Investigating the volume and structure of alcohol consumption in Russian regions

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Abstract

Purpose – The purpose of this paper is to examine macroeconomic factors that are significantly related to consumption of various alcoholic beverages in Russia.

Design/methodology/approach – The authors consider 78 Russian regions for the period from 2008 to 2012. Data were collected from the Federal State Statistics Service of Russia. The authors investigate differences in the volume and structure of consuming absolute alcohol in aggregate, vodka, beer, and wine. Estimating fixed effect panel models enables us to reveal the relationship between alcohol consumption and the set of macroeconomic factors that include economic development of regions and living standards, the effect of unemployment, and the degree of urbanization.

Findings – Alcohol consumption is procyclical in Russia. Two main alcoholic beverages in Russia are vodka and beer. Economic development and urbanization of regions are positively related to consuming alcohol. Unemployment rate affects consumption of different types of alcoholic drinks in a different way. For absolute alcohol, vodka and beer, this relationship is negative. However, it is positive for wine. The effect of unemployment on absolute alcohol and vodka increases over time. For beer, it is remained unchanged. For wine, this effect weakens over time.

Originality/value – To the authors knowledge, the paper is the first one to analyze macro-level factors of consumption of different alcoholic beverages in Russia. Conclusions made on aggregate macroeconomic data add to understanding of drinking patterns in Russia as a country with the large territory and great regional variations. Findings can be used for correcting the alcohol policy at the national and regional level.

Keywords Russia, Beer, Alcohol consumption, Inter-regional differences, Vodka

Paper type Research paper

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. As it is 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. In this regard, correct policy measures designed to prevent hazardous drinking are of the great value. The Russian Government recognizes the importance of promoting healthy lifestyle and increasing life expectancy. At present, one of the main goals of various government initiatives at national and regional level is significant reducing the consumption of alcoholic beverages (Federal Service for Alcohol Market Regulation, 2009).

Most research papers on consuming alcohol in Russia are based on individual-level data. For instance, Tekin (2004), Herzfeld *et al.* (2014), and Keenan *et al.* (2014), along with the growing body of papers in Russian-language journals, carried out studies on the data of the Russian Longitudinal Monitoring Survey (RLMS). This is the only panel database, which enables researchers to analyze alcohol consumption in Russia on the individual level. However, RLMS is not representative on Russian regions. This is not possible to consider regional differences of alcohol consumption using this database. Regional differences can be analyzed reliably only with macro data provided by Federal State Statistics Service of Russia.

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We consider registered alcohol sales in Russian regions as the estimate of the minimum volume of consumed alcohol. We emphasize that the aggregated data of Federal State Statistics Service cover all the volume of alcoholic beverages sold in particular regions. This is an important advantage over the survey data, since people might not tell the truth about the real volume of consumed alcohol or simply forget how much exactly was drunk.

In our research, we examine macro-level factors of alcohol consumption. These are indicators of wealth and unemployment as well as the effect of urbanization. The influence of these factors on alcohol consumption is the subject of discussion in research papers. We reveal changes in the volume and structure of consuming alcoholic beverages in Russian regions. We consider various types of alcoholic beverages, namely, vodka, beer, wine, and cognac. Russia presents a good example of a country with great regional differences on socio-economic development and living standards. The analysis of Russian data adds to understanding macroeconomic predictors of unhealthy behavior. Identified patterns are useful for correcting alcohol policy implemented on the federal and regional levels. Furthermore, it is reasonable to conduct these studies on a regular basis to catch changes in the impact of macroeconomic and institutional environment on alcohol consumption.

2. Review of studies on factors of alcohol consumption

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 (2008) in their research for Sweden find regional and gender differences in alcohol consumption. Benčević-Striehl *et al.* (2009) catch strong regional pattern of alcohol consumption in Croatia. Ogwang and Cho (2009) investigate determinants of consuming alcoholic beverages in Canadian provinces and include into the set of explanatory factors per-capita income and unemployment rate. 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 (2003) in their survey for France discover that the risk of alcohol consumption increases significantly with a household income per person. Authors also find that the risk of alcohol abuse increases with the area-level GDP per capita. Dias *et al.* (2011) examine social and behavioral factors of alcohol consumption in Portugal. Among social factors, they consider employment status.

