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INVESTIGATING THE VOLUME AND STRUCTURE OF ALCOHOL CONSUMPTION AND THEIR IMPACT ON LIFE EXPECTANCY IN RUSSIAN REGIONS

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INVESTIGATING THE VOLUME AND STRUCTURE OF ALCOHOL CONSUMPTION AND THEIR IMPACT ON LIFE EXPECTANCY IN RUSSIAN REGIONS[4]

This paper aims to investigate differences in the volume and structure of alcohol consumption and then to reveal the impact of alcohol consumption on life expectancy in Russian regions. We consider the contribution of different product to the dynamics of consuming absolute alcohol. Necessary data were collected from the Federal State Statistics Service of Russia from 2008 to 2012. Data on the volume of regional alcohol sales in liters were used as proxy variables because of the shortage of regionally divided statistical data on alcohol consumption. The data on absolute alcohol consumption in each region were obtained from the weighted-average share of spirits in each kind of alcoholic product considered. We estimate panel data models and reveal macroeconomic determinants of alcohol consumption that reflect economic development of regions, living standards, unemployment and degree of urbanization. We find strong positive relationship between alcohol consumption and mortality from external causes and negative with life expectancy in Russian regions. Results are valid for both male and female population.

JEL Classification: I15

Key words: alcohol consumption, alcohol abuse, inter-regional differences, life expectancy, mortality, Russian regions

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1. Introduction

The urgency of this study stems from the fact that alcohol abuse has been a serious social problem in Russia for a long time. This problem leads to a reduced life expectancy (especially for males) and to significant differences in life expectancy between men and women, that now equals 12 years on average. The Russian government recognizes the importance of social policy aimed at reducing alcohol consumption and alcohol abuse, and increasing life expectancy (Federal Service for Alcohol Market Regulation, 2009).

As noted in several studies (Nemtsov, 2002; Pridemore, 2008; Popov, 2009), at least one third of all deaths in Russia are directly or indirectly associated with alcohol consumption. According to research of Shkolnikov and coauthors, the life expectancy gap between Russia and Western countries remains substantial. This is largely due to death from alcohol-related conditions (Shkolnikov et al., 2013). Vishnevskiy and Vasin (2011) pay attention to the fact that this is important to study both causes of death and their contribution to the composition of the life expectancy index. Particularly strong differences between Russia and European countries, namely, France and Germany, are in losses from external causes of death in young and middle age. These losses result from alcohol abuse in many ways and prevent the lengthening of the life expectancy. This also raises the question of how significant changes in Russia over the past 20 years affect both the alcohol composition level and life expectancy. Probably, these are changes in household incomes and unemployment, as well as the fundamental expansion of a range of strong and weak alcoholic drinks (especially beer).

Therefore, this is important to investigate macroeconomic factors that significantly influence alcohol consumption in Russia and to study the impact of alcohol consumption on population health and longevity. More precisely, we examine the relationship between alcohol consumption and mortality from external causes as well as life expectancy in Russian regions. The analysis is based on panel data sample collected from the Russian Federal State Statistics Service that is open to the public.

2. Literature review

A significant amount of studies is devoted to assessing the relationship between health indicators and its determinants. Investigations at micro level are usually conducted in a form of adults' survey. Hence, such studies are largely based on self-assessments from respondents. For instance, Demyanova (2005) and Yakovlev (2012) carried out studies about alcohol consumption in Russia on the data of Russian Longitudinal Monitoring Survey. With that, macro level studies usually use as dependent variables life expectancy and various mortality indicators: age-specific mortality, mortality by cause, infant mortality, etc. (Kossova 1991; Ruhm, 2002; McGuire, 2006,

Avendano, 2012). Aggregate mortality indicators are convenient to use for cross-section country analysis (Kossova, 1991; Braninerd & Cutler, 2005; Bhopal et al., 2012), as well as for cross-regional analysis within a country (Langford & Bentham, 1996; Walberg et al, 1998; Treisman, 2010; Grigoriev et al., 2013).

Many scientists around the world have studied the relationship between public health and macroeconomic factors. An analysis of studies in this area suggests that, despite the statistically significant relationship between health outcomes and various macroeconomic parameters (including GDP per capita, unemployment rate, inequality indices, etc.), there are different points of view on the direction of this impact. In particular, most works written before the 1990s note a positive correlation between an improved economic situation and public health (Brenner, 1973, 1975, 1979; Kossova, 1991). A number of papers written mostly during the 1990 show that a relationship between the economic situation and public health is not always evident in the short term (Forbes & McGregor, 1984; Joyce & Mocan, 1993; McAvinchey, 1994). However, empirical studies conducted in developed countries in the early 21st century noted improvements in health during the economic downturn: at the achieved level of economic development, the relationship between these variables in the short term was negative (Ruhm, 2000, 2003, 2005; Neumayer, 2004).

A positive change in lifestyle during an economic recession is often considered as a factor of correlation between economic development and population health (Ruhm, 2003). For example, a number of recent studies revealed a micro-level shift to a healthy lifestyle, including a reduction in alcohol consumption during hard times (Dee, 2001; Macela et al, 2001; Ruhm & Black, 2002; Ruhm, 2005). Many research papers confirm that a reduction in alcohol consumption leads to an almost instantaneous reduction in mortality (Cook & Moone, 1987; Pridemore & Kim 2006, Razvodovsky, 2010). Research papers show that a decrease in alcohol consumption during a recession is explained by a decrease in domestic income (Ruhm & Black, 2002; Johansson et al, 2006). At the same time, an increase in domestic income leads to a decrease in mortality and an increase in average life expectancy (Denisova, 2010).

Studies on the impact of unemployment on mortality give results that are even more controversial. According to research conducted in Finland (Jantti et al, 2000), during high rates of unemployment in the country, no increase in mortality was recorded. At the same time, a number of Russian studies have revealed an increase in mortality rates during periods of unemployment (Walberg et al 1998; Periman & Bobak, 2009; Denisova, 2010). Studies based on micro-data prove that people who lose their jobs start to drink more alcohol (Popov, 2009; Denisova, 2010).

There is no doubt as to the negative impact of alcohol on health, mortality, and life expectancy. We note that the results of studies for different countries revealed a different nature of relationship between alcohol consumption and mortality. In particular, a number of works conducted in the US, UK, Sweden, Germany, Spain, and Japan record positive effects from alcohol consumption on reducing the risks of death from cardiovascular disease. This relationship is U-shaped (Marmot et al, 1981; San Jose, 2003; Arriola, 2009) or J-shaped (Rehm & Sempos, 1995; Skog, 1996; Keil et al, 1997; Kitamura et al, 1998). However, other authors notice a linear relationship between alcohol consumption and mortality (Andersson et al, 1988; Murray & Lopez 1997; Nicholson et al, 2005; Johansson et al, 2006). Studies based on Russian data show that the relationship between alcohol consumption and mortality is linear (Nicholson et al, 2005; Kharchenko et al, 2005).

Research papers investigating the impact of the structure of alcohol consumption on mortality rates are the most interesting for our study. There are currently two points of view on this issue: some authors link the deterioration of public health with an increase in total alcohol consumption (Kauhanen et al, 1997; Krasovski, 2008), while still others argue that only heavy alcohol consumption has a negative effect on health and mortality indicators (Leon et al, 2007; Popov, 2009; Razvodovsky, 2010).

Since this is popular to regard lower-grade alcoholic drinks as harmlessness, there is an increase in the supply of such drinks in countries with heavy alcohol consumption (Khalturina & Korotaev, 2006; Nuzhnij & Rozhanets, 2007). This opinion contradicts the position of the World Health Organization (WHO). In official WHO documents, the transition from strong to weak drinks while maintaining the same overall level of alcohol consumption is not discussed. Thus, the WHO believes that the damage depends on the amount of alcohol consumed, and not on the form in which it is consumed (Krasovski, 2008). This position is clearly expressed in the WHO paper (WHO, 1998). Today, the influence of the structure of alcohol consumption on the population's health in Russia is understood only very poorly (Nemtsov, 2009).

This is important to mention that alcohol consumption in a country is affecting by various economic factors. Referring to existing research papers, we pay attention to studies conducted for regions of a particular country. For instance, Bränström and Andréasson in their research for Sweden find regional and gender differences in alcohol consumption (Bränström & Andréasson, 2008). Benčević-Striehl and coauthors catch strong regional pattern of alcohol consumption in Croatia (Benčević-Striehl et al., 2009). Ogwang and Cho investigate determinants of consuming alcoholic beverages in Canadian provinces and include into the set of explanatory factors per-capita income and the unemployment rate (Ogwang & Cho, 2009). They have shown that

unemployment rate has significant negative effect on beer consumption, and per capita income positively affects the consumption of beer, wine, and spirits.

Chaix and Chauvin in their survey for France discover that the risk of alcohol consumption increases significantly with a household income per person (Chaix & Chauvin, 2003). Authors also find that the risk of alcohol abuse increases with the area-level GDP per capita. Dias and coauthors examine social and behavioral factors of alcohol consumption in Portugal (Dias et al., 2011). Among social factors, they consider employment status.

