5: $25,000-$34,999	-2.20*	-0.43*	0.31*	0.42*	0.59*	0.65*	0.66*
income6: $35,000-$49,999	-6.10*	-1.10*	0.39*	1.09*	1.75*	1.66*	2.32*
income7: $50,000-$74,999	-10.05*	-1.96*	0.51*	1.83*	3.02*	2.72*	3.92*
income8: >$75,000	-17.71*	-4.15*	-0.14	3.15*	5.67*	5.36*	7.81*
Widowed, Separated, Divorced	-4.15*	-0.87*	-0.01	1.13*	1.63*	1.28*	0.98*
Never Married	-4.99*	-0.71*	0.08	1.49*	2.26*	1.10*	0.78*
Unmarried Couple	-8.69*	-1.86*	-0.67*	0.12	1.92*	2.73*	6.44*
High School and Below	4.18*	0.15*	-0.48*	-0.64*	-0.93*	-1.19*	-1.10*
College Graduate and Above	-2.35*	-2.02*	-0.95*	0.18*	1.45*	1.33*	2.36*
Employed for Wages	-5.22*	-1.07*	-0.13	1.27*	1.94*	1.24*	1.97*
Self-employed	-6.59*	-3.13*	-1.31*	-0.01	2.02*	2.74*	6.27*
Short-time Unemployed	-7.62*	-1.42*	-0.66*	0.36	2.32*	1.78*	5.25*
Long-time Unemployed	-8.00*	-1.93*	-0.91*	0.85*	2.38*	2.46*	5.15*
Homemaker	0.03	-2.38*	-1.51*	-1.14*	0.48*	0.84*	3.69*
Student	-4.84*	-1.66*	-0.43	1.08*	2.28*	1.60*	1.97*
Retired	-3.94*	-2.57*	-0.84*	-0.09	1.00*	1.77*	4.67*

（The asterisk denotes significance at the 10% level.）

Table7. Multinomial Logit Marginal Effects for Binge Drinking Frequency (%)							
Binge Drinking Frequency	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Number of Men in Household	-0.43*	-0.12*	0.07*	0.10*	0.20*	0.09*	0.09*
Number of Women in Household	-0.11	-0.01	0.04	0.09*	0	0.01	-0.02
Physical Unhealthy Days Per Month	0.04*	-0.02*	-0.02*	-0.01*	0*	0	0.01*
Mental Unhealthy Days Per Month	-0.20*	0.03*	0.03*	0.04*	0.04*	0.03*	0.03*
Age	0.62*	-0.26*	-0.13*	-0.11*	-0.07*	-0.03*	-0.01*
Hispanic or Latino	-0.09	0.60*	-0.05	0.29*	-0.24*	-0.27*	-0.23*
Children Presence in Household	2.86*	-0.27*	-0.56*	-0.75*	-0.64*	-0.35*	-0.29*
Male	-12.98*	2.91*	2.61*	2.86*	2.20*	1.19*	1.21*
Income1: <$10,000	-1.35*	0.44*	0.06	0.23*	0.30*	0.14*	0.18*
income2: $10,000-$14,999	-0.83*	0.13	0.09	0.20*	0.21*	0.14*	0.07*
income3: $15,000-$19,999	-0.14	0.09	-0.04	-0.08	0.06	0.04	0.07*
income5: $25,000-$34,999	0.38*	-0.12	-0.19*	-0.04	-0.02	0.03	-0.04
income6: $35,000-$49,999	0	0	-0.14	0.01	0.07	0.10*	-0.05*
income7: $50,000-$74,999	-0.42*	0.18	-0.05	0.12	0.18*	0.09*	-0.09*
income8: >$75,000	-1.47*	0.64*	0.27*	0.22*	0.38*	0.14*	-0.17*
Widowed, Separated, Divorced	-4.87*	0.91*	0.99*	1.11*	0.91*	0.51*	0.43*
Never Married	-3.79*	0.06	0.72*	1.08*	1.06*	0.59*	0.28*
Unmarried Couple	-5.24*	1.14*	0.99*	1.37*	0.81*	0.47*	0.45*
High School and Below	-3.58*	0.72*	0.78*	0.96*	0.59*	0.25*	0.28*
College Graduate and Above	4.39*	-0.82*	-0.93*	-1.08*	-0.73*	-0.45*	-0.38*
Employed for Wages	-2.37*	0.60*	0.45*	0.64*	0.57*	0.08	0.04
Self-employed	-2.97*	0.43*	0.68*	0.71*	0.68*	0.25*	0.21*
Short-time Unemployed	-3.94*	0.72*	0.83*	0.86*	0.81*	0.31*	0.42*
Long-time Unemployed	-4.23*	0.67*	0.86*	1.10*	0.96*	0.41*	0.23*
Homemaker	0.49	-0.71*	-0.14	0.08	0.14	0.02	0.12*
Student	-0.21	-0.27	0.08	0.05	0.48*	0.05	-0.18*
Retired	-0.63*	-0.44*	0.13	0.18	0.45*	0.19*	0.12*

（The asterisk denotes significance at the 10% level.）

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