Alcohol Consumption in Russia: Price Elasticity Analysis and Its Policy Implications

Master Thesis Policy Economics

Name: Varvara Sukhanova
Student ID: 543140
Supervisor: prof. dr. B. Visser
Second assessor: dr. Aart Gerritsen
Date: 05.06.2020

Erasmus School of Economics
Erasmus University Rotterdam

Abstract

Russia has long been among the heaviest-drinking countries in the world. During the past decades Russia demonstrated one of the highest rates of alcohol use disorders and male mortality due to the hazardous drinking. Since early 2000's various policy measures were introduced. Price regulation is assumed to be the most efficient measure. This paper investigates the effect of vodka price changes on the amount of alcohol consumed by Russian citizens exploiting the variation caused by the policy measures. Using a Regression Kink Design vodka price elasticities were estimated and lied in the interval from -0.5 and -1.2 for the vodka consumption and -0.33 to -0.93 for the total pure alcohol consumption. Current elasticity estimates can potentially be used in a future social cost-benefit analysis of Russian anti-alcohol policies.

1. Introduction.

The negative consequences caused by excessive alcohol consumption make it difficult to analyze alcohol consumption using the usual methods used for evaluating other consumer products. Unlike most products, alcoholic beverages can cause addiction, reduce the quality of life and health, as well as contribute to the deterioration of the individual's economic and social status in society. Alcohol leads to an increase in the number of deaths from accidents, worsening of the individual's health and, as a result, a drop in the productivity, increased medical expenses and a decrease in the quality of life. It is not only the individual who suffers, but the state as a whole. Negative consequences of alcohol consumption for the state include increased burden on the health system, mortality, crime and traffic accidents, reduced productivity of the working population, and a reduction in the country's human capital. All this has a negative impact on the economic growth and the well-being of society in the long term. The availability of alcohol, government restrictions, the level of income of citizens, and individual characteristics of individuals can influence the consumption of alcohol by the residents (World Bank, 2003).

Russia has long been among the heaviest-drinking countries in the world. During the past decades Russia demonstrated one of the highest rates of alcohol use disorders and male mortality due to the hazardous drinking.

Despite various policy measures directed at curbing alcohol consumption, according to the World Health Organization as of 2016, Russia was one of the leading countries by alcohol consumption among people over 15 years old. Annual per capita consumption of alcohol decreased by 43% between 2003 and 2016 and stopped at 11-12 liters of pure alcohol which is equivalent to 5 bottles of vodka a month (WHO GHO, 2016).

Drinking 60 grams of pure ethanol or more at least once in the past 30 days is called the heavy episodic drinking (HED) and considered as harmful (WHO). 61% of Russian drinkers practiced HED within 30 days in 2016 (WHO GHO, 2016). It is one of the highest rates worldwide (see Appendix A). No wonder that Russia was ranked 2nd both by the share of population suffering from alcohol-related diseases (4.7%) and mortality rate (30.5% of deaths) due to the alcohol consumption (GBD, 2017; WHO GHO, 2012). About one-third of all deaths and half of the deaths among working-age men are somehow related to the excessive alcohol consumption (Nemtsov 2002, Leon et al. 2007). Figure 1 represents countries by both average annual consumption of pure alcohol per capita and the share of population suffering from

alcohol use disorders. According to report of the commission on social and demographic policy (2009) Russia was losing 1.5-2% of its GDP due to excessive alcohol consumption annually.

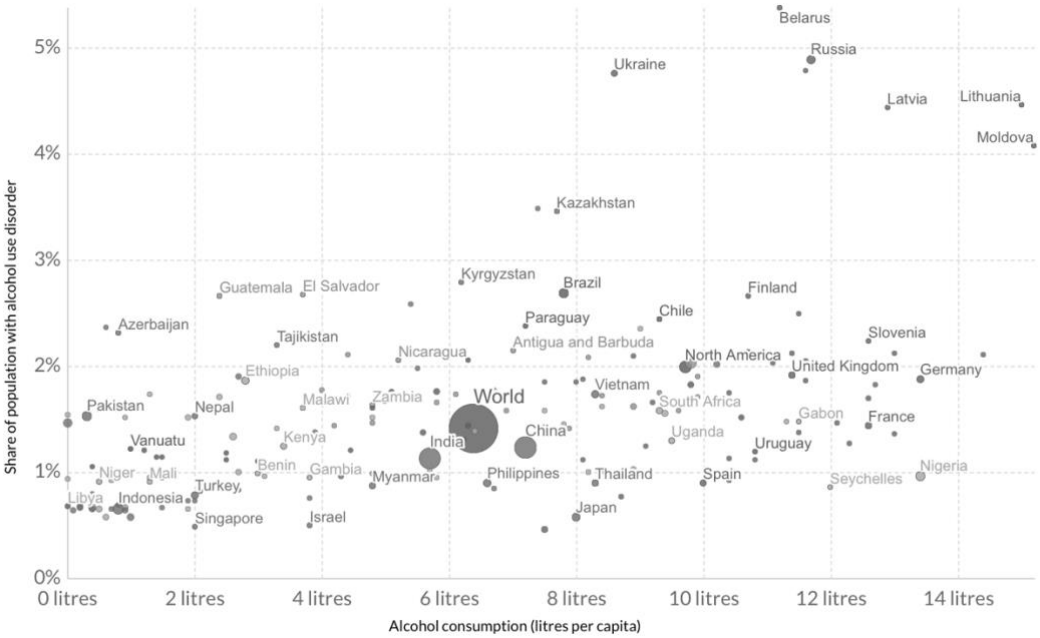

Figure 1. Total Annual Consumption of Pure Alcohol Per Capita (in liters per year, for people 15+ years, adjusted for tourist consumption) and the Share of Population Suffering from Alcohol Use Disorders, 2016

Source: GBD 2017, WHO GHO, 2016

During last two decades, Russia has significantly curbed its alcohol consumption. However, the country remains one of the leading countries suffering from excessive alcohol consumption and requires alcohol policies to be implemented and correctly evaluated.

Generally, increasing alcohol price should be an accessible, easy to implement, regulating mechanism due to the demand curve's negative slope. According to WHO's recommendations raising the price of alcohol (WHO, 2010) and setting a minimum price for certain types of alcohol (WHO, 2017) are the main methods for reducing alcohol consumption in low-income countries. Other studies further support pricing methods being effective anti-alcohol policies (Wagenaar, 2010; Elder et al., 2010; Xu & Chaloupka, 2011).

Since early 2000's Russian government introduced various anti-alcohol measures: implementation of a minimum price on vodka, raising taxes on alcohol and banning sales between certain hours (see Table B.1. in the Appendix). Such policies would be expected to be effective, but there's currently a lack of objective policy evaluations and cost-benefit analysis. The latter is difficult to conduct without price elasticity estimates. Therefore, the purpose of this paper is to determine the effect of vodka price changes on the amount of alcohol consumed by Russian citizens exploiting the variation caused by the policy measures.

Spirits (especially vodka) are very popular in Russia, in contrast with many European countries, where consumption of softer alcoholic beverages prevails. Even the concept of so-called “Russian soul” goes hand in hand with excessive consumption of vodka – one of the most harmful alcoholic beverages linked to hazardous drinking. Therefore, this research focuses on the vodka price regulations introduced during the past years (see Table B.2. in the Appendix).

Data about the individuals (their alcohol drinks consumption during the last 30 days, health and socioeconomic characteristics) will be taken from the Russian Longitudinal Monitoring Survey (RLMS-HSE). It is a nationally representative panel survey of individuals and households they belong to. Data is collected annually since 1994. Local alcohol prices of beverages will be collected from the official Rosstat database.

It is important to take into account such behavioral aspects of alcohol consumption as habit formation and a peer effect. Theoretical models used by Cook and Moor (2000), Becker and Murphy (1988) and Yakovlev (2018) assumed that amount of alcohol consumed depends on its price, price of other alcohol beverages, individual habits, peer effects and a set of demographic and socioeconomic characteristics of the individual and municipality. Using RLMS-HSE data from 2000-2014 Yakovlev (2018) demonstrated that these assumptions hold for discrete choice model, where individuals make decision to drink heavily or not.

The price elasticity will be estimated using a regression kink design (RKD, Card et al. 2016). The purpose of this research is to find a causal effect of the vodka price change on the amount of vodka and pure alcohol consumed. Yakovlev (2018) estimated the price elasticity of being a heavy drinker using a discrete choice model. However, there are still no reliable estimates for the price elasticity of alcohol consumption. Having these estimates can be useful for the cost-benefit analysis. In 2000-2010 Russian authorities annually linked the vodka excise tax to the consumer price index. That means that growth rates of the vodka excise tax and the consumer price index growth rate were following the same trend. After 2011 the growth rate of the tax exceeded the CPI growth rate more than twice. In this paper I will call it a kink in a policy regime, following Yakovlev’s notation (Yalovlev 2018). Change in the slope of the excise tax will be used to obtain causal effect estimates around 2011. Thus, empirical part of the thesis will be based on 2000-2014 data.

The model will control for individual demographic and socioeconomic characteristics, peer effect and habit formation, municipality and time fixed effects as well as their interaction.

It be estimated for females and males separately, as their consumption trends differ a lot. Model will also be estimated for 2 groups of drinkers separately: light/moderate and heavy. Group elasticities can vary due to the strength of drinking habit. Heavy drinkers are the main groups of interest for the policy makers, as they cause the most harm to themselves and society. The sensitivity analysis and a robustness check will be conducted, using alternative variables and subsamples.

The elasticity values will be used to calculate expected change in alcohol beverages consumption caused by the particular vodka price regulation. Based on this information more sophisticated costs and benefits of such a policy measure can be calculated in future and contribute to the CBA analysis of the Russian anti-alcohol policy.

The thesis is organized as follows. Section II includes a literature review and the main hypotheses of the paper. Section III describes the data and methodology of the empirical model. Results of the estimation are presented and discussed in section IV. Sensitivity analysis and robustness check are presented in Section V. Section VI concludes.

II. Literature Review.

If we assume that individuals are rational then we expect them to maximize their utility when choosing the amount of alcohol to consume. Their utility from alcohol consumption depends on the price of alcoholic beverage, past consumption (habit), peers' alcohol consumption (amount of alcohol consumed by one's peers) and a set of demographic and socioeconomic characteristics of the individual and municipality. In this section we will discuss theoretical and empirical papers investigating factors that influence individual's utility from alcohol consumption.

Theoretical papers

Price elasticity represents the effect of price change on quantity of alcoholic beverages consumed. If the price elasticity is negative, alcohol consumption decreases with the rise in its price. If elasticity's absolute value is greater than 1, alcohol beverage is called price-elastic (Anderson et al., 2012): 1% price increase leads to more than 1% consumption decrease. Inelastic alcohol consumption in this case will mean that a decrease in consumption will be less than 1%. There is no effect if elasticity is equal to zero.