Herzfeld and coauthors examine determinants of alcohol demand in Russia for the period from 1994 to 2005 (Herzfeld et al., 2014). Among regional characteristics there consider unemployment and living in rural area as the degree of urbanization. They conclude that these factors are significant for women but not for men. More precisely, the relationship between alcohol demand and unemployment is positive, and between alcohol demand and living in rural area is negative. Authors also consider gross regional product per capita and find it insignificant.

Klein and Pittman study regional differences in alcohol consumption in the US and consider the population density as one of the urbanization measures (Klein & Pittman, 1993). Schnuerer and coauthors in their research for Germany consider rural living environment and being unemployed as factors of risky alcohol use (Schnuerer et al., 2013). They find that the relationship is positive for both factors.

Results of the literature review motivate us to test the following hypotheses regarding alcohol consumption in Russian regions:

1) At present, there is a change in the structure of alcohol consumption concerning a decrease in consuming strong alcoholic beverages and an increase in drinking weak alcoholic beverages.

2) An increase in the welfare of the region leads to a growth of alcohol consumption.

3) Unemployment and the degree of urbanization significantly influence alcohol consumption.

4) Alcohol abuse leads to an increase in mortality from external causes as well as to a decrease in the average life expectancy.

3. Model description

3.1 Data base description

In this section, we describe the main variables used as determinants for alcohol consumption and health. We examine whether the link between the volume and structure of alcohol consumption determinants and health is consistent and how those variables influence population health.

Table 1. Main variables used in this research

Variable	Comments
Life expectancy (for region's population in whole and for men and women separately)	The number of years that a newborn human in particular region is supposed to live in the event that during his lifetime the mortality rate would be the same as this year.
Mortality rate from reasons directly or indirectly connected with alcohol consumption	Death from temulence, suicide, homicide, external causes, and transportation accidents. The mortality rate is calculated as the number of deaths per 100,000 living in a particular region
Population size	Population size in a particular region in particular year
Income per capita	Income per capita is the annual population income divided by 12 (months) and by the average annual population size
Energy consumption per capita	(Electric) energy consumption per capita is a quotient from division of total regional energy consumption by average annual population size
Average unemployment figures during the year	Average number of unemployed in a particular year per 1.000 individuals living in particular region.
Population density	Average number of people living on 1 sq km of territory for a particular region
Urbanization rate	Ratio of urban population to total population in a particular region
Gini coefficient	The Gini coefficient characterizes the degree of deviation of the line of actual distribution of the total money from the line of their uniform distribution. Gini coefficient varies from 0 to 1, where 1 is total inequality
Male population	Ratio of male population to total population in a particular region
Vodka and liqueurs	Sales of alcoholic beverages during the year in physical terms (in liters)
Champagne and sparkling wine	
Wines	
Cognacs, brandy and brandy spirits	
Beer	
Commodity names	Provision with main product types during a particular year, in real terms per capita or per 100 households

Based on data from the Russian Federal State Statistics Service: www.gks.ru

The title of "Commodity names" includes a wide range of products, including staple foods, beverages, cigarettes, durables, household appliances, computers, luxury goods, etc. Alcoholic beverages were put in the table under separate titles. Sales volumes of alcoholic beverages are measured in physical terms (in liters) to make it easier to compare alcohol consumption in different regions. Income per capita, energy consumption per capita and provision of the population with durables by region are proxies of population wealth.

We use two proxies for the population health that are life expectancy and mortality rate from external cause, starting from death from alcoholic intoxication and ending with suicide, homicide, and transport accidents that might be caused by alcohol abuse. Together with such factors as climate and gens, unhealthy lifestyle influences the health of the population. While life expectancy is an index formed under the long-term impact of population health determinants, death from external causes, in fact, comes in a mere few hours (quite a short-term result) after alcohol overconsumption. This peculiarity of the mortality index is the reason why it is more suitable for the analysis of extremely negative unhealthy lifestyle consequences. It is supposed

that there is a strong correlation between alcohol consumption and mortality rate from reasons connected with alcohol abuse.

Because of the lack of data about actual alcohol consumption, we use alcohol sales indices (in physical terms, by alcohol type: beer, wine, vodka, etc.). We assume that the amount of alcohol sold during the year approximately equals the amount of alcohol consumed during this period. Also we consider the alcoholic content in each beverage (vodka and liqueurs – 40%, champagne and sparkling wine – 11%, wines – 14%, cognacs, brandy and brandy spirits – 40%, beer – 4%) to calculate the weight average amount of absolute (or "pure") alcohol, sold in a particular region.

3.2. Analysis of the volume and structure of alcohol consumption in Russian regions

We consider alcohol consumption in Russia from 2008 to 2012. The choice of the time interval for the analysis comes from the lack of data for some regions in previous periods. Figure 1 presents the dynamic of alcohol consumption in Russia for the last 10 years.

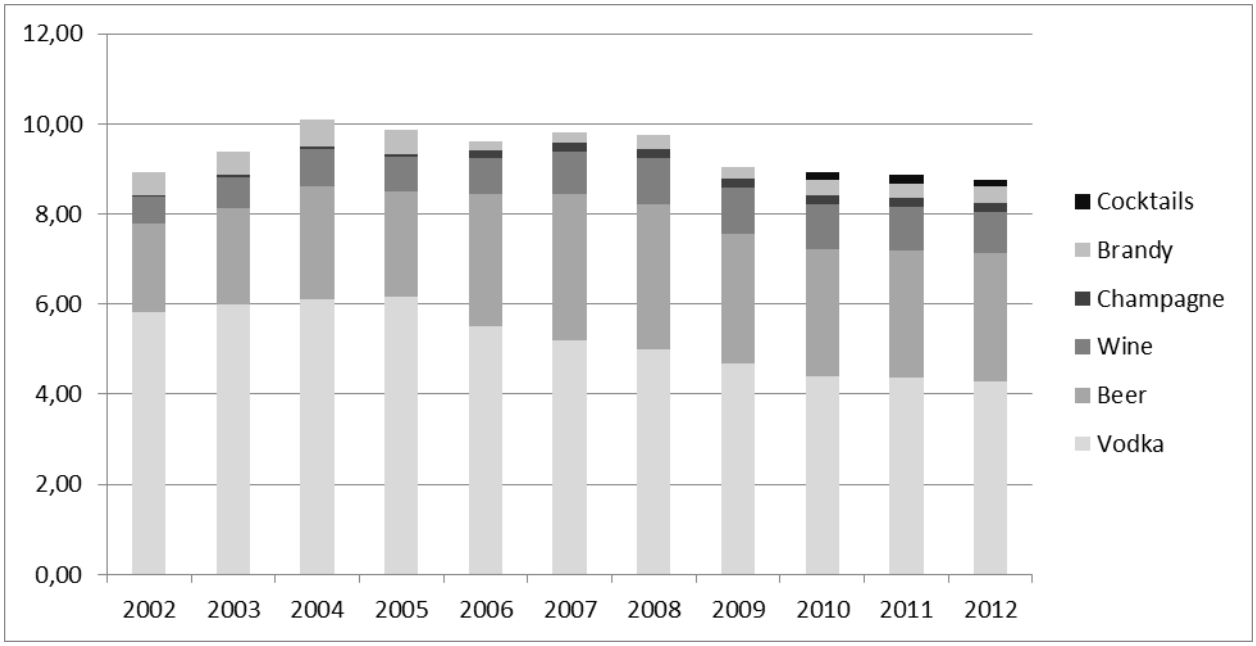

Figure 1. Consumption of alcoholic beverages in liters of absolute alcohol

The above diagram demonstrates that there has been an increase in consumption of all alcoholic beverages in the country before 2004, and hence a noticeble growth in consumption of absolute alcohol. After 2005, there has been a decrease in consumption of vodka. However, consumption of absolute alcohol remain unchanged due to the growth of consuming weak alcoholic beverages, especially beer. For 3 years consumption of beer has increased by more than a third. In 2009 and 2010 there has been a reduction in consuming all alcoholic beverages followed by stabilization of the volume and structure of alcohol consumed.

This causes the reduction in per capita consumption of absolute alcohol from 9,7 litres in 2008 to 8,5 litres in 2012. This tendency is positive, but the level of alcohol abuse in Russia is still too high. According to the WHO, the critical and dangerous level of absolute alcohol consumption nationwide is 8 liters per year per capita[5]. Due to a lack of data on the population's age structure, we calculated the alcohol-consumption level (8 liters per capita) as a quotient of regional alcohol sales (in terms of absolute alcohol levels) over regional population. In world practice, the alcohol-consumption level is usually estimated for the population over 15. We estimate that the part of Russia's population younger than 15 was 14.66%[6] in 2008, and 15,52% in 2012. We conclude that per capita alcohol consumption by the adult population equals approximately 10.1 liters. This number exceeds the maximum WHO alcohol-consumption level by 26%. Furthermore, the estimated amount of alcohol consumed by the average adult in Russia (10.1 liters) might be underestimated due to a lack of data on unregistered alcohol sales.