Herzfeld *et al.* (2014) examine determinants of alcohol demand in Russia for the period from 1994 to 2005. Among regional characteristics authors 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 at the 10 percent level.

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

Thus, existing papers show conflicting results regarding the impact of various economic factors on alcohol consumption. Evidence from individual-level data does not necessarily coincide with aggregate macro-level data. Results of a survey might not give accurate information about the real volume of consumed alcohol and the frequency of drinking. On the contrary, data on alcohol sales reflects the amount of consumed alcohol more honestly.

In our paper, we focus on two groups of macroeconomic factors that might significantly influence alcohol consumption in Russian regions. According to previous studies, there is no

consensus on the mechanism that underlies the impact of these factors. First, we take into account macroeconomic indicators of income and unemployment in order to clarify whether alcohol consumption is procyclical or countercyclical in Russia. Findings will be useful for alcohol policy in terms of understanding the impact of economic downturn on alcohol consumption and, hence, on health of the population. De Goeij *et al.* (2015) conclude from the review of existing studies that "two opposing mechanisms may come into play during a crisis: reductions in alcohol consumption due to tighter budget constraints and a rise in harmful drinking due to increased psychological distress." Dávalos *et al.* (2012) investigate US population and suggest, "Problematic drinking may be an indirect and unfortunate consequence of an economic downturn." On the contrary, Johansson *et al.* (2006) reveal that drinking is procyclical in Finland. Khan *et al.* (2002) conclude, "The effect of unemployment on alcohol abuse changes direction with time" in Canada. Hence, longitudinal data are required for proper estimation.

Second, we consider the impact of urbanization on alcohol consumption in Russia. We assume that urbanization increases the emotional intensity because of a more complex social environment in a city compared with rural areas. Under these conditions, alcohol might be used as a relaxant. Furthermore, we investigate the impact of mentioned macroeconomic factors on drinking different types of alcoholic beverages.

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

We assume that there has been the change in the structure of alcohol consumption, namely, a decrease in consuming strong alcoholic beverages and an increase in consuming weak alcoholic beverages. In recent years, Russian Government has made substantial efforts to reduce the consumption of strong drinks. Measures are mostly restrictive ones, including growth of the minimum price for vodka, and time limits on alcohol sales.

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

Figure 1 presents the dynamic of alcohol consumption in Russia for the period from 2002 to 2012.

Figure 1 shows an increase in the consumption of all alcoholic beverages in the country before 2004, and hence a noticeable growth in consuming absolute alcohol. After 2005, there has been a decrease in consumption of vodka. However, the consumption of absolute alcohol remains unchanged due to the growth of consuming weak alcoholic beverages, especially

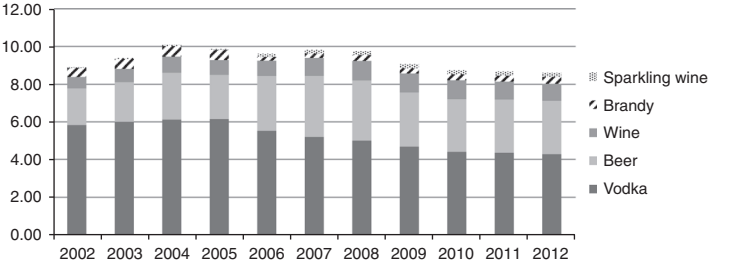

Figure 1.
Consumption of alcoholic beverages in liters of absolute alcohol

beer. For three 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. Due to a lack of data on the population's age structure, we calculated the alcohol consumption level as a ratio of regional alcohol sales (in terms of absolute alcohol levels) to the population of a region. In world practice, the alcohol consumption level is estimated for the population over 15. According to data of Federal State Statistics Service of Russia, the part of population younger than 15 was 14.66 percent in 2008, and 15.52 percent in 2012. Thus, per capita alcohol consumption by the adult population equals approximately 10.1 liters. Besides, the amount of 10.1 liters might be underestimated due to the lack of data on unregistered alcohol sales.

Our further analysis of changes in the volume and structure of alcohol consumption covers the period from 2008 to 2012. The choice of the time interval comes from the lack of data for some regions in previous periods. We exclude from the analysis Ingushetia and Chechnya due to the lack of statistics. Figure 2 presents data on the consumption of absolute alcohol in 2008 and 2012 that is at the beginning and the end of the period under consideration. Differences in the left and right images reflect changes in alcohol consumption. 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.