Habit Formation Models

One of the main issues with analyzing alcohol consumption is that alcohol is causing addiction. Economists came up with the habit formation model (Pollak (1970) and Ryder and Heal (1973)) for analyzing the addictive goods demand. In the habit formation models consumer's utility depends both on current (c_t) and past consumptions ($c_{t-1}, c_{t-2}, \dots$). The utility function can be represented as follows:

$$U_t = U(c_t, z_t), \qquad (1)$$

$$where\ z_t = f(c_{t-1}, c_{t-2}, \dots)$$

Past consumption defines the "habit level". High level of the past consumption ($c_{t-1}, c_{t-2}, \dots$) leads to the higher habit level ($z_t = f(c_{t-1}, c_{t-2}, \dots$). For larger habit level we get higher marginal utility from consuming the good at time t. Larger the marginal utility – more the incentive to consume more good at time t. For instance, extra cigarette gives more joy to the person who smoked a lot in the past. Habit level can be represented either as a vector

of past consumptions, or as a weighted sum of past consumptions ($z_t = \gamma_{t-1}c_{t-1} + \gamma_{t-2}c_{t-2} + \cdots + \gamma_0 c_0$). Pollak (1970) and Ryder and Heal (1973) assumed that habit level is the exponentially weighted sum of previous consumption levels. They assume that consumption in the more distant past affect current preferences less than recent past. This model describes the main idea of addiction which can be applied for the alcohol consumption analysis.

However, this was just a simple example of a one period utility function. We assume that most of the individuals are aware of the addictive nature of alcohol and its negative consequences for their health, despite the fact that some information asymmetry exists. If so, why do people still consume alcohol? There are two main models of habit formation that can explain this. There are two main habit-formation models: myopic or forward-looking.

Myopic Consumer

Moor and Cook (1995) studied alcohol consumption assuming individual to be "myopic". It means that individuals recognize that their current consumption depends on the past consumption (addiction), but they do not understand that future consumption will be affected by their past and current decisions. Therefore, utility of a "myopic" consumer depends on his past and current consumption of addictive good and consumption of a composite good with unit price. Moor and Cook (1995) also included individual's health capital in the utility function, but we will ignore it here. Individual maximizes his utility with respect to the budget constraint:

$$\begin{cases} U_t = U(C_t, C_{t-1}, Y_t) \rightarrow max \\ P_t * C_t + Y_t = I_t \end{cases} \qquad (2)$$

,where U_t – individual's utility at time t, C_t – addictive good consumption at time t, C_{t-1} – addictive good consumption at time $(t-1)$, Y_t – consumption of a composite good with unit price, P_t – price of the addictive good at time t, I_t – individual's income in the period t.

Rational Addiction

The more advanced model described by Becker et al. (1994) assumed that an individual also takes his future consumption of an addictive good into account. So, he realizes his that his current consumption will lead to stronger addiction. Therefore, individual is facing an

intertemporal choice where he tries to maximize a discounted sum of current and all future utilities with respect to the life-long budget constraint:

$$\begin{cases} U = \sum_{t=1}^{\infty} \beta^{t-1} * U\,(C_t, C_{t-1}, Y_t, e_t). \\ \sum_{t=1}^{\infty} \beta^{t-1}\,(Y_t + P_t C_t) = I \\ C_0 = C^0 \end{cases} \qquad (3)$$

, where $\beta = \frac{1}{1+r}$ is a discount factor, r – a discount rate, I is a present value of wealth, e_t – impact of other variables on utility during life, $C_0 = C^0$ is level of alcohol consumption at period zero.

Usually rational addiction dynamic model is used for analyzing cigarettes demand on a panel data (Chaloupka, (1991), Pekurinen (1991)), Bardsley and Olekans (1998)). Both myopic and forward-looking dynamic models need to be estimated carefully to avoid potential serial correlation and biases, thus are not used that frequently.

Both of these models assume some type of consumers' behavior. Many of the researchers prefer to use a myopic setup. However, forward-looking setup could be also useful, as alcohol consumption is related to long run consequences on individual's health. These consequences are widely-discussed in the society, so it is expected that consumers are likely to take them into account.

Peer Effects

Other important factor that can affect consumers' choice of alcohol consumption is peer effect. In general, it can be described as "individual tends to drink more if his peers on average drink more". Individuals' alcohol consumption is correlated with average alcohol consumption in his peer group. Thus, the model used to estimate peer effect can be represented as follows:

$$Alco_{ij} = \alpha + \beta \overline{Alco_j} + \xi_{ij} \qquad (4)$$

, where $Alco_{ij}$ is alcohol consumption of individual *i* from peer group *j*, $\overline{Alco_j}$ is average alcohol consumption in peer group *j*. According to Angrist (2013), if one estimates equation (4) without covariates, he will get $\beta = 1$.

$$\frac{\sum_j \sum_i alco_{ij}(\overline{alco_j} - \overline{alco})}{\sum_j (\overline{alco_j} - \overline{alco})^2} = \frac{\sum_j (\overline{alco_j} - \overline{alco})(n_j \bar{s_j})}{\sum_j (\overline{alco_j} - \overline{alco})^2} = 1 \qquad (5)$$

Thus, it is important to estimate peer effect models using control variables. However, such issues as reflection and selection bias and unobserved correlated effects within a peer sample usually arise during the peer effect estimation (Brock and Durlauf 2001, Moffitt 2001, Caeyers et al. 2016). Reverse causality between peers' alcohol consumption can be an issue, especially in smaller peer groups. Instruments are usually used to avoid this issue (Angrist (2013) and Caeyers et al. (2016)).

Empirical papers

Now let's look at empirical studies in which scientists from around the world estimated alcohol consumption.

Researches from Foreign Countries

In the alcohol consumption research for the European Union Anderson et al. (2012), mentions three meta-analyses in which average price elasticity estimates were obtained. There were some overlaps in studies covered, but not very large. Each research contained a list of unique papers that were not mentioned in previous meta-analyses.

Citing 64 studies made for EU countries, US, Canada, Australia, New Zealand, Korea, Japan and Kenya Fogarty (2006) reported that average price elasticities of spirits in these countries was -0.7, while average spirits intake was 5.5 liters and average alcohol intake 9.4 liters per person. Gallet (2007) based his conclusions on 132 studies from 24 countries and found price elasticity of spirits to be -0.68. Other meta-analysis of Wagenaar et al. (2009) included 112 studies and reported that price elasticity of spirits was equal to -0.8. Last two papers also provide estimates for a total price elasticity of alcoholic beverages (-0.5). It is important to mention that papers included both aggregate and individual-level estimates and used different methods of estimation. However, after the correction for the publication bias and outliers, Nelson (2013) obtained a new average price elasticity of spirits at the individual level equal to -0.55. Overall papers predict that a 1% increase in the alcohol price leads to 0.5-0.8% decrease in spirits consumption and 0.5% decrease in total alcohol consumption. These estimates were obtained mostly from the EU and US data, thus cannot be directly applied for the Russian alcohol market.

Researches for Russian Alcohol Market

All Russian researches were based on the data obtained from the Russia Longitudinal Monitoring Survey of HSE (RLMS-HSE) – a series of annually nationally representative panel surveys. Most of the studies used different methodologies. The studies are discussed below in chronological order.

Andrienko and Nemtsov (2006) used 1994-2002 RLMS-HSE data to estimate individual price elasticities of alcohol consumption. In the "myopic" case they assumed a quadratic utility function and a marginal utility of income to be constant and got the following demand function for an addictive good:

$$C_t = \alpha + \beta_1 \cdot C_{t-1} + \beta_2 \cdot P_t + \beta_3 \cdot I_t + \varepsilon_t, \qquad (6)$$

, where ε_t is an error term.

From the habit formation theory and a classical demand theory authors assumed $\beta_1 \; and \; \beta_3$ to be positive, β_2 negative for the alcohol market. This assumption was proven applying a combination of Tobit and Heckman estimation to Russian vodka consumption data. Using the same assumption, they run both myopic and rational addiction (RA) models and compare the results. However, they did not find any evidence of rational addiction behavior among Russian alcohol drinkers. Vodka price elasticity was statistically significant and equal to -1.8.

Baltagi and Geishecker (2006) aimed to check if Russian alcohol consumers were following a rational addiction behavior in 1994-2003. They made an assumption about quadratic utility function and got the following demand equation:

$$C_t = \alpha_1 \cdot C_{t-1} + \alpha_1\beta \cdot C_{t+1} + \alpha_2 \cdot P_t + \alpha_3 e_t + \alpha_4 e_{t+1}, \qquad (7)$$

Authors recognized that e_t are serially corelated, therefore they implemented an IV approach using lagged and future prices as instruments. They did not use lagged and future consumption as instruments as their model treated them as endogenous. They have found some evidence of RA for men, but not for women. Moreover, they have noticed a difference between factors driving male and female alcohol consumption in Russia and proposed to estimate the models separately by gender. Both short-run and long-run elasticities were not statistically significant for male and female.

Goryakin et al., (2015) estimated price elasticities of demand for different alcoholic beverages using RLMS-HSE from 1994 to 2009. They used a model with regional fixed effects to control for community-level socioeconomic condition. They ignored habit formation and peer effects. Authors found an effect of alcohol price changes on its consumption. However the effect was weak and often insignificant.

Overview of the main papers estimating price elasticities of spirits and pure alcohol is presented in Table 1. We can see that Russian estimates significantly vary because of the different methodologies of the estimation. However, yet none of the researches used a kink in the policy regime that happened in 2011 as a source of the exogenous variation, that can provide reliable estimates due to the estimation design. This method will be discussed in the methodology part later.

Table 1 – Summary of the main papers estimating price elasticities of spirits and pure alcohol.

Source	**Data**	**Methodology**	**Spirits/Vodka elasticity**	**Pure alcohol elasticity**
Fogarty (2006)	64 studies: EU countries, US, Canada, Australia, New Zealand, Korea, Japan and Kenya	meta-analysis	-0.70	n/a
Gallet (2007)	132 studies from 24 countries	meta-analysis	-0.68	-0.50
Wagenaar et al. (2009)	112 studies worldwide	meta-analysis	-0.80	-0.51
Nelson (2013)	Corrected Gallet, 2007 for the publication bias	meta-analysis	-0.55	-0.50
Andrienko and Nemtsov (2006)	Russia, 1994-2002 RLMS-HSE, vodka in grams per 1 drinking session, not monthly	Tobit and Heckman estimation. Participation and consumption decision.	-1.774	0.027
Baltagi and Geishecker (2006)	Russia, 1994-2003 RLMS-HSE	IV approach using lagged and future prices as instruments	n/a	-0.15
Goryakin et al. (2015)	Russia, 1994-2009 RLMS-HSE	Large number of controls and community FE	-0.020	n/a

Yakovlev (2018) estimated price elasticity of being a heavy drinker for male using a discrete choice model and a regression kink design on Russia Longitudinal Monitoring Survey of HSE 2000-2014. He is the first one to incorporate peer effects using RLMS-HSE alcohol consumption data. To define peer groups in RLMS-HSE dataset he used people from the same age groups living in the same census districts. Each census district included 250-400 respondents. Yakovlev assumed that due to the low level of personal mobility people usually make friends and hang out with people living nearby. He proved this hypothesis showing that during months when at least one of the peers is celebrating his birthday, vodka consumption of all the peers in the group was increasing by 6-18%, while there was no effect on the consumption of other goods.

To incorporate peer effects, he estimated discrete games with incomplete information using Bajari et al. (2010) and Bajari et al. (2015) approach. He assumed that individuals choose to drink heavily based on what they expect their peer group probability to choose heavy drinking is. Individual forms his expectations about the probability of peer group to drink heavily based on known socio-economic characteristics and past alcohol consumption of his peers. Yakovlev proceeds using a two-step estimation. First, estimate group's probability to drink heavily. Second, incorporate this probability into individual's discrete choice model. Applying this methodology to Russian data Yakovlev has found a positive peer effect. I will not provide a deeper explanation of the method as it is relevant only for the discrete choice (drink heavily or not), not continuous that will be considered in this paper.

