ESTIMATION OF INDIVIDUAL DEMAND FOR ALCOHOL: EVIDENCE FROM UKRAINE

by

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Abstract

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The paper focuses on the empirical estimation of the demand for alcohol from individual standpoint using the recent data of the Ukrainian Longitudinal Monitoring Survey (ULMS). More specifically, the paper examines the nature of the demand curve slope, structure of alcohol consumption by types of drinks, as well as evaluates the normality assumption of alcohol and drinking pattern in Ukraine. The analysis is performed in the context of rational addiction model developed by Becker and Murphy (1988). A Heckman two-stage procedure along with static and dynamic Tobit models on panel data were used to estimate the model. The obtained results are generally consistent both with economic intuition and findings of other papers on alcohol. Estimation results support our expectations on the classical decreasing demand curve. In addition, individual income and price on ethanol are found to be significant determinants of risk to be a drinker. Notably, this risk is more sensitive to price than to income. We received an empirical evidence that alcohol is a normal good as many other consumer goods. In addition, the paper can be considered as an argument in favor of the rational addiction model suggesting that Ukrainian consumers behave rationally in choosing addictive consumption.

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INTRODUCTION

"Whether a commodity conforms to the law of diminishing or increasing return, the increase in consumption arising from a fall in price is gradual; and, further, habits which have once grown up around the use of a commodity while its price is low are not so quickly abandoned when its price rises again."
Principles of Economics
Marshall, 1920

Since ancient times people were concerned about different views on alcohol, whether it is good or bad and how these approaches influence drinking decisions.

Alcohol cannot be treated like other ordinary commodities because of its specific properties that can cause severe negative consequences such as dependence, abuse, death, injury, personal violence (homicides and suicides), cancer, life expectancy, family disruption, depression, and loss of work productivity.

Alcohol abuse is one of the major causes of death and human disability all over the world (World Health Organization (WHO), 2004). The situation is aggravated by the fact that a wide range of social and health problems associated with drinking often affect other people around the drinker. In particular, women suffer from heavily drinking men to a great extent, thus facing numerous adverse consequences including home violence, reduced family budgets, and deficiency in men's support in day-to-day activity. Moreover, alcohol represents a leading risk factor for young people. It results in high rates of injuries, infringements, youthful criminal behavior, as well as poor academic performance. For instance, in Eastern Europe 41% of deaths among 15-29 year old were due to alcohol use. Given the fact that alcohol is of particular risk for young adults, government policies should primarily target the given population segment (World Bank, 2003).

The level of harm from alcohol is related to the pattern, level and structure of alcohol consumption in a country. In its turn, the level of alcohol consumption and alcohol dependency are determined by the number of factors like availability, personal income, retail process, government policies, such as taxation, regulation and restrictions on advertising and promotion, family history, education, as well as different individual factors, such as genetic, environmental, and psychological. (World Bank, 2003).

It goes without saying that the production of highly demanded alcoholic beverages is profitable, thus contributing to the increase in budget revenues. There are a number of studies that demonstrate a strict relationship between the volume of alcohol consumption and harm at the population level (Edwards et al., 1994; Babor et al., 2003). In its turn, the level of beverage use positively influences upon sales volumes and producers' profits. Therefore, the increased revenues are likely to be associated with the increased harm to the population. As a result, a conflict of interests appears, implying that alcohol policy has adverse implications for beverage sales. "Alcohol producers are engaged in a campaign to capture the hearts and minds of alcohol researchers and public health people, as part of a major effort to win the war of ideas that shapes alcohol policy at national and international level. They are driven by the imperative for sales and profits, which is often in fundamental conflict with the public health goal of reducing hazardous drinking and alcohol-related harm" (McCreanor et al., 2000). In the given framework, the primary goal of the public alcohol regulation policy has not only to be directed towards revenues maximization, but also to the minimization of harm from alcohol consumption. In particular, it should be emphasized that preventive measures have to be addressed mainly towards certain population groups (adolescents, women, hard drinkers), as well as to external manifestations (drinking in public places, drunk driving) (Sewel, 2002).

The most effective way to forestall the development of alcohol dependence and misuse, as well as to diminish the number of alcohol-related problems is to implement a set of measures directed to significantly reduce the level of alcohol consumption. This should constitute one of the major tasks of governments (Edwards et al., 1994). As it was shown by two prohibition campaigns in Russian history in XX century, a significant reduction of alcohol production leads to serious negative outcomes associated with the consumption of low-quality, mainly home-made, drinks (Andrienko and Nemtsov, 2005).

Government regulation has proven to be effective in the improvement of public health to a great extent. Policy measures comprise taxation, price increases, restrictions on strong drinks availability, limitation of beverage sales, min-age limits, as well as strict drink-driving legislation, and free equal access to treatment (World Bank, 2003). Public regulation and law enforcement are of great importance in the given context. Drink-driving conditions stipulate the maximum level for blood alcohol concentration for drivers. It is natural to assume that the more severe sanctions (loss of driving license, fines) are, the better drink-driving rules are respected. In addition, public education needs to play an informative role, spreading information regarding health risks and forming attitudes towards drinking by generating a "drinking" culture. Price increases, as a result of higher taxes on alcoholic beverages, are considered to be the most effective tool in reducing the demand for alcohol among youth. Moreover, the government

monopoly of retail sales and restrictions on hours and days of sale could bring positive results. Finally, better consumer information and bans on aggressive alcohol advertising and promotion tend to minimize the harm on population (Alcohol Research and Health, 2000).

In terms of economics, alcohol can be viewed as an ordinary consumer good. Given a limited amount of income, higher prices are expected to lead to lower alcohol consumption. Indeed, it was empirically estimated, that in developed countries the demand for alcohol is a decreasing function of price (Nelson, 1997; Leung And Phelps, 1993). However, in Russia the increase in price on alcoholic beverages results ultimately in the substitution of illegal, primarily home-made, alcohol for legal drinks (Andrienko and Nemtsov, 2005).

It is reasonable to assume that the growth of personal income may lead to higher availability of alcohol beverages, as well as to greater consumption of high-quality spirits. Therefore, the consumption of one type of drink can be higher with increase in income, but lower for other type of drinks. Due to the fact that rich people spend a higher proportion of their income on alcohol beverages, alcohol can also be treated as a luxury good.

In addition, the estimation of demand for alcohol is interesting because of another distinctive feature of alcohol that is a bias towards habit formation. This means that a demand for alcohol is likely to be stable for certain group of people, regardless of changes in price and income. Moreover, most psychologists and sociologists claim that alcohol possesses the so-called "communicative dope". It was proven that a greater part of teenagers uses strong drinks for a first time in a society where all people around drink in order to be more sociable and communicative (Grossman et al., 1998).

The view of alcohol as beneficent is as old as the idea that alcohol produces harm. Christian religion interprets wine as a gift and uses it in their sacraments. The Greeks considered wine as a boon. Since ancient times till nowadays, many people value wine and other beverages for their ritualistic and celebratory benefits. Moreover, drinkers all over the world claim alcohol to be a positive experience. At the same time, alcohol use brings numerous health benefits. Moderate alcohol consumption protects against coronary heart disease (CHD) and raises the haemoglobin level in blood. Therefore, the extent of alcohol goodness depends on the style of alcohol use. It is extremely important for each individual to develop skills to manage its own alcohol consumption (Peele and Grant, 1999).

The actuality of the given topic arises also from the fact that Ukraine is among the worst performers with regard to high mortality rates and accidents related to

alcohol misuse. The suicide rate in Ukraine is extremely high, amounting to 46.0 deaths per 100,000 population (or 11 806 persons in the whole male population) for men and 7.6 deaths per 100,000 population (equivalently, 2 646 persons out of total female population) for women in 1999. This represents the forth highest rate after Russian Federation, USA and Japan. Furthermore, the Ukrainian rate of mortality caused by homicide constitutes 17.8 per 100,000 population (4 421 persons) for men and 6.1 per 100,000 population (1 839 persons) for women, thus positioning Ukraine to the seventh highest place among 74 countries (WHO, 2002). The statistical reviews also demonstrate that nowadays labor force in Ukraine is gradually decreasing, leading to questioning of government policies and future sustainable economic growth. According to the State Statistics Committee of Ukraine, economically active population aged 15-70 years constitutes 22 202.4 th. pers. in 2004 as compared to the total population amounting to 47 318.9 as of December 1, 2004. Moreover, the amount of active population declines by 31.1 th. pers. as compared to year 2003. In addition, healthy life expectancy in Ukraine for women is 63.6 years and for men – 54.9 years (WHO, 2002). This is one of the widest sex gaps in the world. One possible rational explanation is a persistent male alcohol abuse that leads to high rates of injuries, poisoning, accidents, and violence. Hence, it should be acknowledged that the most valuable asset is human capital and authorities have to make it work efficiently. It is worth strengthening that the government is able to regulate the alcohol consumption, especially by vulnerable groups, thus improving the public health in a great degree (WHO, 2004).

At present the availability of strong drinks is not restricted. The market is a competitive one. There is no strict control of retail sale and beverages production. However, a beverage-specific license on wine and spirits is required. Ukraine has age limits (18 years) for buying wine, spirits, and beer. On the contrary, Armenia, Kazakhstan and Kyrgyzstan have no age limitation, whereas the Republic of Moldova has no age limit only on beer purchasing. In addition, in Ukraine the maximum level of alcohol blood concentration is not defined in the legislation. It is assumed to be 0.0 per mille (see Appendix 1).

As a result, a natural question arises: what forces drive the alcohol consumption? What determines its pattern and level in Ukraine? We are going to tackle the given issue from micro-level perspective. Thus, our interest focuses on the estimation of individual demand for alcohol in Ukraine. In this project we analyze rational addictive behavior of individuals by considering static and dynamic economic models.

The purpose of the paper is to investigate the nature of the demand curve slope, whether it exhibits a classical negative slope or has its own peculiarities.

Moreover, we are interested in estimating alcohol consumption viewing it as a normal good. In particular, whether individual demand for alcohol increases with rise in income.

It is quite within reason to assume that individual demand depends on economic characteristics (household income, prices on different types of strong drinks), as well as on individual characteristics such as age and gender.

For empirical investigation of the demand curve slope we explore individual data from Ukrainian Longitudinal Monitoring Survey (ULMS). This is a household-based survey that comprises complete labor market history from December 1997 till year 2004. The given survey constitutes a representative sample of the Ukrainian population aged between 15 and 72 years old. It includes 6959 individuals. Two types of questionnaires were examined: individual and household. We explore data on household income and expenditures, as well as individual data like age, gender, household preferences, and their consumption of addictive goods (cigarettes and different types of alcohol beverages).

The empirical part of our project is based on the traditional economic model of rational addictive behavior. We estimate separately the participation and consumption decisions of individuals. Independent variables in the model are average individual income, average prices for different types of alcoholic drinks, sugar, and tobacco, as well as other individual characteristics like age and gender. Due to a large number of censored (zero) observations, we use Tobit model to estimate both static and dynamic demand equations.

The present paper is organized as follows. Chapter 1 presents a brief overview of literature engaged in estimating population addictive behavior. In Chapter 2 theoretical models of alcohol consumption are examined. Chapter 3 concerns the methodology and data description. Finally, Chapter 4 discusses empirical results and implications.

Chapter 1

LITERATURE REVIEW

At present, economic research frames the problem of rational addiction in terms of better understanding of alcohol consumption and the prevention and treatement of alcohol-related problems.

When perusing the literature, one can find that researchers focus primarily on the two most popular addicitve goods – alcohol and tobacco. They are treated as similar normal goods due to their common specific properties and negative consequences for public health. However, the volume of literature dedicated to alcohol consumption is significantly low as compared to that of cigarettes use.

Economic analysis of the given field has produced substantial insights in recent years. Alcohol reseach comprises a broad sphere of studies, including consumer behavior and efficiency estimation of government alcohol control policies. In particular, economic researchers analyze the effects of beverage taxation and price changes on individual alcohol consumption and on the aggregate level of harm associated with strong drinks. Moreover, the relationship between alcohol taxes and traffic fatalities, as well as the analysis of costs and cost-effectiveness of alcoholism treatment have received a special attention. Other recent studies continue to investigate the economic costs of alcohol abuse, as well as to estimate the overall magnitude of the burden imposed by drinks misuse disease.

The bulk of research shows that alcohol problems are highly correlated with per capita consumption and the reduction in individual alcohol consumption leads to the decrease in social and health-related problems. These conclusions have received support from economic evidence such as Klingemann et al., (1993), Holder and Edwards (1995), and Babor (2002).

"Psychological studies of harmful addiction have introduced the three basic dimensions of addiction: gradual adaptation (tolerance); irreversibility (withdrawal) and positive effects of habits (reinforcement) that are now part of the formal economic models of addictive behavior. Tolerance means that a given level of consumption is less satisfying when past consumption has been greater. Withdrawal denotes the loss of satisfaction following consumption cessation. Finally, reinforcement means that greater current consumption of a good causes its future consumption to rise." (Grossman, 1995). Starting from the end of the 50ies, alcohol demand has begun to be characterized via the addictive nature of drinking.

To a larger extent, addictive behavior has attracted greater attention since the seminal contibution of Becker and Murphy (1988). They have shown that addiction can be characterized by the pattern and level of past and future consumption of such goods like alcohol, tobacco, and drugs. The Becker and Murphy theory of the demand for addictive goods states that future consumption of alcohol is determined by its current use. Moreover, factors that are expected to influence future demand have an impact over current alcohol consumption. That is why long-term demand for addictive goods is more price sensitive than short-term demand (Grossman et al., 1998). "A rational addictive consumer is supposed to maximize over the life cycle a stable utility function and to be fully aware of the future consequences of his or her addiction and chooses to be an addicted because he or she evaluates the benefits of addiction to be greater than its full costs. It follows that public policy should not interfere with such fully rational behavior. However, the additional public health care costs smokers (drinkers) impose on non-smokers (non-drinkers) could be internalised using price mechanisms, as the long-run price elasticity of demand is supposed to be significantly higher than the short-run one and higher than elasticities obtained from the myopic model of addiction, for instance." (Tiezzi, 2003).

A large body of research strengthens the importance of economic analysis with regard to alcohol consumption (Chaloupka (1993), Leung and Phelps (1993), Kenkel and Manning (1996), Chaloupka (1998), and Cook & Moore (1999)). The economic model of consumer behavior suggests that the law of demand holds for alcohol beverages. This means that like for other consumer goods, the consumption of alcohol falls when prices rise. Also, economic research shows that different types of beverages (beer, wine, spirits) exhibit a negative slope of demand curve and an increase in price on one type of drink results in an inevitable decrease in overall consumption of alcohol and fewer drinking-related problems. These results require a special attention due to the fact that excise taxes and other public policies, directed towards higher prices, can affect the demand for alcohol. Thus, taking into consideration negative consequences of alcohol misuse for the public health and economy as a whole, the obtained results acquire vital importance for studing the consumers' reaction to rises in beverages' prices.

More frequently economists are interested in the magnitude of consumer reaction to price or tax changes. Therefore, the estimation of price elasticity of alcohol consumption requires a special attention. Following the paper by Leung and Phelps (1993), the demand for beer is less price sensitive than the demand for other types of beverages. The authors reported that 1-percent increase in price resulted in fall of demand for beer of 0.3 percent, 1 percent for wine, and 1.5 percent for spirits.

Given the fact that higher alcoholic beverage prices and taxes result in less drinking, the proportion of heavy drinkers decreases. However, there are differences in price changes effects for different groups of population (Cook and Moore, 1999). It is hard to estimate precisely the price elasticity for heavy drinkers and abusing people because they seem to be less sensitive to price changes. The only driving force is drinking habit and addiction to alcohol. That is why, as prices increase, they keep to consume strong beverages on the same level by substituting high-quality drinks for lower-quality ones. However, speaking about young people, this may not be the case because youth is not yet addicted to alcohol and they may change their behavior in response to price changes. The given issue is addressed in a number of papers that use individual-level data to focus on alcohol demand among young adults, who are considered to be at particularly high risk in terms of alcohol-related problems. Using data from the national Monitoring the Future (MTF) Study, Grossman and his colleagues suggest that higher prices on strong beverages lead to the reduction of alcohol consumption among youth, constituting an effective public policy for diminishing the number of social and health problems from drinking (Grossman et al., 1998). The given result is based on the assumption of rational addictive behavior of consumers, that takes into account the intertemporal consumption choices and controls for social effects such as "stocks of habits" and "communicative dopes". The Becker and Murphy theory of the demand for addictive goods states that future consumption of alcohol is determined by its current use. Moreover, factors that are expected to influence future demand have an impact over current alcohol consumption. That is why long-term demand for addictive goods is more price sensitive than short-run demand does (Grossman et al., 1998). The given result is based on the assumption of rational addictive behavior of consumers that takes into account the intertemporal consumption choices and controls for social effects such as "stocks of habits" and "communicative dopes". At the same time, another study by Dee (1999) demonstrates a lack of consistency with previously performed analysis. The author applied the same set of data from the MTF Study and examined the effects of minimum legal drinking laws and beer taxes on teenagers. He concluded that beer tax rates had no significant result on teen drinking. However, raising the legal drinking age above 18 years brings positive results in reducing the alcohol consumption among youth.

In addition to investigating price elasticity of addictive goods, a number of studies pointed out the "non-linear relation between alcohol consumption and income" (Andrienko and Nemtsov, 2005). In this context, Petry (2000) identified the importance of income to understand the participation and purchasing decisions of abusing population. The author emphasized that demand for alcohol was income elastic among alcohol abusers. He provided evidence to demonstrate that the number of purchases would rise along with an increase in income.

It is quite within reason to suggest that not only the level of individual alcohol consumption matters, but also the pattern and consumption composition, namely frequency, dose, and types of beverages. The paper of Bobak et al.. (2004) identified the importance of drinking patterns that contribute to different rates of alcohol-related problems at national level. Bobak and his colleagues examined alcohol behavior in one Russian, one Polish, and one Czech city and came to conclusion that in order to reduce the number of alcohol-related problems, it is important to trace both drinking volumes in a country and drinking patterns (dose and frequency) while carrying out alcohol policy. The authors demonstrated that the highest drinking frequency was observed in Czecks and the lowest – in Russians. However, Russian men used to consume the highest alcohol dose per occasion on average. In addition, negative outcomes associated with drinking were most common also for Russians. Russian men and women showed the highest index of drinking problems per litre of alcohol consumed. This can be explained by the fact that in developed countries people usually consume weak drinks, beer, and wine, while in Russia a binge drinking, as well as strong drinks and spirits are rather popular. The present facts let the authors to conclude that, for a given volume of alcohol consumption, drinking patterns in Russa are more harmful for the whole population than those in Poland and the Czech Republic. In the given framework, it is important to investigate individual demand for alcohol, including frequency, drinking dose (how much an individual consumes per occasion), and types of alcohol beverages. The purpose of present paper is to revisit this issue using a panel of households from Ukraine.

Nowadays, alcohol control policy is considered to be an effective tool for improving public health via minimization of alcohol-related problems. Moreover, decision-makers are now better equiped with precise estimates and a great number of available scientific evidence in order to make "informed public policy choices" (World Health Organization).

It is worth noting that during the last years a great attention was allocated to state regulation of addictive goods market. In many countries the issue of alcohol consumption involves government intervention, thus becoming a politically tinted problem. This is the case for Russia, that has been experiencing the increase in alcohol consumption since 1999, whereas prices remain relatively stable (Andrienko and Nemtsov, 2005).

There are several ways for government policies to influence price levels. One way is to impose excise taxes on alcohol drinks. This implies that a tax is set on the amount of purchased beverages. Due to the fact that relatively little attention was paid to the mechanism of distribution of higher excise taxes burden among consumers and firms, the precise effect upon prices is still ambiguous. For instance, the government can influence the price level by exercising a full control

over retail sale and production. In particular, several states in the USA have a monopoly power over sales of alcohol drinks, thus enabling them to control prices. However, Nelson (1990) claims that the overall level of prices set by monopolists in a number of american states was the same or tiny higher as compared to other states. Unlike the US, Ukraine has no monopoly on production and sales of strong beverages. But it does require a licence for both production and sale. In addition, privatization sometimes leads to the decrease in alcohol prices (MacDonald, 1986).