In both 2008 and 2012, relatively little alcohol was consumed in southern regions of the European part of Russia (less than five liters per capita), particularly in North Ossetia-Alania, 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. With that, Arkhangelsk region, Udmurtia and Magadan region have increased alcohol consumption to the amount higher than the average in the country.

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 Krai. In addition, these are Moscow and Leningrad regions, and the western enclave of Kaliningrad. Southern regions of the European part of Russia and the Caucasian republics are the most favorable on this criterion. Thus, alcohol consumption in Russia increases from south to north and from west to east. We explain results for Moscow and St Petersburg by significant number of migrants, tourists, and people coming to these cities to earn money. In such circumstances, the level of per capita alcohol consumption in these two cities is overestimated. With regard to Kaliningrad region, 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.

In the whole Russia, per capita consumption of registered absolute alcohol decreased in five years from 9.7 to 8.8 liters. This is about by 10 percent, but 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,

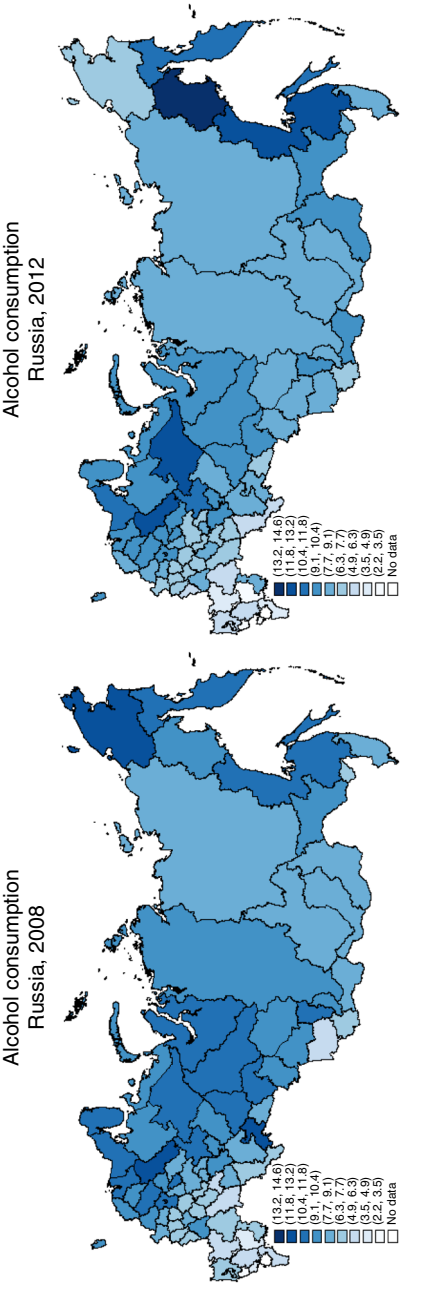

Figure 2.
Per capita consumption of absolute alcohol in 2008-2012

Volgograd and Chelyabinsk regions, Chukotka and Saint Petersburg demonstrate the greatest reduction in alcohol consumption that is more than 20 percent from the level of 2008.

Alcohol consumption has been increased in 25 regions. The greatest concern is devoted to the negative dynamics in problem regions of the northern European part of Russia and the Far East. Here, we observe a significant increase in alcohol consumption for the period of five years. This is 45 percent in Magadan region, 7 percent in Khabarovsk Krai, about 10 percent in republics of Komi and Karelia, and 4 percent in Arkhangelsk region. 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 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 I illustrates the structure of alcohol consumption by aggregative groups of regions in 2008 and 2012. We range regions by the level of alcohol consumption, and then consider the top and bottom 10 and 25 percent of regions.

Regional differences in absolute alcohol consumption are determined mainly by the differences in the consumption of two products that are vodka and beer. Their combined share is about 80 percent. It is approximately the same both for the top 10 percent of alcohol-consuming regions and for the bottom 10 percent 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.

During 2008-2012, 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.