Yakovlev concluded that a 50% vodka price increase can decrease proportion of heavy drinkers by 25%. He also incorporated the elasticity estimates in the survival model and it turned out that a 50% increase in vodka price can save the life of 30,000–50,000 men every year.

Radaev and Roshchina (2019) investigated differences in alcohol consumption by age group in 1994-2016 in Russia. They identified strong differences in the factors that influence the consumption of different types of alcoholic beverages, and analyzed the consumption of each of them separately. Thus, the level of education, income, marital status, and urbanization had different effects on the consumption of various alcoholic beverages. Researchers differentiated the effect of age (14 age groups), birth cohort (17 groups), and a life span (1994-2016) when analyzing alcohol consumption. They have found that the birth cohort effect is negative: the later individuals were born, the less alcohol they consume. In addition, when

investigating the life period effect, they found that vodka and beer were substitutes in 1994-2003. They also linked the reduction of alcohol consumption to the 2008-2015 anti-alcohol policy. Consumption of all alcoholic beverages, except wine and moonshine, was demonstrating a negative square relationship with age. As a result, Radaev and Roshchina concluded that the decline in alcohol consumption in recent years may be due to the low involvement in alcohol use by people born after 1990.

Non-price determinants of an individual alcohol consumption

Since the aim of this thesis is to estimate the price elasticity of alcohol demand, there will not be a detailed analysis of studies analyzing non-price determinants of alcohol consumption. In order to provide a complete picture and being able to select control variables in Table 2 I list main non-price determinants and papers where they were statistically significant in influencing alcohol consumption behavior. Table demonstrates the direction of their impact on alcohol consumption, where the plus sign means an increase in alcohol consumption with an increase in the factor, and the minus sign – a decrease in alcohol consumption due to an increase in the factor.

Most of the studies indicate that men tend to consume alcohol more frequently and in larger amounts. Moreover, completely different factors can influence the amount of alcohol consumed by men and women. These differences are potentially important for the policy makers. Thus, many researchers estimate two separate models for each gender. Nelson (2014) reviewed 15 studies on alcohol demand for adults and 8 for young adults in order to find major gender differences in drinking patterns. Studies used Russian, Ukrainian, US, Canadian, Chinese and Italian data. Authors concluded that men have less elastic demand on alcohol than women. Regardless the gender, price was not very important for heavy-drinking adults and young adults. However, higher prices can prevent young adults from drinking participation.

It is important to note the impact of macroeconomic factors on alcohol consumption. Ruhm (2003) suggests that when the economic situation worsens, individuals start to follow a healthier lifestyle and risk-taking behavior becomes less common. Therefore, a one percent increase in unemployment leads to a decrease in the prevalence of smoking, lack of exercise and obesity by 0.6, 0.3, and 1.8 percent, respectively. This idea can also be tested on alcohol consumption market.

Table 2 – Main Non-price Determinants of an Individual Alcohol Consumption (amount of alcohol consumed, alcohol spending, likelihood of heavy drinking and drinking vodka)

Paper	Country	Age	Age Squared	Male	Community size	Education	Income	Married	Working
Dependent variable: quantity of alcohol consumed									
Blaylock and Blisard (1993)	US, 1987, females only	—			+	+	+		
Wang et al. (1996)	US, 1987-1988, spirits			+	—		+		
Andrienko and Nemtsov (2006)	Russia, 1994-2002	+	—	+	+		+		
Christie-Mizell and Peralta (2009)	US, 1979-1994, 14-30 years old only	—		+				—	Female – Male +
Goryakin et al. (2015)	Russia, 1994-2009, vodka	+	—	+		—		—	—
Dependent variable: personal spending on alcohol									
Yen and Jensen (1996)	US, 1989-1990	—	—	+		+	+	—	
Dependent variable: likelihood of heavy drinking									
Cheah (2015)	Malaysia, 2006-2007	—		+	—	—	—	+	+
Auld (2005)	Canada, 1985, 1991, men only					—		—	
Carlson and Vagero (1998)	Russia, Taganrog city, 1993					—	+		—
Malyutina et al. (2004)	Russia, Novosibirsk city, 1985-1995					Male –		Male –	
Tomkins et al. (2007)	Russia, Izhevsk city, 2003-2005, men only					—		—	—
Dependent variable: likelihood of drinking vodka									
Radaev and Roshchina (2019)	Russia, 1994-2016				+	Female –	+	+	

Taking into account results of other researchers, the null and alternative hypotheses can be formulated.

- *Null Hypothesis 1: There is no effect of the exogeneous vodka price increase on the individual alcohol consumption of vodka (price elasticity of vodka is not significantly different from zero).*
- *Alternative Hypothesis 1: There is negative effect of the exogeneous vodka price increase on the individual alcohol consumption of vodka (price elasticity of vodka is less than zero).*

There is also one hypothesis that needs to be checked in order to be able to check the main hypothesis.

- *Null Hypothesis 2: There was no effect of the excise tax increase on the price of vodka.*
- *Alternative Hypothesis 2: There was an effect of the excise tax increase on vodka price.*

From the methodological point of view, it is useful to discuss The World Bank study (Fuchs Tarlovsky et al., 2018), where authors investigated impact of tobacco taxation on the income distribution of Russians. The authors suggest that price elasticities differ depending on the tobacco consumption by an individual. For example, an individual with a strong tobacco addiction and an occasional smoker may react differently to an increase in the price of cigarettes. It corresponds to the habit formation theory. The researchers divided the sample into deciles by their expenditures on cigarettes. After calculating the price elasticity of tobacco demand for the 10 groups obtained, the authors found that the higher the level of an individual's addiction to cigarettes, the weaker their response to tobacco tax increases. At the same time, respondents who rarely smoke are more likely to be willing to reduce their consumption of cigarettes when prices increase. This approach to the analysis of tobacco consumption and price elasticity of demand can be used in the analysis of alcohol consumption.

Habit formation can be incorporated in the model by estimating a dynamic panel data model (DPD). This approach is based on adding lags of the dependent variable to the model. In our case by doing so we can take into account the effect of previous alcohol consumption on current consumption. The DPD is usually estimated using the Arellano-Bond model (Arellano & Bond, 1991). It is estimated in first differences using longer lags as an instrument that does not depend on error term difference. It is estimated by the Generalized Method of Moments (GMM). This method helps to obtain more efficient estimates of the dynamic panel data model.

III. Data and Methodology

Data

A representative sample of the Russian Longitudinal Monitoring Survey (RLMS-HSE) is used to conduct an empirical study. The sample included respondents aged 15 years and older, who participated in at least 1 of the 7 waves of the study from 2008 to 2014. New individuals are added every year and sample is representative. After removing the outliers, the sample contained 72,504 responses from 7-13 thousands of respondents annually. Outliers were top 1% in alcohol consumption (unrealistic values: more than 6 liters of beer and 3 liters of vodka every day). Survey information is obtained using interviews. 95% of RLMS-HSE interviews are conducted every year in October-December. 5% in January, February and March. Survey was carried out in 38 out of 85 regions of Russia. People from 1 to 21 residential areas (communities) were surveyed in each region. Residential areas are divided into census districts. In larger areas respondents from several census districts were interviewed, in smaller – only one. There were maximum 26 census districts surveyed within one residential area. The RLMS-HSE sample is representative of the Russian Federation at the national-level. Samples of Moscow and St. Petersburg are self-representative at the sub-national level.

Every round of RLMS-HSE includes 3 main surveys: individual (adult or child), household, community. Data used from each survey will be discussed below.

Individual survey

Individual data included a set of socioeconomic characteristics: age, gender, marital status, level of education, employment status, religion. Dummy for college degree was created to take a level of education into account. Following Yakovlev's approach, I created a dummy indicating if the person is Muslim or not (Yakovlev, 2018). He showed that Muslim people drink less. About 5% of the sample are Muslims. Moreover, dummy indicating if the person lives in a city that is an administrative regional center (including Moscow and Saint Petersburg), was created.

As part of the survey, respondents were asked questions about alcohol consumption (in grams), in particular vodka, beer, fortified and table wine, homemade spirit (moonshine) and a number of other alcoholic beverages. They had to say how many times and in which quantities they were drinking each type of the beverages during last month. 33% of the sample said that

they do not drink alcohol at all. 47% of the sample consumed alcohol within last 30 days before the survey.

The volume of vodka consumed was calculated on the basis of the frequency and quantity of consumption of each alcoholic beverage by individuals. All quantities were measured in grams per month. Alcohol consumption of those who did not consume alcohol at all or only within last 30 days was set equal to zero. If we removed these respondents, we would only get an effect for drinkers. Thus, it is important to leave these consumers in the sample as we want to find an overall effect of vodka price change on the amount of alcohol consumed.

In addition, the amount of pure alcohol consumed within last 30 days (in grams) was calculated using formula 8. The calculations were based on standard data from the RLMS-HSE and Rosstat on the pure alcohol concentration in various alcoholic beverages. Notice, that consumption of moonshine (homemade spirit) is also included in calculations, thus allows to capture potential substitution effects. However, each year only 5-8% of the sample reported that they consume it and share of moonshine in the total alcohol intake is around 3-5%. All the beverage quantities were measured in grams.

$$Pure\ Alcohol = 0.4 * HardDrinks + 0.4 * Moonshine + 0.18 * FortifiedWine + 0.12 * DryWine + 0.05 * Beer \quad (8)$$

Household survey

Each individual is attached to a household. Household size varies from 1 to 14 members. 70% of them consisted of 2-4 members. Using data on aggregate family income and size of the family, average income per family member was calculated. It is important to use this variable instead of the individual wage, as 45% of the sample (including retired) do not work. However, it does not prevent these people from consuming alcohol.

Community survey

Every year interviewers also collect community-level data including minimum and maximum prices of goods in local grocery stores in each residential area. In order to get information about prices, interviewers visit local grocery stores and collect the prices they see there. Thus, minimum and maximum prices of 1 liter of vodka are available. Maximum prices are not very representative for the purpose of this research, as cheaper vodka is the one that is mostly consumed in Russia. Moreover, average household income per a family member is quite low, that also proves that minimum price will be more relevant for this research. Therefore, I

use a logarithm of a minimum price of 1 liter of vodka as regressor of interest. I also use a community-level consumer price index calculated by Yakovlev (2018).

Rosstat Data

Region-level data was obtained from Rosstat, Russian governmental statistics agency. I used average regional prices of vodka as an alternative price variable for future sensitivity analysis. Also, regional consumer price index and unemployment rate were used.

Descriptive Statistics

First, let us a look at the main individual characteristics. Table 3 demonstrates descriptive statistics of the sample on an individual level. Individuals aged 15 to 90 years are included in the sample. The average age of respondents is 46 years. Females prevail over male in the sample. More than half of the sample is married or lives together with their partner. 24% have higher education and only 55% are employed. Therefore, average income per family member during last 30 days varies from 0 to 140 000 rubles, however mean and median are quite low, 12 477 and 10 125 respectively. 40% of the sample leave in the regional center (including Moscow and Saint Petersburg).