According to Godfrey and Maynard (1995), alcohol-related startegies can be divided into three main groups:

- population-based policies (aim at reducing the alcohol level of the whole population through different economic instruments);
- problem-directed policies (tackle specific problems associated with excess drinking, such as drunk driving, drinking at working places, etc.);
- direct interventions (target individual drinkers).

In the monograph Alcohol Policy and the Public Good (Edwards et al., 1994), Edwards argue that public alcohol policy should constitute one of the major tasks for governments and has to be directed primarily to ethanol use minimization. The authors strenghen the importance of a wide range of health policies including price setting, beverage availability, public education, age restrictions, primary health, and drink-driving legislation. In addition, they support the idea that in order for an alcohol policy to be efficient, it should incorporate a set of measures to form a policy "mix". A policy mix that combines taxation, state regulation of alcohol beverages supply, and invests particularly in treatment, primary care, advertising limitations and public awareness campaigns, proved to be effective in bringing improvements in public health. Therefore, policy-makers need to be involved in finding the optimal combination of policies to reduce all alcohol-related problems. Moreover, alcohol strategies require public support, that is they should be transparent and publicly available. Thus, in order to achieve success in reducing the level of alcohol consumption, governments are recommended to communicate their decisions to the whole public.

The achievement of an optimal level of strong beverages consumption presents a true dilemma that needs state intervention. It is very difficult task to implement involving cost-benefit comparative analysis from the society and producers' stand points. On the one side, heavy alcohol use leads to long-term health-related negative outcomes that adversely affect the whole public and, on the other side, is very profitable for beverages producers who tend to maximize profits, thus stimulating budget revenues collection. Therefore, the role of government is to find an optimal combination between alcohol-related harm and funds collection.

Recently several researches on alcohol problems were performed in Ukraine. They were aimed at estimating the epidemiology of heavy alcohol use and alcohol disorders in Ukraine. The given studies used data from the World Mental Health survey and were primarily directed towards providing valuable advice in order to improve Ukrainian health system and develop pragmatic efficient health policies. The "Epidemiology of Heavy Alcohol Use in Ukraine: Findings from the World Mental Health Survey" reported that the highest rates of heavy alcohol use were identified among men who were middle-aged (26-54 years), fathers of a young child, had low education, and were unemployed. In particular, 38.7% men and 8.5% women suffered from alcohol abuse during the reporting period of 12 months. Highly significant risk factors of becoming a heavy drinker were discovered for both sexes who were living in the Southeast region of Ukraine.

Against this background, WHO statistics provide a strong evidence on the fast-growing mortality rates of middle-aged people, in particular 30-44 aged males. Whereas the mortality among children under 14 has decreased by 20% and among elderly population above 75 years has remained unchanged since 1987, the mortality rates for males aged between 30-44 has doubled and for females has augmented by 1.5 times. In addition, mortality caused by poisoning among 30-44 years old men increased by 2.15 times as compared to 1991. As might be expected, alcohol poisoning holds a major wieght (71% in 2002) in the overall level of poisoning. As regards mortality from direct alcohol poisoning, the growth constitutes 48% for middle-aged males (30-44 years old) during 1991-2002, that is 37% higher than for all other age groups of male population. In such a way, according to the Ukrainian State Statistics Committee, the level of mortality caused by alcohol poisoning is growing much faster than the overall mortality from other factors.

It is possible to conclude that economic research on alcohol consumption facilitates addictive behavior understanding, as well as provides policy-makers with concrete evidence in order to help public policies to be efficient in achieving the desired goals.

Chapter 2

THEORETICAL FRAMEWORK

An issue of addiction can be viewed in the light of different standpoints: psychologic, sociologic, medical, etc. No need to say that a better knowledge of the economic interactions among variables responsible for demand would be a corner-stone to understand particular behavior and market activities such as tobacco, alcohol and drug consumption.

Following Chaloupka and Warner (2000), economic models of addiction can be divided into three groups:

- Imperfectly rational models of addictive behavior;
- Models of myopic addiction, and
- Rational addiction models.

Imperfectly rational models assume stable but inconsistent short-run and long-run preferences.

In myopic addiction models individuals recognize the dependence of present addictive consumption on past consumption, but ignore the impact of current and past choices on future consumption decisions when making current choices. Many of these models treat preferences as endogenous, allowing tastes to change over time in response to past consumption (Gorman, 1967; Pollak, 1978; von Weizsacker, 1971).

The fundamental theoretical framework of rational addiction, however, was not documented until Becker and Murphy have recently, within the last two decades, introduced the economic interpretation to analyze the addiction phenomenon. Since the end of the eighties, the given model of rational addiction (Becker and Murphy, 1988) has proved to be a dominant approach to estimate addiction effects. In this model past and future consumption play a primary role in revealing the addictive behavior of individuals. Thus, rationality implies that individuals incorporate the interdependence between past, present, and future consumption into their utility maximization process in order to adjust their intertemporal consumption path in an optimal way. Unlike in myopic models, rational agents do not ignore future implications when making current decisions.

First of all, we start with the description of myopic model of demand for addictive good presented by Cook and Moor (1995) and then proceed with the

common economic model of rational addiction of Becker and Murphy (1988) that presents the theoretical basis of our paper.

Under myopia assumption the individual's utility is a function of the addictive good past and present consumption and consumption of a composite good with unit price. Other exogeneous variables like education (years of schooling), age, income, marital status, employment status, price (past and future anticipation), and religious affiliation that determine the utility function are not considered here just for simplicity of model specification. The following utility maximization problem is solved:

$$\text{Max} \quad U_t = U(C_t, C_{t-1}, Y_t), \tag{1}$$

$$\text{s.t.} \quad P_t C_t + Y_t = I_t \quad \text{(budget constraint)}, \tag{2}$$

where U - utility, C_t - consumption of the addictive good at period t, Y_t - consumption of the composite good, P_t - price of the addictive good, and I_t - income level.

In addition, we assume quadratic utility function and constant marginal utility of income. By solving first-order conditions, the following econometric Euler equation is derived: [1]

$$C_t = c + \alpha C_{t-1} + \beta P_t + \gamma I_t + \varepsilon_t . \tag{3}$$

Under imposed assumption of quadratic utility function, the expected signs of coefficients are the following: $\alpha > 0$, $\beta < 0$, $\gamma > 0$.

"A myopic demand function for an addictive good follows a partial adjustment model where the lagged dependent variable represents a fixed propensity to addiction which is carried over from period to period and its coefficient can be interpreted as the speed of adjustment to the steady state level of consumption. In this case, following a price change, we would have an immediate response given by the impact multiplier, whereas the adjustment to the new steady state level of consumption will take place in more than one period. As a consequence, the long-run multiplier (or equilibrium multiplier) will be greater than the short-run one." (Tiezzi, 2003).

[1] For a derivation and interpretation of this equation as well as the implied restrictions on the coefficients, see Cook and Moor (1995).

Following the model of rational addiction (Becker and Murphy, 1988; Becker et al., 1994) rationality, as opposed to myopia, implies that agents foresee future consumption of addictive goods that is determined by past and present consumption choices. Rational consumers maximize their utility from stable preferences as they try to anticipate the future consequences of their choices.

An important hypothesis of the model is that addictive consumption displays adjacent complementarity. This means that due to reinforcement, the quantities of the addictive good consumed in different time periods are complements. The basic "definition of addiction...is that a person is potentially addicted to a good if an increase in his curent consumption of that good increases his future consumption of the given good. This occurs if and only if his behavior displays adjacent complementarity...The degree of addiction is stronger when the complementarity in consumption is greater." (Becker and Murphy, 1988). Hence, an individual is addicted to a good only when past consumption of the good raises his or her marginal utility of present consumption.

The Becker model of addiction assumes a stable lifetime utility function over time, perfect foresight of future price changes, discrete time framework, discounting of the future at the market interest rate, instantaneous depreciation rate, constant rate of time preference, constant over time interest rate, and constant marginal utility of income (drinking has no influence on future earnings). In addition, we suppose that capital markets are perfect, past consumption of an addictive good affects current utility through a process of "learning by doing", as well as that earnings at time t are a concave function of the stock of consumption capital at t.

The consumer's problem is to maximize the sum of lifetime utilities discounted at rate r :

$$U = \sum_{t=1}^{\infty} \beta^{t-1} U(C_t, C_{t-1}, Y_t, \varepsilon_t), \qquad (4)$$

where $\beta = 1/(1+r)$ is discount factor, C_t is the quantity of addictive good consumed in period t, Y_t is the consumption of a composite commodity in period t and ε_t reflects the impact of unmeasured life-cycle variables on utility. Becker et al. (1994) take the composite commodity Y as the numeraire and the rate of interest is assumed to be equal to the rate of time preference.

This utility maximization is subject to the following constraints:

$$C_0 = C^0 \quad \text{and} \quad \sum_{t=1}^{\infty} \beta^{t-1}(P_t C_t + Y_t) = I^0 \quad \text{(budget constraint)}, \qquad (5)$$

where P_t is the price of addictive good at period t, C^0 is the initial condition indicating the level of consumption of addictive good at period zero. I^0 is the present value of income.

Assuming strongly concave quadratic utility function and solving the first-order conditions for C_t, the following linear first-difference equation is obtained: [2]

$$C_t = c + \alpha C_{t-1} + \delta C_{t+1} + \beta P_t + \gamma I_t + \varepsilon_t + \varepsilon_{t+1}, \qquad (6)$$

where current consumption of addictive good is a function of past and future consumption, P_t, I_t and the unobservable shift variables ε_t and ε_{t+1} reflect the impact of unmeasured life cycle variables.

Under assumption of strongly concave utility function the sign of coefficient β is negative. Parameters α and δ are positive in case of rational addiction. Thus, consumption path exhibits adjacent complementarity, that is consumption in past and present periods are complements as in present and future periods.

As a result, current consumption of an addictive good is inversely related to not only the current price of the good, but also to all past and future prices. Consequently, the long-run effect of a permanent change in price will exceed the short-run effect. In particular, the ratio of the long-run to short-run price effect rises as the degree of addiction rises.

"An important implication of the Becker and Murphy model (1988) is that long-run price elasticity of demand for an addictive good should be higher than that obtained from the myopic model, as a rational addicts takes also into account his future behavior when facing current prices for the addicitve good. This last point has very strong policy implications, because it means that legalization of drugs

[2] For a derivation and interpretation of this equation as well as the implied restrictions on the coefficients, see Becker, Grossman and Murphy (1994).

use, for instance, and the following price fall could cause a significant rise in the demand for those goods...Another implication of the rational addiction model is that announcements of future price changes could strongly affect the demand for addicitve goods, because smoking (drinking) in different years are assumed to be complements." (Tiezzi, 2003).

Becker et al. (1994) find that ε_t is serially correlated. Even if it is not correlated, ε_t affects utility and consumption in each period through econometric Euler equation (6). Therefore, C_{t-1} and C_{t+1} are treated as endogenous variables and lagged and lead prices are used as instruments for forecasting current consumption. Empirical equation (6) can also include other exogenous variables such as income, demographic characteristics of individuals, short and long distance smuggling indexes and taxes.

In principle, the choice between two models (myopic and rational) should be made based on a test of statistical significance of the coefficient on the lead consumption term and the plausibility of the implied discount rate.

Chapter 3

METHODOLOGY

While econometric theory provides estimation of rational and myopic models mostly on aggregate level data, the use of micro data is justified by numerous advantages presented hereafter. First of all, longitudinal data allows to increase the number of observations that leads to more precise estimates (lower standard errors). In addition, we add cross-sectional dimension by analyzing Ukrainian regions. Given the fact that some regions are richer than the other, as well as price level and population income differ, we decrease multicollinearity by allowing greater variability.

The presence of zero observations requires dealing with censored samples. Without dealing with censored nature of individual alcohol consumption data, estimated coefficients tend to be biased. Hence, the estimation of individual demand for alcohol is based on limited dependent variable models. Conventional regression methods require that the dependent variable be observed on a continuous scale. However, the existence of non-drinkers implies non-consumption of alcoholic beverages, thus leading to discontinuous dependent variable. Individual data on alcohol consumption is censored at zero. The given fact is explained by the double nature of zero outcomes: someone wants to drink alcohol but cannot afford it while another does not consume alcohol because he/she dislikes it.

The empirical part of estimating the demand for alcohol from an individual standpoint is based on the model on censored data with separate participation and consumption decisions. According to Haines et al. (1988), modeling food consumption decisions is a two-step process. "Ignoring the two-step nature of the decision process may hamper understanding of true behavioral patterns, lead to erroneous conclusions, and generate incorrect policy recommendations."

One way to deal with censored response model is double-hurdle approach. Double-hurdle method implies that the first hurdle is a participation decision and the second hurdle is a choice of non-zero consumption. In particular, Jones (1989) used this approach for cigarette consumption and Labeaga (1999) developed a panel version of the given model for estimation of smoking behavior.

In Labeaga (1999), a trivariate model with four equations is examined: start equation, quit equation, observed consumption, and consumption equation.

Similar to cigarette consumption, in case of alcohol we need to distinguish between real abstainers and rare drinkers. Therefore, there is no a guarantee that a rare drinker or abstainer who has zero alcohol consumption at present will not drink in the future. Thus, a quit equation does not play a substantial role while estimating drinking decision.

In the empirical part we employ an alternative method. Panel Tobit model on censored data is likely to be the most appropriate model for studying the consumption of alcoholic beverages. The estimation is performed based on a number of assumptions. First, we assume that participation decision is not as important as consumption decision and zeros are mostly generated by rare frequency of ethanol consumption. This follows from our main goal to stimulate moderate drinking and not to ban alcohol consumption completely. Hence, we focus our attention on drinking pattern rather than on making decision with respect to drinking behavior. Second, once a person has decided to consume alcoholic beverages, he/she knows the amount of a drink to be consumed. Hence, we suppose that a decision to consume is the same as a decision about how much to consume.

The empirical analysis of the model of addictive behavior will be as follows. First, Heckman two-equation model of alcohol demand is used:

$$D_i = X_i' \beta_1 + e_i, \tag{7}$$

$$C_i = H_i' \gamma_1 + u_i, \tag{8}$$

where D_i is a binary variable associated with being involved in drinking behavior, X_i is a vector of determinants of participation choice, C_i is alcohol consumption, H_i is a vector of variables that determine consumption, β_1 and γ_1 are the associated parameter vectors, and e_i and u_i are i.i.d error terms. The error terms are supposed to be correlated, formally

$$\begin{pmatrix} e_i \\ u_i \end{pmatrix} \text{ are NID } \left\{ \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_1^2 & \sigma_{12} \\ \sigma_{12} & 1 \end{pmatrix} \right\}, \quad \sigma_2^2 \text{ is normalized to 1.}$$

Following Heckman sample selection two-stage procedure, the expected consumption can be expressed as follows:

$$E(C_i \mid D_i > 0) = H_i'\gamma_1 + E(u_{1i} \mid e_{1i} > -X_i'\beta_1) = H_i'\gamma_1 + \theta_i\lambda_{1i},$$

where λ_{1i} is an inverse Mills ratio.

$\lambda_{1i} = \frac{\phi(X_i'\beta_1)}{\Phi(H_i'\gamma_1)}$, here $\phi(.)$ denotes density function of normal distribution and $\Phi(.)$ denotes cumulative density function of normal distribution, and

$\theta_i = \rho_{12}\sigma_1, \rho_2 = \frac{\sigma_2}{\sigma_1}$ is a correlation coefficient of e_i and u_i.

Then consumption equation can be represented in the following form:

$$E(C_i \mid D_i > 0) = H_i'\gamma_1 + \theta_1\lambda_i + \varepsilon_i. \quad (9)$$

Second, we estimate both static and dynamic models with autoregressive terms (lagged and lead), including correction for censoring bias. Dependent variable in consumption equation is daily average ethanol consumption that is equal to the frequency of alcohol consumption multiplied by the usual dose of ethanol for different types of drinks in one day. Independent variables are real income per head in a household, average prices for different types of alcoholic beverages, sugar, and tobacco, as well as other individual characteristics, such as gender, age, religious affiliation, health status, marital status, number of kids a person has, education, employment, level of life satisfaction, as well as region of living.

The first step in Heckman model is participation equation:

$$D_i = \alpha + \beta P_i + \gamma I_i + \lambda H_i + \theta CH_i + \varepsilon_i, \quad (10)$$

where D_i is dummy for participation decision.

Binary dependent variable is equal to 0 if a person never drank during the survey period and participated at least in one out of two survey waves and is equal to 1 if a person drank at least in one round. Participation equation is estimated by probit model on pooled cross-section data.

The second step in Heckman model is consumption equation:

$$C_i = \alpha + \beta P_i + \gamma I_i + Mills_i + \varepsilon_{i,} \qquad (11)$$

where $Mills_i$ is inverse Mills ratio obtained from the participation equation.

In order to reduce multicollinearity and standard errors, as well as to identify participation equation, we include two additional explicative variables H_i (health status) and CH_i (presence of a chronic disease) which are not in the consumption equation. The rationality of health variables in determining the choice to drink or not to drink lies in the fact that if a person evaluates his/her health as being a bad one along with a chronic disease being present, he/she is unlike to participate in drinking and, hence, to consume alcoholic beverages above a moderate level set to be 400 ml of ethanol (1000 ml of vodka equivalent) per week. Consumption equation is estimated by simple OLS regression with additional variable (inverse Mills ratio) that allows for correcting censoring bias.

Static model on panel data can also be estimated via Tobit model on censored data. Similarly, the list of independent variables includes average price, real income, individual characteristics, and Mills ratio for biased estimates correction:

$$C_{it} = \alpha + \beta P_{it} + \gamma I_{it} + \delta Mills_i + u + \varepsilon_{it}, \qquad (12)$$

where u is random effect.

In addition, we estimate dynamic model of alcohol consumption that includes one extra explicative variable (lagged consumption) – myopic addiction model:

$$C_{it} = \alpha + \eta C_{it-1} + \beta P_{it} + \gamma I_{it} + \delta Mills_i + u + \varepsilon_{it,} \qquad (13)$$

and both lagged and lead consumption – rational addiction model:

$$C_{it} = \alpha + \eta C_{it-1} + \tau C_{it+1} + \beta P_{it} + \gamma I_{it} + \delta Mills_i + u + \varepsilon_{it.} \qquad (14)$$

Chapter 4

EMPIRICAL PART

4.1 DATA DESCRIPTION

Our data on alcohol come from two major sources. The individual-level data and household information on real monetary income, employment, education, dose of alcohol intakes, consumption frequency are taken from the Ukrainian Longitudinal Monitoring Survey (ULMS) conducted by the Kyiv International Institute of Sociology in years 2003 and 2004. This presents a household-based survey aimed at estimating various economic, social, and health aspects of household activity. The survey comprises two questionnaires: individual and household that allow us to explore a dynamics of a wide range of socio-economic indicators during two consecutive years in all regions of Ukraine. This is a representative sample of the Ukrainian population aged between 17 and 75 years old that covers more than 8000 individuals and more than 5000 households.

There is a series of drawbacks of ULMS data. As regards alcohol consumption levels, the given dataset is regarded to contain a problem of underreporting a drinking status. Individuals tend to understate their actual volume of consumption. The rational explanation of this phenomenon lies in the negative attitude towards drinking. In particular, the survey sample can be biased because it does not include cases of hard drinking as well as it excludes some groups of hard drinkers. This kind of people are either underrepresented or refused to participate in the survey.

In addition, reported individual data on frequency of alcohol consumption is stated for all types of drinks as a whole. However, intakes frequency varies for different types of beverages. It is quite within reason to assume that the marginal effect of being a drinker of hard drinks (vodka, home-made liquor) on frequency is higher than that of soft drinks (beer and wine). Moreover, if a person consumes several types of drinks, his/her total ethanol consumption is generally overestimated. Therefore, to be able to compare daily average ethanol consumption across individuals and time, we need to distinguish between drinking frequency for separate groups of drinks. Hereby, in order to avoid a problem of alcohol consumption underestimation/overestimation, we use usual dose of a certain drink as a dependent variable instead of incorporating daily average consumption (that is equal to the frequency times usual dose) of a particular beverage in our analysis.