Next, we focus on the analysis of alcohol consumption in Russian regions and changes in the volume and structure of alcohol consumption that occurred in the period from 2008 to 2012. Annex 3 presents the list of Russian regions. We exclude from the analysis Ingushetia and Chechnya due to the lack of statistics.

Figure 2 presents data on consumption of absolute alcohol in 2008 and 2012 that is at the beginning and the end of the period under consideration. The color of regions varies from light to dark depending on the amount of alcohol consumption. The differences of the left and right images reflect changes in alcohol consumption that occurred during the period under consideration. The amount of absolute alcohol consumed per capita differs from 2 to 14 liters. The color of regions varies from light to dark depending on the amount of alcohol consumption.

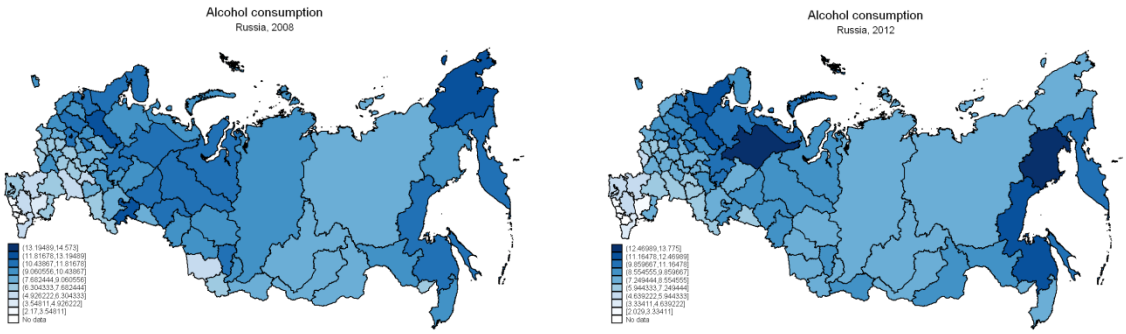

Figure 2. Per capita consumption of absolute alcohol in 2008 – 2012

In both 2008 and 2012, relatively little alcohol was consumed in the southern regions of the European part of Russia (less than 5 liters per capita), particularly in North Ossetia-Alania,

[5] http://www.itar-tass.com/level2.html?NewsID=15331987
[6] http://www.gks.ru/free_doc/new_site/population/demo/demo14.xls

Kabardino-Balkaria, Karachay-Cherkessia, Dagestan and Kalmykia. In 2008, we observe a considerably higher-than-average amount of "pure" alcohol consumption (more than 10,5 liters per capita) in Kaliningrad, Novgorod, Leningrad, Karelia, Murmansk, Vologda, Ivanovo, Kirov, Komi, Tver, Moscow, Chelyabinsk, Sverdlovsk, Tumen, Kemerovo, Khabarovsk, Kamchatka, Sakhalin and Chukotka regions, as well as in the cities of Moscow and St. Petersburg themselves. By 2012, several regions have reduced alcohol consumption and have left this group. These are Ivanovo and Tver regions of the central European part of Russia, and regions of the Urals and Western Siberia, namely, Chelyabinsk, Sverdlovsk, Tyumen, as well as particularly distinguished Chukotka and Saint Petersburg. At the same time, Arkhangelsk region, Udmurtia and Magadan region have increased alcohol consumption to the amount higher than the average in the country.

Therefore, we conclude that the most problem regions concerning alcohol consumption are northern regions of the European part of Russia and the Far East excluding Primorsky Kray. Moreover, these are Moscow and Leningrad regions, and the western enclave of Kaliningrad. With that, southern regions of the European part of Russia and the Caucasian republics are the most favorable on this criterion.

Papers of Andreev and coauthors (1994), Walberg and coauthors (1998) support the conclusion that alcohol consumption in Russia increases from north to south and from west to east. The presence of Moscow and St. Petersburg in this list might be caused by the significant number of migrants, tourists, and people coming to these cities to earn money. Therefore, the level of per capita alcohol consumption in these two cities is overestimated. With regard to Kaliningrad region, we note that a possible reason for getting into the category of problem regions is a peculiarity of its geographical position. The geography of this region contributes to taking out of alcohol sold in its territory outside the region including neighboring states. However, this problem requires deeper investigation.

This is important that in the whole Russia per capita consumption of registered absolute alcohol decreased in five years from 9.7 to 8.8 liters that is about by 10%. With that, regional trends vary significantly. There was a decrease in alcohol consumption in 53 regions, namely, Chukotka, regions of Western and Eastern Siberia, the Urals, most regions of the European part including Moscow and Saint Petersburg. In addition, the Caucasian republics, Belgorod, Volgograd and Chelyabinsk regions, Chukotka and Saint Petersburg demonstrate the greatest reduction in alcohol consumption that is more than 20% from the level of 2008.

At the same time, there was an increase in alcohol consumption in 25 regions. The greatest concern is devoted to the negative dynamics in problem regions of the northern European part and the Far East. In the mentioned parts of Russia, we observe a significant

increase in alcohol consumption for the period of 5 years. This is 45% in Magadan region, 7% in Khabarovsk Krai, about 10% in republics of Komi and Karelia, and 4% in Arkhangelsk region. Moreover, we reveal the growth of alcohol consumption in Zabaykalsky Krai, particularly Amur region and Jewish Autonomous District, as well as in Altai Kray and Tuva. Findings are the same for Volga regions including the republics of Bashkortostan, Mordovia, Udmurtia, as well as for Kostroma, Saratov, Ulyanovsk and the Astrakhan regions. Besides, the trend is identical in regions of the central European part forming the agricultural chernozem zone, namely, Kaluga, Tula, Orel, Ryazan, Tambov, and Penza regions.

In addition to differences in the volume of consuming absolute alcohol, Russian regions vary significantly in terms of the structure of consumed alcoholic beverages. Table 2 illustrates the structure of alcoholic-beverage consumption by aggregative groups of regions in 2008 and 2012.

Table 2. Amount of alcohol, consumed in regions with the maximum and minimum levels of alcohol consumption, liters per capita

		Vodka and liqueurs	Champagne and sparkling wine	Cognacs, brandy and brandy spirits	Beer	Wines	Absolute alcohol
Min alcohol consumption, 10% regions	2008	4.85	0.80	0.37	26.38	3.20	3.68
	2012	4.80	0.85	0.50	26.70	2.40	3.62
Min alcohol consumption, 25% regions	2008	6.92	0.99	0.39	38.24	4.55	5.20
	2012	6.28	1.32	0.57	47.2	4.34	5.10
Max alcohol consumption, 25% regions	2008	16.40	2.34	1.15	81.51	9.75	11.90
	2012	15.35	2.49	1.25	77.83	8.73	11.25
Max alcohol consumption, 10% regions	2008	17.30	2.67	1.23	89.96	9.51	12.64
	2012	18.20	3.20	1.40	81.70	8.86	12.70
Share in absolute alcohol	2008	55%	2%	3%	29%	11%	
	2012	52%	2%	4%	31%	11%	

Based on data from the Russian Federal State Statistics Service: www.gks.ru

We conclude from the table that regional differences in absolute alcohol consumption are determined mainly by the differences in consumption of two products: vodka and beer. The combined share of these two categories is about 80%. It is approximately the same both for the top 10% of alcohol-consuming regions and for the bottom 10% of alcohol-consuming regions. This structure corresponds to the so-called “northern” style of alcohol consumption, according to which alcohol consumption occurs mainly in the form of spirits (vodka and liqueurs).

Figure 3 illustrates the distribution of regional vodka consumption per capita in 2008 and 2012.

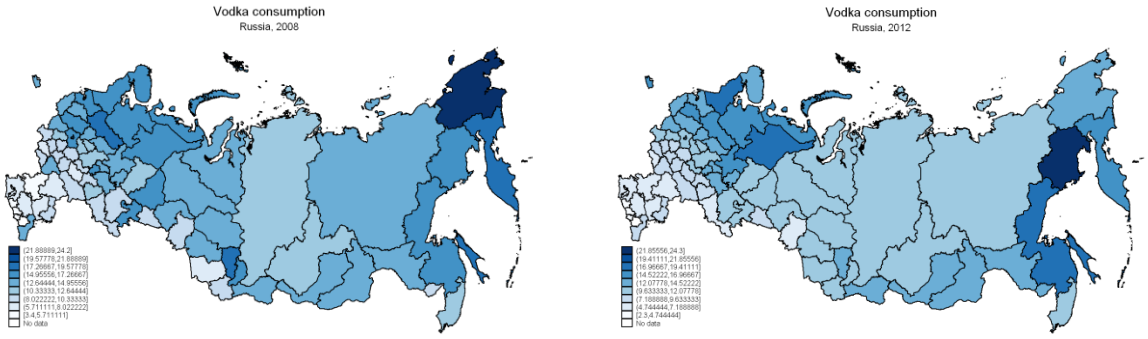

Figure 3. Per capita consumption of alcoholic beverages in 2008 and 2012

During the period from 2008 to 2012, per capita consumption of vodka has decreased from 12.2 to 11 liters per year. The maximum level of consumption equals 24,3 liters per person per year for Magadan region. The minimum level equals 2,3 liters for republics of Kabardino-Balkaria and Karachay-Cherkessia. The distribution of regions by vodka consumption is identical to the distribution of regions by the level of consuming absolute alcohol, since vodka is the main alcoholic beverage.