Table 3 – Descriptive Statistics of The Main Individual Characteristics

VARIABLES	(1) mean	(2) median	(3) sd	(4) min	(5) max
[N = 72,502]					
Age	46.01	46	18.56	15	90
I(Female)	0.584	1	0.493	0	1
I(Married)	0.597	1	0.491	0	1
I(Muslim)	0.0436	0	0.204	0	1
I(College)	0.240	0	0.427	0	1
I(Employed)	0.545	1	0.498	0	1
Income per family member	12,477	10,125	9,677	0	140,000
I(Regional Center)	0.401	0	0.490	0	1
I(Ever Drinks)	0.672	1	0.470	0	1
I(Drunk in the last 30 days)	0.469	0	0.499	0	1
Vodka Consumption in the last 30 days (in grams)	185.3	0	751.6	0	15,000
Pure alcohol consumption in the last 30 days (in grams)	160.2	0	459.5	0	8,000

Source: RLMS-HSE.

On average, 185 grams of vodka is consumed by an individual within 30 days. These calculations were made including every respondent, even those who never drink. They have a zero consumption. Overall, consumption of vodka varies from 0 to 15 liters per months. The latter corresponds to 1 bottle of vodka daily.

The table demonstrates that on average, one individual over the age of 15 consumes 160 grams of pure alcohol per month, which is equivalent to 1.9 liters per year.

Table 4 – Descriptive Statistics of The Main Regional and Community-level Characteristics.

VARIABLES	(1) mean	(2) median	(3) sd	(4) min	(5) max
COMMUNITY [N = 1043: 149 communities over 7 years]					
Log (Lowest Real Price of Vodka per 1 liter in community)	0.507	0.520	0.385	-0.927	1.356
Log (Highest Real Price of Vodka per 1 liter in community)	1.497	1.404	0.630	-0.0692	3.989
Community-level CPI	131.3	127.2	36.85	56.61	347.2
REGION [N = 266: 38 regions over 7 years]					
Regional Unemployment	6.474	6.200	2.281	0.800	17.80
Regional CPI	108.5	107.0	3.585	103.8	118.0
Average regional vodka price (in rubles)	304.9	256.8	122.3	149.1	680.6

Source: Rosstat, RLMS-HSE, Yakovlev (2018)

As can be seen from Table 4, data on vodka prices and consumer price index (CPI) was collected both on residential area-level and region-level. Community-level prices include higher and lower vodka prices (per 1 liter) which were observed by interviewers in local stores. Community level CPI was calculated by Yakovlev (2018) using prices of 18 most populated in data goods. Average regional CPI and regional unemployment rate as long as average regional vodka price are taken form Rosstat. The latter will be used to conduct a sensitivity analysis.

Data Issues

RLMS-HSE almost does not include wealthy and upper-middle class. Average monthly income in Russia was around 23.000 – 27.000 rubles *(Rosstat)* during the current period, while

sample average was 12.300 rubles. It is important to take into account that elasticity estimates can differ between groups with different income levels. Thus, in this thesis we are more likely to get elasticity estimates for less wealthy people.

Average per capita alcohol consumption in RLMS-HSE sample is significantly lower than in the reality. Average per capita pure alcohol consumption in our sample is 1.9 liters. According to the WHO data (WHO GHO, 2016), the average per capita alcohol consumption in Russia is about 11-12 liters per year. WHO calculates indicator of official alcohol consumption based on the following formula (WHO, 2000):

$$Annual\ per\ capita\ alcohol\ consumption\ per\ adult = \frac{alcohol\ production + alcohol\ imports - alcohol\ exports}{population\ 15\ years\ of\ age\ and\ over} \quad (9)$$

Moreover, WHO adds their estimates of unobservable consumption. Estimation method can be found in WHO, 2000. Underreporting of alcohol consumption may have occurred for several reasons:

- The sample is biased in income and it inevitably leads to a bias in the volume of alcohol consumed, since those who drink more are those whose incomes are higher (other things being equal). In other words, RLMS-HSE respondents drink less simply because they are less wealthy. However, for the purpose on this research this is not such an issue. Goal of this paper is to find and estimate a causal effect. We are more interested in finding the relationship between vodka price and alcohol consumption rather than calculating average amount of alcohol consumed.

- Respondents may have intentionally misrepresented information in order not to make themselves look bad in front of the interviewer or their family members who were in the same room at the moment,

- Respondents may have unintentionally underestimated their consumption because they do not remember or cannot calculate how much alcohol they actually consumed,

- Respondents who consumed a large amount of alcohol could refuse to answer questions about the frequency and volume of its consumption.

- Individuals who practice heavy drinking regularly may have been underrepresented in the sample.

However, the sample still includes individuals who consume significant amounts of alcohol. For example, the maximum volume of pure alcohol consumed per month is 7 liters, that corresponds to more than 1 bottle of vodka per day (583 grams).

Other potential issue of this data is that we do not have information about alcohol consumption of all of the individuals. Some of them refused to answer or replied that they do not remember how much alcohol did they consume. So, these individuals were out of the sample. Here can potentially be a source of selection bias. For the future research it can be useful to understand if there is a particular underlying selection mechanism or not (Tobit and Heckman estimation can be used). However, share of these individuals is not that substantial and will be ignored for now.

Methodology

The price of vodka is not random. Local price is defined by many underlying and factors such as CPI, demand for alcohol, excise taxes and other unobservable factors. Thus, if we simply include vodka price in the model, we are likely to face endogeneity problem. As a result, final estimates will be biased due to the influence of unobservable characteristics. Special estimation design is required to avoid this issue. Therefore, I will use a kink in a federal excise tax policy that happened in 2011 to find a causal effect of the price change on the amount of alcohol consumed. In 2000-2010 Russian authorities annually linked the vodka excise tax to the consumer price index growth rate. From 2011 to 2014 the growth rate of the tax exceeded the CPI growth rate more than twice. After 2014 excise tax was not linked to the CPI anymore, its nominal value stayed almost same and increase only by 8.8% since 2014 to 2020. Thus, data after 2014 is not included in the sample.

Figure 2 presents the kink in a policy regime and demonstrates that the average price of vodka moves along the same trajectory as the excise tax on vodka. This exogeneous modification in a policy regime allows to use change in the slope of a policy function to obtain a local average treatment effect around 2011 using a regression kink design (RDK, Card et al. 2016). The idea of this method is similar to a Regression Discontinuity Design.

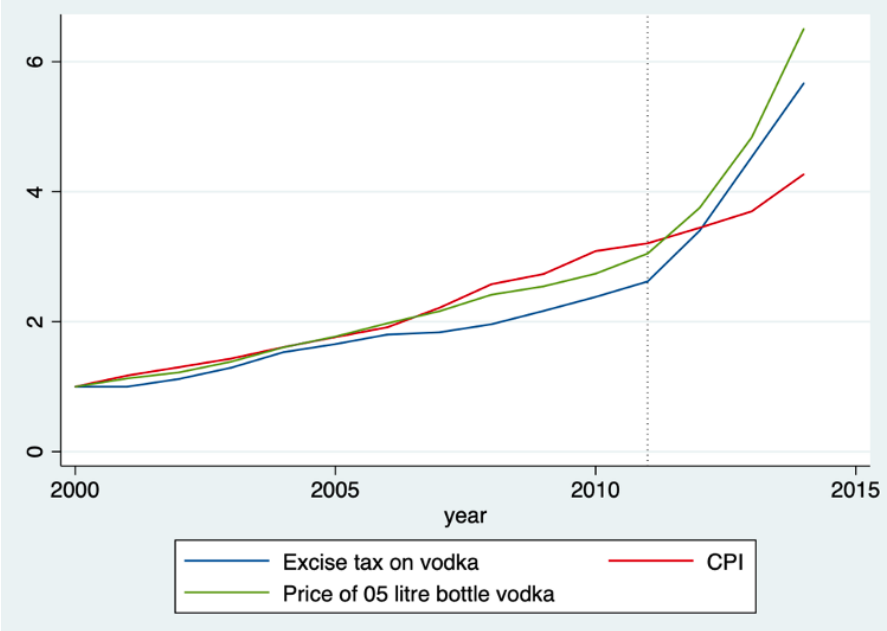

Figure 2. Excise Tax on Vodka, Average Price of 0.5l vodka, Consumer Price Index, 2000-2014 (all the values are set to 1 at year 2000)

Source: Rosstat, Consultant Plus.

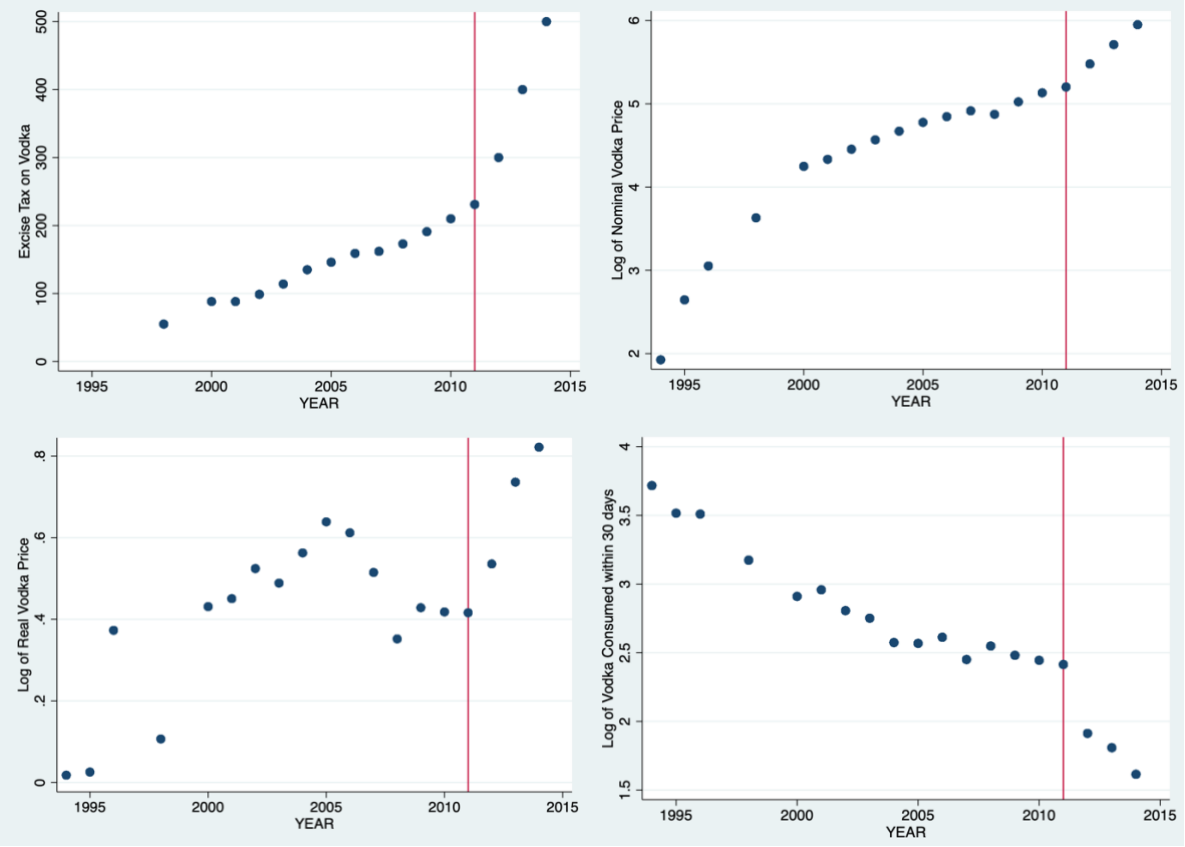

Figure 3. Averages (by year) of the Excise Tax on Vodka, Real and Nominal Prices of Vodka and Its Quantity Consumed Within Last 30 Days.