Another shortcoming of our dataset is a lack of seasonality of reporting individuals drinking decisions. According to the available data, alcohol consumption seems to be time-invariant. However, the choice of the reference week matters a lot. People tend to consume more alcohol during holidays, vacations or family celebrations.

Further, data on price levels across regions are taken from the Ukrainian State Statistics Committee (Derzhkomstat). Due to the potential endogeneity problem associated with the calculation of prices from individual households consumption, we employ this alternative source of data on prices for different types of alcoholic beverages.

In addition, household questionnaire provides us with real monetary income received by the family during the month before the reference week. Individual data on usual consumption of various drinks (beer, dry wine, fortified wine, home-made liquor, and vodka) and frequency of intakes are presented in individual questionnaire. Given the availability of data on ethanol content in different alcoholic beverages, we are allowed to calculate daily average ethanol consumption for each drinker and usual dose of ethanol for each type of drink (see Appendix 2).

In order to understand how representative ULMS data by various alcohol attributes is, the general description of data is presented in Table 1 .

TABLE 1. GENERAL CHARACTERISTICS OF ULMS DATA ON ALCOHOL (for respondents above 15 years old)

Year	Total number of observations	Known alcohol status	Unknown alcohol status	Share of drinkers, %	Daily average volume of alcohol consumption per capita, ml of ethanol (drinkers only)	Annual average volume of alcohol consumption per capita, litres of ethanol a year (litres of vodka equivalent, drinkers only)
2003	8641	8628	13	50.22	16.00	5.84 (14.60)
2004	7175	7165	10	52.25	19.22	7.01 (17.54)

As it can be seen from the table, less than 1% of respondents (0.15% and 0.14% in 2003 and 2004 respectively) do not report their current drinking status. Alternatively, slightly above a half of respondents were drinkers. One fact to be mentioned is that the share of drinkers in the whole population has increased by 2.03% within 2 years of interest.

Table 2 presents a distribution of drinking status by gender in years 2003 and 2004. As might be expected, females dominate in our sample amounting to 58.37% of the whole number of permanent survey participants.

TABLE 2. DRINKING STATUS OF RESPONDENTS PARTICIPATED IN BOTH WAVES (YEARS 2003 AND 2004), %

	Males	**Females**	**Whole sample (only permanent drinkers participated in both rounds)**
Abstainers	16.02	39.21	29.55
Occasional drinkers*	21.96	28.69	25.89
Permanent drinkers**	62.02	32.10	44.56
Total	**100**	**100**	**100**
Never hard drinkers***	55.89	40.26	48.02
Occasional hard drinkers****	37.77	48.13	42.99
Permanent hard drinkers*****	2.84	2.39	2.62
Number of individuals	2891	4053	6944
Number of drinkers (occasional + permanent)	2428	2464	4892

Note: * - respondents reported drinking during the last 30 days not in every round.
** - respondents reported drinking during the last 30 days in every round.
*** - consumption is less than 400 ml of ethanol (1,000 ml of vodka) a week in both rounds.
**** - consumption is more than 400 ml of ethanol (1,000 ml of vodka) a week not in every round.
***** - consumption is more than 400 ml of ethanol (1,000 ml of vodka) a week in both rounds.

Table 2 provides interesting insights with respect to the structure of drinking behavior. Permanent drinkers among men occupy the largest share (62.02%) in the total number of suvey participants. On the contrary, women prefer to remain abstainers whose share accounts for 39.21% of the number of females participated in survey in both rounds. However, small variation in proportions of abstainers and drinkers among women should raise serious circumspection in terms of public health and negative consequences for future demographic situation in Ukraine. About 22% of males and 29% of females are reported to be occasional drinkers. The number of permanent drinkers among men is roughly twice higher as compared to the number of permanent drinkers among women.

One may also note that females hold a greater share among occasional hard drinkers (48.13%) against 37.77% for males.

In addition, in Appendix 4 we present a distribution of our sample by the volume of alcohol consumption in year 2004 separately for men and women. About 20% of drinking males consume 5-15 litles of ethanol (vodka equivalent) annually whilst about 47% of drinking females consume only 5 litres of ethanol (vodka equivalent) per year.

Not surprisingly, gender difference is also observed in the level of consumption differentiated by age groups (see Appendix 5). Maximum ethanol consumption is achieved at 40-49 years of age for males and 30-39 years of age for females. It is worth strengthening that drinking pattern of both genders is not characterized by abrupt changes for elderly population. People aged between 70-79 years consume about as much as young 20-29 aged people. This suggests a stable consumption during the whole life-time.

As regards frequency of drinking, a large gender difference is present as well (see Appendix 6). The ratio is 6:2 in favor of males. Along with a higher volume of drinking, an average man increases frequency by 30-39 years of age and then slowly decreases it. Taking into account the fact that the pick in alcohol consumption for males is reached by 40-49 years of age, this provides an evidence of an increasing dose of ethanol with age. The same holds for females. A gradual reduction in drinking frequency is observed after 29. However, the pick in consumption is achieved during 30-39 years of age mostly because of a higher dose of alcohol.

The structure of alcohol consumption by types of drinks and gender is presented in Table 3.

TABLE 3. DISTRIBUTION OF DRINKERS BY TYPES OF DRINKS, %

Year	Beer			Wine		
	male	*female*	*total*	*male*	*female*	*total*
2003	53.04	33.66	43.85	21.30	68.69	43.77
2004	62.62	36.33	50.70	17.78	64.40	38.92
	Home-made liquor			**Vodka**		
	male	*female*	*total*	*male*	*female*	*total*
2003	3.87	9.38	6.48	78.40	36.97	58.75
2004	2.37	7.13	4.53	77.23	39.08	59.94

It is possible to conclude that there is a considerable increase in beer consumers in Ukraine along with a pronounced decline in wine consumers. Consumption of vodka also displays a slight growth as compared to another hard drink – home-made-liquor – whose consumption registers a diminishing trend. However, one should be worried by the increasing share of female vodka consumers, whereas males prefer to change their preferences towards beer.

The next table demonstrates the distribution of ethanol consumption by types of drinks. Here we are interested in how much ethanol people consume given their beverages choices present. Not surprisingly, due to an increasing share of beer drinkers, their share in ethanol consumption also increases. The noteworthy exception is wine consumption. While share of wine consumers is gradually decreasing, they continue to consume a greater volume of ethanol. The growth constitutes 6.73% against a decline in the amount of wine drinkers by 4.85%. This provides an evidence of an increasing dose of wine. On the contrary, given a raising share of vodka drinkers (mostly female drinkers), the weight of ethanol from vodka consumption diminishes. A possible explanation is a decreasing dose that incorporates the fact that women drink lower doses of hard drinks.

TABLE 4. ALCOHOL CONSUMPTION BY TYPES OF DRINKS, %

Year	Beer	Wine[4]	Home-made liquor	Vodka
2003	13.71	32.22	22.34	31.73
2004	17.84	38.95	15.13	28.08

Furthermore, knowing the proportion of drinkers, their share by types of drinks, and ethanol consumption with respect to beverages (see Tables 1, 3, and 4), we proceed with calculation of the amount of alcohol consumed by an average drinker for each type of alcoholic drink during a year. Results are presented in Table 5.

TABLE 5. AVERAGE ETHANOL CONSUMPTION BY TYPES OF DRINKS, LITERS OF ETHANOL A YEAR (VODKA EQUIVALENT), drinkers only

Year	Beer	Wine	Home-made liquor	Vodka
2003	2.47 (6.18)	5.82 (14.54)	4.03 (10.08)	5.73 (14.32)
2004	3.69 (9.23)	8.06 (20.16)	3.13 (7.83)	5.81 (14.53)

[4] Hereafter under wine we mean combined dry wine and fortified wine.

As expected, consumers of hard beverages (vodka and home-made liquor) drink more ethanol. However, especially high volume of ethanol consumption is among wine drinkers.

Among independent variables in consumption equation we explore prices on different alcoholic drinks (vodka, beer, and wine). As an alternative price on home-made liquor we use price on sugar which is a main ingredient in its production. Data on price levels across regions are taken from the Ukrainian State Statistics Committee (Derzhkomstat). Moreover, we calculated an average price on ethanol for each individual using his structure of alcohol consumption and available prices on drinks.

In addition, individual income was calculated as total household expenditures in last 30 days divided by the number of household members. This information is available in ULMS database.

Table 6 presents a descriptive statistics with respect to average frequency and level of alcohol consumption, as well as individual income and price levels in 2003 and 2004.

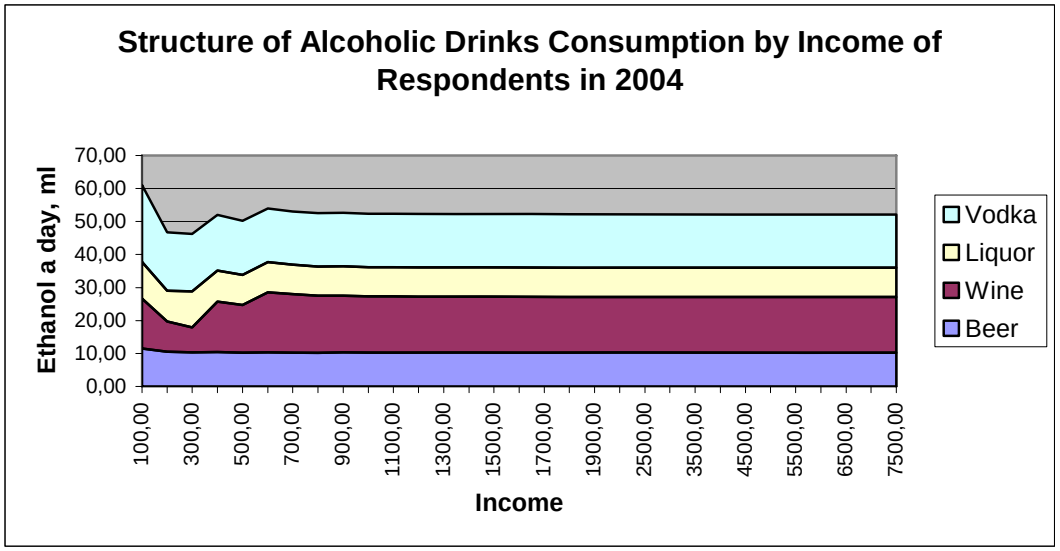
TABLE 6. DESCRIPTIVE STATISTICS

Year	Frequency, times per day	Ethanol consumption per capita, ml a day (vodka equivalent)	Income per capita, UAH	Price on vodka, UAH	Price on liquor, UAH	Price on wine, UAH	Price on beer, UAH	Price on sugar, UAH
2003	0.12	16.00 (40)	219.47	8.15	18.48	7.99	3.44	2.75
2004	0.14	19.22 (48.05)	317.15	8.82	19.77	8.32	3.62	3.02

By taking a brief glance at statistics, one may note that the volume of alcohol consumption in Ukraine is increasing along with a raising level of income. To demonstrate the relationship between income and level of consumption of different drinks, we plot Figure 1 with income on x-axis and daily average consumption on y-axis. Also, we display the number of daily intakes against individual income of respondents (see Appendix 7). Interestingly, frequency of alcohol consumption has the same distribution as consumption itself. The poorest part of population (income lower than 300 UAH) is characterized by maximum level of ethanol consumption with maximum frequency. However, we should stress the fact that the poorest group does not consume the most of alcohol because, according to ULMS data, there are less drinkers among poor. The number of drinkers among people with income lower than 300 UAH accounts for 2027, whilst non-drinkers amount to 2130 persons. Also, we suppose that hard drinkers, who are mostly poor, are underrepresented in ULMS.

Moreover, our sample is biased towards poor people. Therefore, the resulting tendency might be overrepresented. As regards consumption of various types of drinks, there is no clear relationship between beer consumption and income level. This supports the idea that beer is the most democratic drink affordable to anyone. In contrast, consumption of wine is higher with income.

FIGURE 1.



4.2 EMPIRICAL RESULTS

This section presents the results of empirical estimation of the effect of core variables, namely price of ethanol and income, as well as numerous individual characteristics on the level of alcohol consumption from individual perspective.

In order to estimate the specified models, we start the empirical part with participation equation estimation in the framework of Heckman two-stage procedure. The main question of interest here is to study determinants that influence the decision to be a drinker. Furthermore, we continue with consumption equation estimation exploring information obtained from participation equation. In particular, inverse Mills ratio is calculated for every individual and added as an explicative variable in consumption equation. Afterwards we proceed with static consumption equation estimated on panel data using Tobit model. In addition, two dynamic models of addiction, myopic and rational, are examined via Tobit model on panel data. Finally, we conclude our empirical part with estimation of static consumption equations on different subsamples.

Being guided by the fact that human organism generates alcohol in small doses and alcohol is found to be present in medicaments and food, we assign a minimal volume of ethanol consumption to be equal to 0.1 ml a day for each non-drinker. This allows us to estimate our model on the entire sample. Moreover, the given minimal volume of ethanol is treated as treshhold meaning that all data equal or below this level are assumed to be censored. The same procedure is applied to usual dose which is a dependent variable in regressions for particular types of drinks. In addition, minimum frequency of ethanol intakes is assumed to be 0.01 times a day.

4.2.1 HECKMAN TWO-STAGE PROCEDURE ESTIMATION

To estimate participation equation, we use normal probability model for binary choice dependent variable (probit). The equation is specified as follows. The probability of being a drinker is expected to be influenced by a dummy variable for a drinker among the rest of household members, individual income, price on ethanol, age, gender, employment status, smoke dummy, availability of chronic disease, health status (very good is a base), marriage (separated is a base), number of kids a person has (7 kids is a base), educational level (other education is a base), religious affiliation (Krishnaism is a base), degree of life satisfaction (fully satisfied is a base), as well as settlement type (small town as a base), and region of residence (Volynskaya oblast is a base).

The coefficients of the probit model do not show the change in the probability of the dependent variable being equal to one due to a unit change in the relevant explanatory variable. This probability is given by the marginal effect of the explanatory variable.[5] The estimated marginal effects for the probit model are reported in Appendix 8. In the regressions' results, a positive (negative) sign means that a variable increases (decreases) the probability of being a drinker.

Having estimated the participation equation as a first step in Heckman model, the correlation between error terms is checked (ρ_{12} is significantly different from zero), hence, inverse Mills ratio can be calculated for each individual in our sample. As a second step we analyze average consumption equation. Among all relevant variables that determine the level of ethanol consumption are a dummy variable for a drinker among the rest of household members, individual income, price on ethanol, age, gender, employment status, smoke dummy, marriage (separated is a base), number of kids a person has (7 kids is a base), educational level (other education is a base), religious affiliation (Krishnaism is a base), degree of life satisfaction (fully satisfied is a base), inverse Mills ratio, as well as settlement type (small town as a base), and region of residence (Volynskaya oblast is a base). The estimation results are shown in Appendix 6. In the last two columns of the table we present results of regressions with prices on types of alcoholic drinks.

In general, results are in line with our expectations and are consistent with theory. Dummy for a drinker among the rest of household members is statistically different from zero and has expected sign. The risk to become a drinker, as well as to consume more alcohol is higher for a person who lives in household that has a drinker.

Price on ethanol and income are found to be significant determinants of risk to be a drinker. However, this risk is more sensitive to price than to income since the magnitude of price elasticity is higher. At the same time, the level of income an individual earns has no influence upon the volume of alcohol consumption. Instead, it negatively depends on the price on ethanol suggesting that as long as price increases, the volume of ethanol consumed by individuals will decrease. This supports our expectations on the negative slope of demand curve. Prices on different types of drinks are only marginally significant and price on sugar negatively affects the probability to be a drinker and consumption.

Obtained coefficients for other variables indicate that age has significant negative impact both on the risk to become a drinker and level of consumption. Also, a negative sigh for employment dummy suggests that the risk is lower for an

[5] Marginal effect is a partial derivative of the expression for prob(y=1) with respect to the factor.

individual who does not work. A plausible explanation could lie in fact that income is an important decisive factor and as long as a person does not have a job to earn his/her living, he/she is less likely to become a drinker and spend money on alcoholic beverages.

Moreover, the risk is exaggerated by the smoking behavior of individuals and the availability of chronic diseases. In gerenal, if a person evaluates his/her health as being a good or an average one, he/she is supposed to the risk to be a drinker to a larger extent. However, if a person is not married (single), the opposite is true.

In addition to Heckman model on the whole sample, we examine both participation and consumption equations separately for men and women. Estimation results are reported in Appendix 9. Not surprisingly, males and females are supposed to a higher risk to become a drinker in the presence of a drinker in a household. And this risk is more than 3 times higher for women than for men. Unlike males, females evaluate income as a significant determinant of risk and alcohol consumption. However, due to a higher magnitude, price on ethanol plays a major role in determining the volume of consumption.

The age of males has a significant positive impact on the probability of being a drinker, whereas the age of females negatively influences this probability. Therefore, we expect the older a man is, the more likely for him is to become a drinker. In case of females, the situation is reversed.

Another finding of our estimation is that men appreciate their health status as a serious determinant of risk to be a drinker. If their health is evaluated as a good one, then men are supposed to a higher risk. At the same time, if health is a bad one, the given risk is diminished. As regards women, health variables turn to be insignificant.

Inverse Mills ratio is inversely related to the probability of being a drinker by its construction. Hence, a negative sign of Mills ratio indicates that individuals who have higher probability to be a drinker consume more. From the obtained results we can notice that Mills ratio coefficient is higher for females suggesting a lower probability for women to become drinkers.

4.2.2 ESTIMATION OF A TOTAL DEMAND FOR ETHANOL

Estimation of a total demand for alcohol is performed on panel data via Tobit model on censored data. We start with a static demand equation (12) estimated on a set of independent viables: individual income, price on ethanol, price on types of drinks, age, gender, employment status, smoke dummy, availability of

chronic disease dummy, health status (very good is a base), marriage (separated is a base), number of kids a person has (7 kids is a base), educational level (other education is a base), religious affiliation (Krishnaism is a base), degree of life satisfaction (fully satisfied is a base), as well as settlement type (small town as a base), and region of residence (Volynskaya oblast is a base). Descriptive statistics of variables used in demand models on panel data is reflected in Appendix 10.

All empirical results obtained in Tobit regression analysis are presented in Appendix 11. We use total alcohol consumption in millilitres of ethanol as a dependent variable, as well as frequency of consumption (number of intakes in last 30 days divided by 30, varying between 0 and 1) and usual dose of ethanol.

Obtained results reveal that both income and price elasticities of ethanol consumption, including prices on particular types of drinks, are insignificant determinants of frequency, usual dose, and, as a consequence, alcohol consumption. Only price on sugar has a significantly negative impact on dependent variables. As long as price on sugar rises, frequency of alcohol intakes, as well as usual dose and total demand diminish.

Concerning other coefficients in demand equations, we find that females consume less ethanol along with a decreased dose and rare drinking frequency. Also, smoking behavior stimulates drinking leading to a higher demand for alcohol. Moreover, health status of individuals results in a gradually decreasing demand meaning that if a person cares about his/her health, he/she will decrease usual dose and frequency, and, as a result, volume of ethanol consumption. In addition, we got an evidence that married, widowed, and divorced people consume less alcohol as opposed to non-married people. Level of education and place of living are not significant in all regressions.

4.2.3 ESTIMATION OF DEMAND FOR A PARTICULAR TYPE OF DRINK

Having estimated a total demand for alcohol, we analyze demand for each type of alcoholic beverage separately. Results of static Tobit models for usual dose of vodka, beer, wine, and home-made spirits are presented in Appendix 12.

Unlike total ethanol consumption, consumption of beer and wine are increasing with income. At the same time, income has no impact upon vodka and home-made spirits consumption. The latter are statistically negatively influenced by price on sugar. Given the fact that sugar presents a main ingredient in moonshine production, higher price on sugar results in lower consumption of this, usually

low-quality, drink. The given conclusion is of crucial importance for public policy aimed at improving the level of public health.