In 2008, the share of vodka in total "pure" alcohol consumption was 55%. Beer was second at 29%. In 2012, shares of these products are 52% and 31% respectively. The obtained parameters values imply a significant change in the alcohol consumption structure compared to the results of earlier studies, according to which the average contribution of vodka and beer in absolute alcohol consumption in the mid-1990s were 80% and 13%, respectively (Razvodovsky, 2010).

Figure 4 illustrate differences in regional beer consumption in 2008 and 2012.

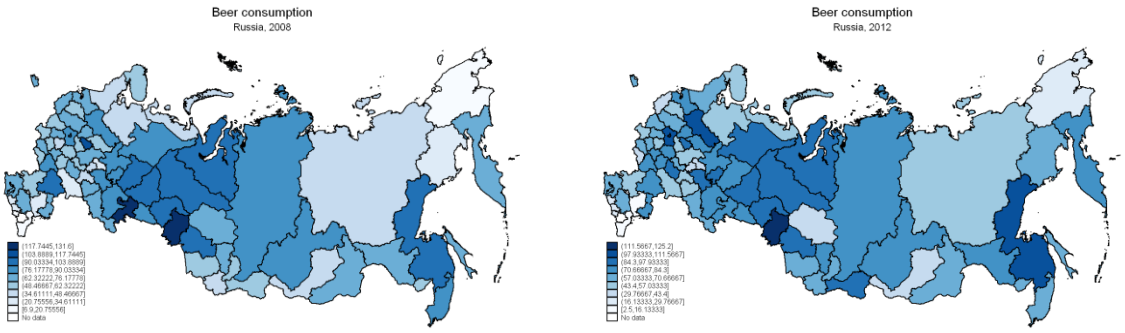

Figure 4. Per capita consumption of beer in 2008 and 2012

Data about beer sales in Russia (in physical terms) show significant regional differences for beer consumption with the average of 65,5 liters per person per year. The relatively low consumption of beer (less than 35 liters per capita) was observed in the Caucasian republics: North Ossetia-Alania, Adygeya, Dagestan, Kabardino-Balkaria and Karachay-Cherkessia, as well as in Chukotka and the republics of Kalmykia and Mari El. We note that Dagestan

demonstrates the minimum level of beer consumption with the reduction of this indicator from 6 to 2,5 liters per person per year during 2008 – 2012. It is worth noting that most of regions in the first group are characterized by low alcohol consumption in absolute terms. The exception is Chukotka that demonstrates problem drinking.

At the same time, Moscow region, Ivanovo, Penza, Omsk and Sverdlovsk regions, republics of Komi, Udmurtia, and Tuva, Khabarovsk Krai excelled with the highest consumption of beer (more than 90 liters per person per year). The maximum level of beer consumption equals 125 liters per person per year for Omsk region. In all regions in this group, excluding Penza and Omsk, the consumption of absolute alcohol is much higher than the national average.

We also pay attention to an increase in per capita consumption of beer in 39 regions during 2008-2012. In 27 regions, a growth of beer consumption is accompanied by a reduction of vodka consumption. Nevertheless, this change in the structure of alcohol consumption leads to a decrease in consuming absolute alcohol only in 17 regions. In 22 regions, a growth of beer consumption significantly contributes to an increase in consuming absolute alcohol. With that, in 12 regions, namely, Arkhangelsk, Kostroma, Orel, Tambov, Penza, Amur, as well as in republics of Udmurtia, Altai, Tuva, and Zabaykalsky Krai, an increase in consuming absolute alcohol is caused by beer consumption with a reduction of vodka consumption. In 12 regions, beer consumption increases concurrently with vodka consumption. However, in Ulyanovsk, Saratov, and Astrakhan regions a significant growth of beer consumption is the main driver of an increase in consuming absolute alcohol. It is further worth noting that in six Russian regions beer influences the consumption of absolute alcohol more than vodka. These are Volgograd, Omsk, Kurgan, Orenburg and Penza regions, as well as Krasnodar Krai and Stavropol Krai. Overall, we conclude that an increase in beer consumption is incrementally becoming a significant factor of alcoholism in Russia. We also find a slight decrease in consumption of absolute alcohol in Kaliningrad, Vladimir, Ivanovo, Kirov, and Novgorod regions. This decrease was achieved by reducing beer consumption even though the consumption of vodka and cognac increased.

The hypothesis that vodka and liqueurs are the main products forming the consumption of absolute alcohol was verified while analyzing the structure of consumption of alcoholic beverages. At the same time, there are substantial regional differences on this indicator, with values ranging from 32% to 86%.

The role of other alcoholic beverages, such as grape and fruit wines, champagnes, and sparkling wines, as well as brandy and cognac, was relatively small in the formation of the volume of alcohol consumption, equaling about 17% in the total “pure” alcohol consumption in physical terms.

3.3. Macroeconomic determinants of alcohol abuse in Russian regions

In this section, we identify factors that have the most significant effect on the level of alcohol consumption. Dependent variables are indicators of alcohol consumption in terms of "pure" alcohol by type of alcoholic beverage. Table 1 presents indicators chosen as independent variables including macroeconomic factors and their derivatives. Macroeconomic factors characterize economic development of the region and living standards (income per capita, consumption of electricity, provision of the population with computers), degree of urbanization (urban population, population density, population size of the region), and level of psychological tension (unemployment rate, Gini coefficient). These indicators are traditionally used for modeling macroeconomic determinants of unhealthy lifestyles (Ruhm, 2000, 2003; Macela et al, 2001; McAvinchey, 1994 Neumayer, 2004; Johansson et al, 2006; Li & Zhu, 2006; Periman & Bobak, 2009). However, conclusions about the direction of their impact on the dependent variable do not always coincide. The objective of this study is to identify economic reasons explaining the differences in regional alcoholism levels in Russia based on inter-regional comparisons. Results enable one to determine subsequent measures for the development of alcohol policy.

We estimate panels with fixed effects and random effects. Panel data contains observations from 2008 to 2012 on 78 regions excluding Republic of Ingushetia and Chechnya. Since we investigate regions, the primary model is the model with fixed effects. Estimates of panels with fixed effects, in contrast to estimates of panels with random effects, are consistent even in the presence of correlation between regressors and individual effects. However, we take into account that in the case of not correlated regressors and individual effects panels with random effects are more effective. Therefore, the final model contains all variables that are significant in at least one of the models. In order to choose between panels with fixed and random effects we conduct Hausman test. In all models, directions of the influence of explanatory variables are the same. Coefficients differ within their confidence intervals even when Hausman test shows inconsistency of panels with random effects. This confirms the robustness of results. According to F-statistics and Wald-statistics, all models are adequate at any reasonable level of significance in spite of low determination coefficients. All estimation results are given in Annex 1.

We also tested the robustness of our results by restricting the sample size. Estimates for the coefficient of variables in the model with fewer observations were almost unchanged.

We chose a log-linear form to describe the dependence on absolute alcohol consumption and consumption of different types of alcoholic beverages.

Models describing the relationship between regional differences in (absolute) alcohol consumption and macroeconomic factors are presented in Table 3.

Table 3. Result of econometric analysis on absolute alcohol consumption (Russian regions)

VARIABLES	(1) Ln(alcohol)	(2) Ln(alcohol)	(3) Ln(alcohol)
Ln(income_min)	0.0397		-0.101
	(0.0881)		(0.0789)
Ln(energy_consumption)	0.326***	0.335***	0.309***
	(0.0695)	(0.0678)	(0.0698)
Ln(computers)	-0.121***	-0.111***	
	(0.0297)	(0.0260)	
Unemployment_rate	-0.00136		
	(0.00357)		
Unemployment_rate *(year-2008)	-0.00185***	-0.00189***	-0.00363***
	(0.000710)	(0.000667)	(0.000545)
Gini_coefficient	1.307	1.631**	1.986**
	(0.883)	(0.661)	(0.888)
Urbanization_rate	0.0181***	0.0186***	0.0178***
	(0.00556)	(0.00539)	(0.00553)
1/population	0.289***	0.287***	0.268***
	(0.0733)	(0.0730)	(0.0749)
Constant	-0.179	-0.364	-0.697
	(0.544)	(0.470)	(0.514)
Observations	390	390	390
R-squared	0.294	0.293	0.255
Number of reg	78	78	78

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The coefficient signs on the variables verify our hypotheses about the positive link between alcohol consumption and economic development of regions. Economic development is characterized by logarithm of per capita consumption of electricity, provision of computers per 100 households, and per capita income normalized by the subsistence minimum in the region. Normalization of income enables us to eliminate regional differences in the level of prices and inflation during 2008-2012.