Source: RLMS-HSE 1994-2014

If there is a causal relationship between regressor of interest and dependent variable, a change in a policy regime that causes a kink in the regressor of interest will lead to a kink in the dependent variable. In our case we assume that a kink in the excise vodka tax causes kink in the price of vodka which subsequently leads to a kink in the amount of vodka consumed. Figure 3 represents this idea on our data. We can notice a clear kink in all mentioned variables. If we look at 2008-2014 data, we can see a kink in both real and nominal vodka prices in 2011.

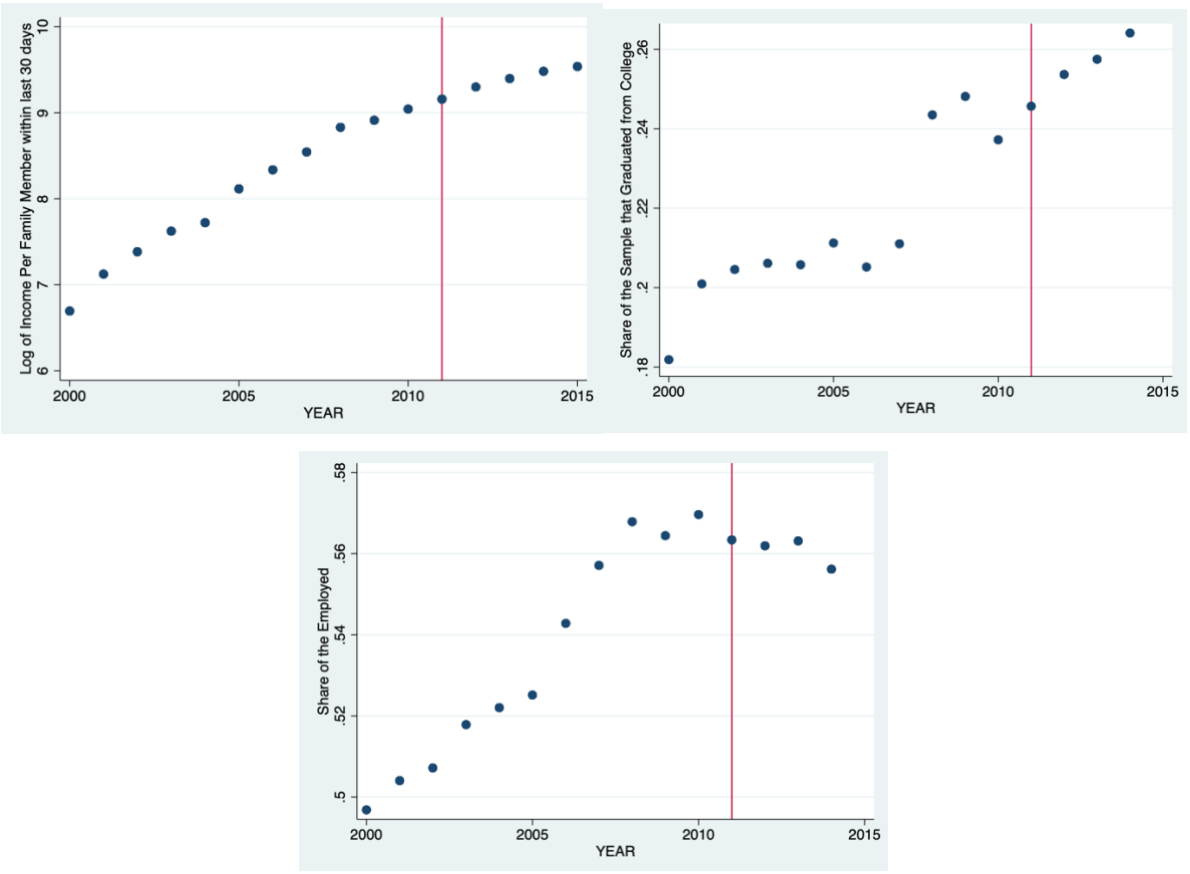

Figure 4. Averages (by year) of the Log of Income Per Family Member within Last 30 Days, Share of Employed, Share of Respondents with a College Degree.

Source: RLMS-HSE 2000-2014

We assume that observations around a cutoff on average have similar characteristics. If there is a kink in the regressor of interest while all other underlying variables behave smoothly before and after 2011, then we can conclude that change in the dependent variable was entirely caused by a kink in a policy. The smooth distribution of other covariates is a main identifying assumption of the RKD. Figure 4 represents the behavior of three variables during the period. We can see that there was no kink in 2011. However, we can notice a kink in some variables

around 2008. It could be caused by the economic crisis. Overall controls vary smoothly around 2011, so we can proceed using RKD.

In order to estimate RKD specification a two-stage procedure represented by equations (10), (11) can be used. I assume a linear RKD, as before 2011 excise tax growth rate was linked to the CPI growth rate and after 2011 it exceeded the CPI growth rate more than twice.

First Stage

$$Ln(Lowest\ Vodka\ Price\ Real_{ct}) = \alpha_1 * I\{t \geq 2011\} * (t - 2011) + \alpha_2 * (t - 2011) \quad (10)$$
$$+\alpha_3 * \ln(CPI_{ct}) + \alpha_4 * \chi_r + \alpha_5 * X_{ict} + \xi_{ct}$$

Second Stage

$$LnQ(Vodka)_{it} = \beta_1 * Ln(Lowest\ \widehat{Vodka}\ Price\ Real_{ct}) + \beta_2 * (t - 2011) \quad (11)$$
$$+ \beta_3 * \ln(CPI_{ct}) + \beta_4 * \chi_r + \beta_4 * X_{ict} + \varepsilon_{itc}$$

At the first stage real price of vodka is instrumented by $I\{t \geq 2011\} * (t - 2011)$, which allows for the different slopes before and after 2011. $I\{t \geq 2011\}$ is an indicator which is equal zero if year is before 2011 and 1 otherwise. $t - 2011$ indicates time before/after 2011. Alternatively, exact value of the excise tax can be used instead of $t - 2011$. However, excise taxes are universal for the whole country and do not vary between regions. Therefore, it is easier to include $year - 2011$ instead. Logarithm of a consumer price index at a community-level, $\ln(CPI_{ct})$, takes into account that excise tax is linked to the CPI growth rate. Regional fixed effects χ_r are also included in the model. X_{ict} are the demographic and socioeconomic characteristics of the individual. In the second stage we use price estimate from the first stage and the same set of control variables. Estimation was done with the *ivreg* STATA function.

In the literature review we saw that many non-price characteristics affect alcohol consumption: demographic and socioeconomic characteristics of the individual and municipality as long as individual's habits and peer effect. Thus, most of the papers on this topic control for these variables. Considering the design of this research, we can estimate the causal effect by simply running a model without any extra control variables at first. If the exogeneous kink in a policy regime is significant and other variables behave smoothly around the cutoff, we should get an unbiased estimate of the elasticity even without control variables. In this situation adding new controls will only improve the goodness of fit, but should not affect the elasticity estimate. However, we cannot be sure if all the underlying variables, that affect

vodka consumption, behaved smoothly, therefore it is useful to check how do adding control variables will change the elasticity estimate.

Peer effects were effectively implemented in Yakovlev's (2018) discrete choice case. However, there is no econometric or empirical literature that uses this approach in case of continuous dependent variable (quantities of alcohol consumed). Moreover, it seems impossible to extend this decision model to a continuous case. Thus, this method cannot be implemented for the purpose of this research.

Besides the methodological difficulties, peer effects analysis also requires special type of the data. One of the main factors that is missing in our data is the frequency of communications and interactions between individuals. Usually peer effect is studied based on data from schools or universities, where people belong to some groups that are easy to interview. RLMS-HSE is not designed to provide reliable information that will be helpful for the peer effect analysis. As it was mentioned by Yakovlev, RLMS-HSE does not provide exact data about all the members of a peer group as not all the peers are interviewed in each census district. Peer effect can hold in tiny villages, where most of the people same age spend their time together. However, 70% of the sample lives in the cities. In Russia people living in the cities are not used to communicate with their neighbors much. Therefore, assumption about peers within one census district and age group does not sound convincing. Moreover, even if there was a link between peers' alcohol consumption in this data, it will not be helpful for analyzing female alcohol consumption, as they in Russia female do not tend to make friends in the neighborhood and drink with them, like male do. Taking all the data and methodological issues into account, it was decided not to incorporate peer effect in current model.

Three main specifications of the model are estimated. First one is just a two-stage RKD estimation with and without controls as discussed above. In the second specification I combine RKD with fixed effect within estimation model on the second stage. Simply using RKD we ignore panel structure of the data, therefore using FE estimation should help to increase share of the explained variance, while not dramatically changing the elasticity estimate. This model can also be considered as a robustness check. Moreover, I estimate third specification that allows to incorporate habit formation by combining RKD estimation with the dynamic panel data estimator (Arellano & Bond, 1991). This method allows not only to use change in the kink, but also to include one lag of alcohol consumption to account for habit formation. With this specification we should also get a similar elasticity estimate as in first two specifications.

IV. Results of the estimation

At first, I estimated a simple RK model including only region dummies and log of CPI as controls besides the kink variables. First stage estimates are presented in the Panel A of Table 5. We have a significant first stage with positive coefficient in front of the kink variable. It suggests that the second null hypothesis of the paper is rejected at a 10% level, an upward policy kink in the excise tax lead to an upward kink in the price of vodka. We can proceed to the second stage. Here everything except for the time variable is significant and has meaningful signs. We have an elasticity estimate equal to -0.79. It means that if we increase minimum vodka price by 1%, we will experience a 0.8% decrease in its consumption. Logarithm of the community-level CPI is also negative: higher the overall prices – less people consume due to the income effect. This model looks quite realistic from the economic perspective, so I add individual and control variables to check if the estimate changes. First stage remains almost the same, second stage only slightly changes. The elasticity estimate changed from -0.79 to -0.75. Probably some of the control variables took part of the effect that was previously explained by the prices. However, the change is very small. Overall, model is stable to adding controls.

It is important to mention, that first null hypothesis was about no effect and alternative hypothesis about a negative effect, while two-sided confidence intervals were used to find statistical significance in Table 5. Thus, from this table we can conclude that first null hypotheses is rejected in favor of alternative hypothesis at a 5% confidence level.

Most of the control variables in Panel B, Table 5 have meaningful effect. Let us discuss each of them from the economic point of view. Age has a positive coefficient, meaning that individual drinks more when gets older. At the same time there is a negative quadratic dependence from age. At first people start drinking more when they get older, but at one moment of their life they reach a peak and their consumption slowly decreases. These results are in line with the intuition and correspond to other studies based on Russian data by Andrienko and Nemtsov (2006) and Goryakin et al. (2015). Female consume much less vodka than male do. It is also in line with what we saw from most of the studies discussed in a literature review. Married respondents consume more vodka than single. Even though most of the studies usually demonstrate opposite effect of marriage, some papers also identified positive dependency: Radaev and Roshchina (2019) in Russia and Cheah (2015) in Malaysia. 60% of our sample is married or live together with their partner. In Russia it can often lead to more quarrels and stress that people are tend to wash down with alcohol. Moreover, having a

partner guarantees them a drinking companion who is always ready to drink with them. Muslims drink less than non-Muslims due to their religious rules.

Table 5 — Estimates of Price Elasticity.