Prices on different alcoholic drinks are only marginally significant. Estimation results bear a strong evidence on the classical decreasing demand curve for beer, since its consumption falls with its own price. Price elasticity for beer consumption constitutes -9.131. Notably, the value of this estimate is much higher than own-price elasticity for beer in developed countries. For instance, in Finland price elasticity of beer consumption is -0.6; in Canada - -0.28; and in the USA - -0.09.

No less important finding is that there is a substitution effect between wine and beer. When price on wine is higher, demand for beer is higher with cross-price elasticity equal to 6.007 for beer. Surprisingly, if we consider price on beer elasticity of demand (for wine), it turns to be -3.366, meaning that demand for wine falls with higher price on beer. Therefore, beer and wine seem to be complementary goods. As a result, we conclude that wine consumers change their preferences towards beer consumption in case of a growing price on wine. However, beer drinkers do not prefer switching to another types of drinks. Hereby, they lower their consumption of both beverages (beer and wine) as long as price on beer increases.

As might be expected, estimation results provide an evidence of gender difference in alcohol consumption. Frequency, dose of vodka, dose of beer, and overall level of consumption are lower for females as compared to males, except to wine that is considered to be the most popular drink among women.

Finally, we identify a slowly decreasing demand for beer with age. This suggests that beer is mostly consumed by young people – quite intuitive result. In addition, it is observed that married, widowed, and divorced people consume less vodka and beer as opposed to non-married people who consume less home-made spirits. Level of education, number of children, and place of living are not significant in all regressions.

4.2.4 MYOPIC AND RATIONAL ADDICTION MODELS

The main question of interest in this section is to test whether alcohol consumption follows myopic or rational addiction model in Ukraine. For this purpose we need to estimate dynamic Tobit models. Results of regressions (13 and 14) are reported in Appendix 13.

Being constrained by insufficient time periods (only two years), we test our hypotheses exclusively for year 2003. Moreover, following the methodology of Becker et al. (1994), lagged and lead consumption variables were instrumented by past and future prices of different drinks in order to receive unbiased estimates.

Obtained results provide interesting insights for our analysis. Both models, myopic and rational, demonstrate a strong positive impact of individual income on alcohol consumption. As regards prices, lagged prices on vodka and beer, as well as lead prices on vodka and beer are significantly different from zero. These findings are in line with myopic model. At the same time, future prices on vodka and beer (year 2004) are also found to be statistically significant and different from zero. Therefore, we cannot reject the importance of past and future prices on current alcohol consumption. This conclusion supports our expectations with respect to rational addiction behavior of Ukrainians.

4.2.5 ESTIMATION OF A TOTAL DEMAND FOR ETHANOL ON SUBSAMPLES

On the last stage of our analysis we estimate static demand for ethanol on different subsamples.

First, we differentiate male consumers from female ones and study their alcohol consumptions separately. Results are presented in Appendix 14. In this case none of core variables (income and price) is significant. Only female demand is sensitive to price elasticity of sugar. In addition, smoking males are more likely to exhibit an increasing demand for alcohol. Unlike men, women appreciate their health status as a serious factor determining their volume of ethanol consumption. It is also observed that married and widowed males consume less alcohol. Level of life satisfaction, number of children, and place of living are not significant in all regressions.

Second, we divide our sample into 3 subsamples depending on the level of income individuals earn and estimate demand for ethanol separately on these groups (see Appendix 15). On the one hand, obtained results indicate high sensitivity of lower and middle income groups to income. On another hand, demand of a higher income group is not influenced by income at all. However, for a poor group income exercises a negative effect on total alcohol consumption, thus lowering it as long as income grows. A possible explanation could be as follows. Poor people are not rich enough to spend their limited amount of money on alcohol, instead they mainly prefer to satisfy their primary needs on food, clothes, shelter, etc. As soon as individuals become richer (middle income group),

they begin to spend money on alcohol, thus increasing their consumption of ethanol. This intuition is completely supported by received results.

With respect to prices, only the richest group is sensitive to price on vodka. Instead, the poorest group is adversely influenced by the price on sugar. This result is not a surprising one. It is believed that mostly poor people consume low-quality home-made liquor. Hence, sugar price growth can limit its production and reduce the consumption of ethanol.

Concerning other results in demand equations, we find that rich people in our sample decrease their consumption by 22.7% as they get older. Also, poor and rich women are characterized by a reduced demand. Poor smokers consume alcohol by 94.8% more than non-smokers.

Chapter 5

DISCUSSION AND CONCLUDING REMARKS

Using the recent data of the Ukrainian Longitudinal Monitoring Survey (ULMS), we have empirically studied the demand for alcohol from individual standpoint. More specifically, the paper examines the nature of the demand curve slope, structure of alcohol consumption by types of drinks, as well as evaluates the normality assumption of alcohol and drinking pattern in Ukraine. The study is based on the model of rational addiction developed by Becker and Murphy (1988). The given model allows empirical estimation of the consumption of an addictive good – alcohol. Moreover, it makes possible to distinguish between myopia and rationality. The latter implies that individuals foresee future consumption of an addictive good that is determined by past and present consumption choices.

It is important to mention that the model of rational addiction employed here is able to capture a number of interesting effect. The obtained results are generally consistent with findings of other papers on alcohol. More specifically, we have found an evidence that alcohol exhibits an ordinary negatively sloped demand as many other consumer goods. The raised price on ethanol leads to a reduction in the volume of ethanol consumption. This conclusion presents a great importance for public policy aimed at improving the level of population health.

Prices on different types of alcoholic drinks are only marginally significant. Estimation results support our expectation on the classical decreasing demand curve only for beer, suggesting that its consumption falls with its own price. Also, own-price elasticity for beer is found to be much higher than that for highly developed countries.

No less valuable result of my thesis is that there is a substitution effect between wine and beer. When price on wine is higher, demand for beer is higher with cross-price elasticity equal to 6.007 for beer. If we consider price on beer elasticity of demand (for wine), it turns to be -3.366, meaning that demand for wine falls with higher price on beer. Therefore, beer and wine seem to be complementary goods. A plausible story explaining this empirical result could be as follows. Wine consumers change their preferences towards beer consumption in case of a growing price on wine. However, beer drinkers do not prefer switching to another types of drinks. Hereby, they lower their consumption of both beverages (beer and wine) as long as price on beer increases.

Coming back to our theoretical prediction that income growth has a positive effect on demand, we have found that price on ethanol and individual income are significant determinants of risk to be a drinker and alcohol consumption. However, this risk is more sensitive to price than to income since the magnitude of price elasticity is higher. Also, price on ethanol plays a major role in determining the volume of consumption. As regards particular types of drinks, consumption of beer and wine are increasing with income. But income has no impact upon vodka and home-made spirits consumption. The latter are statistically negatively influenced by price on sugar.

As we have expected, the risk to become a drinker, as well as to consume more alcohol is higher for a person who lives in household that has a drinker. More specifically, this risk is 3 times higher for women than for men.

In addition, the paper can be considered as an argument in favor of the rational addiction model, as it provides empirical support: one of the main results of my thesis predicts that Ukrainian consumers behave rationally in choosing addictive consumption.

Finally, our findings do not fully support current changes that take place in the structure of ethanol consumption. For further research I would suggest separate estimation of participation decision for hard and soft drinks that may explain significantly growing number of beer consumers, as well as increased number of vodka drinkers. Also, area that merits further investigation is the impact of taxation and advertising limitations on consumption choices of individuals.

By inspection, the data provides interesting insights for our analysis. It suggests that the share of drinkers among the whole population is growing on a permanent basis. For instance, the growth in the number of people consuming alcohol constitutes 2.03 % during 2004. It is worth noting that the given growth is associated with an increasing volume of daily average consumption of ethanol. This very finding could have important implications per se. First of all, the level of per capita consumption is directly related to the incidence of social, economic, and health problems associated with excess drinking that adversely affect the whole public health in Ukraine. In addition, currently about 10% of all deaths are caused by accidents, poisoning, and traumas that are related to alcohol consumption to a great extent. Finally, direct alcohol poisoning is responsible for 1.4 % of overall mortality. Therefore, in order to solve the given problems, it is necessary to promote an efficient alcohol control policy seeking for stimulating a responsible drinking behavior via minimization of harm and maximization of benefits to society. For the case of Ukraine, the primary goal of the alcohol policy should be a reduction of alcoholic beverages consumption and drinking prevalence. Notably, we do not argue in favor of a complete ban of consumption,

since it cannot be fully enforced and supported by the general public to be an effective and sustainable policy.

Additional concerns raises the evidence on the increasing number of female drinkers. In particular, occasional hard drinkers among women constituted 48.13% as opposed to 37.77% among men in year 2004. The share of permanent drinkers among women (32.10%) also does not display promising results. Therefore, the government should primarily tackle the female part of population in order to minimize the public health burden of excess drinking. Against this background, alcohol taxation is considered to be one of the most effective tools allowing to reduce alcohol consumption. Changes in the level of taxes have a direct impact upon the level of prices on alcoholic beverages. The given tool is crucially important for Ukraine, where population, in particular women, is more sensitive to price changes, as it was shown in my thesis. Hence, price increases on alcoholic beverages via increases in excise taxes are likely to produce sound results in terms of reducing the average volume of ethanol consumption. A "gradual increase" scenario as opposed to one-time large increase in the tax rate is politically more easy to implement.

Needless to say, advertising is a powerful tool for promoting alcohol consumption in Ukraine. It is widely used by companies in order to affect current consumption and to establish long-run effects. That is why advertising ban is considered to be an effective measure to limit the alcohol use due to public considerations. Moreover, being an addictive good, alcohol current consumption depends on its past consumption. This suggests that demand for alcoholic drinks is even more sensitive to changes in the volume of advertising in the long-term perspective. Until now, Ukraine has enjoyed some restrictions on alcohol advertising. In particular, the advertising of wines and spirits on national radio and television is strongly prohibited. However, there is no ban on TV, radio, and billboards beer advertising. As many research papers suggest, partial restrictions on advertising are not effective in stimulating non-drinking behavior. Without enforcement of advertising and sponsorship restrictions alcohol consumption will tend to grow further due to increasing volume of advertising by the alcohol industry. The efficiency of alcohol advertising bans in terms of improving the level of public health was proven by recent World Health Organisation (WHO) studies. They suggest that complete ban of alcohol ads would reduce the alcohol consumption by 5%-8%. As a result, partial or complete restrictions on sports and youth events sponsorship activity will definitely improve public health by discounraging drinking behavior. Moreover, additional restrictions on beer advertising might also be useful to control the consumption of beverages and to diminish the growing number of beer drinkers.

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APPENDICES

Appendix 1. Alcohol policy in Ukraine

Ukraine		Beverage categories		
		Beer	Wine	Spirits
Control of retail sale and production	Monopoly on production of	.	NO	NO
	Monopoly on sales of	.	NO	NO
	Licence for production of	.	YES	YES
	Licence for sale of	.	YES	YES
Off-premise sales restrictions and level of enforcement	Hours of sale	NO	NO	NO
	Days of sale	NO	NO	NO
	Places of sale	NO	YES	YES
	Density of outlets	NO	NO	NO
	Level of enforcement	FULLY		
Age limit for purchasing alcoholic beverages	On-premise:	18	18	18
	Off-premise:	18	18	18
Taxation of alcoholic beverages	Sales TAX/VAT exists?	YES		
	% sales TAX/VAT	20		
	Tax as % of retail price	20	50	85
	Excise stamps exist?	YES		
Restrictions on advertising	National television	NO	BAN	BAN
	National radio	NO	BAN	BAN
	Print media	PARTIAL	PARTIAL	PARTIAL
	Billboards	NO	PARTIAL	PARTIAL
	Health warning on advertisements	YES		
	Enforcement of advertising and sponsorship restrictions	NO		
Restrictions on sponsorship of	Sports events	NO	NO	NO
	Youth events	NO	NO	NO
Restrictions on alcoholic beverage consumption in public domains	Health care establishments	BAN		
	Educational buildings	BAN		
	Government offices	PARTIALLY		
	Public transport	PARTIALLY		
	Parks, streets, etc.	PARTIALLY		
	Sporting events	PARTIALLY		
	Leisure events (concerts, etc.)	VOLUNTARY		
	Workplaces	BAN		
Definition of alcohol, BAC level and RBT	Definition of alcohol (vol. %)	3.0		
	Maximum Blood Alcohol Concentration (BAC) level [123]	NO		
	Use of Random Breath Testing (RBT)	SOMETIMES		

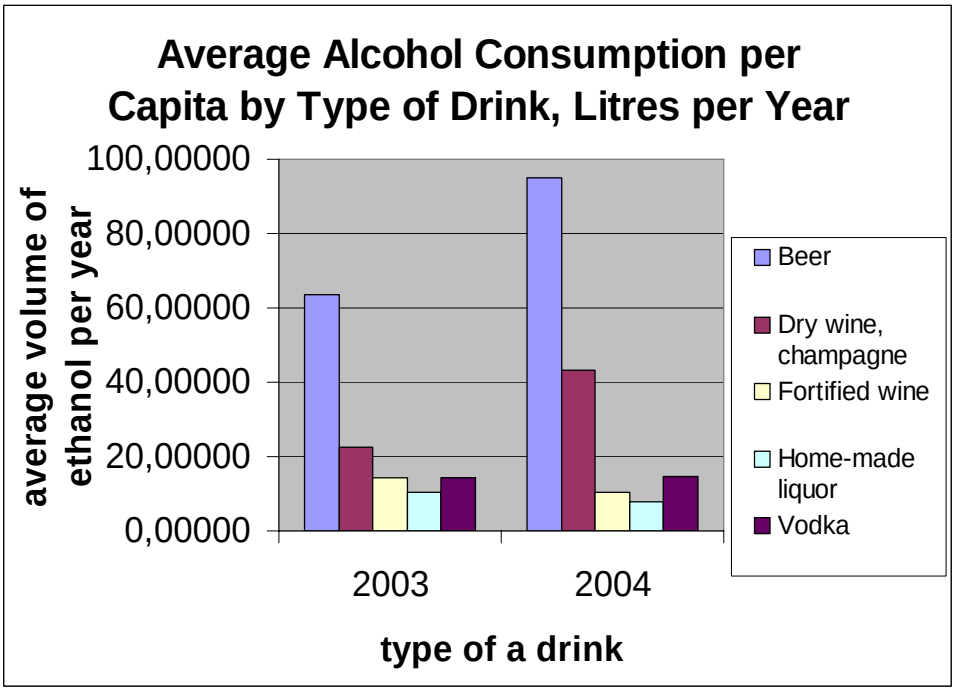
[123] Not clearly defined in the legislation, but is assumed to be zero.

Source: World Health Organization, Global Status Report: Alcohol Policy (2004)

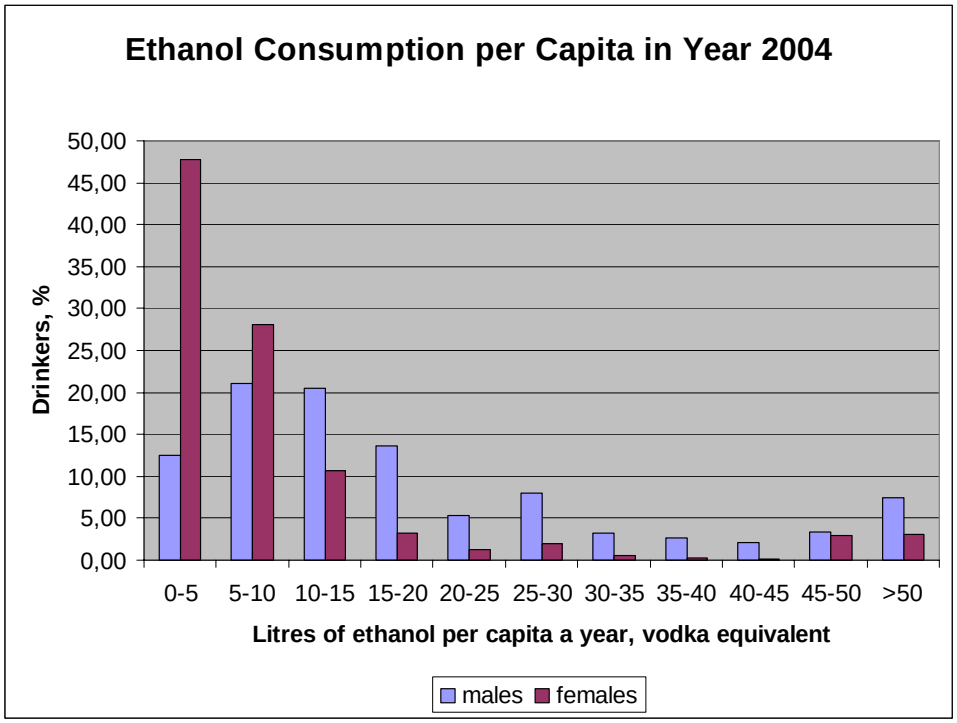
Appendix 2. Ethanol content in alcoholic beverages

Beer	Dry wine	Fortified wine	Home-made liquor	Vodka
0.0389	0.144	0.18	0.39	0.4

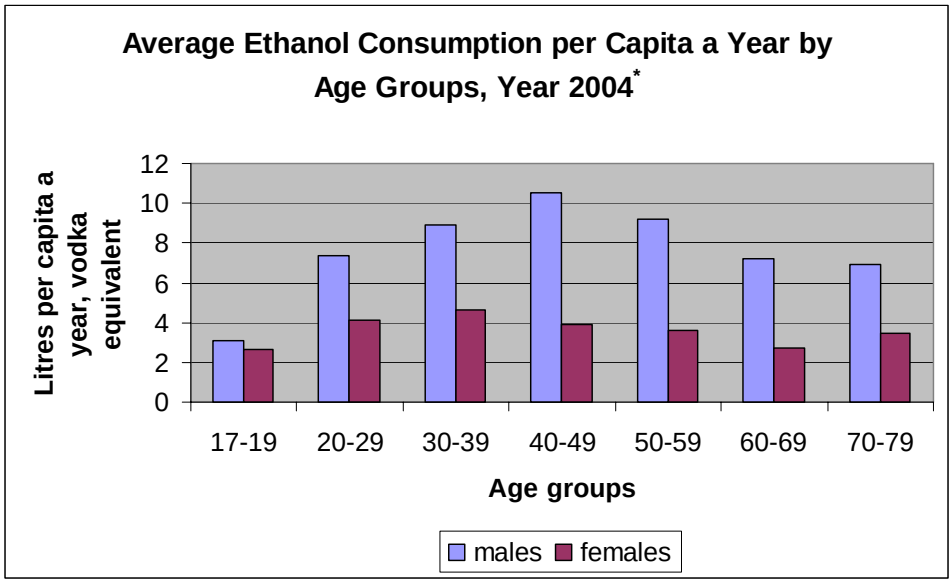
Appendix 3.



Appendix 4.

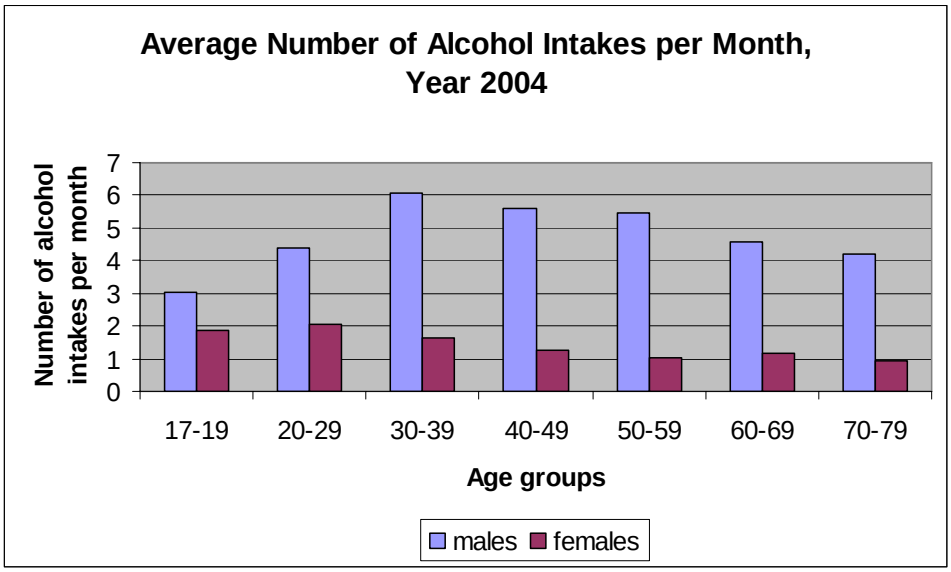

Ethanol Consumption per Capita in Year 2004
Drinkers, %
50,00
45,00
40,00
35,00
30,00
25,00
20,00
15,00
10,00
5,00
0,00
0-5
5-10
10-15
15-20
20-25
25-30
30-35
35-40
40-45
45-50
>50
Litres of ethanol per capita a year, vodka equivalent
males
females

Appendix 5.