Consumption of electricity is significant in all models. In models 1 and 2, we consider provision of computers as an additional characteristic of the welfare. Normalized per capita income is insignificant in all models.

Considering the level of unemployment in a region, we use the unemployment rate and unemployment_rate *(year-2008). The latter variable is included in order to take into account possible changes in the relationship between the dependent variable and the unemployment rate over 2008-2012. As a preliminary analysis, we estimate models with different coefficients at the level of unemployment for each year. These coefficients show a linear change with time. In order

to increase the effectiveness of estimation we include a cross variable into analysis. The negative sign of the estimate for unemployment rate does not coincide with the results of studies based on micro data (Brenner, 1975; Treisman, 2010). At the same time, this result is logical and reflects the fact that, when competition on the labor market increases, employed people reduce their alcohol consumption. Furthermore, we note an increase of this effect over time. In 2009, alcohol consumption differs by 0,2% in regions where the unemployment rate varies by 1%, other things being equal. In 2012, alcohol consumption differs by 0,8% in the same regions. We note that this tendency refers only to the period under consideration and it cannot be extrapolated for several years ahead.

Gini coefficient characterizes social tensions, and this variable is significant in models 2 and 3. Positive sign at the variable confirms positive relationship of this factor with alcohol consumption.

To characterize urbanization of regions we use the share of urban population and the reciprocal value of the population of the region. This conversion provides compliance of dimensions of indicators. Both indicators are significant in all models. Positive sign at variables enables us to conclude that higher alcohol consumption is typical for sparsely populated regions or regions with a high share of the urban population.

In order to identify factors determining cross-regional differences in the structure of alcoholic beverages consumption, we used the models presented in tables 4-7.

Table 4. Result of econometric analysis on vodka consumption (Russian regions)

VARIABLES	(1) Ln(vodka)	(2) Ln(vodka)	(3) Ln(vodka)
Urbanization_rate	0.0195***	0.0199***	0.0188***
	(0.00664)	(0.00643)	(0.00659)
Ln(income_min)	0.0421		-0.130
	(0.105)		(0.0941)
Ln(energy_consumption)	0.311***	0.318***	0.288***
	(0.0830)	(0.0809)	(0.0833)
Ln(computers)	-0.143***	-0.134***	
	(0.0354)	(0.0310)	
1/population	0.405***	0.403***	0.380***
	(0.0875)	(0.0871)	(0.0893)
Unemployment_rate	-0.000945		
	(0.00425)		
Unemployment_rate *(year-2008)	-0.00324***	-0.00326***	-0.00532***
	(0.000847)	(0.000795)	(0.000650)
Gini_coefficient	1.560	1.885**	2.375**
	(1.053)	(0.788)	(1.059)
Constant	-0.101	-0.265	-0.685
	(0.649)	(0.560)	(0.613)

Observations	390	390	390
R-squared	0.350	0.350	0.314
Number of reg	78	78	78

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Vodka consumption is the main factor influencing the consumption of pure alcohol in a majority of the regions. Given that, we included factors into the model that contribute the most to regional differences in pure alcohol consumption.

Results in table 4 are similar to results of estimating the model of consuming absolute alcohol. The difference consists in coefficients on the population size and the unemployment rate. For strong alcoholic drinks, the effect of unemployment appears twice stronger. The coefficient on the variable "1/population" is also somewhat higher.

Table 5. Result of econometric analysis on beer consumption (Russian regions)

VARIABLES	(1) Ln(beer)	(2) Ln(beer)	(3) Ln(beer)	(4) Ln(beer)
Ln(income_min)	0.128	0.252**		0.0192
	(0.143)	(0.107)		(0.0889)
Ln(energy_consumption)	0.567***	0.580***	0.603***	0.529***
	(0.113)	(0.112)	(0.113)	(0.114)
Ln(computers)	-0.144***	-0.126***	-0.0793***	
	(0.0482)	(0.0339)	(0.0277)	
Urbanization_rate	-0.00765			
	(0.00904)			
1/population	-0.164	-0.184	-0.193	-0.216*
	(0.119)	(0.117)	(0.118)	(0.120)
Unemployment_rate	-0.0109*	-0.00831	-0.0118**	-0.00630
	(0.00579)	(0.00542)	(0.00525)	(0.00550)
Unemployment_rate *(year-2008)	0.00132			
	(0.00115)			
Gini_coefficient	1.514			
	(1.434)			
Constant	3.742***	3.604***	3.671***	3.450***
	(0.883)	(0.242)	(0.242)	(0.243)
Observations	390	390	390	390
R-squared	0.138	0.130	0.115	0.092
Number of reg	78	78	78	78

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

F-test shows adequacy of the model (for details see Annex 1). Coefficient of determination is only 0,13.

Estimation results of this group of models differ from previous ones by the number of explanatory variables. Only variables that characterize economic development of a region are consistently significant. We note that the coefficient on per capita consumption of electricity is

almost twice as much as the corresponding coefficient in the model for strong alcoholic beverages. This means that volumes of beer consumption differ more than volumes of consumption of strong alcoholic beverages comparing regions with different level of welfare. However, both volumes are higher for wealthier regions. The relationship with unemployment has become weakly significant, and it appears not in all models.

Table 6. Result of econometric analysis on wine consumption (Russian regions)

VARIABLES	(1) Ln(wine)	(2) Ln(wine)	(3) Ln(wine)
Ln(income_min)	-0.141	-0.191*	
	(0.152)	(0.112)	
Ln(energy_consumption)	0.248**	0.271**	0.277**
	(0.120)	(0.117)	(0.116)
Ln(computers)	-0.114**		-0.126***
	(0.0511)		(0.0479)
Urbanization_rate	0.0586***	0.0604***	0.0616***
	(0.00958)	(0.00951)	(0.00938)
1/population	0.165		
	(0.126)		
Unemployment_rate	0.0169***	0.0207***	0.0193***
	(0.00614)	(0.00598)	(0.00581)
Unemployment_rate *(year-2008)	-0.00231*	-0.00427***	-0.00270**
	(0.00122)	(0.000914)	(0.00119)
Gini_coefficient	0.439		
	(1.520)		
Constant	-2.529***	-2.721***	-2.505***
	(0.937)	(0.732)	(0.731)
Observations	390	390	390
R-squared	0.224	0.207	0.217
Number of reg	78	78	78

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Similarly to the previous models, variables for economic development of regions remain significant. Values of coefficients are close to analogs in the models for strong alcoholic beverages.

Models for wine consumption show much higher coefficient on variables for urbanization in comparison with models for consumption of strong alcoholic beverages and absolute alcohol. With that, the population size in the region is insignificant. This fact indicates that wine is consumed mainly in urban areas.

The principal difference between models in this group from the previous models is that wine consumption is positively related to unemployment. However, this relationship weakens over time. Therefore, an increase in the unemployment rate has various effects on the consumption of different types of alcoholic beverages.

Table 7 presents models of consuming relatively expensive and therefore less common drinks that are cognac, brandy, champagne, and sparkling wine.

Table 7. Models of per capita consumption of cognac beverages, champagne, and sparkling wine

VARIABLES	(1) Ln(champ)	(2) Ln(champ)	(3) Ln(cogn)	(4) Ln(cogn)	(5) Ln(cogn)
Ln(income_min)	0.234	0.227*	0.134	0.227*	
	(0.145)	(0.126)	(0.164)	(0.121)	
Ln(energy_consumption)	0.518***	0.499***	0.140		
	(0.115)	(0.109)	(0.130)		
Ln(computers)	0.00524		0.135**		0.158***
	(0.0489)		(0.0553)		(0.0516)
Urbanization_rate	0.0323***	0.0310***	0.0516***	0.0520***	0.0507***
	(0.00917)	(0.00875)	(0.0104)	(0.0103)	(0.0101)
1/population	-0.0630		0.0654		
	(0.121)		(0.137)		
Unemployment_rate	0.00144		-0.0182***	-0.0239***	-0.0218***
	(0.00587)		(0.00664)	(0.00636)	(0.00614)
Unemployment_rate * (year-2008)	0.00192	0.00206**	0.00278**	0.00517***	0.00314**
	(0.00117)	(0.000872)	(0.00132)	(0.000979)	(0.00128)
Gini_coefficient	-1.352	-1.354	-0.235		
	(1.454)	(1.421)	(1.645)		
Constant	-2.465***	-2.393***	-4.906***	-4.230***	-4.541***
	(0.896)	(0.822)	(1.013)	(0.754)	(0.751)
Observations	390	390	390	390	390
R-squared	0.256	0.255	0.429	0.413	0.424
Number of reg	78	78	78	78	78

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In all models, the degree of urbanization is the consistently significant variable. Hence, we conclude that mainly urban population consumes cognac beverages, champagne, and sparkling wine. Positive relationship of the consumption volume of these beverages and the level of economic development of the region is confirmed. Though in models for cognac this factor is estimated by an indicator of “provision with computers”, since consumption of electricity is insignificant.