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. First Stage. ***Dependent Variable: Log of Lowest Real Price of Vodka in Community***						
$I\{t \geq 2011\} * (t - 2011)$	0.118***	0.118***	0.125***	0.122***	0.125***	0.122***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Log of Community-level CPI	-0.475***	-0.466***	-0.259***	-0.302***	-0.259***	-0.302***
	(0.007)	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)
Time (t-2011)	0.061***	0.071***	0.038***	0.032***	0.038***	0.032***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Constant	2.709***	2.391***	1.668***	1.811***	1.668***	1.811***
	(0.032)	(0.039)	(0.039)	(0.046)	(0.039)	(0.046)
Region Dummies	Yes	Yes	No	No	No	No
Controls	No	Yes	No	Yes	No	Yes
Method	RKD	RKD	RKD	RKD	RKD & Arellano-Bond	RKD & Arellano-Bond
Fixed Effects	No	No	Individual	Individual	No	No
Observations	67,089	67,089	67,089	67,089	67,089	67,089
R-squared	0.447	0.452	0.197	0.220	0.197	0.220

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

People with higher education drink less vodka. They are more likely to understand how serious are the negative consequences of excessive alcohol consumption and tend to have more intellectual entertainments apart from drinking. This result is in line with most of the papers mentioned in Table 2 from a literature review. Higher income leads to more vodka intake, as people can afford more alcohol. Sign of the coefficient in front of income is positive, but not significant, while employment coefficient is positive and significant. This effect can be stronger than income effect in the sample due to a large share of unemployed. People who live in larger residential areas drink more alcohol. It corresponds to other papers based on Russian data and can be due to the higher wages and more access to alcohol.

Table 5 — Estimates of Price Elasticity (continued).

	(1)	(2)	(3)	(4)	(5)	(6)
Panel B. Second Stage.						
Dependent Variable: Log of Vodka Consumption in the last 30 days						
Log of Lowest Real Price of Vodka in Community	-0.792***	-0.752***	-1.087***	-1.128***	-1.071***	-1.238***
	(0.159)	(0.152)	(0.144)	(0.149)	(0.250)	(0.288)
Log of Community-level CPI	-0.463***	-0.424***	-0.400***	-0.456***	-0.441***	-0.530***
	(0.091)	(0.085)	(0.059)	(0.065)	(0.099)	(0.113)
Time (Year-2011)	-0.006	-0.011	0.031*	-0.039	0.038	0.022
	(0.022)	(0.023)	(0.017)	(0.034)	(0.035)	(0.061)
Lag of Log(Vodka Consumprion)					0.120***	0.119***
					(0.014)	(0.015)
Age		0.133***		0.133***		0.086*
		(0.004)		(0.033)		(0.046)
Age Squared		-0.001***		-0.001***		-0.001*
		(0.000)		(0.000)		(0.000)
I(Female)		-1.497***				
		(0.031)				
I(Married)		0.156***		0.029		0.135
		(0.029)		(0.051)		(0.098)
I(Muslim)		-0.227***				
		(0.069)				
I(College)		-0.209***		0.027		0.007
		(0.032)		(0.064)		(0.113)
I(Employed)		0.173***		0.072*		0.029
		(0.031)		(0.038)		(0.066)
Log of Income per family member		0.025		0.043*		0.068*
		(0.019)		(0.022)		(0.039)
I(Regional Center)		0.788***				
		(0.124)				
Log of Regional Unemployment		0.126**		-0.113**		0.046
		(0.059)		(0.048)		(0.148)
Constant	3.715***	0.291	3.850***	-0.509	3.894***	0.801
	(0.511)	(0.521)	(0.340)	(1.453)	(0.572)	(2.073)
Region Dummies	Yes	Yes	No	No	No	No
Controls	No	Yes	No	Yes	No	Yes
Method	RKD	RKD	RKD	RKD	RKD & Arellano-Bond	RKD & Arellano-Bond
Fixed Effect	No	No	Individual	Individual	No	No
Observations	67,089	67,089	67,089	67,089	23,954	23,954
R-squared	0.015	0.149	0.010	0.011		
Number of IDIND			21,652	21,652	10,15	10,15

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Higher the unemployment rate in the region – higher the alcohol consumption of an individual. This effect is not in line with what we expected from Rhum (2003). However, the coefficient not large and is significant only at 10% level.

Next I estimate a combination of RK and FE designs using a two-stage estimation procedure, columns (3) and (4). Obviously, all the time-invariant variables are not included in the model. Both first and second stages with (3) and without controls (4) have meaningful coefficients. The estimated price elasticity is around -1.1. This estimate is slightly larger than in simple RKD. Regional unemployment rate now has negative effect on vodka consumption. College has insignificant positive coefficient very close to zero. Other control variables behave very similar to columns (1) and (2). It shows that the results are quite stable even when we add individual fixed effects.

In the combined RKD and Arellano-Bond models (columns (5) and (6)) first stage is same as in the fixed effect case, as it includes the same set of controls. In the second stage some of the coefficients in front of control variables became insignificant, but their signs remained the same. It can be due to the estimation in first differences that is used in Arellano-Bond models. Estimated elasticities are close to -1.1 and -1.2. So, they are very similar to the results obtained from the fixed effect estimation. Lag of the vodka consumption is significant and has a positive effect (0.120) on current consumption. It captures a habit formation. The test proved that model does not have a second order serial correlation. All models were estimated using robust standard errors.

All estimates from Table 5 are lying in the interval between -0.75 and -1.23. It is close to the results obtained by Fogarty (2006), Gallet (2007) and Wagenaar et al. (2009).

To check the hypothesis that heavy drinkers are less price elastic, I run a model for the sample of heavy drinkers (those who practice heavy episodic drinking - more than 60 grams of pure alcohol a day). As can be seen from Table 6 they turned out to be more price elastic. It can happen if those who practice heavy drinking, do it less regularly.

However, if we compare these groups, we find that average amount of pure alcohol consumed by heavy drinkers in 30 days is 544 grams and for moderate drinkers – 87 grams. It is hard to correctly compare these elasticities, as they are estimated on different samples, however at a first glance it seems that heavy drinkers are more price elastic than moderate. It

can be due to the strong income effect, as overall RLMS-HSE sample is downward biased in income, as it was mentioned above. Moreover, one should notice that these elasticities were calculated only for those respondents who consumed alcohol within past 30 days. That is why overall elasticities are higher than those presented in Table 5 for the whole sample.

Table 6 — Estimates of Price Elasticity for Drinkers, Who Do and Do Not Practice Heavy Episodic Drinking. Second Stage.

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Respondents, practicing heavy episodic drinking. Dependent Variable: Log of Vodka Consumption in the last 30 days						
Log of Lowest Real Price of Vodka in Community	-1.418***	-1.591***	-1.654***	-1.669***	-1.784**	-2.576***
	(0.329)	(0.306)	(0.337)	(0.349)	(0.727)	(0.816)
Region Dummies	Yes	Yes	No	No	No	No
Controls	No	Yes	No	Yes	No	Yes
Method	RKD	RKD	RKD	RKD	RKD & Arellano-Bond	RKD & Arellano-Bond
Fixed Effect	No	No	Individual	Individual	No	No
Observations	17,836	17,836	17,836	17,836	3,103	3,103
R-squared	0.033	0.143	0.010	0.012		
Number of IDIND			8,717	8,717	1,656	1,656
Panel B: Respondents, who are drinking, but do not practice heavy episodic drinking. Dependent Variable: Log of Vodka Consumption in the last 30 days						
Log of Lowest Real Price of Vodka in Community	-0.653***	-0.707***	-1.081***	-1.116***	-0.707	-0.730
	(0.234)	(0.222)	(0.261)	(0.266)	(0.749)	(0.793)
Region Dummies	Yes	Yes	No	No	No	No
Controls	No	Yes	No	Yes	No	Yes
Method	RKD	RKD	RKD	RKD	RKD & Arellano-Bond	RKD & Arellano-Bond
Fixed Effect	No	No	Individual	Individual	No	No
Observations	14,351	14,351	14,351	14,351	1,225	1,225
R-squared	0.017	0.110	0.007	0.009		
Number of IDIND			8,493	8,493	786	786

Robust standard errors in parentheses
**** p<0.01, ** p<0.05, * p<0.1*

One of the main concerns about price regulation measures on alcohol market if a potential substitution effect. Policy makers are worrying that increase in the price of vodka will

make Russian drinkers to produce and consume more homemade spirits, that can cause even more damage to health. Figure 5 represents that moonshine consumption stopped decreasing as quickly after 2011. It may have been caused by a substitution effect due to increase of vodka price; however, there is lack of observations to confirm this. Instead I will estimate a model for a pure alcohol to capture total effect of vodka price change on alcohol consumption, as consumers could potentially switch to any other cheaper alcoholic beverage. We can notice a slight downward kink in pure alcohol consumption graph after 2011. It can be an evidence of the effectiveness of the kink in a policy regime.

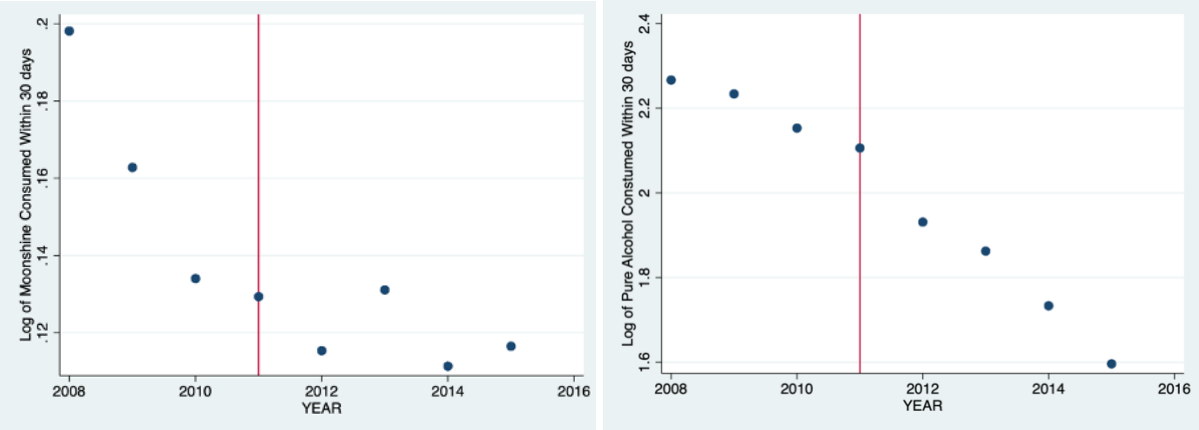

Figure 5 – Averages (by year) of the Quantity of Moonshine and Pure Alcohol Consumed Within Last 30 Days.

Source: RLMS-HSE.

Following the same approach, I estimate the effect of vodka price change on the amount of pure alcohol consumed. Main coefficients are presented in Table 7 (for the full results of the estimation see Appendix C). The first stage is significant and the control variables have the same sign as before and are mostly significant. We can notice that elasticity estimates are lower than for vodka consumption. It goes in line with economic intuition. We expect vodka prices regulations to influence its consumption directly, while total pure alcohol intake can be influenced less: apart from decrease in vodka consumption we can potentially observe an increase in consumption of other alcohol beverages due to the substitution effect. However, the substitution effect does not prevail and we still see negative price elasticity estimate. It means, that if price of vodka increases by 1% it will cause a 0.5-0.93% decrease in total alcohol intake. From this we can assume that price measures were effective not only for vodka consumption but also for the overall pure alcohol intake.