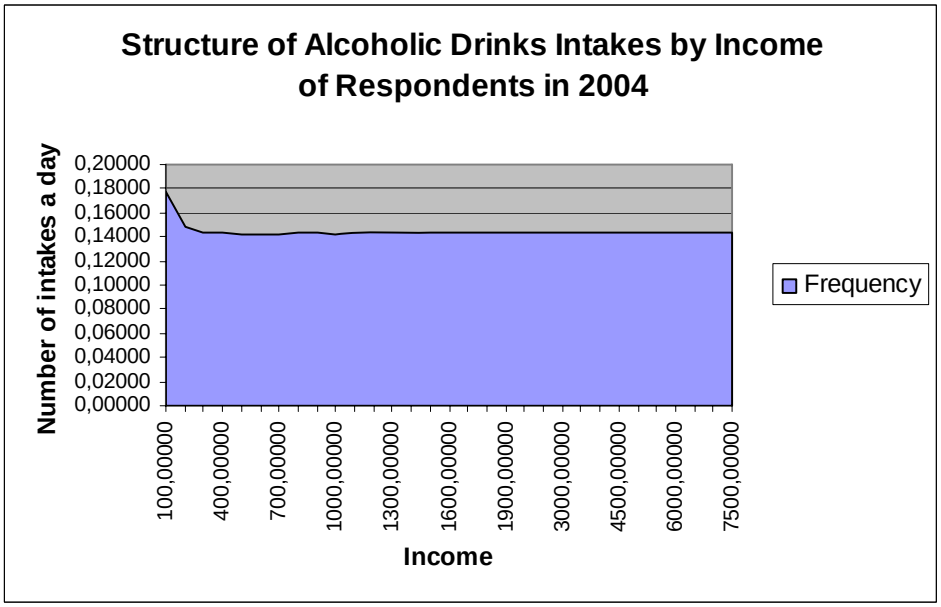


* Only for permanent drinkers participated in both rounds

Appendix 6.



Appendix 7.



Appendix 8.

Participation and consumption equations, Heckman model

(z-statistics of probit participation model and
t-statistics of OLS consumption model are in the parentheses)

	Dependent variable method			
	Drinker(0/1), probit	**Consumption,log OLS**	**Drinker(0/1), probit**	**Consumption,log OLS**
Drinker among the rest of household (0/1)	0.445*** (39.720)	0.428*** (6.170)	0.445*** (39.720)	0.427*** (6.160)
Income per cap, log	0.129*** (2.770)	0.005 (0.120)	0.130*** (2.770)	0.010 (0.240)
Price on ethanol, log	0.176* (1.680)	-2.518*** (-2.820)	-	-
Price on vodka, log	-	-	1.464** (2.480)	0.909 (0.820)
Price on beer, log	-	-	0.571 (0.850)	-1.284 (-0.600)
Price on wine, log	-	-	-0.682 (-0.950)	-0.092 (-0.070)
Price on sugar, log	-	-	-0.488* (-1.760)	-2.541** (-2.340)
Age	-0.114*** (-4.180)	-0.008** (-1.980)	-0.114*** (-4.170)	-0.008** (-2.000)
Gender (0-male, 1-female)	-0.162*** (-16.160)	-0.576*** (-5.320)	-0.162*** (-16.160)	-0.579*** (-5.350)
Employment (0/1)	-0.054*** (-7.140)	-0.062 (-0.940)	-0.053*** (-7.110)	-0.059 (-0.900)
Smoke (0/1)	0.115*** (18.520)	0.494*** (6.330)	0.116*** (18.620)	0.493*** (6.320)
Chronic disease (0/1)	0.015** (2.280)	-	0.016** (2.300)	-
Health status				
Very good				
Good	0.027** (2.240)	-	0.026** (2.200)	-
Average	0.081*** (2.830)	-	0.080*** (2.780)	-
Bad	-0.010 (-0.79)	-	-0.011 (-0.840)	-
Marriage status				
Single	-0.025** (-2.270)	-0.088 (-0.310)	-0.026** (-2.300)	-0.105 (-0.370)
Non-registered marriage	-0.001 (-0.230)	-0.131 (-0.570)	-0.001 (-0.260)	-0.141 (-0.610)
Registered marriage	-0.041 (-1.220)	-0.182 (-0.910)	-0.043 (-1.270)	-0.204 (-1.020)

Widowed	-0.008 (-1.500)	-0.240 (-1.110)	-0.008 (-1.540)	-0.260 (-1.200)
Divorced	-0.002 (-0.500)	-0.315 (-1.410)	-0.002 (-0.540)	-0.334 (-1.490)
Separated				
Kids				
0	-0.157*** (-2.600)	-0.679 (-0.480)	-0.157*** (-2.600)	-0.638 (-0.450)
1	-0.166** (-2.420)	-0.639 (-0.450)	-0.166** (-2.420)	-0.595 (-0.420)
2	-0.258** (-2.310)	-0.639 (-0.450)	-0.258** (-2.300)	-0.593 (-0.420)
3	-0.500** (-2.290)	-0.717 (-0.500)	-0.500** (-2.280)	-0.671 (-0.470)
4	-0.011** (-2.230)	-0.582 (-0.410)	-0.011** (-2.220)	-0.533 (-0.370)
5	-0.003** (-2.090)	-0.238 (-0.160)	-0.003** (-2.090)	-0.180 (-0.120)
6	-0.001** (-2.250)	-1.241 (-0.830)	-0.001** (-2.250)	-1.211 (-0.810)
7				
8	-	-	-	-
14	-	-	-	-
Education				
Grades 1-6	0.012* (1.710)	-0.651 (-0.730)	0.012* (1.740)	-0.610 (-0.680)
Grades 7-9	0.056* (1.820)	-0.790 (-0.890)	0.057* (1.850)	-0.749 (-0.850)
Grades 10-11 without a diploma of a high school	0.036** (1.980)	-0.871 (-0.980)	0.036** (2.000)	-0.845 (-0.950)
Diploma of a high school	0.098** (2.190)	-0.953 (-1.080)	0.010** (2.220)	-0.911 (-1.030)
Diploma of PTU, FZU, FZO without a secondary education	0.034** (2.470)	-0.860 (-0.960)	0.034** (2.500)	-0.820 (-0.920)
Diploma of PTU with a secondary education	0.080** (2.430)	-1.004 (-1.130)	0.081** (2.460)	-0.966 (-1.090)
Diploma of a technical, medical, music, art, pedagogical school	0.115** (2.340)	-0.993 (-1.120)	0.116** (2.380)	-0.949 (-1.070)
Incomplete professional higher education	0.013** (2.520)	-1.152 (-1.230)	0.013** (2.550)	-1.085 (-1.160)
Bachelor degree	0.008*** (2.690)	-1.242 (-1.360)	0.008*** (2.730)	-1.192 (-1.300)
Diploma of specialist	0.072**	-0.908	0.073**	-0.873

	(2.350)	(-1.020)	(2.390)	(-0.980)
Master's degree	0.007***	-0.835	0.007***	-0.801
	(3.080)	(-0.900)	(3.110)	(-0.860)
Candidate of sciences, doctor of sciences	0.002***	-	0.002***	-
	(3.050)		(3.070)	
Other				
Life satisfaction				
Fully satisfied				
Satisfied	0.008	-0.266	0.007	-0.264
	(1.220)	(-1.620)	(1.180)	(-1.610)
Rather satisfied	0.005	-0.302*	0.005	-0.310*
	(0.690)	(-1.880)	(0.620)	(-1.930)
Less than satisfied	0.012	-0.350**	0.011	-0.357**
	(1.310)	(-2.210)	(1.250)	(-2.260)
Not satisfied at all	0.011	-0.280*	0.011	-0.291*
	(1.290)	(-1.750)	(1.210)	(-1.830)
Religion				
Do not follow any religion	0.153**	0.729	0.150**	0.671
	(2.440)	(1.320)	(2.370)	(1.210)
Ukrainian Orthodox (Kyiv Patriarchy)	0.341**	0.587	0.335**	0.525
	(2.460)	(1.060)	(2.390)	(0.950)
Ukrainian Orthodox (Moscow Patriarchy)	0.111**	0.483	0.109**	0.425
	(2.450)	(0.870)	(2.370)	(0.770)
Russian Orthodox	0.049**	0.495	0.048**	0.441
	(2.430)	(0.880)	(2.360)	(0.780)
Orthodox without any partition	0.099**	0.661	0.098**	0.660
	(2.410)	(1.200)	(2.360)	(1.190)
Catholicism (Rome)	0.047**	0.576	0.046**	0.562
	(2.350)	(1.000)	(2.300)	(0.970)
Greek Catholicism	0.036**	1.032*	0.035**	0.927
	(2.080)	(1.800)	(1.980)	(1.610)
Protestantism	0.003	0.448	0.003	0.387
	(1.540)	(0.620)	(1.470)	(0.540)
Baptism/Evangelism	0.001	-0.405	0.001	-0.411
	(0.840)	(-0.440)	(0.790)	(-0.440)
Islam	0.003*	-0.046	0.003*	-0.061
	(1.780)	(-0.060)	(1.750)	(-0.080)
Hinduism	-	-	-	-
Judaism	0.000	-	0.000	-
	(1.630)		(1.560)	
Buddhism, Lamaism	0.014**	-	0.014**	-
	(2.120)		(2.040)	
Krishnaism				
Jehovah's witnesses	0.002**	-0.024	0.002**	-0.117
	(2.040)	(-0.040)	(1.990)	(-0.200)
Believe in God but do not belong to any confession	0.081**	0.507	0.080**	0.509
	(2.490)	(0.910)	(2.430)	(0.920)

Other	0.003**	0.711	0.002**	0.620
	(2.190)	(0.990)	(2.100)	(0.860)
Settlement type				
Village	-0.000	-0.012	-0.002	-0.012
	(-0.020)	(-0.070)	(-0.120)	(-0.070)
Urban settlement	-0.007	0.051	-0.008	0.043
	(-1.250)	(0.260)	(-1.370)	(0.220)
Small town				
Medium town	-0.009	-0.224	-0.009	-0.220
	(-1.510)	(-1.140)	(-1.590)	(-1.120)
City	0.008	0.064	0.008	0.062
	(0.910)	(-0.340)	(0.820)	(-0.330)
Large city	0.001	-0.099	0.000	-0.104
	(0.090)	(-0.490)	(0.000)	(-0.520)
Oblast				
Crimea	-0.006**	0.100	-0.015**	-0.101
	(-2.120)	(0.390)	(-2.470)	(-0.180)
Kyiv city	-0.003	0.473	-0.001	-0.029
	(-0.670)	(1.490)	(-0.140)	(-0.070)
Kyivskaya	-0.003*	-0.077	-0.002	-0.244
	(-1.830)	(-0.300)	(-1.040)	(-0.079)
Vinnitskaya	-0.001	-0.380	-0.007	-0.637
	(-0.200)	(-1.570)	(-1.590)	(-1.580)
Volynskaya				
Dnepropetrovskaya	-0.005	-0.088	-0.006	-0.229
	(-1.380)	(-0.380)	(-1.490)	(-0.940)
Donetskaya	-0.013**	-0.019	-0.021***	-0.243
	(-2.080)	(-0.080)	(-2.770)	(-0.850)
Zitomirskaya	0.000	-0.446*	-0.000	-0.761***
	(0.290)	(-1.680)	(-0.250)	(-2.600)
Zakarpatskaya	-0.002	-0.072	-0.002	-0.157
	(-1.020)	(-0.270)	(-1.160)	(-0.570)
Zaporojskaya	0.001	-0.357	-0.006	-0.423
	(0.380)	(-1.460)	(-1.150)	(-0.880)
Ivano-frankovskaya	0.000	0.063	0.001	-0.239
	(0.180)	(0.210)	(-0.540)	(-0.750)
Kirovogradskaya	0.001	0.233	0.001	-0.371
	(0.320)	(0.850)	(0.240)	(-0.970)
Luganskaya	-0.006*	0.002	-0.007	-0.370
	(-1.740)	(0.010)	(-1.220)	(-1.000)
Lvovskaya	-0.001	-0.132	-0.003	-0.521
	(-0.200)	(-0.470)	(-0.640)	(-1.590)
Nikolaevskaya	-0.005***	0.029	-0.005***	-0.211
	(-3.880)	(0.090)	(-3.430)	(-0.620)
Odesskaya	-0.004	0.314	-0.005*	0.093
	(-1.330)	(1.240)	(-1.690)	(0.350)
Poltavskaya	-0.006***	0.033	-0.003	-0.502
	(-2.760)	(0.120)	(-0.670)	(-0.940)
Rovenskaya	0.002*	0.389	0.001	0.169

	(1.760)	(1.350)	(0.490)	(0.480)
Sumskaya	0.000	-0.140	-0.003	-0.339
	(0.000)	(-0.560)	(-1.060)	(-1.000)
Ternopolskaya	-0.001	-0.256	0.001	-0.258
	(-0.510)	(-0.890)	(0.520)	(-0.660)
Kharkovskaya	-0.003	0.014	-0.003	-0.271
	(-0.770)	(0.060)	(-0.530)	(-0.970)
Khersonskaya	-0.005***	0.129	-0.010***	0.044
	(-2.860)	(0.460)	(-2.670)	(0.070)
Khmelnitskaya	-0.003*	0.191	-0.004*	0.055
	(-1.710)	(0.750)	(-1.760)	(0.200)
Cherkasskaya	-0.005**	0.174	-0.004	-0.328
	(-2.450)	(0.640)	(-1.460)	(-0.840)
Chernovitskaya	-0.004***	0.261	-0.005***	-0.105
	(-3.410)	(0.850)	(-4.010)	(-0.310)
Chernigovskaya	-0.003	0.412	-0.004*	0.011
	(-1.630)	(1.380)	(-1.930)	(0.030)
Inverse Mills ratio	-	-2.773***	-	-2.774***
		(-13.660)		(-13.670)
Const	-2.320**	4.712**	-3.667**	6.296**
	(-1.960)	(2.520)	(-2.160)	(2.100)
Log likelihood	-5556.0714	-	-5553.4656	-
McFadden R-squared	0.3297	-	0.3300	-
R-squared	-	0.3174	-	0.3187
Prob(F-statistic)	-	0.0000	-	0.0000
Censored obs.	4363	-	4363	-
Uncensored obs.	8622	-	8622	-
Total obs.	12985	5832	12985	5832

*** significant at 1% ** significant at 5% * significant at 10%

Appendix 9.

Participation and consumption equations by gender, Heckman model

(z-statistics of probit participation model and
t-statistics of OLS consumption model are in the parentheses)

	Dependent variable method							
	Males				**Females**			
	Drinker (0/1), probit	**Consumption, log OLS**	**Drinker (0/1), probit**	**Consumption, log OLS**	**Drinker (0/1), probit**	**Consumption,log OLS**	**Drinker (0/1), probit**	**Consumption, log OLS**
Drinker among the rest of household	0.218*** (23.880)	0.187** (1.980)	0.218*** (23.750)	0.186** (1.970)	0.761*** (30.850)	0.785*** (7.420)	0.761*** (30.830)	0.782*** (7.400)

(0/1)								
Income per cap, log	0.006 (0.160)	-0.097 (-1.530)	0.007 (0.190)	-0.095 (-1.500)	0.300*** (3.290)	0.106* (1.900)	0.299*** (3.270)	0.111** (2.000)
Price on ethanol, log	0.140 (1.570)	-1.097 (-0.800)	-	-	0.162 (0.800)	-3.288*** (-2.810)	-	-
Price on vodka, log	-	-	0.797 (1.590)	0.239 (0.140)	-	-	1.337* (1.780)	1.585 (1.100)
Price on beer, log	-	-	0.151 (0.260)	-0.654 (-0.200)	-	-	1.290 (1.010)	-1.652 (-0.590)
Price on wine, log	-	-	-0.045 (-0.080)	-0.191 (-0.090)	-	-	-1.704 (-1.210)	0.033 (0.020)
Price on sugar, log	-	-	-0.186 (-0.810)	-0.777 (-0.470)	-	-	-0.864 (-1.590)	- 3.924*** (-2.760)
Age	0.087*** (3.670)	-0.003 (-0.570)	0.087*** (3.660)	-0.004 (-0.570)	- 0.507*** (-9.310)	-0.020*** (-3.230)	- 0.506*** (-9.300)	- 0.019*** (-3.200)
Employment (0/1)	-0.012** (-2.140)	-0.051 (-0.500)	-0.012** (-2.110)	-0.050 (-0.490)	- 0.125*** (-7.890)	-0.097 (-1.090)	- 0.125*** (-7.880)	-0.092 (-1.030)
Smoke (0/1)	0.102*** (18.520)	0.310*** (2.760)	0.102*** (12.690)	0.311*** (2.760)	0.058*** (10.180)	0.747*** (5.310)	0.058*** (10.170)	0.745*** (5.300)
Chronic disease (0/1)	0.011 (2.280)	-	0.011 (1.600)	-	0.017 (1.450)	-	0.017 (1.490)	-
Health status								
Very good								
Good	0.017* (1.760)	-	0.017* (1.730)	-	0.009 (0.410)	-	0.008 (0.370)	-
Average	0.021 (1.190)	-	0.021 (1.160)	-	0.099 (1.310)	-	0.096 (1.270)	-
Bad	-0.041** (-2.080)	-	-0.014** (-2.100)	-	-0.020 (-0.520)	-	-0.021 (-0.560)	-
Marriage status								
Single	-0.017 (-1.360)	-0.505 (-1.170)	-0.017 (-1.360)	-0.516 (-1.200)	-0.034* (-1.880)	0.280 (0.730)	-0.035* (-1.910)	0.266 (0.690)
Non-registered marriage	-0.005 (-1.550)	-0.801** (-2.370)	-0.005 (-1.570)	-0.807** (-2.390)	0.007 (1.190)	0.474 (1.500)	0.006 (1.160)	0.469 (1.480)
Registered marriage	-0.043 (-1.240)	-0.639** (-2.160)	-0.044 (-1.250)	-0.649** (-2.190)	-0.041 (-0.710)	0.191 (0.700)	-0.044 (-0.760)	0.160 (0.590)
Widowed	-0.003** (-1.970)	- 1.123*** (-3.120)	-0.003** (-1.970)	- 1.131*** (-3.140)	0.006 (0.420)	0.317 (1.100)	0.006 (0.370)	0.286 (1.000)
Divorced	-0.002 (-0.750)	-0.510 (-1.440)	-0.002 (-0.760)	-0.517 (-1.450)	0.002 (0.210)	0.012 (0.040)	0.001 (0.160)	-0.018 (-0.060)
Separated								
Kids								
0	- 0.355***	-0.748 (-1.520)	-0.354** (-2.240)	-0.752 (-1.530)	-0.213** (-2.410)	0.810 (1.350)	-0.213** (-2.410)	0.811 (1.360)