We note that unemployment influences consumption of champagne and sparkling wine similar to the consumption of wine, but the significance of these variables is considerably lower. However, in models for consuming cognac we find the maximal negative values of coefficients on the variable "unemployment rate" in comparison with all previously considered models. This suggests a high sensitivity of consuming cognac to this factor, despite the tendency to weaken the influence of this factor over time.

Based on the results of the regression analysis in tables 3 – 7, we conclude that the main macroeconomic determinant explaining inter-regional differences in alcohol consumption is the welfare of a region (positive correlation).

The relationship between alcohol consumption and the level of unemployment is not so univocal. Negative sign at the appropriate variables occurs in models of consuming strong alcoholic drinks, beer and hence in models of consuming absolute alcohol. However, in models of consuming wine the sign of the corresponding coefficient is positive.

In order to test the robustness of the relationship between unemployment and consuming alcohol we estimate the same models on data that does not include North Caucasian Republics, namely, North Ossetia-Alania, Kabardino-Balkaria, Karachay-Cherkessia, and Dagestan. These Republics have an abnormally high unemployment rate and low alcohol consumption. Estimation results are given in Annex 4. We note that the removal of Caucasus regions from the sample does not change the conclusion about negative relationship between unemployment and consuming absolute alcohol. This effect increases over time. In these models, coefficients at the variable for unemployment fall into the confidence intervals for the corresponding coefficients in models that include North Caucasian Republics. This confirms the robustness of results.

It is also worth noting that the Gini coefficient (indicating inequality) was significant only in certain models of consuming vodka and absolute alcohol.

The variable for the degree of urbanization is significant in all models except the model for beer consumption. We find positive correlation between urbanization and consumption of absolute alcohol as well as all other mentioned alcoholic beverages except beer. In models for consuming vodka and absolute alcohol, the population size in the region is significant.

We also consider the overconsumption of alcohol in Russia as a cause of severe adverse health effects and Russian population's shorter life duration.

3.4. The impact of alcohol on population health analysis

The influence of excessive alcohol consumption on health is evident not only in the form of worsening health and increasing injury. This also leads to increasing mortality especially from external causes that are mortality from accidents, injuries and poisoning, including alcohol and its substitutes, as well as murder and suicide. This indicator reflects the short-term and the most tragic consequences of alcohol abuse. However, there are also accumulated negative effects of alcohol abuse appearing in worsening health of abusers and their relatives and even in premature death. This is reflected in the indicator of the average life expectancy.

In the period from 2008 to 2012, the average life expectancy in Russia has increased from 68 to 70,2 years on average, which exceeds the 1990s level of 69 years according to the Federal

State Statistics Service of Russia. With that, there is a considerable difference in life expectancy of men and women, which is 11 years on average for Russia.

At the same time, among Russian regions there are significant differences on this index, ranging from 60.8 in Chukotka to 75.7 in Moscow.

Figure 5 illustrates the dynamics of regional indicators of life expectancy for men and women during 2008 – 2012. We note that the increase in this indicator is accompanied by the reduction of the gap in life expectancy between men and women. However, the magnitude of this gap remains substantial, ranging from 7 to 15 years.

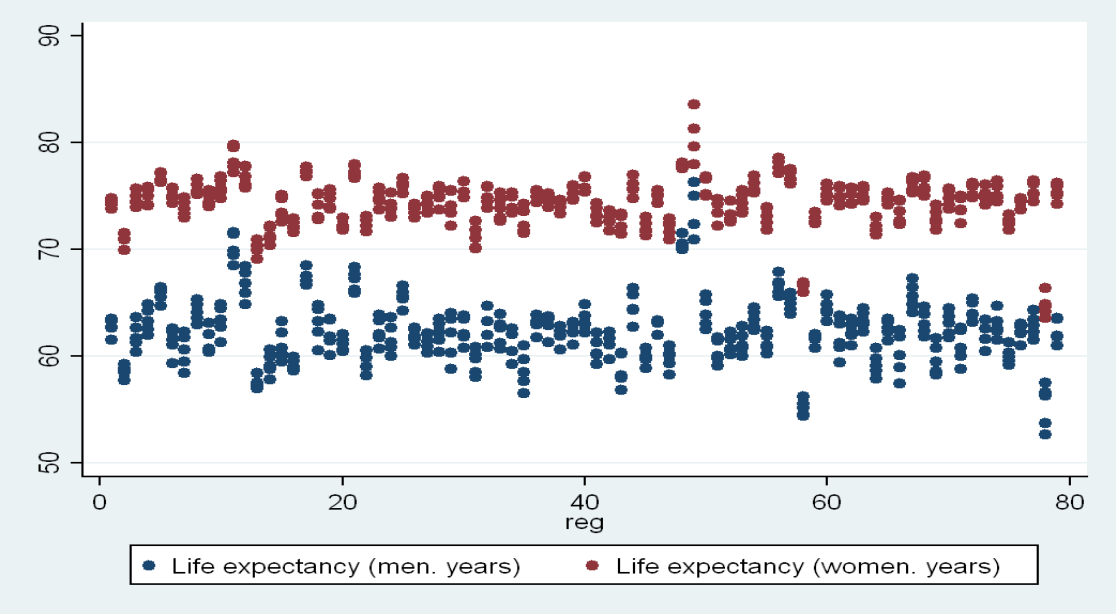

Figure 5. Regional indicators of life expectancy for men and women

In order to test the hypotheses regarding the negative impact of alcohol consumption on the mortality from external causes and life expectancy, we conducted research on macroeconomic determinants of life expectancy and on the level of alcohol consumption.

GDP per capita (in US dollars) or energy consumption per capita are usually used to assess standards of living (Brenner, 1975, 1979; Kossova, 1991; McAvinchey, 1994; Macela et al, 2001; Johansson et al, 2006). However, for cross-regional analysis, we recognized a need to find indicators reflecting more subtle differences in the level of welfare. This problem is particularly acute in Russia, where uneven regional development has become one of the most important migration factors. The most active part of the population (especially youth) migrates to more developed regions and regularly supports their relatives financially. This trend is not reflected in the population income data. In such circumstances, indicators of consumption of certain products reflecting the level of well-being are more informative.

One of the products indicating wealth is sugar. Sugar consumption has a positive correlation with standards of living. Analysis of data on the cost structure of the Russian

population has shown that the category of indicative goods in Russia in additional to sugar may include computers and gold, as well as meat. Variation on these measures in the Russian regions allows us to evaluate the differences in wealth, so the per capita consumption on these indicative goods could be used as a factor in our model. Since these products are not classified as essential, regions with higher consumption of them are considered well off in terms of disposable income.

In addition to wealth indicators, we used common macroeconomic determinants, such as unemployment rate, urbanization rate and Gini index as independent variables in the models discussed below.

In order to test the hypothesis that the level of alcohol consumption has a negative impact on health in both the male and female populations, we have built regression models where the dependent variables were indicators of life expectancy for men and women separately.

As an estimation method, we chose the method of instrumental variables for the panel with fixed effects, since alcohol consumption may be endogenous to mortality from external causes and average life expectancy. The choice of instruments is based on the estimation results presented in previous sections of this working paper.

We exclude North Caucasian Republics from estimating models of average life expectancy. These republics, namely, Dagestan, Kabardino-Balkaria, Karachay-Cherkessia, North Osetia-Alania, are characterized by low alcohol consumption. Moreover, the relationship between alcohol consumption and life expectancy is different from other Russian regions.

Table 8. Estimation results for models of life expectancy and mortality from external causes (Russian regions)

VARIABLES	(1) Ln(death)	(2) Ln(life_m)	(3) Ln(life_w)
Ln(alcohol)	0.334***	-0.0346*	-0.0219*
	(0.101)	(0.0198)	(0.0116)
Ln(income_min)	-0.286***	0.0348***	0.0152**
	(0.0785)	(0.0122)	(0.00671)
Ln(computers)		0.0204***	0.0106***
		(0.00457)	(0.00284)
Ln(meet)		0.0374**	
		(0.0173)	
Ln(shuger)		0.0370**	
		(0.0154)	
Ln(Unempl_rate)	0.0345*		-0.00346*
	(0.0204)		(0.00184)
Ln(Unempl_rate)*(year-2008)	-0.0199***	0.00256***	0.00171***
	(0.00208)	(0.000407)	(0.000234)
Gini_coefficient	2.215***	-0.235**	-0.144**
	(0.795)	(0.117)	(0.0677)
Constant	3.836***	3.874***	4.350***

	(0.309)	(0.111)	(0.0373)
Observations	390	370	370
Number of reg	78	74	74

Estimation results confirm the positive relationship between alcohol consumption and mortality from external causes. An increase of consumption of absolute alcohol by 1% leads to an increase of mortality by 0,3%.

We supposed that alcohol consumption is significant in models for average life expectancy for men and women. We based this supposition on the fact that alcohol consumption significantly influences the mortality from external causes, and mortality is taken into account when determining the average life expectancy. Indeed, in both models, estimated coefficients on per capita alcohol consumption are negative. This indicates that the average life expectancy is lower in regions with high alcohol consumption. Mentioned effect is twice stronger for men than for women. However, this variable is significant only on 10% level. With that, it is difficult to understand whether we observe here the cumulative result of unhealthy habits for health or the reduction of the average life expectancy because of an increase in mortality from external causes.