Table 7 — Estimates of Price Elasticity of Pure Alcohol.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable: Log of Pure Alcohol Consumption in the last 30 days						
Log of Lowest Real Price of Vodka in Community	-0.669***	-0.503***	-0.769***	-0.788***	-0.889***	-0.930***
	(0.154)	(0.146)	(0.131)	(0.134)	(0.214)	(0.251)
Region Dummies	Yes	Yes	No	No	No	No
Controls	No	Yes	No	Yes	No	Yes
Method	RKD	RKD	RKD	RKD	RKD & Arellano-Bond	RKD & Arellano-Bond
Fixed Effect	No	No	Individual	Individual	No	No
Observations	67,089	67,089	67,089	67,089	23,954	23,954
R-squared	0.032	0.189	0.009	0.012		
Number of IDIND			21,652	21,652	10,150	10,150

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

V. Sensitivity Analysis & Robustness check

For the sensitivity analysis same models are estimated with an alternative price measure – average price of vodka in the region (Rosstat, 2008-2014). Main coefficients are presented in Table 8 (for the full results of the estimation see Appendix D). The first stage is significant and the main control variables have the same sign as before. We can notice that elasticity estimates are lower than in the case with minimum community prices. Average regional prices are calculated based on prices collected in 2-4 cities from each region. It is important that Rosstat collects prices only in the cities and stores that have stable supply of all goods from a list of consumer products. These are more likely to be larger grocery stores that on average have higher prices on alcohol. Prices from the smaller cities and villages are not collected at all. Therefore, minimum local prices from RLMS-HSE dataset are more likely to provide better estimates of the elasticity.

Table 8 — Alternative Estimates of Price Elasticity using Log of Real Average Regional Price of Vodka as an explanatory variable. Second Stage.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable: Log of Vodka Consumption in the last 30 days						
Log of Average Regional Price of Vodka, Real	-0.525***	-0.496***	-0.732***	-0.752***	-0.721***	-0.826***
	(0.105)	(0.099)	(0.097)	(0.099)	(0.169)	(0.192)
Region Dummies	Yes	Yes	No	No	No	No
Controls	No	Yes	No	Yes	No	Yes
Method	RKD	RKD	RKD	RKD	RKD & Arellano-Bond	RKD & Arellano-Bond
Fixed Effect	No	No	Individual	Individual	No	No
Observations	67,089	67,089	67,089	67,089	23,954	23,954
R-squared	0.022	0.155	0.010	0.011		
Number of IDIND			21,652	21,652	10,150	10,150

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Overall results of the estimation already seem to be quite robust, as throughout the paper different specifications with and without controls were giving similar estimates. For extra robustness check I estimated the main specification on a sample that excluded 8 thousand respondents who said they consume alcohol in restaurants and bars. These people are more likely to face different level of prices and there could be no kink because of the policy regime.

Results of the estimation are presented in Table 9. It is clear that results are mostly the same and variation is very small. Therefore, we can conclude that results are robust.

Table 9 — Price Elasticity estimates in a subsample excluding those who drink in bars and restaurants.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable: Log of Vodka Consumption in the last 30 days						
Log of Lowest Real Price of Vodka in Community	-0.774***	-0.786***	-1.082***	-1.131***	-1.125***	-1.248***
	(0.163)	(0.157)	(0.148)	(0.152)	(0.263)	(0.302)
Region Dummies	Yes	Yes	No	No	No	No
Controls	No	Yes	No	Yes	No	Yes
Method	RKD	RKD	RKD	RKD	RKD & Arellano-Bond	RKD & Arellano-Bond
Fixed Effect	No	No	Individual	Individual	No	No
Observations	59,941	59,941	59,941	59,941	19,810	19,810
R-squared	0.014	0.141	0.009	0.010		
Number of IDIND			20,182	20,182	8,617	8,617

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

VI. Conclusion

In this paper I estimate the effect of vodka price changes on the amount of alcohol consumed by Russian citizens exploiting the variation caused by the kink in a policy measure. Regression Kink Design in combination with fixed effect estimator and Arellano-bond estimator provided a list of elasticity values. Price elasticities of vodka that were estimated using the lowest price in the local store vary between -1.24 and – 0.75. Variation exists but it is not too dramatic. If we use average regional prices instead of minimum, we get slightly lower values: between -0.83 and -0.5. Same we observe analyzing price elasticity estimates of pure alcohol consumption: average prices give smaller values of the elasticity.

Table 10 — Summary of Main Price Elasticity Estimates of Vodka and Pure Alcohol.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable: Log of Vodka Consumption in the last 30 days						
Log of Lowest Real Price of Vodka in Community	-0.792***	-0.752***	-1.087***	-1.128***	-1.071***	-1.238***
	(0.159)	(0.152)	(0.144)	(0.149)	(0.250)	(0.288)
Log of Average Regional Price of Vodka, Real	-0.525***	-0.496***	-0.732***	-0.752***	-0.721***	-0.826***
	(0.105)	(0.099)	(0.097)	(0.099)	(0.169)	(0.192)
	(7)	(8)	(9)	(10)	(11)	(12)
Dependent Variable: Log of Pure Alcohol Consumption in the last 30 days						
Log of Lowest Real Price of Vodka in Community	-0.669***	-0.503***	-0.769***	-0.788***	-0.889***	-0.930***
	(0.154)	(0.146)	(0.131)	(0.134)	(0.214)	(0.251)
Log of Average Regional Price of Vodka, Real	-0.443***	-0.331***	-0.518***	-0.526***	-0.599***	-0.620***
	(0.102)	(0.096)	(0.088)	(0.089)	(0.144)	(0.168)
Region Dummies	Yes	Yes	No	No	No	No
Controls	No	Yes	No	Yes	No	Yes
Method	RKD	RKD	RKD	RKD	RKD & Arellano-Bond	RKD & Arellano-Bond
Fixed Effect	No	No	Individual	Individual	No	No

Estimates based on the average prices can be less accurate as they consider the whole region, whereas in the reality significant differences between the residential areas can be found: people face different prices in different areas of one region. Moreover, as it was mentioned above, most of the people in Russia prefer cheaper vodka.

Minimum prices are especially relevant for analyzing alcohol consumption on the sample that is a downward-biased in income per family member. All of our estimates allow us to reject the main null hypothesis of this research, as we see the negative effect of positive exogeneous vodka price variation on the individual alcohol consumption of vodka. All price elasticities are negative and significant and lie in the interval from -0.5 and -1.2 for the vodka consumption and -0.33 to -0.93 for the total pure alcohol consumption. All estimates from different specifications are listed in Table 10.

These results are quite similar to the estimates for other countries reported by Fogarty (2006), Gallet (2007) and Wagenaar et al. (2009). Their average price elasticities of spirits varied from -0.68 to -0.8. For the total alcohol consumption price elasticity was -0.5. However, our results do not really correspond to the results of Nelson (2013). He concluded spirits price elasticity is -0.55, while we on average got higher estimates. However, it is important to take into account that Russia on of the leaders in alcohol consumption and heavy drinking in the world. Therefore, it is very likely that Russian alcohol demand can differ from most of the countries mentioned in previous researches.

These elasticities represent a local average treatment effect around 2011. Results were quite stable during the sensitivity analysis and robustness checks. Results suggest that a 1% price increase in price of vodka leads to 0.5-1.2% decrease in its consumption and to 0.33-0.93% decrease in overall pure alcohol consumption. As the sample is biased in income, we are more likely to get elasticity estimates for less wealthy people, that can differ from overall elasticity. This is of course a limitation of this paper.

This research is useful not only from the social but also policy and academic perspectives. Current elasticity estimates together with Yakovlev's (2018) elasticities of being a heavy-drinker can potentially become part of the future social cost-benefit analysis of Russian anti-alcohol policies.

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Appendix A

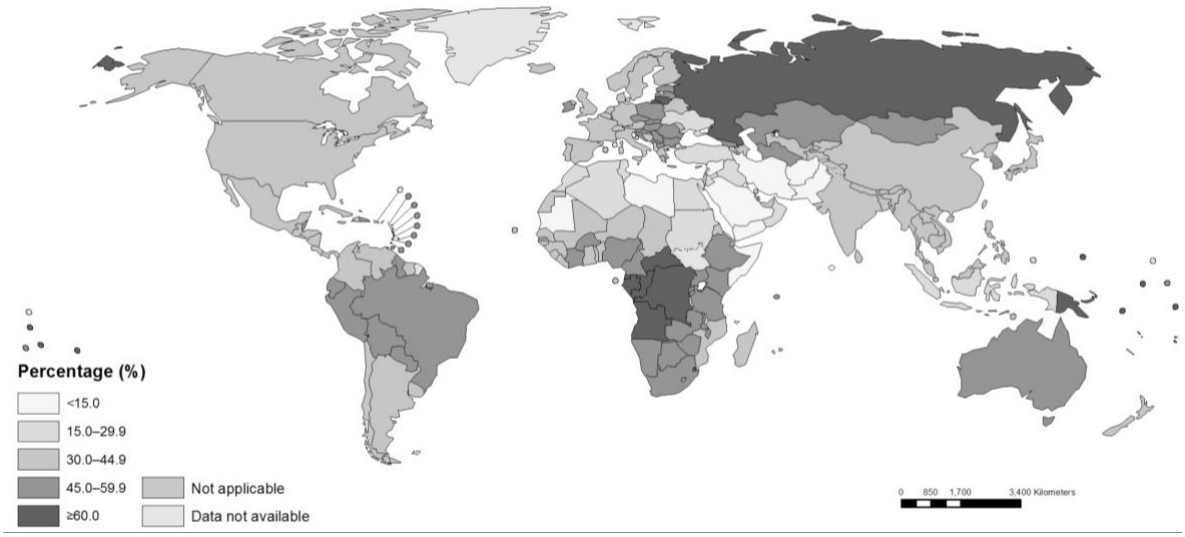

Figure A.1. – Share of Drinkers Who Practice Heavy Episodic Drinking (%, 15+), 2016.
Source: WHO Global status report on alcohol and health, 2018.

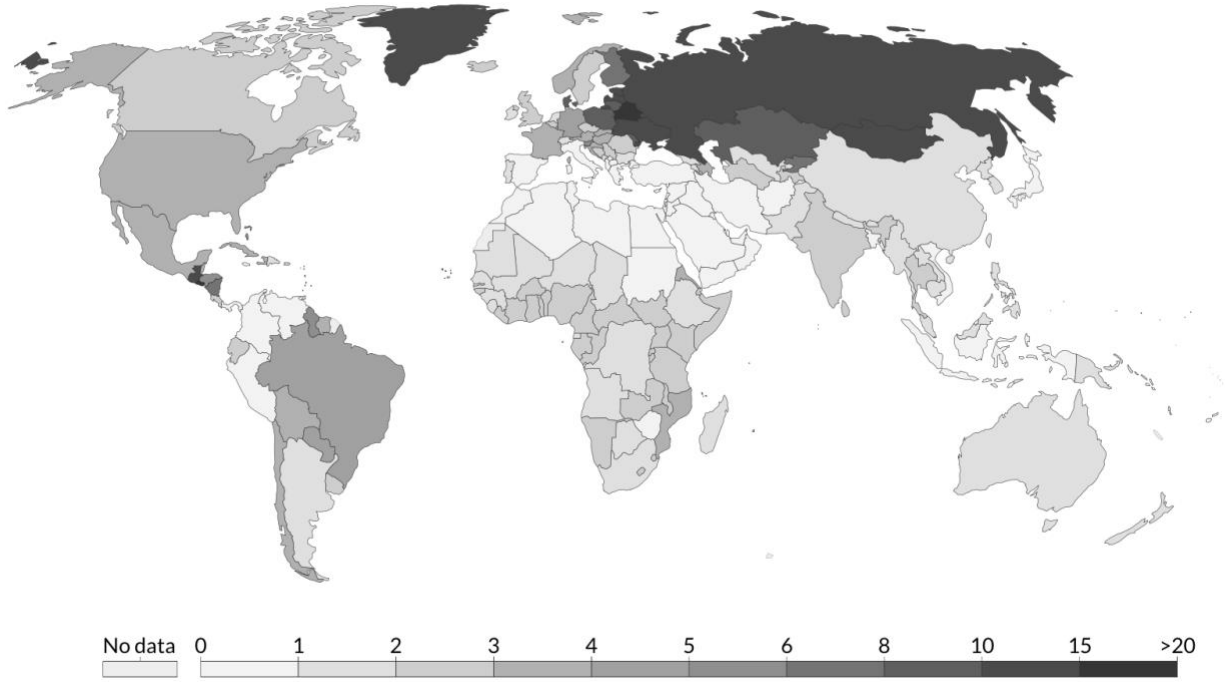

Figure A.2 – Disability-adjusted Years from Alcohol Use Disorders
(per 100,000 individuals, 2017).