	(-4.000)							
1	-0.301*** (-3.930)	-0.723 (-1.560)	-0.300** (-2.190)	-0.728 (-1.570)	-0.293** (-2.350)	0.848 (1.480)	-0.292** (-2.340)	0.853 (1.490)
2	-0.475*** (-3.800)	-0.508 (-1.110)	-0.475** (-2.120)	-0.512 (-1.120)	-0.474** (-2.320)	0.670 (1.180)	-0.473** (-2.320)	0.681 (1.200)
3	-0.099*** (-3.960)	-0.734 (-1.570)	-0.099** (-2.210)	-0.737 (-1.530)	-0.084** (-2.140)	0.736 (1.280)	-0.084** (-2.130)	0.744 (1.290)
4	-0.022*** (-3.900)	-0.860* (-1.670)	-0.022** (-2.190)	-0.863* (-1.670)	-0.019** (-2.140)	1.044* (1.710)	-0.018** (-2.130)	1.055* (1.730)
5	-0.006*** (-3.800)	-	-0.006** (-2.160)	-	-0.005* (-1.940)	0.913 (1.330)	-0.005* (-1.940)	0.939 (1.370)
6	-0.001*** (-3.110)	-0.301 (-0.240)	-0.001** (-1.990)	-0.329 (-0.260)	-0.003** (-2.010)	-	-0.003** (-2.010)	-
7								
8	-	-	-	-	-	-	-	-
14	-	-	-	-	-	1.963 (1.290)	-	1.894 (1.250)
Education								
Grades 1-6	0.003 (0.700)	-2.334 (-1.620)	0.003 (0.690)	-2.336 (-1.620)	0.024 (1.370)	0.366 (0.320)	0.025 (1.420)	0.468 (0.410)
Grades 7-9	0.015 (0.660)	-2.541* (-1.770)	0.015 (0.650)	-2.545* (-1.780)	0.106 (1.550)	0.307 (0.270)	0.109 (1.600)	0.412 (0.370)
Grades 10-11 without a diploma of a high school	0.008 (0.610)	-2.668* (-1.860)	0.008 (0.600)	-2.678* (-1.860)	0.074* (1.760)	0.337 (0.300)	0.075* (1.810)	0.421 (0.370)
Diploma of a high school	0.027 (0.780)	-2.755* (-1.920)	0.027 (0.780)	-2.760* (-1.930)	0.183* (1.900)	0.170 (0.150)	0.187* (1.960)	0.279 (0.250)
Diploma of PTU, FZU, FZO without a secondary education	0.015 (1.000)	-2.743* (-1.910)	0.015 (1.000)	-2.749* (-1.910)	0.040** (2.060)	0.328 (0.290)	0.041** (2.110)	0.434 (0.380)
Diploma of PTU with a secondary education	0.030 (1.010)	-2.859** (-1.990)	0.030 (1.000)	-2.864** (-1.990)	0.122** (2.020)	0.168 (0.150)	0.124** (2.070)	0.264 (0.230)
Diploma of a technical, medical, music, art, pedagogical school	0.021 (0.720)	-3.004** (-2.090)	0.021 (0.720)	-3.006** (-2.100)	0.252** (2.060)	0.278 (0.250)	0.258** (2.110)	0.385 (0.340)
Incomplete	0.003	-2.862*	0.003	-2.858*	0.025**	0.009	0.026**	0.155

professional higher education	(1.030)	(-1.930)	(1.030)	(-1.920)	(2.020)	(0.010)	(2.070)	(0.130)
Bachelor degree	0.004* (1.920)	-2.817* (-1.910)	0.004* (1.910)	-2.820* (-1.910)	0.015** (2.000)	-0.281 (-0.240)	0.016** (2.050)	-0.162 (-0.140)
Diploma of specialist	0.014 (0.680)	-2.846** (-1.980)	0.014 (0.670)	-2.852** (-1.990)	0.145** (2.080)	0.320 (0.280)	0.149** (2.140)	0.412 (0.370)
Master's degree	0.002 (1.150)	-2.593* (-1.730)	0.002 (1.140)	-2.604* (-1.740)	0.015*** (2.600)	0.477 (0.400)	0.015*** (2.650)	0.572 (0.480)
Candidate of sciences, doctor of sciences	-	-	-	-	0.002** (2.030)	-	0.002** (2.070)	-
Other								
Life satisfaction								
Fully satisfied								
Satisfied	0.006 (1.100)	-0.153 (-0.660)	0.006 (1.090)	-0.152 (-0.650)	0.013 (1.110)	-0.279 (-1.190)	0.013 (1.070)	-0.277 (-1.190)
Rather satisfied	0.007 (1.170)	-0.247* (-1.080)	0.007 (1.120)	-0.253 (-1.110)	0.004 (0.300)	-0.329 (-1.430)	0.003 (0.240)	-0.335 (-1.460)
Less than satisfied	0.009 (1.330)	-0.272** (-1.210)	0.009 (1.300)	-0.274 (-1.220)	0.016 (0.850)	-0.387* (-1.710)	0.015 (0.790)	-0.399* (-1.770)
Not satisfied at all	0.012* (1.770)	-0.223* (-0.990)	0.011* (1.730)	-0.229 (-0.101)	0.015 (0.800)	-0.276 (-1.210)	0.014 (0.730)	-0.291 (-1.280)
Religion								
Do not follow any religion	0.085 (1.500)	1.342 (0.950)	0.084 (1.470)	1.322 (0.940)	0.473*** (6.160)	-0.205 (-0.310)	0.466*** (3.490)	-0.189 (-0.280)
Ukrainian Orthodox (Kyiv Patriarchy)	0.108 (1.470)	1.043 (0.740)	0.107 (1.440)	1.022 (0.720)	1.821*** (6.220)	-0.264 (-0.400)	1.797*** (3.520)	-0.248 (-0.380)
Ukrainian Orthodox (Moscow Patriarchy)	0.034 (1.510)	1.202 (0.850)	0.033 (1.470)	1.181 (0.830)	0.611*** (6.180)	-0.535 (-0.800)	0.603*** (3.500)	-0.513 (-0.770)
Russian Orthodox	0.015 (1.410)	1.037 (0.730)	0.015 (1.380)	1.017 (0.710)	0.266*** (6.210)	-0.466 (-0.690)	0.262*** (3.530)	-0.437 (-0.650)
Orthodox without any partition	0.034 (1.570)	1.289 (0.910)	0.034 (1.550)	1.287 (0.910)	0.532*** (6.070)	-0.367 (-0.550)	0.526*** (3.450)	-0.256 (-0.390)
Catholicism (Rome)	0.021* (1.740)	1.470 (1.020)	0.021* (1.720)	1.460 (1.010)	0.230*** (5.970)	-0.544 (-0.800)	0.227*** (3.420)	-0.445 (-0.650)
Greek Catholicism	0.014 (1.380)	1.371 (0.950)	0.013 (1.340)	1.332 (0.920)	0.201*** (5.780)	0.257 (0.380)	0.198*** (3.250)	0.219 (0.320)
Protestantism	0.001 (1.020)	0.584 (0.350)	0.001 (0.990)	0.553 (0.340)	0.024*** (5.220)	-0.415 (-0.480)	0.024*** (2.990)	-0.367 (-0.420)
Baptism/Evangelism	0.000 (0.500)	-2.890 (-1.180)	0.000 (0.480)	-2.934 (-1.200)	0.016*** (4.490)	-0.988 (-0.950)	0.016*** (2.630)	-0.850 (-0.810)
Islam	0.001	0.405	0.001	0.399	0.017***	-0.675	0.017***	-0.583

	(1.030)	(0.250)	(1.020)	(0.250)	(5.520)	(-0.730)	(3.200)	(-0.630)
Hinduism	-	-	-	-	-	-	-	-
Judaism	0.000 (0.020)	-	0.000 (0.000)	-	0.003*** (5.500)	-	0.003*** (3.430)	-
Buddhism, Lamaism	0.005 (1.200)	0.331 (0.230)	0.004 (1.170)	0.294 (0.200)	0.083*** (6.000)	-0.861 (-1.210)	0.082*** (3.410)	-0.880 (-1.240)
Krishnaism								
Jehovah's witnesses	0.001** (2.020)	-	0.001** (1.990)	-	0.011*** (5.400)	-0.993 (-1.130)	0.011*** (3.140)	-0.877 (-1.000)
Believe in God but do not belong to any confession	0.033 (1.590)	0.975 (0.690)	0.033 (1.570)	0.976 (0.690)	0.368*** (6.170)	-0.359 (-0.540)	0.364*** (3.500)	-0.250 (-0.370)
Other	0.001* (1.840)	1.289 (0.830)	0.001* (1.790)	1.252 (0.800)	0.013*** (5.530)	-	0.013*** (3.170)	-
Settlement type								
Village	-0.013 (-0.980)	0.081 (0.290)	-0.013 (-1.010)	0.077 (0.270)	0.024 (0.880)	-0.113 (-0.460)	0.022 (0.790)	-0.103 (-0.420)
Urban settlement	-0.005 (-0.960)	0.120 (0.410)	-0.005 (-1.010)	0.113 (0.380)	-0.007 (-0.670)	-0.051 (-0.200)	-0.008 (-0.760)	-0.045 (-0.180)
Small town								
Medium town	-0.006 (-1.090)	-0.172 (-0.580)	-0.006 (-1.120)	-0.175 (-0.590)	-0.007 (-0.670)	-0.302 (-1.150)	-0.008 (-0.750)	-0.282 (-1.080)
City	-0.006 (-0.700)	-0.089 (-0.310)	-0.006 (-0.720)	-0.092 (-0.320)	0.036** (1.990)	-0.014 (-0.060)	0.034* (1.920)	-0.003 (-0.010)
Large city	-0.011 (-1.340)	-0.144 (-0.470)	-0.011 (-1.390)	-0.151 (-0.490)	0.029 (1.530)	-0.055 (-0.210)	0.028 (1.460)	-0.047 (-0.180)
Oblast								
Crimea	- 0.010*** (-3.800)	-0.443 (-1.150)	-0.013** (-2.440)	-0.527 (-0.620)	0.001 (0.260)	0.475 (1.390)	-0.018 (-1.470)	0.174 (0.240)
Kyiv city	- 0.010*** (-2.730)	-0.115 (-0.240)	-0.010** (-2.080)	-0.266 (-0.390)	0.007 (0.790)	0.859** (2.050)	0.012 (1.050)	0.103 (0.180)
Kyivskaya	- 0.005*** (-2.790)	-0.148 (-0.390)	-0.005** (-2.330)	-0.208 (-0.460)	-0.001 (-0.300)	-0.090 (-0.250)	0.002 (0.360)	-0.328 (-0.790)
Vinnitskaya	- 0.007*** (-2.600)	-0.482 (-1.350)	-0.010** (-2.250)	-0.568 (-0.920)	0.007 (1.550)	-0.348 (-1.060)	-0.005 (-0.580)	-0.746 (-1.400)
Volynskaya								
Dnepropetrovskaya	- 0.011*** (-2.650)	-0.279 (-0.820)	- 0.011*** (-2.660)	-0.335 (-0.940)	0.000 (0.060)	0.014 (0.040)	-0.000 (-0.030)	-0.188 (-0.570)
Donetskaya	- 0.023*** (-3.550)	-0.345 (-1.040)	- 0.026*** (-3.380)	-0.444 (-1.040)	-0.002 (-0.170)	0.164 (0.520)	-0.017 (-1.220)	-0.150 (-0.390)
Zitomirskaya	-0.003** (-2.140)	- 1.049***	-0.003** (-2.220)	- 1.172***	0.005 (1.610)	-0.020 (-0.060)	0.003 (1.080)	-0.473 (-1.210)

		(-2.630)		(-2.650)				
Zakarpatskaya	-0.004*** (-2.630)	-0.205 (-0.520)	-0.004*** (-2.630)	-0.247 (-0.600)	0.002 (0.510)	0.009 (0.020)	0.001 (0.360)	-0.105 (-0.280)
Zaporojskaya	-0.008*** (-3.250)	-1.042*** (-2.870)	-0.010** (-2.320)	-1.060*** (-1.440)	0.016*** (3.020)	0.127 (0.380)	0.001 (0.120)	0.007 (0.010)
Ivano-frankovskaya	-0.005** (-2.470)	-0.671 (-1.490)	-0.006*** (-2.630)	-0.784 (-1.620)	0.008* (1.790)	0.535 (1.350)	0.005 (1.030)	0.087 (0.210)
Kirovogradskaya	-0.006*** (-3.020)	-0.056 (-0.140)	-0.007** (-2.420)	-0.251 (-0.430)	0.010** (2.550)	0.519 (1.400)	0.011** (2.000)	-0.388 (-0.760)
Luganskaya	-0.012*** (-3.270)	-0.505 (-1.490)	-0.013** (-2.330)	-0.674 (-1.210)	0.001 (0.230)	0.387 (1.190)	0.002 (0.190)	-0.126 (-0.260)
Lvovskaya	-0.010*** (-2.990)	-0.310 (-0.740)	-0.011*** (-2.830)	-0.464 (-0.940)	0.010 (1.510)	-0.020 (-0.050)	0.007 (0.930)	-0.583 (-1.330)
Nikolaevskaya	-0.004*** (-3.720)	-0.365 (-0.780)	-0.004*** (-3.350)	-0.465 (-0.880)	-0.006*** (-2.670)	0.039 (0.090)	-0.006** (-2.310)	-0.293 (-0.630)
Odesskaya	-0.008*** (-2.940)	0.006 (0.020)	-0.009*** (-3.010)	-0.081 (-0.200)	0.002 (0.380)	0.484 (1.400)	0.000 (0.020)	0.171 (0.470)
Poltavskaya	-0.006*** (-2.730)	-0.254 (-0.620)	-0.005 (-1.360)	-0.444 (-0.550)	-0.008* (-1.820)	0.053 (0.140)	-0.000 (-0.010)	-0.719 (-1.020)
Rovenskaya	-0.001 (-0.370)	0.426 (0.990)	-0.001 (-0.650)	0.363 (0.680)	0.004* (1.930)	0.410 (1.060)	0.002 (0.560)	0.066 (0.140)
Sumskaya	-0.001 (-0.630)	-0.108 (-0.300)	-0.003 (-0.890)	-0.158 (-0.310)	0.001 (0.330)	-0.265 (-0.770)	-0.004 (-0.840)	-0.581 (-1.270)
Ternopolskaya	-0.003* (-1.740)	-0.669 (-1.520)	-0.003 (-1.050)	-0.683 (-1.140)	0.001 (0.250)	-0.080 (-0.200)	0.005 (1.150)	-0.071 (-0.140)
Kharkovskaya	-0.010** (-2.310)	-0.133 (-0.390)	-0.010** (-2.030)	-0.238 (-0.570)	0.004 (0.510)	0.072 (0.230)	0.007 (0.670)	-0.345 (-0.910)
Khersonskaya	-0.003** (-2.040)	0.328 (0.780)	-0.005 (-1.470)	0.261 (0.290)	-0.008** (-2.360)	-0.125 (-0.330)	-0.019** (-2.490)	-0.232 (-0.300)
Khmelnitskaya	-0.005*** (-2.970)	0.024 (0.060)	-0.005*** (-2.870)	-0.037 (-0.090)	0.001 (0.140)	0.257 (0.740)	0.000 (0.020)	0.071 (0.190)
Cherkasskaya	-0.005*** (-2.660)	-0.157 (-0.400)	-0.006* (-1.950)	-0.344 (-0.580)	-0.006 (-1.520)	0.215 (0.570)	-0.004 (-0.640)	-0.503 (-0.950)
Chernovitskaya	-0.003*** (-3.270)	0.214 (0.470)	-0.004*** (-3.400)	0.079 (0.160)	-0.005** (-2.290)	0.118 (0.270)	-0.007*** (-2.880)	-0.414 (-0.900)
Chernigovskaya	-0.005*** (-3.220)	-0.007 (-0.010)	-0.005*** (-3.130)	-0.126 (-0.240)	0.001 (0.210)	0.634 (1.610)	-0.001 (-0.240)	0.024 (0.050)

Inverse Mills ratio	-	-3.825*** (-5.760)	-	-3.828*** (-5.760)	-	-2.076*** (-7.420)	-	-2.092*** (-7.490)
Const	3.004 (1.340)	6.673*** (2.930)	0.633 (1.250)	7.818* (1.830)	-7.553 (0.980)	1.706 (1.050)	-8.191 (1.050)	3.149 (0.910)
Log likelihood	-1917.2954	-	-1916.7908	-	-3425.707	-	-3423.4779	-
McFadden R-squared	0.2776	-	0.2778	-	0.3364	-	0.3368	-
R-squared	-	0.0965	-	0.0967	-	0.2139	-	0.2173
Prob(F-statistic)	-	0.0000	-	0.0000	-	0.0000	-	0.0000
Censored obs.	1039	-	1039	-	3324	-	3324	-
Uncensored obs.	4407	-	4407	-	4197	-	4197	-
Total obs.	5446	2548	5446	2548	7521	3284	7521	3284

*** significant at 1% ** significant at 5% * significant at 10%

Appendix 10.

Descriptive statistics of variables in panel data*

Variable	Obs.	Mean	St. Dev.	Min	Max
Drinker, dummy	15793	0.572	0.495	0	1
Ethanol, daily average	14687	2.162	10.401	0.001	285.714
Frequency, times a day	15589	0.079	0.154	0.01	1
Total dose of ethanol	14835	9.570	24.176	0.017	535.786
Dose of beer	10701	3.180	9.305	0.056	277.857
Dose of wine	7027	0.731	9.582	0.1	412.2
Dose of moonshine	7105	0.587	3.273	0.006	111.429
Dose of vodka	11441	6.525	15.608	0.006	342.875
Income per capita	14891	264.068	259.631	0	7500
Price on ethanol	17764	1.617	0.112	1.414	2.002
Price on beer	17764	3.530	0.260	3.03	4.16
Price on wine	17764	8.153	1.105	5.44	11.09
Price on vodka	17764	8.485	0.590	7.03	10.15
Price on sugar	17764	2.890	0.183	2.51	3.26
Inverse Mills ratio	6090	0.395	0.327	0.001	1.78

* - doses and ethanol consumption are in ml of ethanol; income and prices are in UAH

Appendix 11.