We also accept the hypothesis on the impact of the welfare on the life expectancy. Regions with higher incomes have lower mortality from external causes and higher average life expectancy. At the same time, variables for the welfare in models for the average life expectancy of men are more significant and higher than in models for women. This fact suggests a higher sensitivity of the average life expectancy of men to the impact of this factor.

The significance and sign of Gini coefficient indicate that, other things being equal, the mortality from external causes is higher and life expectancy is lower in regions with great social inequality than in regions with more homogenous income.

We analyze the impact of unemployment on dependent variables and find the change in the direction of the impact of this factor. In 2008 and 2009, regions with higher rate of unemployment had higher mortality from external causes and relatively low average life expectancy. However, the situation has changed since 2010.

An important implication of this model is the negative impact of the consumption of pure alcohol on average life expectancy in the regions.

We noted that alcohol abuse not only has a significant impact on mortality from external causes, but also reduces life expectancy. Regions with the least mortality from external causes are usually included in the list of regions with the highest life expectancy, and vice versa. At the same time, variations in mortality from external causes are significantly higher.

Overall, the above analysis proves the hypothesis that the level of alcohol consumption in Russia has a significant negative impact on the population’s life expectancy.

4. Implications and conclusions

The analysis has confirmed the findings of other authors about the continuous troubled state of alcohol consumption in Russia and about the prevalence of vodka and spirits in the structure of alcohol consumed, as well as about the negative impact of excessive alcohol consumption on the population's average life expectancy. At the same time, we find significant regional differences in the volume and structure of consumed alcohol.

We reveal a general trend of reduction in drinking alcohol for Russia as a whole over 2008-2012. However, there is a growth of alcohol consumption in 25 regions. The most significant one is in the North of the European part of Russia and the Far East that are characterized by problem drinking. We also reveal significant regional differences in the direction of structural changes. Vodka and beer are the main alcoholic beverages consumed in Russia. We observe a decrease in per capita consumption of vodka in 57 regions and an increase in per capita consumption of beer in 39 regions during 2008 – 2012. At that, in 15 regions, including Central chernozem zone, the Southern Volga, and Zabaykalie, an increase in consumption of absolute alcohol is caused by a significant growth of beer consumption with a reduction or stable level of vodka consumption. In 6 regions, beer is the main product in the structure of consumption of absolute alcohol.

We consider the welfare of regions through a set of indicators and reveal the positive link of this factor with alcohol consumption. We find that the best indicator reflecting the welfare of a region is consumption of electricity. Concerning the unemployment rate, we reveal the negative relationship between this factor and alcohol consumption and an increase of this effect over time. Urbanization of a region positively affect alcohol consumption. In addition, sparsely populated regions are characterized by higher alcohol consumption.

To the extent of our investigation, we divide alcohol consumption by types of alcoholic beverages (vodka, beer, wine, and other types that are cognac, champagne and sparkling wine). Overall, the results of econometric analysis confirm conclusions on models for consuming absolute alcohol. However, we find that the unemployment rate affects the consumption of different types of alcoholic beverages in a different way. The relationship between consuming vodka and unemployment is negative. This conclusion also holds for consuming beer. However, coefficients at this variable in models for consuming beer are less significant than in models for consuming vodka. At the same time, the factor of unemployment has positive impact on consuming wine. In addition, we show that mainly urban population consumes wine, cognac, champagne and sparkling wine.

We confirm the positive relationship between alcohol consumption and mortality from external causes in Russian regions. Moreover, we find that the average life expectancy, other

things being equal, is lower in regions where alcohol consumption is high. Besides, this effect is stronger for men than for women. This fact underlines the importance of the problem of alcohol abuse and raises the question of adequate social policies aimed at reducing alcohol consumption in Russian regions.

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Annex 1 Complete models for consumption of alcoholic beverages in Russian regions

Table 1.1 Complete fixed effect and random effect models for consumption of absolute alcohol, vodka, and beer

VARIABLES	**Ln(alcohol)**		**Ln(vodka)**		**Ln(beer)**	
	Fixed	Random	Fixed	Random	Fixed	Random
Urbanization_rate	0.0181***	0.0113***	0.0195***	0.0121***	-0.00765	0.00263
	(0.00556)	(0.00247)	(0.00664)	(0.00304)	(0.00904)	(0.00389)
Ln(income_min)	0.0397	-0.0259	0.0421	-0.0261	0.128	0.0273
	(0.0881)	(0.0858)	(0.105)	(0.103)	(0.143)	(0.136)
Ln(energy_consumption)	0.326***	0.241***	0.311***	0.252***	0.567***	0.385***
	(0.0695)	(0.0456)	(0.0830)	(0.0558)	(0.113)	(0.0720)
Ln(computers)	-0.121***	-0.0939***	-0.143***	-0.112***	-0.144***	-0.115**
	(0.0297)	(0.0300)	(0.0354)	(0.0359)	(0.0482)	(0.0475)
1/population	0.289***	0.0162	0.405***	0.0456***	-0.164	-0.0698***
	(0.0733)	(0.0124)	(0.0875)	(0.0154)	(0.119)	(0.0195)
Unemployment_rate	-0.00136	-0.00306	-0.000945	-0.00175	-0.0109*	-0.0125**
	(0.00357)	(0.00351)	(0.00425)	(0.00420)	(0.00579)	(0.00556)
Unemployment_rate * (year-2008)	-0.00185***	-0.00155**	-0.00324***	-0.00291***	0.00132	0.000989
	(0.000710)	(0.000685)	(0.000847)	(0.000820)	(0.00115)	(0.00109)
Gini_coefficient	1.307	1.239	1.560	1.332	1.514	1.940
	(0.883)	(0.813)	(1.053)	(0.980)	(1.434)	(1.288)
Constant	-0.179	0.800**	-0.101	1.033**	3.742***	3.056***
	(0.544)	(0.333)	(0.649)	(0.404)	(0.883)	(0.526)
Observations	390	390	390	390	390	390
Number of reg	78	78	78	78	78	78
R-squared	0.294		0.350		0.138	
F test/Wald test, p	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
F test that all u_i=0, p	0.0000		0.0000		0.0000	
Rho	0.9898	0.9190	0.9914	0.9251	0.9463	0. 9175
Hausman test, p	0.0000		0.0000		0.0024	
Standard errors in parentheses						
*** p<0.01, ** p<0.05, * p<0.1						

Table 1.2 Complete fixed effect and random effect models for consumption of wine, champagne, and cognac

VARIABLES	**Ln(wine)**		**Ln(champ)**		**Ln(cogn)**	
	Fixed	Random	Fixed	Random	Fixed	Random
Urbanization_rate	0.0586***	0.0234***	0.0323***	0.0253***	0.0516***	0.0244***
	(0.00958)	(0.00350)	(0.00917)	(0.00314)	(0.0104)	(0.00381)
Ln(income_min)	-0.141	-0.237*	0.234	0.121	0.134	0.0739
	(0.152)	(0.141)	(0.145)	(0.135)	(0.164)	(0.151)
Ln(energy_consumption)	0.248**	0.123*	0.518***	0.129**	0.140	0.00986
	(0.120)	(0.0669)	(0.115)	(0.0606)	(0.130)	(0.0726)
Ln(computers)	-0.114**	-0.0947*	0.00524	0.0459	0.135**	0.166***
	(0.0511)	(0.0504)	(0.0489)	(0.0485)	(0.0553)	(0.0538)
1/population	0.165	0.00593	-0.0630	0.0355**	0.0654	0.0574***
	(0.126)	(0.0166)	(0.121)	(0.0146)	(0.137)	(0.0182)
Unemployment_rate	0.0169***	0.00738	0.00144	-0.00777	-0.0182***	-0.0221***

	(0.00614)	(0.00590)	(0.00587)	(0.00567)	(0.00664)	(0.00630)
Unemployment_rate * (year-2008)	-0.00231*	-0.000861	0.00192	0.00201*	0.00278**	0.00360***
	(0.00122)	(0.00116)	(0.00117)	(0.00112)	(0.00132)	(0.00124)
Gini_coefficient	0.439	-0.398	-1.352	-0.400	-0.235	-0.322
	(1.520)	(1.306)	(1.454)	(1.228)	(1.645)	(1.403)
Constant	-2.529***	0.761	-2.465***	-1.779***	-4.906***	-2.779***
	(0.937)	(0.513)	(0.896)	(0.476)	(1.013)	(0.553)
Observations	390	390	390	390	390	390
Number of reg	78	78	78	78	78	78
R-squared	0.224		0.256		0.429	
F test/Wald test, p	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
F test that all u_i=0, p	0.0000		0.0000		0.0000	
Rho	0.9689	0.8717	0.9471	0.8469	0.9436	0. 8776
Hausman test, p	0.0000		0.0000		0.0000	
Standard errors in parentheses						
*** p<0.01, ** p<0.05, * p<0.1						