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

Source: Authors' calculations are based on data from the Russian Federal State Statistics Service: www.gks.ru

Table I. Amount of alcohol, consumed in regions with the higher and lower levels of alcohol consumption, liters per capita

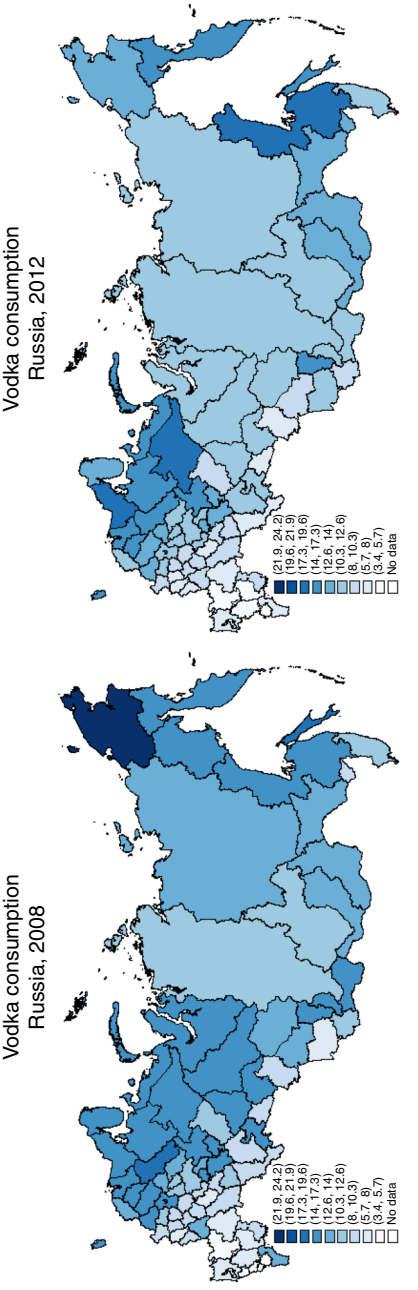

Figure 3.
Per capita consumption of alcoholic beverages in 2008 and 2012

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

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

Data about beer sales in physical terms shows significant regional differences and 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, as well as in Chukotka and the republics of Kalmykia and Mari El. Dagestan shows 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 with 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 this group of regions, 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.

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 analysis of the structure of consumed alcoholic beverages confirms that vodka and liqueurs are the main products forming the consumption of absolute alcohol in Russia. At the same time, there are substantial regional differences on this indicator, with values ranging from 32 to 86 percent. The role of other alcoholic beverages, such as brandy and cognac, was relatively small in the formation of the volume of alcohol consumption, equaling about 17 percent in the total "pure" alcohol consumption in physical terms.

4. Macroeconomic determinants of alcohol consumption in Russian regions

In this section, we consider macroeconomic factors that might significantly influence alcohol consumption in Russian regions. Dependent variables are indicators of alcohol consumption in terms of "pure" alcohol by type of alcoholic beverage. We consider alcoholic content in each type of drinks, namely, vodka and liqueurs (40 percent), beer (4 percent), wine (14 percent), sparkling wine (11 percent), brandy and brandy spirits (40 percent). We exclude from analysis non-food alcohol.