Total demand for alcohol, panel Tobit static model with random effect

(z-statistics are in the parentheses)

	Dependent variable			
	Total ethanol consumption, log	**Total ethanol consumption, log**	**Frequency, log**	**Dose, log**
Income per cap, log	-0.090 (-0.950)	-0.090 (-0.950)	-0.027 (-0.830)	-0.057 (-0.880)
Price on ethanol, log	1.102 (0.440)	-	-	-
Price on vodka, log	-	1.010 (0.540)	-0.271 (-0.390)	1.386 (0.950)
Price on beer, log	-	-1.252 (-0.320)	0.304 (0.230)	-1.545 (-0.550)
Price on wine, log	-	0.155 (0.060)	0.766 (0.900)	0.203 (0.110)
Price on sugar, log	-5.901*** (-3.390)	-5.495*** (-2.680)	-1.398** (-2.010)	-4.625*** (-3.180)
Age	-0.010 (-1.060)	-0.010 (-1.050)	-0.005 (-1.500)	-0.003 (-0.510)
Gender (0-male, 1-female)	-0.563* (-1.820)	-0.562* (-1.820)	-0.444*** (-4.020)	-0.081 (-0.380)
Employment (0/1)	-0.057 (-0.380)	-0.056 (-0.370)	-0.002 (-0.040)	-0.052 (-0.500)
Smoke (0/1)	0.909*** (4.800)	0.910*** (4.800)	0.479*** (7.100)	0.395*** (3.000)
Chronic disease (0/1)	-0.129 (-0.940)	-0.128 (-0.930)	-0.035 (-0.730)	-0.094 (-0.990)
Health status				
Very good				
Good	-1.345* (-1.690)	-1.338* (-1.680)	-0.529* (-1.920)	-0.873 (-1.580)
Average	-1.860** (-2.340)	-1.855** (-2.330)	-0.679** (-2.460)	-1.227** (-2.220)
Bad	-1.825** (-2.300)	-1.818** (-2.290)	-0.737*** (-2.680)	-1.114** (-2.020)
Marriage status				
Single	-0.811 (-1.280)	-0.817 (-1.290)	-0.169 (-0.750)	-0.671 (-1.520)
Non-registered marriage	-0.562 (-1.130)	-0.567 (-1.140)	-0.027 (-0.160)	-0.590* (-1.710)
Registered marriage	-0.763* (-1.790)	-0.770* (-1.800)	-0.143 (-0.950)	-0.631** (-2.120)
Widowed	-0.903* (-1.900)	-0.910* (-1.920)	-0.163 (-0.970)	-0.780** (-2.370)
Divorced	-1.105** (-2.270)	-1.110** (-2.280)	-0.179 (-1.040)	-0.942*** (-2.780)

Separated				
Kids				
0	1.665 (1.210)	1.667 (1.210)	-2.293* (-1.790)	0.110 (0.050)
1	1.717 (1.270)	1.719 (1.280)	-2.281* (-1.790)	0.190 (0.080)
2	1.707 (1.270)	1.709 (1.270)	-2.269* (-1.780)	0.163 (0.070)
3	1.581 (1.170)	1.584 (1.170)	-2.264* (-1.780)	0.038 (0.020)
4	1.875 (1.340)	1.876 (1.340)	-2.248* (-1.76)	0.306 (0.130)
5	2.065 (1.360)	2.071 (1.360)	-2.315* (-1.780)	0.517 (0.210)
6	-	-	-2.753** (-2.030)	-1.023 (-0.400)
7	-	-	-	-
8				
14	3.818 (1.030)	3.827 (1.040)	-	-
Education				
Grades 1-6	0.332 (0.450)	0.335 (0.450)	-0.643 (-0.820)	-0.504 (-0.330)
Grades 7-9	0.418 (0.630)	0.422 (0.640)	-0.478 (-0.610)	-0.588 (-0.390)
Grades 10-11 without a diploma of a high school	0.233 (0.350)	0.237 (0.360)	-0.465 (-0.600)	-0.735 (-0.490)
Diploma of a high school	0.039 (0.060)	0.041 (0.060)	-0.549 (-0.700)	-0.850 (-0.560)
Diploma of PTU, FZU, FZO without a secondary education	0.025 (0.040)	0.027 (0.040)	-0.594 (-0.760)	-0.875 (-0.580)
Diploma of PTU with a secondary education	0.012 (0.020)	0.016 (0.020)	-0.501 (-0.640)	-0.931 (-0.620)
Diploma of a technical, medical, music, art, pedagogical school	0.079 (0.120)	0.084 (0.130)	-0.513 (-0.660)	-0.885 (-0.590)
Incomplete professional higher education	-	-	-	-1.024 (-0.650)
Bachelor degree	-0.352 (-0.460)	-0.354 (-0.460)	-0.447 (-0.550)	-1.272 (-0.820)
Diploma of specialist	0.146 (0.230)	0.150 (0.230)	-0.589 (-0.740)	-0.806 (-0.530)
Master's degree	-0.067 (-0.080)	-0.060 (-0.070)	-0.529 (-0.680)	-1.013 (-0.650)
Candidate of sciences, doctor of sciences				
Other	1.411	1.418	-0.581	-

	(0.630)	(0.630)	(-0.720)	
Life satisfaction				
Fully satisfied				
Satisfied	-0.694**	-0.696**	-0.184	-0.522**
	(-2.020)	(-2.030)	(-1.550)	(-2.170)
Rather satisfied	-0.637*	-0.638*	-0.152	-0.504**
	(-1.880)	(-1.880)	(-1.290)	(-2.120)
Less than satisfied	-0.782**	-0.784**	-0.225*	-0.593**
	(-2.320)	(-2.330)	(-1.930)	(-2.520)
Not satisfied at all	-0.631*	-0.635*	-0.194*	-0.464*
	(-1.860)	(-1.870)	(-1.650)	(-1.950)
Religion				
Do not follow any religion	27.129***	27.154***	0.477	18.675***
	(11.600)	(5.630)	(1.050)	(4.350)
Ukrainian Orthodox (Kyiv Patriarchy)	26.823***	26.848***	0.338	18.507***
	(11.510)	(5.570)	(0.750)	(4.310)
Ukrainian Orthodox (Moscow Patriarchy)	26.712***	26.735***	0.336	18.418***
	(11.45)	(5.56)	(0.740)	(4.300)
Russian Orthodox	26.842***	26.867***	0.380	18.431***
	(11.410)	(5.560)	(0.830)	(4.290)
Orthodox without any partition	27.108***	27.135***	0.399	18.733***
	(11.360)	(5.580)	(0.880)	(4.340)
Catholicism (Rome)	27.077***	27.010***	0.461	18.633***
	(11.470)	(5.660)	(0.980)	(4.360)
Greek Catholicism	27.849***	27.888***	0.564	19.398***
	(11.580)	(5.650)	(1.210)	(4.450)
Protestantism	26.740***	26.767***	0.098	18.848***
	(10.170)	(5.380)	(0.170)	(4.320)
Baptism/Evangelism	-	-	-11.876	-
			(-0.000)	
Islam	25.411***	25.445***	-0.541	17.874***
	(9.730)	(5.110)	(-0.900)	(4.080)
Hinduism	-	-	-	-
Judaism	-	-	-	-
Buddhism, Lamaism	25.422***	25.441***	0.004	17.405***
	(10.770)	(5.280)	(0.010)	(4.060)
Krishnaism				
Jehovah's witnesses	25.811***	25.856***	-	17.770***
	(9.550)	(5.120)		(4.020)
Believe in God but do not belong to any confession	26.696***	26.728***	0.296	18.410***
	(11.210)	(5.490)	(0.650)	(4.270)
Other	27.171***	27.221***	0.491	18.666***
	(10.820)	(5.460)	(0.870)	(4.250)
Settlement type				
Village	0.042	0.030	-0.042	0.010
	(0.100)	(0.070)	(-0.270)	(0.030)
Urban settlement	0.366	0.353	0.077	0.161
	(0.800)	(0.770)	(0.480)	(0.520)

Small town				
Medium town	-0.474	-0.485	-0.256	-0.305
	(-1.030)	(-1.050)	(-1.580)	(-0.970)
City	0.010	-0.002	-0.041	-0.075
	(0.020)	(-0.000)	(-0.260)	(-0.240)
Large city	-0.121	-0.131	-0.142	-0.106
	(-0.260)	(-0.280)	(-0.850)	(-0.330)
Oblast				
Crimea	0.135	0.175	0.353	0.032
	(0.220)	(0.160)	(0.930)	(0.040)
Kyiv city	-0.061	-0.017	-0.173	-0.071
	(-0.080)	(-0.020)	(-0.560)	(-0.110)
Kyivskaya	-0.559	-0.605	-0.232	-0.264
	(-0.880)	(-0.860)	(-0.930)	(-0.550)
Vinnitskaya	-1.088*	-1.019	-0.175	-0.836
	(-1.820)	(-1.230)	(-0.600)	(-1.430)
Volynskaya				
Dnepropetrovskaya	-0.410	-0.456	-0.254	-0.244
	(-0.730)	(-0.800)	(-1.250)	(-0.620)
Donetskaya	-0.260	-0.331	-0.081	-0.166
	(-0.480)	(-0.530)	(-0.370)	(-0.380)
Zitomirskaya	-1.243*	-1.316**	-0.395*	-0.904**
	(-1.930)	(-1.970)	(-1.660)	(-1.960)
Zakarpatskaya	-0.134	-0.191	0.150	-0.204
	(-0.210)	(-0.290)	(0.650)	(-0.460)
Zaporojskaya	-0.897	-0.791	-0.175	-0.555
	(-1.530)	(-0.820)	(-0.520)	(-0.820)
Ivano-frankovskaya	-0.169	-0.218	0.050	-0.328
	(-0.240)	(-0.300)	(0.190)	(-0.650)
Kirovogradskaya	-0.819	-0.806	-0.242	-0.789
	(-1.110)	(-1.000)	(-0.850)	(-1.390)
Luganskaya	-0.421	-0.635	-0.169	-0.425
	(-0.750)	(-0.830)	(-0.640)	(-0.790)
Lvovskaya	-0.688	-0.802	-0.174	-0.671
	(-1.030)	(-1.110)	(-0.680)	(-1.330)
Nikolaevskaya	-0.274	-0.382	-0.337	-0.072
	(-0.360)	(-0.470)	(-1.170)	(-0.130)
Odesskaya	0.395	0.347	0.294	0.164
	(0.650)	(0.560)	(1.350)	(0.380)
Poltavskaya	-0.639	-0.764	-0.289	-0.711
	(-0.910)	(-0.720)	(-0.780)	(-0.950)
Rovenskaya	0.346	0.428	0.273	0.053
	(0.490)	(0.550)	(1.010)	(0.100)
Sumskaya	-1.033*	-0.920	-0.507*	-0.515
	(-1.660)	(-1.250)	(-1.950)	(-1.000)
Ternopolskaya	-0.640	-0.771	-0.448	-0.293
	(-0.900)	(-0.900)	(-1.480)	(-0.490)
Kharkovskaya	-0.408	-0.480	-0.248	-0.312
	(-0.720)	(-0.770)	(-1.120)	(-0.720)

Khersonskaya	0.561 (0.820)	0.506 (0.430)	0.480 (1.180)	0.291 (0.350)
Khmelnitskaya	0.404 (0.650)	0.331 (0.520)	0.200 (0.880)	0.141 (0.320)
Cherkasskaya	-0.376 (-0.550)	-0.487 (-0.590)	-0.146 (-0.500)	-0.442 (-0.760)
Chernovitskaya	-0.425 (-0.540)	-0.452 (-0.560)	-0.271 (-0.940)	-0.215 (-0.390)
Chernigovskaya	-0.366 (-0.480)	-0.292 (-0.380)	-0.137 (-0.500)	-0.142 (-0.270)
Inverse Mills ratio	-7.607*** (-10.550)	-7.609*** (-10.550)	-2.078*** (-8.090)	-5.764*** (-11.580)
Const	-19.066 (-1.420)	-20.045 (-0.980)	1.261 (0.570)	-9.109 (1.480)
Log likelihood	-11895.039	-11894.96	-8376.6782	-10780.342
Wald chi2(82)	61013.980	68567.63	1978.81	46332.68
Prob(chi2-statistic)	0.0000	0.0000	0.0000	0.0000
Left-censored obs.	2078	2078	2076	2078
Uncensored obs.	3692	3692	3937	3754
Total obs.	5770	5770	6013	5832

*** significant at 1% ** significant at 5% * significant at 10%

Appendix 12.

Demand for alcohol by types of drinks, panel Tobit static model with random effect

(z-statistics are in the parentheses)

	Dose of vodka, log	**Dose of beer, log**	**Dose of wine, log**	**Dose of home-made spirits, log**
Income per cap, log	-0.080 (-0.980)	0.286*** (2.760)	0.406*** (2.680)	0.760 (1.390)
Price on vodka, log	0.558 (0.320)	0.784 (0.300)	1.664 (0.740)	-13.170 (-0.990)
Price on beer, log	-2.172 (-0.660)	-9.131* (-1.760)	-3.366* (-1.910)	25.402 (0.970)
Price on wine, log	-0.856 (-0.400)	6.007* (1.810)	-0.245 (-0.290)	-9.658 (-0.610)
Price on sugar, log	-2.954* (-1.680)	-1.120 (-0.440)	-0.141 (-0.070)	-24.333* (-1.740)

Age	-0.004 (-0.540)	-0.024** (-2.440)	0.014 (0.190)	0.069 (1.370)
Gender (0-male, 1-female)	-0.867*** (-3.230)	-1.012*** (-3.220)	2.110*** (0.920)	0.792 (0.470)
Employment (0/1)	0.012 (0.090)	0.108 (0.690)	-1.758 (-1.600)	0.253 (0.340)
Smoke (0/1)	0.615*** (3.880)	0.635*** (3.330)	-1.010*** (-0.690)	-0.500*** (-0.480)
Chronic disease (0/1)	-0.041 (-0.350)	-0.043 (-0.290)	1.462 (1.400)	-0.899 (-1.140)
Health status				
Very good				
Good	-0.464 (-0.660)	-0.219 (-0.270)	28.571 (0.000)	-6.189* (-1.900)
Average	-0.793 (-1.130)	-0.587 (-0.720)	29.021 (0.000)	-6.882** (-2.130)
Bad	-0.805 (-1.150)	-1.008 (-1.240)	27.913 (0.000)	-8.479*** (-2.640)
Marriage status				
Single	-0.924 (-1.640)	-1.001 (-1.480)	5.374 (0.910)	0.927 (0.290)
Non-registered marriage	-0.609 (-1.440)	-0.789 (-1.500)	2.180 (0.410)	-5.211* (-1.870)
Registered marriage	-0.723** (-1.990)	-0.890** (-1.970)	6.141 (1.460)	-3.301 (-1.510)
Widowed	-0.863** (-2.130)	-1.027** (-2.040)	5.253 (1.190)	-2.802 (-1.190)
Divorced	-1.081*** (-2.590)	-0.998* (-1.950)	3.061 (0.680)	-2.801 (-1.130)
Separated				
Kids				
0	-0.356 (-0.130)	0.201 (0.230)	-2.529 (-0.410)	27.103 (0.000)
1	-0.243 (-0.090)	0.067 (0.080)	-1.402 (-0.250)	30.226 (0.000)
2	-0.299 (-0.110)	0.185 (0.230)	-1.020 (-0.180)	30.712 (0.000)
3	-0.486 (-0.180)	0.234 (0.280)	-3.743 (-0.640)	30.070 (0.000)
4	-0.048 (-0.02)	0.336 (0.370)	0.094 (0.020)	30.918 (0.000)
5	-0.025 (-0.010)	-	-	-
6	-1.040 (-0.360)	-0.900 (-0.560)	-	-17.114 (-0.000)
7	-	-	-	-
8				
14	-	-	-	-
Education				

Grades 1-6	0.857 (1.370)	0.120 (0.140)	18.558 (0.000)	-2.884 (-0.750)
Grades 7-9	0.886 (1.600)	0.431 (0.580)	18.928 (0.000)	-5.055 (-1.470)
Grades 10-11 without a diploma of a high school	0.672 (1.220)	0.434 (0.580)	20.951 (0.000)	-1.570 (-0.470)
Diploma of a high school	0.483 (0.900)	0.232 (0.320)	16.106 (0.000)	-5.065 (-1.530)
Diploma of PTU, FZU, FZO without a secondary education	0.581 (1.060)	0.057 (0.080)	21.555 (0.000)	-2.641 (-0.800)
Diploma of PTU with a secondary education	0.282 (0.520)	0.377 (0.520)	17.175 (0.000)	-5.605* (-1.670)
Diploma of a technical, medical, music, art, pedagogical school	0.283 (0.540)	0.153 (0.210)	20.801 (0.000)	-2.999 (-0.940)
Incomplete professional higher education	0.157 (0.210)	-	20.206 (0.000)	-4.600 (-0.980)
Bachelor degree	-0.324 (-0.500)	0.215 (0.250)	18.249 (0.000)	-8.016* (-1.700)
Diploma of specialist	0.271 (0.520)	0.513 (0.710)	22.904 (0.000)	-3.970 (-1.230)
Master's degree	-	0.748 (0.810)	25.312 (0.000)	-
Candidate of sciences, doctor of sciences				
Other	2.244 (1.310)	2.974 (1.210)	-	-47.006 (-0.000)
Life satisfaction				
Fully satisfied				
Satisfied	-0.738** (-2.530)	-0.127 (-0.340)	1.576 (0.520)	2.323 (0.980)
Rather satisfied	-0.714** (-2.480)	-0.284 (-0.770)	3.352 (1.140)	3.561 (1.520)
Less than satisfied	-0.725** (-2.550)	-0.222 (-0.610)	2.757 (0.940)	2.180 (0.940)
Not satisfied at all	-0.557* (-1.940)	-0.220 (-0.590)	3.762 (1.230)	2.936 (1.240)
Religion				
Do not follow any religion	2.273 (1.490)	19.378*** (3.290)	32.746 (0.000)	32.752 (0.000)
Ukrainian Orthodox (Kyiv Patriarchy)	2.025 (1.330)	18.830*** (3.200)	34.308 (0.000)	32.658 (0.000)
Ukrainian Orthodox (Moscow Patriarchy)	2.032 (1.330)	19.147*** (3.26)	35.942 (0.010)	30.660 (0.000)
Russian Orthodox	2.172 (1.410)	18.796*** (3.180)	29.853 (0.000)	29.931 (0.000)
Orthodox without any	2.166	19.600***	34.026	32.841

partition	(1.420)	(3.300)	(0.000)	(0.000)
Catholicism (Rome)	2.295 (1.470)	19.292*** (3.310)	34.546 (0.000)	33.050 (0.000)
Greek Catholicism	2.583* (1.660)	19.928*** (3.310)	41.014 (0.010)	36.580 (0.000)
Protestantism	2.119 (1.170)	19.732*** (3.300)	42.778 (0.010)	-12.106 (-0.000)
Baptism/Evangelism	-23.361 (-0.000)	-	-	-10.373 (-0.000)
Islam	1.196 (0.680)	17.110*** (2.830)	36.501 (0010)	-16.641 (-0.000)
Hinduism	-	-	-	-
Judaism	-	-	-	-
Buddhism, Lamaism	1.072 (0.690)	17.176*** (2.92)	-	-17.752 (-0.000)
Krishnaism				
Jehovah's witnesses	-	17.394*** (2.800)	-	-17.800 (-0.000)
Believe in God but do not belong to any confession	1.927 (1.260)	19.136*** (3.220)	-	31.688 (0.000)
Other	1.628 (0.950)	19.540*** (3.230)	34.904 (0.000)	-
Settlement type				
Village	0.410 (1.070)	-0.213 (-0.480)	1.057 (0.380)	-0.820 (-0.390)
Urban settlement	0.584 (1.450)	-0.300 (-0.640)	2.439 (0.850)	1.241 (0.570)
Small town				
Medium town	0.054 (0.130)	-0.537 (-1.140)	-0.258 (-0.090)	0.587 (0.270)
City	0.291 (0.740)	0.006 (0.010)	1.667 (0.580)	2.194 (1.040)
Large city	0.302 (0.720)	-0.060 (-0.130)	3.127 (1.040)	-3.701 (-1.550)
Oblast				
Crimea	-0.139 (-0.150)	1.303 (0.980)	9.635 (1.090)	-7.581 (-1.000)
Kyiv city	0.199 (0.260)	-1.714* (-1.680)	-0.221 (-0.030)	9.065 (1.510)
Kyivskaya	-0.312 (-0.540)	-1.525** (-2.180)	-0.025 (-0.010)	4.456 (0.990)
Vinnitskaya	-0.815 (-1.150)	-0.060 (-0.060)	4.435 (0.660)	-1.082 (-0.200)
Volynskaya				
Dnepropetrovskaya	-0.435 (-0.890)	-0.885* (-1.700)	-1.106 (-0.310)	4.812 (1.220)
Donetskaya	-0.443 (-0.820)	-0.559 (-0.870)	2.140 (0.510)	2.906 (0.660)

Zitomirskaya	-1.043* (-1.810)	-1.875*** (-2.810)	-2.629 (-0.540)	-2.952 (-0.590)
Zakarpatskaya	-1.451** (-2.500)	-0.569 (-0.960)	-	0.819 (0.190)
Zaporojskaya	-1.189 (-1.450)	0.511 (0.440)	6.518 (0.850)	-2.435 (-0.390)
Ivano-frankovskaya	-0.061 (-0.100)	-0.370 (-0.530)	3.614 (0.780)	0.681 (0.150)
Kirovogradskaya	-0.361 (-0.510)	-2.151** (-2.410)	1.099 (0.190)	4.549 (0.880)
Luganskaya	-0.732 (-1.130)	-1.670** (-1.970)	-2.748 (-0.480)	7.460 (1.430)
Lvovskaya	-0.712 (-1.150)	-1.250* (-1.720)	2.445 (0.500)	4.724 (1.000)
Nikolaevskaya	-0.339 (-0.490)	-1.811** (-2.150)	-2.193 (-0.370)	4.556 (0.940)
Odesskaya	0.542 (-1.000)	-0.430 (-0.740)	-2.620 (-0.610)	-0.291 (-0.060)
Poltavskaya	-0.611 (-0.680)	-4.071*** (-3.19)	-5.293 (-0.640)	7.671 (1.120)
Rovenskaya	0.345 (0.520)	0.649 (0.820)	-	3.856 (0.810)
Sumskaya	-0.456 (-0.730)	-0.468 (-0.580)	1.380 (0.230)	1.709 (0.350)
Ternopolskaya	-0.869 (-1.200)	-2.957*** (-3.120)	-10.699 (-1.620)	5.911 (1.100)
Kharkovskaya	-0.244 (-0.460)	-1.934*** (-3.010)	-6.387 (-1.420)	5.550 (1.290)
Khersonskaya	-0.033 (-0.030)	2.196 (1.560)	-	2.352 (0.320)
Khmelnitskaya	0.066 (0.120)	-1.182* (-1.810)	-	-1.261 (-0.260)
Cherkasskaya	-0.340 (-0.480)	-1.832** (-2.030)	-3.361 (-0.540)	4.846 (0.870)
Chernovitskaya	-0.167 (-0.250)	0.228 (0.310)	-	7.837* (1.740)
Chernigovskaya	0.534 (0.810)	-2.829*** (-3.090)	-	2.411 (0.510)
Inverse Mills ratio	-5.982*** (-9.600)	-5.696*** (-7.240)	-9.836* (-1.670)	-8.932** (-2.340)
Const	8.799* (1.740)	-18.400 (-0.980)	-6.768 (-1.910)	-28.641 (-1.090)
Log likelihood	-7737.8475	-4446.9782	-500.15679	-914.94821
Wald chi2(82)	1722.06	61434.33	-	1462.49
Prob(chi2-statistic)	0.0000	0.0000	-	0.0000
Left-censored obs.	2083	2079	2076	2077
Uncensored obs.	2588	1399	94	175
Total obs.	4671	3478	2170	2252

*** significant at 1% ** significant at 5% * significant at 10%

Appendix 13.