Annex 2 Complete fixed effect and random effect models with instrumental variables for mortality from external causes and for the average life expectancy of men and women

VARIABLES	**Ln(death)**		**Ln(life_m)**		**Ln(life_w)**	
	Fixed	Random	Fixed	Random	Fixed	Random
Ln(alcohol)	**0.334*** **	**0.394*** **	**-0.0430***	**-0.0585*** **	**-0.0236***	**-0.0504*** **
	(0.101)	(0.0977)	(0.0221)	(0.0216)	(0.0125)	(0.0158)
Ln(income_min)	-0.286***	-0.333***	0.0376***	0.0395***	0.0119*	0.0165**
	(0.0785)	(0.0791)	(0.0125)	(0.0121)	(0.00709)	(0.00781)
Ln(computers)			0.0206***	0.0187***	0.00980***	0.00628*
			(0.00511)	(0.00494)	(0.00290)	(0.00327)
Ln(meet)			0.0375**	0.0345**	0.0182*	0.0133
			(0.0181)	(0.0145)	(0.0103)	(0.0103)
Ln(sugar)			0.0391**	0.0409***	2.93e-05	0.00616
			(0.0164)	(0.0139)	(0.00929)	(0.00960)
Ln(Unemployment_rate)	0.0345*	0.0478**	0.00249	-0.00112	-0.00297	-0.00494**
	(0.0204)	(0.0215)	(0.00352)	(0.00350)	(0.00200)	(0.00226)
Ln(Unemployment_rate) *(year-2008)	-0.0199***	-0.0174***	0.00247***	0.00233***	0.00157***	0.00158***
	(0.00208)	(0.00214)	(0.000438)	(0.000439)	(0.000249)	(0.000276)
Gini_coefficient	2.215***	1.344*	-0.226*	-0.0727	-0.134**	-0.0795
	(0.795)	(0.763)	(0.120)	(0.110)	(0.0681)	(0.0731)
Constant			3.836***	4.065***	3.872***	3.864***
			(0.309)	(0.288)	(0.132)	(0.109)
Observations	390	390	370	370	370	370
Number of reg	78	78	74	74	74	74
R-squared	0.600		0.757		0.733	
Wald test, p	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
F test that all u_i=0, p	0.0000		0.0000		0.0000	
Rho	0.9501	0.9125	0.9269	0. 8954	0. 9643	0.8954
Hausman test, p	0.0000		0.0000		0.0000	
Standard errors in parentheses						
*** p<0.01, ** p<0.05, * p<0.1						

Annex 3 The list of Russian regions with the assigned numbers

The name of the region	**number**	**The name of the region**	**number**
Altai Kray	1	Perm	41
Amur	2	Primorsky Kray	42
Arkhangelsk	3	Pskov	43
Astrakhan	4	Republic of Adygeya	44
Belgorod	5	Republic of Altai	45
Bryansk	6	Republic of Bashkortostan	46
Vladimir	7	Republic of Buryatia	47
Volgograd	8	Republic of Dagestan	48
Vologda	9	Republic of Ingushetia	49
Voronezh	10	Republic of Kalmykia	50
City of Moscow	11	Republic of Karelia	51
City of Saint Petersburg	12	Republic of Komi	52
Jewish Autonomous District	13	Republic of Mari El	53
Zabaykalsky Krai	14	Republic of Mordovia	54
Ivanovo	15	Republic of Sakha (Yakutia)	55
Irkutsk	16	Republic of North Ossetia-Alania	56
Republic of Kabardino-Balkaria	17	Republic of Tatarstan	57
Kaliningrad	18	Republic of Tuva	58
Kaluga	19	Republic of Khakassiya	59
Kamchatka Krai	20	Rostov	60
Republic of Karachay-Cherkessia	21	Ryazan	61
Kemerovo	22	Samara	62
Kirov	23	Saratov	63
Kostroma	24	Sakhalin	64
Krasnodar	25	Sverdlovsk	65
Krasnoyarsk Krai	26	Smolensk	66
Kurgan	27	Stavropol Krai	67
Kursk	28	Tambov	68
Leningrad	29	Tver	69
Lipetsk	30	Tomsk	70
Magadan	31	Tula	71
Moscow	32	Tumen	72

Murmansk	33	Republic of Udmurtia	73
Nizhni Novgorod	34	Ulyanovsk	74
Novgorod	35	Khabarovsk	75
Novosibirsk	36	Chelyabinsk	76
Omsk	37	Republic of Chuvashia	77
Orenburg	38	Chukotka Autonomous District	78
Orel	39	Yaroslavl	79
Penza	40		

Annex 4 Models for consumption of different alcoholic beverages in Russian regions excluding North Caucasian Republics

Table 4.1 Models for per capita consumption of absolute alcohol and vodka

VARIABLES	(1) Ln(alk)	(2) Ln(alk)	(3) Ln(vodka)	(4) Ln(vodka)
Ln(income_min)	0.0550		0.0367	
	(0.0847)		(0.102)	
Ln(energy_consumption)	0.178**	0.204**	0.213**	0.243**
	(0.0818)	(0.0795)	(0.0986)	(0.0957)
Ln(computers)	-0.123***	-0.106***	-0.149***	-0.131***
	(0.0291)	(0.0256)	(0.0350)	(0.0309)
1/population	0.298***	0.292***	0.370***	0.364***
	(0.0720)	(0.0719)	(0.0868)	(0.0866)
Unemployment_rate	-0.00371		-0.00500	
	(0.00362)		(0.00436)	
Unemployment_rate *(year-2008)	-0.00110	-0.00124*	-0.00197**	-0.00220***
	(0.000716)	(0.000677)	(0.000862)	(0.000815)
Urbanization_rate	0.0166***	0.0178***	0.0130*	0.0147**
	(0.00556)	(0.00540)	(0.00670)	(0.00651)
Gini_coefficient	1.065	1.581**	0.990	1.431*
	(0.866)	(0.657)	(1.043)	(0.792)
Constant	0.301	-0.0674	0.868	0.456
	(0.552)	(0.480)	(0.665)	(0.578)
Observations	370	370	370	370
R-squared	0.222	0.217	0.263	0.259
Number of reg	74	74	74	74

Standard errors in parentheses

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

Table 4.2 Models for per capita consumption of beer and wine

VARIABLES	(1) Ln(beer)	(2) Ln(beer)	(3) Ln(wine)	(4) Ln(wine)
Ln(income_min)	0.137	0.277***	-0.0886	
	(0.133)	(0.102)	(0.149)	
Ln(energy_consumption)	0.166	0.133	0.107	
	(0.129)	(0.124)	(0.144)	
Ln(computers)	-0.121***	-0.139***	-0.129**	-0.183***
	(0.0458)	(0.0447)	(0.0513)	(0.0308)
1/population	-0.137		0.175	0.206*
	(0.113)		(0.127)	(0.122)
Unemployment_rate	-0.0114**	-0.0114**	0.0139**	0.0128**
	(0.00569)	(0.00554)	(0.00638)	(0.00573)
Unemployment_rate *(year-2008)	0.00205*	0.00186*	-0.00144	
	(0.00113)	(0.00104)	(0.00126)	
Urbanization_rate	-0.00114		0.0560***	0.0528***
	(0.00875)		(0.00981)	(0.00902)
Gini_coefficient	2.051		-0.194	
	(1.362)		(1.526)	
Constant	3.706***	4.243***	-1.841*	-1.418**
	(0.868)	(0.279)	(0.973)	(0.617)
Observations	370	370	370	370
R-squared	0.091	0.079	0.196	0.189
Number of reg	74	74	74	74

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4.3 Models for per capita consumption of champagne and cognac

VARIABLES	Ln(champ)	Ln(champ)	Ln(cogn)	Ln(cogn)
Ln(income_min)	0.256*	0.207**	0.115	
	(0.137)	(0.0938)	(0.159)	
Ln(energy_consumption)	0.212	0.215*	0.100	
	(0.132)	(0.123)	(0.153)	
Ln(computers)	0.0482		0.143***	0.165***
	(0.0471)		(0.0545)	(0.0503)
1/population	-0.00456		0.0642	
	(0.117)		(0.135)	
Unemployment_rate	0.00276		-0.0207***	-0.0242***
	(0.00585)		(0.00678)	(0.00625)
Unemployment_rate *(year-2008)	0.00142	0.00242***	0.00254*	0.00296**
	(0.00116)	(0.000879)	(0.00134)	(0.00129)
Urbanization_rate	0.0434***	0.0432***	0.0540***	0.0527***
	(0.00900)	(0.00865)	(0.0104)	(0.0102)
Gini_coefficient	-1.288		0.343	
	(1.401)		(1.622)	
Constant	-2.999***	-3.250***	-5.252***	-4.707***
	(0.893)	(0.636)	(1.034)	(0.767)
Observations	370	370	370	370
R-squared	0.301	0.295	0.463	0.459
Number of reg	74	74	74	74

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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