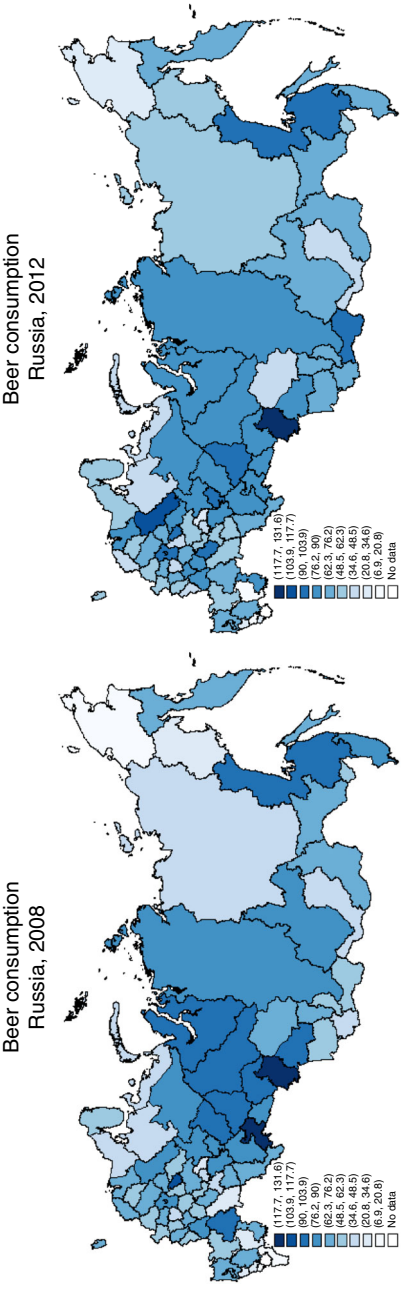

Figure 4.
Per capita consumption of beer in Russian regions in 2008 and 2012

The strategy of choosing explanatory variables is the following. Since our main hypothesis is devoted to correlation of alcohol consumption with business cycles in Russia, we pay attention to indicators of a cycle. These are monetary per capita income of the population, unemployment rate, and consumption of electricity. We also try to investigate how the influence of these indicators changes with time. Income as well as energy consumption per capita help to assess living standards and wealth (Brenner, 1975; Kossova, 1991; Johansson *et al.*, 2006). While indicators of per capita income are commonly used to estimate wealth, electricity consumption per capita requires explanation. In our study, electricity consumption per capita reflects the total volume of electricity consumed in a particular region by all users including enterprises, households, etc. These data are provided for all regions on the website of the Federal State Statistics Service of Russia. There are no data disaggregated by consumers of electricity in open access. This indicator is one of leading indicators reflecting the direction of economic development of a region. There is no doubt that electricity consumption per capita is higher in those Russian regions where there is energy-intensive production such as metallurgy. However, regions with energy-intensive production tend to be more prosperous in terms of wealth. Hence, consuming electricity is informative for measuring economic development of a particular region.

According to previous studies, degree of urbanization is also useful to explain variations in alcohol consumption. Herzfeld *et al.* (2014) based their research on micro data of RLMS from 1994 till 2005 and found that rural residents drink less alcohol than others. This effect has been revealed on an individual level, but there is no sufficient evidence on macroeconomic trends. On the one hand, more complex social environment in the city might result in greater alcohol consumption. On the other hand, depressive economic conditions in rural areas might cause the significant problem of alcohol abuse. Moreover, this relationship might be different for various types of alcoholic drinks.

We control for population size of a region, because there is large differentiation of Russian regions on the population size. Gini coefficient helps us to control for differences in the level of social tension. Federal State Statistics Service of Russia provides values of Gini coefficient for all Russian regions. The methodology is based on income data. In total, 20 percent groups of the population are considered. The range of the coefficient is from 0 to 1. The higher the coefficient, the more unequal distribution of income in society is.

Designated factors do not cover all variables that could have a significant impact on the alcohol consumption in Russian regions. For instance, it might be cultural factors such as religious beliefs. A significant part of the population of the North Caucasian Republics is Muslim. These Republics demonstrate lower level of alcohol consumption in comparison with other regions. However, such factors remain unchanged in the medium term. Since we apply panel models with fixed effects in econometric estimation, unchanging factors are included in fixed effects.

Table II presents descriptive sample statistics.

Descriptive statistics shows that there is a substantial differentiation of Russian regions on the selected variables. The greatest difference between maximum and minimum values of indicators is observed for the population size. It is more than 200 times. Considerable variation of the population size is caused by the presence in the sample of the most sparsely populated and the most densely populated regions that are Chukotka and Moscow, respectively. For Chukotka, the population size is more than three times less than that of the value for the region, which follows Chukotka by this indicator. For Moscow, this difference is more than 1.5 times. We note that even with this clarification, Russian regions differ significantly on the population size.

We note that the greatest diversity of regions is devoted to an indicator of "per-capita consumption of electricity." Variation in the level of per capita income is quite significant. We find the smallest difference for Gini coefficient. Variation of an indicator of "degree of urbanization" shows that the sample includes both agricultural regions and regions with a

Table II.
Descriptive statistics of the variables used in the study

Variable	Mean	SD	Min	Max
Income per-capita (rubles)	16,398	6,568.6	5,513	48,622
Per-capita consumption of electricity (thousands kWh)	7	5.2	1.23	33.15
Unemployment rate (%)	7.6	2.9	0.8	21.7
Degree of urbanization (%)	69.5	12.6	26.4	100
Population size (thousands)	1,792.1	1,694.2	48.6	11,918.1
Gini coefficient	0.4	0.03	0.33	0.54
Vodka and liqueurs[a]	11.4	3.8	2.2	24.3
Beer[a]	64.3	23.1	2.5	149.9
Wine[a]	7.1	2.6	1.4	14.8
Cognacs, brandy and brandy spirits[a]	0.7	0.4	0.1	2.3

Note: [a]Per-capita consumption in liters

100 percent urban population, namely Moscow and Saint Petersburg cities. This highlights the fact that smoothing differentiation in living standards and providing support to problem regions remain a big challenge for public policy. We also note that there is more than 25-fold difference between the most advantaged regions in terms of unemployment rate and the least advantaged ones. With that, the level of unemployment is rather low in Russia.