Source: GBD 2017.

Appendix B

Table B.1 – Russian anti-alcohol campaign 2005-2016: non-price measures.

ALCOHOL ACCESS RESTRICTIONS	
2005	Strengthening of the control for production and sale of alcohol
	Prohibition of drinks with more than 15% alcohol concentration sale in small shops without license
	Endowment of Russian Federation constituent entities with the power to introduce time limitations on alcohol realization
2011	Toughening of penalties for selling alcohol to juveniles
	Restriction of the sale of alcohol in mobile points of sale
	Prohibition of the all alcoholic beverages, apart from beer, between 11pm and 8am on the whole territory of Russian Federation
2013	Prohibition of the beer sale between 11pm to 8am on the whole territory of Russian Federation
2014	Introduction of the increased penalties for the sale of alcohol to juveniles and the criminal responsibility for the relapse
2016	The creation of the system for registration of alcoholic beverages in the sales point
DRIVING UNDER THE INFLUENCE POLICY	
2010	Introduction of the zero-level concentration of alcohol in blood of the vehicle drivers
2011	Prohibition of the sale of alcoholic beverages on gas stations
2013	Increase in the concentration of alcohol in blood to 0.16 mg/l for breathalysers
	Introduction of the aadministrative responsibility for car accidents due to DUI: driver's license revocation for 1.5-2 years and 30 000 RUB penalty
2015	Introduction of the criminal responsibility from 2 to 9 years for the second car accident due to DUI and car accident entailing deaths of people
ALCOHOLIC BEVERAGES ADVERTISING RESTRICTION	
2008	Prohibition of advertisements of all alcoholic beverages in public transport
2012	Prohibition of advertisements of all alcoholic beverages in the Internet and online mass media
2012	Prohibition of advertisement was eased for the local types of wine
2013	Prohibition of advertisements of all alcoholic beverages in printed editions
OTHER MEASURES	
2009	Approval of the"Concept of government policy realization for reduction of excessive alcohol consumption and alcoholism prevention among the citizens up to 2020"
2013	Introduction of 500-1500 RUB penalty for public areas alcohol drinking
2014	Approval of the "Healthcare development" program and focus on the reduction of excessive alcohol consumption
2016	Creation of the system of registration of alcoholic beverages for retail sales in cities
	The development of project of "Interdepartmental strategy for development of healthy lifestyle among the citizens and prevention of non-infectious diseases up to 2025" was launched
2017	Extension of the registration of alcoholic beverages system for retail sales to the rural areas and villages

Sources: WHO, Global status report on alcohol and health, 2018; Kolosnitsyna & Dubynina 2019.

Table B.2 – Vodka Excise Tax in 2000-2020.

Year	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Vodka Excise Tax	88.2	88.2	98.78	114	135	146	159	162	173	191	210
Year	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	
Vodka Excise Tax	231	300	400	500	500	500	523	523	523	544	

Appendix C

Table C.1 — Estimates of Price Elasticity of Pure Alcohol

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. First Stage. *(Same as in the Main Model, Table 5 in the text)* ***Dependent Variable: Log of Lowest Real Price of Vodka in Community***						
$I\{t \geq 2011\} * (t - 2011)$	0.118***	0.118***	0.125***	0.122***	0.125***	0.122***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Log of Community-level CPI	-0.475***	-0.466***	-0.259***	-0.302***	-0.259***	-0.302***
	(0.007)	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)
Time (t-2011)	0.061***	0.071***	0.038***	0.032***	0.038***	0.032***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Constant	2.709***	2.391***	1.668***	1.811***	1.668***	1.811***
	(0.032)	(0.039)	(0.039)	(0.046)	(0.039)	(0.046)
Region Dummies	Yes	Yes	No	No	No	No
Controls	No	Yes	No	Yes	No	Yes
Method	RKD	RKD	RKD	RKD	RKD & Arellano-Bond	RKD & Arellano-Bond
Fixed Effect	No	No	Individual	Individual	No	No
Observations	67,089	67,089	67,089	67,089	67,089	67,089
R-squared	0.447	0.452	0.197	0.220	0.197	0.220

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table C.1 — Estimates of Price Elasticity of Pure Alcohol (continued).

	(1)	(2)	(3)	(4)	(5)	(6)
Panel B: Second Stage.						
Dependent Variable: Log of Pure Alcohol Consumption in the last 30 days						
Log of Lowest Real Price of Vodka in Community	-0.669***	-0.503***	-0.769***	-0.788***	-0.889***	-0.930***
	(0.154)	(0.146)	(0.131)	(0.134)	(0.214)	(0.251)
Log of Community-level CPI	-0.267***	-0.164**	-0.212***	-0.253***	-0.203**	-0.256**
	(0.089)	(0.083)	(0.055)	(0.059)	(0.092)	(0.103)
Time (Year-2011)	-0.021	-0.056**	-0.003	-0.084**	-0.003	-0.039
	(0.021)	(0.028)	(0.016)	(0.038)	(0.029)	(0.065)
Lag of Log(Vodka Consumprion)					0.136***	0.138***
					(0.015)	(0.015)
Age		0.105***		0.149***		0.0762
		(0.004)		(0.038)		(0.059)
Age Squared		-0.001***		-0.001***		-0.001*
		(0.000)		(0.000)		(0.000)
I(Female)		-1.445***				
		(0.032)				
I(Married)		0.269***		-0.058		0.066
		(0.031)		(0.051)		(0.097)
I(Muslim)		-0.322***				
		(0.074)				
I(College)		-0.024		-0.0556		0.121
		(0.034)		(0.064)		(0.123)
I(Employed)		0.473***		0.169***		0.135**
		(0.034)		(0.036)		(0.067)
Log of Income per family member		0.095***		0.094***		0.127***
		(0.021)		(0.022)		(0.038)
I(Regional Center)		0.712***				
		(0.152)				
Log of Regional Unemployment		-0.0581		-0.191***		-0.0218
		(0.052)		(0.046)		(0.131)
Constant	3.936***	0.382	3.810***	-1.185	3.509***	0.182
	(0.501)	(0.520)	(0.310)	(1.681)	(0.516)	(2.580)
Region Dummies	Yes	Yes	No	No	No	No
Controls	No	Yes	No	Yes	No	Yes
Method	RKD	RKD	RKD	RKD	RKD & Arellano-Bond	RKD & Arellano-Bond
Fixed Effect	No	No	Individual	Individual	No	No
Observations	67,089	67,089	67,089	67,089	23,954	23,954
R-squared	0.032	0.189	0.009	0.012		
Number of IDIND			21,652	21,652	10,150	10,150

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix D

Table D.1 — Alternative Estimates of Price Elasticity using Log of Real Average Regional Price of Vodka as an explanatory variable.

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. First Stage						
Dependent Variable: Log of Lowest Real Price of Vodka in Community						
Log of Average Regional Price of Vodka, Real	0.179***	0.179***	0.186***	0.183***	0.186***	0.183***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log of Community-level CPI	0.010***	0.007***	0.046***	0.011***	0.046***	0.011***
	(0.001)	(0.000)	(0.002)	(0.002)	(0.002)	(0.002)
Time (Year-2011)	0.088***	0.084***	0.083***	0.080***	0.083***	0.080***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.934***	1.027***	0.584***	0.891***	0.584***	0.891***
	(0.005)	(0.006)	(0.009)	(0.012)	(0.009)	(0.012)
Region Dummies	Yes	Yes	No	No	No	No
Controls	No	Yes	No	Yes	No	Yes
Method	RKD	RKD	RKD	RKD	RKD & Arellano-Bond	RKD & Arellano-Bond
Fixed Effect	No	No	Individual	Individual	No	No
Observations	67,089	67,089	67,089	67,089	67,089	67,089
R-squared	0.984	0.985	0.919	0.933	0.919	0.933

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table D.1 — Alternative Estimates of Price Elasticity using Log of Real Average Regional Price of Vodka as an explanatory variable (continued)

	(1)	(2)	(3)	(4)	(5)	(6)
Panel B. Second Stage.						
Dependent Variable: Log of Vodka Consumption in the last 30 days						
Log of Average Regional Price of Vodka, Real	-0.525***	-0.496***	-0.732***	-0.752***	-0.721***	-0.826***
	(0.105)	(0.099)	(0.097)	(0.099)	(0.169)	(0.192)
Log of Community-level CPI	-0.0808	-0.0694	-0.0848*	-0.107**	-0.131*	-0.148*
	(0.050)	(0.048)	(0.047)	(0.047)	(0.077)	(0.077)
Time (Year-2011)	-0.00867	-0.0227	0.0513***	-0.0156	0.0576	0.0484
	(0.021)	(0.021)	(0.019)	(0.035)	(0.039)	(0.065)
Lag of Log(Vodka Consumprion)					0.120***	0.119***
					(0.014)	(0.015)
Age		0.133***		0.134***		0.0876*
		(0.004)		(0.033)		(0.046)
Age Squared		-0.001***		-0.001***		-0.0001*
		(0.000)		(0.000)		(0.000)
I(Female)		-1.497***				
		(0.031)				
I(Married)		0.153***		0.0172		0.121
		(0.028)		(0.051)		(0.098)
I(Muslim)		-0.201***				
		(0.068)				
I(College)		-0.214***		0.008		-0.014
		(0.032)		(0.064)		(0.113)
I(Employed)		0.175***		0.048		0.003
		(0.031)		(0.038)		(0.066)
Log of Income per family member		0.023		0.017		0.040
		(0.020)		(0.022)		(0.039)
I(Regional Center)		0.874***				
		(0.125)				
Log of Regional Unemployment		-0.018		-0.071		0.091
		(0.048)		(0.047)		(0.151)
Constant	2.058***	-1.216***	2.466***	-1.881	2.530***	-0.705
	(0.276)	(0.338)	(0.236)	(1.439)	(0.387)	(2.043)
Region Dummies	Yes	Yes	No	No	No	No
Controls	No	Yes	No	Yes	No	Yes
Method	RKD	RKD	RKD	RKD	RKD & Arellano-Bond	RKD & Arellano-Bond
Fixed Effect	No	No	Individual	Individual	No	No
Observations	67,089	67,089	67,089	67,089	23,954	23,954
R-squared	0.022	0.155	0.010	0.011		
Number of IDIND			21,652	21,652	10,150	10,150

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1