Myopic and rational addiction Tobit models with random effect for year 2003.

(z-statistics are in the parentheses)

Logarithm of ethanol consumption is a dependent variable

	Myopic model	**Rational addiction model**
Income per cap, log	0.282*** (7.760)	0.180*** (4.440)
Price on vodka, log		
2002	-6.101*** (-9.390)	3.319*** (3.440)
2003	9.231*** (11.000)	-2.550 (-1.570)
2004		-2.828** (-2.370)
Price on beer, log		
2002	7.105*** (6.390)	9.635*** (7.060)
2003	-4.292*** (-4.470)	-15.310*** (-8.380)
2004		12.012*** (5.990)
Price on wine, log		
2002	0.002 (0.000)	1.940** (2.160)
2003	0.987 (1.180)	-0.627 (-0.400)
2004		-0.453 (-0.370)
Price on sugar, log	-5.352*** (-4.610)	-12.881*** (-8.930)
Age	-0.017*** (-4.840)	0.012*** (3.250)
Employment (0/1)	-0.311*** (-4.130)	-0.601*** (-8.030)
Smoke (0/1)	-2.522*** (-34.810)	-2.558*** (-35.240)
Settlement type		
Village		
Urban settlement	0.052 (0.560)	-0.291** (-2.430)
Small town	-0.875*** (-2.900)	-0.212 (-1.290)
Medium town	-0.587*** (-5.590)	-1.026*** (-10.590)
City	-0.684*** (-7.520)	-0.777*** (-9.460)
Large city	-0.924*** (-10.220)	-0.358*** (-2.780)
Inverse Mills ratio	-2.913*** (-26.590)	-3.207*** (-26.240)
Const	-4.575	9.555*** (4.250)
Log likelihood	-9103.5982	-9086.2504
Wald chi2(82)	12865.81	4726.38
Prob(chi2-statistic)	0.0000	0.0000
Left-censored obs.	1903	1903
Uncensored obs.	3591	3591
Total obs.	5494	5494

*** significant at 1% ** significant at 5% * significant at 10%

Appendix 14.

Demand for alcohol by gender, panel Tobit static model with random effect.
(z-statistics are in the parentheses)
Logarithm of ethanol consumption is a dependent variable

	Males	**Females**
Income per cap, log	-0.133 (-1.080)	-0.038 (-0.170)
Price on vodka, log	-0.309 (-0.120)	3.200 (0.980)
Price on beer, log	0.946 (0.190)	-2.788 (-0.440)
Price on wine, log	0.129 (0.040)	-0.680 (-0.170)
Price on sugar, log	-0.555 (-0.220)	-11.443*** (-3.450)
Age	-0.018 (-1.400)	-0.008 (-0.330)
Employment (0/1)	-0.072 (-0.380)	0.038 (0.140)
Smoke (0/1)	1.335*** (5.110)	0.741 (1.390)
Chronic disease (0/1)	0.061 (0.360)	-0.403 (-1.580)
Health status		
Very good		
Good	-0.153 (-0.180)	-4.340** (-2.480)
Average	-0.391 (-0.460)	-5.380*** (-2.990)
Bad	-1.395* (-1.670)	-4.413*** (-2.630)
Marriage status		
Single	-0.801 (-1.010)	-0.724 (-0.670)
Non-registered marriage	-1.113* (-1.880)	0.233 (0.260)
Registered marriage	-1.142** (-2.240)	-0.282 (-0.380)
Widowed	-1.754*** (-2.670)	-0.418 (-0.480)
Divorced	-0.557 (-0.880)	-1.246 (-1.420)
Separated		
Kids		
0	-0.972 (-0.420)	2.946 (1.540)
1	-0.861 (-0.380)	2.816 (1.520)
2	-0.496 (-0.220)	2.448 (1.330)
3	-0.734 (-0.320)	2.426 (1.300)
4	-1.084 (-0.470)	3.274* (1.680)
5	-0.262 (-0.110)	2.403 (1.100)
6	-	-
7	-	-
8		
14	-	2.165 (0.440)
Education		
Grades 1-6	-5.187* (-1.750)	1.083 (0.300)
Grades 7-9	-4.920* (-1.670)	1.201 (0.340)
Grades 10-11 without a diploma of a	-4.966* (-1.680)	1.035 (0.290)

high school		
Diploma of a high school	-5.144* (-1.740)	0.628 (0.180)
Diploma of PTU, FZU, FZO without a secondary education	-5.081* (-1.720)	0.574 (0.160)
Diploma of PTU with a secondary education	-5.199* (-1.760)	0.597 (0.170)
Diploma of a technical, medical, music, art, pedagogical school	-5.429* (-1.840)	0.911 (0.250)
Incomplete professional higher education	-4.791 (-1.580)	0.242 (0.060)
Bachelor degree	-4.750 (-1.570)	-0.747 (-0.200)
Diploma of specialist	-5.199* (-1.760)	0.789 (0.220)
Master's degree	-4.581 (-1.500)	0.033 (0.010)
Candidate of sciences, doctor of sciences		
Other	-	-
Life satisfaction		
Fully satisfied		
Satisfied	-0.272 (-0.660)	-0.955 (-1.550)
Rather satisfied	-0.292 (-0.720)	-0.838 (-1.400)
Less than satisfied	-0.302 (-0.750)	-1.173* (-1.940)
Not satisfied at all	-0.187 (-0.460)	-0.892 (-1.430)
Religion		
Do not follow any religion	1.831 (0.750)	21.075** (2.370)
Ukrainian Orthodox (Kyiv Patriarchy)	1.244 (0.510)	20.956** (2.360)
Ukrainian Orthodox (Moscow Patriarchy)	1.702 (0.690)	20.355** (2.290)
Russian Orthodox	1.544 (0.620)	20.539** (2.310)
Orthodox without any partition	1.522 (0.620)	21.205** (2.360)
Catholicism (Rome)	2.096 (0.840)	20.788** (2.340)
Greek Catholicism	1.914 (0.760)	22.575** (2.470)
Protestantism	-1.106 (-0.380)	23.001** (2.410)
Baptism/Evangelism	-30.232 (-0.000)	-
Islam	-0.798 (-0.280)	20.649** (2.250)
Hinduism	-	-
Judaism	-	-
Buddhism, Lamaism	-0.360 (-0.140)	19.639** (2.190)
Krishnaism		
Jehovah's witnesses	-	20.425** (2.200)
Believe in God but do not belong to any confession	1.298 (0.530)	20.578** (2.310)
Other	2.954 (1.090)	20.067** (2.220)
Settlement type		
Village	0.569 (1.040)	-0.477 (-0.680)

Urban settlement	0.598 (1.040)	0.263 (0.350)
Small town		
Medium town	-0.104 (-0.180)	-0.738 (-0.980)
City	0.495 (0.890)	-0.360 (-0.490)
Large city	0.246 (0.410)	-0.489 (-0.640)
Oblast		
Crimea	-1.201 (-0.870)	1.043 (0.590)
Kyiv city	-0.588 (-0.520)	0.579 (0.410)
Kyivskaya	-0.176 (-0.210)	-1.167 (-1.000)
Vinnitskaya	-0.633 (-0.610)	-1.870 (-1.390)
Volynskaya		
Dnepropetrovskaya	-0.961 (-1.380)	0.015 (0.010)
Donetskaya	-1.043 (-1.340)	0.203 (0.180)
Zitomirskaya	-2.020** (-2.440)	-0.696 (-0.640)
Zakarpatskaya	-0.609 (-0.760)	0.152 (0.140)
Zaporojskaya	-1.954 (-1.610)	-0.319 (-0.210)
Ivano-frankovskaya	-1.615* (-1.770)	0.914 (0.760)
Kirovogradskaya	0.020 (0.020)	-1.685 (-1.250)
Luganskaya	-1.311 (-1.390)	-0.610 (-0.050)
Lvovskaya	-0.948 (-1.060)	-0.787 (-0.650)
Nikolaevskaya	-2.219** (-2.140)	0.970 (0.590)
Odesskaya	-0.468 (-0.610)	1.074 (1.000)
Poltavskaya	-1.136 (-0.850)	-0.456 (-0.250)
Rovenskaya	1.033 (1.060)	-0.205 (-0.160)
Sumskaya	-0.971 (-1.080)	-1.416 (-1.150)
Ternopolskaya	-2.302** (-2.120)	0.626 (0.410)
Kharkovskaya	-0.599 (-0.780)	-0.363 (-0.340)
Khersonskaya	0.114 (0.080)	0.407 (0.200)
Khmelnitskaya	-0.256 (-0.320)	0.843 (0.780)
Cherkasskaya	-0.9240 (-0.910)	-0.159 (-0.110)
Chernovitskaya	-0.744 (-0.770)	-0.589 (-0.380)
Chernigovskaya	-0.409 (-0.420)	-0.453 (-0.360)
Inverse Mills ratio	-1.927 (-1.020)	-10.363*** (-4.480)
Const	6.418 (0.860)	-6.661 (-0.920)
Log likelihood	-6041.0605	-5724.9785
Wald chi2(82)	276.65	741.18
Prob(chi2-statistic)	0.0000	0.0000
Left-censored obs.	427	1651
Uncensored obs.	2085	1607
Total obs.	2512	3258

*** significant at 1% ** significant at 5% * significant at 10%

Appendix 15.

Demand for alcohol by income groups, panel Tobit static model with random effect.

(z-statistics are in the parentheses)

Logarithm of ethanol consumption is a dependent variable

	Lower income (<500 UAH)	**Middle income (>=500 & <1000 UAH)**	**Higher income (>=1000 UAH)**
Income per cap, log	-0.264** (-2.350)	2.153** (2.400)	0.067 (0.070)
Price on vodka, log	1.941 (0.850)	-6.722 (-0.880)	27.346** (1.990)
Price on beer, log	0.631 (0.150)	-23.930 (-1.450)	-32.528 (-1.210)
Price on wine, log	-0.628 (-0.230)	6.320 (0.640)	13.090 (0.790)
Price on sugar, log	-6.501*** (-2.840)	7.526 (1.030)	-17.488 (-1.410)
Age	-0.006 (-0.520)	-0.046 (-1.640)	-0.227*** (-3.690)
Gender	-0.681** (-1.980)	0.178 (0.240)	-4.183*** (-3.390)
Employment (0/1)	-0.081 (-0.510)	0.356 (0.800)	0.987 (1.010)
Smoke (0/1)	0.948*** (4.560)	0.680 (1.400)	0.436 (0.390)
Chronic disease (0/1)	-0.104 (-0.700)	0.030 (0.080)	-0.090 (-0.130)
Health status			
Very good			
Good	-1.435* (-1.650)	3.432 (1.290)	1.457 (0.510)
Average	-1.917** (-2.210)	3.082 (1.150)	1.169 (0.380)
Bad	-1.914** (-2.210)	2.819 (1.040)	0.065 (0.020)
Marriage status			
Single	-0.483 (-0.690)	-1.102 (-0.720)	-
Non-registered marriage	-0.258 (-0.470)	-0.965 (-0.690)	2.938 (0.950)
Registered marriage	-0.592 (-1.240)	0.072 (0.060)	3.104 (1.100)
Widowed	-0.731 (-1.390)	-0.054 (-0.040)	5.975* (1.950)
Divorced	-0.916* (-1.680)	-0.707 (-0.570)	4.168 (1.510)
Separated			
Kids			
0	-2.787 (-0.790)	1.415 (1.020)	2.799 (1.260)
1	-2.645 (-0.750)	1.071 (0.880)	0.968 (0.450)
2	-2.552 (-0.720)	0.753 (0.630)	0.868 (0.400)
3	-2.670 (-0.760)	-0.371 (-0.280)	-
4	-2.325 (-0.650)	-	-
5	-2.279 (-0.630)	-	-
6	-4.242 (-1.130)	-	-
7	-	-	-
8			
14	-	-	-
Education			
Grades 1-6	0.271 (0.340)	1.968 (0.660)	-

Grades 7-9	0.495 (0.690)	-0.094 (-0.040)	6.834* (1.930)
Grades 10-11 without a diploma of a high school	0.250 (0.350)	1.237 (0.520)	2.913 (0.920)
Diploma of a high school	0.010 (0.140)	1.444 (0.630)	0.252 (0.130)
Diploma of PTU, FZU, FZO without a secondary education	0.087 (0.120)	0.222 (0.100)	1.140 (0.440)
Diploma of PTU with a secondary education	-0.003 (-0.000)	2.308 (1.020)	-
Diploma of a technical, medical, music, art, pedagogical school	0.132 (0.200)	1.180 (0.530)	1.327 (0.720)
Incomplete professional higher education	0.226 (0.240)	1.809 (0.750)	-
Bachelor degree	-0.536 (-0.650)	1.424 (0.630)	2.093 (0.780)
Diploma of specialist	0.126 (0.190)	0.971 (0.390)	1.186 (0.620)
Master's degree	-	-	-
Candidate of sciences, doctor of sciences			
Other	2.205 (0.810)	4.032 (0.970)	6.120* (2.210)
Life satisfaction			
Fully satisfied			
Satisfied	-0.734* (-1.800)	0.184 (0.250)	-0.283 (-0.310)
Rather satisfied	-0.600 (-1.500)	-0.230 (-0.300)	-1.275 (-1.320)
Less than satisfied	-0.807** (-2.040)	0.442 (0.580)	0.556 (0.550)
Not satisfied at all	-0.659* (-1.660)	1.029 (1.240)	-0.655 (-0.600)
Religion			
Do not follow any religion	20.712*** (3.330)	18.518 (1.020)	5.863** (2.540)
Ukrainian Orthodox (Kyiv Patriarchy)	20.419*** (3.290)	17.575 (0.970)	7.191*** (2.960)
Ukrainian Orthodox (Moscow Patriarchy)	20.286*** (3.270)	18.305 (1.010)	5.923** (2.290)
Russian Orthodox	20.290*** (3.260)	18.869 (1.040)	7.301** (2.960)
Orthodox without any partition	20.558*** (3.290)	18.778 (1.030)	8.779*** (2.990)
Catholicism (Rome)	20.819*** (3.360)	17.986 (1.000)	3.903*** (1.630)
Greek Catholicism	21.621*** (3.410)	18.826 (1.030)	-
Protestantism	20.420*** (3.240)	-14.207 (-0.000)	-
Baptism/Evangelism	-	-	-
Islam	19.082*** (3.000)	-	-
Hinduism	-	-	-
Judaism	-	-	-

Buddhism, Lamaism	18.846*** (3.040)	18.835 (1.040)	-
Krishnaism			
Jehovah's witnesses	20.861*** (3.220)	14.675 (0.800)	-
Believe in God but do not belong to any confession	20.236*** (3.230)	18.726 (1.020)	3.903 (1.630)
Other	20.761*** (3.250)	18.730 (1.010)	-
Settlement type			
Village	0.083 (0.180)	-0.057 (-0.040)	1.004 (0.370)
Urban settlement	0.390 (0.800)	1.635 (1.130)	1.809 (0.480)
Small town			
Medium town	-0.405 (-0.820)	0.172 (0.120)	0.593 (0.250)
City	0.048 (0.100)	0.752 (0.550)	0.623 (0.340)
Large city	-0.005 (-0.010)	0.449 (0.320)	-2.288 (-1.010)
Oblast			
Crimea	-0.351 (-0.290)	4.710 (1.190)	6.303 (1.060)
Kyiv city	-0.007 (-0.010)	0.191 (0.060)	-1.059 (-0.220)
Kyivskaya	-0.332 (-0.440)	-3.168 (-1.600)	-18.533*** (-4.320)
Vinnitskaya	-1.277 (-1.410)	1.011 (0.340)	-0.946 (-0.240)
Volynskaya			
Dnepropetrovskaya	-0.100 (-0.160)	-2.634* (-1.880)	0.154 (0.080)
Donetskaya	-0.299 (-0.430)	-0.607 (-0.380)	2.449 (0.940)
Zitomirskaya	-1.153 (-1.610)	-3.129 (-1.460)	-
Zakarpatskaya	0.003 (0.000)	-1.986 (-1.140)	-
Zaporojskaya	-1.173 (-1.120)	3.862 (1.090)	11.152** (2.050)
Ivano-frankovskaya	-0.358 (-0.450)	0.679 (0.330)	-0.542 (-0.200)
Kirovogradskaya	-0.723 (-0.820)	-0.379 (-0.150)	-
Luganskaya	-0.436 (-0.520)	-3.153 (-1.250)	-4.601 (-1.060)
Lvovskaya	-0.896 (-1.140)	0.763 (0.360)	0.615 (0.180)
Nikolaevskaya	-0.396 (-0.450)	-2.0760 (-0.890)	0.395 (0.130)
Odesskaya	0.351 (0.520)	-1.087 (-0.670)	2.257 (0.930)
Poltavskaya	-0.404 (-0.350)	-3.942 (-1.010)	-
Rovenskaya	0.387 (0.450)	1.644 (0.770)	0.235 (0.090)
Sumskaya	-1.032 (-1.290)	0.989 (0.370)	-
Ternopolskaya	-0.550 (-0.590)	-2.786 (-1.070)	-2.146 (-0.580)
Kharkovskaya	-0.259 (-0.380)	-1.567 (-0.910)	-7.396 (-1.530)
Khersonskaya	0.126 (0.100)	3.492 (0.840)	6.420 (1.010)
Khmelnitskaya	0.440 (0.630)	0.084 (0.050)	-1.802 (-0.530)
Cherkasskaya	-0.227 (-0.250)	-2.983 (-1.120)	-
Chernovitskaya	-0.445 (-0.510)	-0.423 (-0.210)	-5.877 (-1.360)
Chernigovskaya	-0.437 (-0.510)	1.771 (0.860)	-2.063 (-0.810)
Inverse Mills ratio	-7.566*** (-9.640)	-8.011*** (-3.410)	4.491 (0.840)
Const	-10.400	-12.653	-27.118 (-0.910)
Log likelihood	-10495.266	-1129.776	-177.0762

Wald chi2(82)	11866.82	5149.22	-
Prob(chi2-statistic)	0.0000	0.0000	-
Left-censored obs.	1940	125	13
Uncensored obs.	3214	391	87
Total obs.	5154	516	100

*** significant at 1% ** significant at 5% * significant at 10%