Table I suggests significant differences in the volume of alcohol consumption not only between well-off and problem regions, but also within each group. Maximum and minimum values for consuming each type of alcoholic beverages substantially differ from mean values for regions with the highest and lowest levels of drinking.

5. The model and estimation results

Panel data contains observations from 2008 to 2012 on 78 regions excluding Republic of Ingushetia and Chechnya. Data are provided in open access on the website of the Federal State Statistics Service of Russia. 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, in the case of not correlated regressors and individual effects, panels with random effects are more effective. In order to choose between fixed effects and random effects models, we conduct Hausman test. This test shows the preference for fixed effects models. We also perform *F*-tests for fixed effects models. In all models, directions of the influence of explanatory variables are the same. Coefficients in fixed effects and random effects models differ within their confidence intervals even when Hausman test shows inconsistency of panels with random effects. This supports the robustness of results. We also test the robustness by restricting the sample size. We exclude North-Caucasian regions that demonstrate low level of alcohol consumption. Then, we continue to exclude various groups of regions by the criterion of the level of alcohol consumption. Chow test shows that there are no structural breaks in the sample. In the model with fewer observations, estimates for coefficients on variables are almost unchanged.

Finally, we choose the following log-linear form of the model for each type of alcoholic beverage:

$$\ln Y_{it}^{k} = \alpha_i + \beta_1 X_{it}^{1} + \beta_2 X_{it}^{2} + \beta_3 X_{it}^{3} + \beta_4 X_{it}^{3}(t-2008) + \beta_5 X_{it}^{4} + \beta_6 X_{it}^{5} + \beta_7 X_{it}^{6} + \varepsilon_{it}, \quad (1)$$

where Y_{it}^{k} is the annual consumption (in litres) per-capita of a particular alcoholic beverage k in the ith region in year t ($i = 1, \ldots, 78$; $t = 2008, 2009, \ldots, 2012$). The variables X_{it}^{s} ($s = 1, \ldots, 6$) represent macroeconomic determinants in the ith regions in year t. The exact definitions of the variables are provided in Table III.

Symbol	Variable	Comments
Y^1	ln(alcohol)	Logarithm of absolute alcohol consumption
Y^2	ln(vodka)	Logarithm of vodka and liqueurs consumption[a]
Y^3	ln(beer)	Logarithm of beer per-capita consumption[a]
Y^4	ln(wine)	Logarithm of wine per-capita consumption[a]
X^1	ln(income_min)	Logarithm of annual population income divided by 12 (months) and by the average annual population size normalized by the subsistence minimum in the region
X^2	ln(electricity_consumption)	Logarithm of per capita consumption of electricity
X^3	ln(unemployment_rate)	Ratio of the unemployed to the labor force in a particular region
X^4	ln(urbanization_rate)	Ratio of urban population to total population in a particular region
X^5	ln(population)	Logarithm of annual population of the region
X^6	ln(gini_coefficient)	Logarithm of Gini coefficient estimated by the Federal State Statistics Service of Russia for a particular region

Notes: [a]Sales of alcoholic beverages during the year in physical terms (in liters). Measurement in physical terms make it easier to compare alcohol consumption in different regions

Table III. Definitions of variables used in the model

Per capita income is normalized by the subsistence minimum in the region. Normalization enables us to calculate purchasing power parities and eliminate regional differences in consumer basket and the structure of consumption. Considering 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 on the unemployment rate 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.

Logarithm of the population helps to control for large regional differences on the population size. Table IV presents estimates of coefficients for models of consuming different types of alcoholic beverages. We do not estimate model for sparkling wine and brandy, since drinking these beverages makes little contribution to the total volume of consumed alcohol. According to Table I, vodka, beer, and wine are leaders among alcoholic beverages in Russia. With that, the volume of absolute alcohol consists of consumption of all drinks, including sparkling wine, brandy, and brandy spirits.

The indicator of normalized income per capita is insignificant at the 10 percent level in all models. With that, coefficients on the variable of electricity consumption per capita verify our hypothesis about positive link between alcohol consumption and economic development

Variables	(1) Ln(alcohol)	(2) Ln(vodka)	(3) Ln(beer)	(4) Ln(wine)
Ln(Income_min)	0.000195 (0.0976)	−0.0165 (0.117)	0.0228 (0.161)	−0.0903 (0.171)
Ln(Electricity_consumption)	0.246*** (0.0721)	0.214** (0.0861)	0.341*** (0.119)	0.269** (0.127)
Ln(Unemployment_rate)	−0.0101 (0.0223)	−0.0162 (0.0266)	−0.0622* (0.0367)	0.104*** (0.0391)
Ln(Unemployment_rate)*(year-2008)	−0.0165*** (0.00201)	−0.0234*** (0.00240)	−0.00411 (0.00331)	−0.0212*** (0.00352)
Ln(Urbanization_rate)	0.784** (0.314)	0.738** (0.375)	−0.992* (0.517)	3.455*** (0.551)
Ln(Population)	−1.862*** (0.225)	−2.307*** (0.269)	−1.920*** (0.371)	−0.971** (0.396)
Ln(Gini_coefficient)	0.362 (0.337)	0.433 (0.402)	0.611 (0.555)	−0.131 (0.592)
Constant	10.28*** (2.456)	14.36*** (2.934)	19.62*** (4.048)	−8.349* (4.314)
Observations	390	390	390	390
R^2	0.321	0.374	0.146	0.225
Number of reg	78	78	78	78

Notes: Standard errors in parentheses. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

Table IV. Fixed effects panel regression results for consumption of absolute alcohol, vodka, beer, and wine

of regions. Since electricity consumption is a leading indicator of an economic cycle, the revealed relationship supports the view that alcohol consumption is procyclical in Russia.

The relationship between unemployment rate and alcohol consumption in year t varies by types of alcoholic beverages. Table V presents the sum of coefficients $\beta_3 + \beta_4$ (year-2008).

Considering rows in Table V, we made conclusions about changes in consuming absolute alcohol in aggregate and each product separately with the growth of unemployment. In 2008, the model shows that *ceteris paribus* the consumption of beer has decreased with the growth of unemployment rate. However, the consumption of wine has increased with the growth of unemployment. Total alcohol consumption has remained at the same level with the growth of unemployment rate, since contribution of beer to the total volume of consumed absolute alcohol is twice higher than the contribution of wine. Besides, there has been no significant correlation between unemployment rate and vodka consumption.

In subsequent years, we find negative correlation between unemployment rate and all types of drinks except wine. Moreover, the correlation increases in absolute value for pure alcohol and vodka. A year of 2009 was the peak of the financial crisis in Russia. With the growth of unemployment, there has been the decrease in alcohol consumption, *ceteris paribus*. Most likely, higher unemployment rate indicates tighter budget constraints. This leads to a decrease in consuming absolute alcohol in aggregate, particularly, vodka, and beer. When competition on the labor market increases, employed people reduce their alcohol consumption. There is an increase of this effect over time. In 2009, alcohol consumption differs by 0.02 percent in regions where the unemployment rate varies by 1 percent, other things being equal. In 2012, alcohol consumption differs by 0.07 percent in the same regions. This tendency refers only to the period 2008-2012 without extrapolation for several years ahead.

In models of consuming wine, the sign of the coefficient on unemployment rate is positive. Here it is necessary to clarify the role of wine in the drinking culture of Russians. Specificity lies in the fact that Russian-made wine is very often a relatively cheap product of low quality. The most common type is fruit or berry wine that is significantly different by price and quality from the European-made wine. With that, government restrictive policy does not open a subject of establishing a minimum price for wine. The government sets a minimum price only for vodka. Wine is often cheaper than vodka and beer. Therefore, people might decide to switch to cheaper alcoholic beverages in a situation of tightening budget constraints and increasing unemployment.

We find a strengthening effect of unemployment on alcohol consumption in aggregate in 2010-2012. Coefficients on pure alcohol are less than coefficients on vodka and beer in absolute value. Hence, there has been a replacement of vodka and beer by cheaper products. Since 2011, we find no effect of unemployment on consuming wine. The relationship between beer consumption and unemployment rate does not change over 2008-2012. Overall, we observe the effect of reducing alcohol consumption with the growth of unemployment and the effect of switching to the consumption of cheaper alcoholic beverages. The change of coefficients over time shows that the population of regions with higher unemployment reduces consumption of vodka and beer.

Table V.
Coefficients reflecting the relationship between unemployment rate and alcohol consumption in year t

	Ln(alcohol)	Ln(vodka)	Ln(beer)	Ln(wine)
2008	0	0	−0.0622*	0.104***
2009	−0.0165***	−0.0234***	−0.0622*	0.0828**
2010	−0.033***	−0.0468***	−0.0622*	0.0616*
2011	−0.0495***	−0.0702***	−0.0622*	0.0404
2012	−0.066***	−0.0936***	−0.0622*	0.0192

Notes: *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

Gini coefficient is insignificant at the 10 percent level in all models. Probably, it is explained by the fact that Gini coefficient changes little over time. Therefore, panel models with fixed effects do not capture this relationship.

The coefficient on the variable of the population size shows that more populated regions demonstrate lower alcohol consumption in comparison with less populated ones. Urbanization rate is significant in all models. The relationship is positive for all types of alcoholic beverages except beer. With that, the significance of this coefficient is the lowest in the model for beer. Models for wine consumption show much higher coefficient on variables for urbanization in comparison with models for consuming strong alcoholic beverages and absolute alcohol. Positive sign at urbanization rate shows that relatively high level of alcohol consumption is typical for urban regions. Findings at macro level support studies conducted on individual-level data in Russia. Herzfeld *et al.* (2014) find negative relationship between alcohol demand and living in rural area in Russia. This result confirms our suggestion that urbanization increases alcohol consumption in Russia. However, we take into account the fact that people living in rural areas often have lower incomes in comparison with urban citizens. Therefore, there might be an effect of switching to homemade alcohol, since its production is much cheaper than buying commercially available alcoholic drinks. This effect is most likely to occur in a situation of decreasing incomes.

6. Conclusions

We reveal the general trend of reduction in drinking alcohol over 2008-2012 for Russia as a whole. However, there has been 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.

We find that the unemployment rate affects consumption of different types of alcoholic beverages in a different way. Unemployment rate is negatively related to consuming vodka and beer. At the same time, the factor of unemployment rate is positively related to consuming wine. The effect of unemployment on the volume of consumed alcoholic beverages increases over the 2008-2012 for all beverages except beer.

We find from econometric estimations that alcohol consumption is procyclical in Russia. Higher consumption of electricity is related to higher alcohol consumption. Higher income level and lower unemployment rate in a region are related to higher volume of consumed alcohol. Hence, government policy should undertake preventive measures during economic growth when the probability of worsening the problem of alcohol abuse is high. During an economic downturn, tighter budget constraints contribute to a certain decrease in alcohol consumption. Reduction of the demand for alcohol leads to reducing taxes and excise duties. This motivates some politicians to cancel or weaken the legislative restrictions imposed on alcohol sales earlier. A bright example is the recent initiative of the Ministry of Industry and Trade to permit alcohol sales near social and sports facilities again. Sales of alcohol in close proximity to schools, hospitals, stadiums, and other similar facilities are forbidden in Russia since 2012. In an economic downturn, the focus of the authorities should be concentrated on preventing the weakening of previously established restrictive measures, since it will lead to a reversal of the favorable trend of reducing the volume of consumed alcohol.

We reveal that urbanization of a region is positively related to alcohol consumption. Policy implications are open to discussion. As there are differences in the volume of

consuming alcoholic beverages in the urban and rural areas, measures of alcohol policy should vary depending on the place of residence of the target population group. For instance, support to urban residents may include development of psychological assistance services for coping with psychological stress and complex social environment.

To our knowledge, our paper is the first one, which considers macroeconomic factors related to consumption of different alcoholic beverages in Russian regions. The analysis of regional data on alcohol consumption and related factors on macro-level is particularly important for countries with large territories and substantial differentiation of regions by their geographical location and the level of economic development.

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