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Is life satisfaction hump-shaped with alcohol consumption? Evidence from Russian panel data

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HIGHLIGHTS

- The shape of the relationship between alcohol use and well-being is still debated.
- Controlling for unobserved individual heterogeneity might be of importance.
- We used individual longitudinal data from Russia to investigate this issue.
- In fixed effect regressions, we found a hump-shaped relationship among men.
- We found no relationship between alcohol use and satisfaction among women.

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ABSTRACT

There has been a growing interest in the study of the shape of the relationship between alcohol consumption and psychological well-being in recent years. Overall, evidence is however still mixed and debated, the type of measures and methods of analysis having been emphasized as key elements in these studies. This paper contributes to this debate by providing new evidence relying on a large-scale population-based study. We used the Russia Longitudinal Monitoring Survey to build an unbalanced panel of 17,953 individuals providing 97,973 observations throughout 10 rounds. We studied the shape of the relationship between alcohol consumption (defined in grams of pure alcohol consumed in the last 30 days) and life satisfaction (measured by a five-item scale) by running a set of regressions. We successively introduced a large number of control variables (age, gender, marital status, occupation, income, health condition, education, living area, smoking status, and body mass index) and individual fixed effects in order to take both potential confounders and unobserved individual heterogeneity into account. Unadjusted analyses indicated a clear hump-shaped relationship between life satisfaction and alcohol use. The association was inverse J-shaped among men and inverse U-shaped among women. When control variables and individual fixed effects were introduced, the hump-shaped curve became increasingly flattened in all samples. Among women, all specifications (linear, quadratic and based on quartile dummies) turned non-significant. The quadratic specification for alcohol use remained however significant in the full sample and among men. In addition, in these two samples, being a fourth quartile drinker was negatively associated with satisfaction.

1. Introduction

There has been a growing interest in the study of the shape of the relationship between alcohol consumption and psychological well-being in recent years. A non-linear relationship between alcohol consumption and symptoms of depression has already been described, alternatively as a J-shaped and a U-shaped relationship (Alati et al., 2005; Lipton, 1994; Rodgers et al., 2000; Skogen, Harvey, Henderson, Stordal, & Mykletun, 2009). Overall, evidence is however still mixed and debated. Firstly, some authors have regarded some of these results as a statistical artifact due to study design and interpretation (Taylor & Rehm, 2005). Secondly, important gender differences have been underlined, with a number of studies suggesting a linear relationship among women (Alati et al., 2004; Caldwell et al., 2002; Zhan et al., 2012). Thirdly, the types of measures used for both alcohol consumption and well-being have been emphasized as being key issues, leading to inconsistent findings, in such studies (El-Guebaly, 2007; Graham, Massak, Demers, & Rehm, 2007).

For all these reasons, it seems important to accumulate new evidence about the shape of the relationship between alcohol consumption and well-being using various samples, various types of measures for the

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two variables of interest and various statistical methods. In this paper, we wish to contribute to this aim by studying the relationship between alcohol consumption and life satisfaction data using a large-scale population-based study. Existing evidence concerning the relationship between alcohol consumption and positive measures of well-being, such as life satisfaction or happiness scores, is very limited. Restricting ourselves to surveys in the adult population, we found five studies that addressed this issue, often as a secondary objective. They relied on quite heterogeneous measures of well-being: happiness categories (Brenner, 1967), a happiness score (Ventegodt, 1995; cited by Veenhoven, 2003), the Cantril Self Anchoring Striving Scale (Levy, Bell, & Lin, 1980), a life satisfaction score (Koivumaa-Honkanen et al., 2012) and the Personal Well-being Index (Cummins, 2008).

One of these studies (Levy et al., 1980) reported a U-shaped relationship: excluding heavy drinkers, a decreasing linear relationship was found between drinking and perceived satisfaction. Heavy drinkers however reported a higher satisfaction than moderate drinkers. A possible explanation, put forward by the authors, is that the levels of satisfaction reported by heavy drinkers might be inappropriate since alcohol abusers would be more susceptible to deny or fail to perceive or report their dissatisfaction.

The four other studies tended to confirm the plausibility of a hump-shaped relationship. First, Brenner (1967) indicated that light drinkers had a higher mean happiness score than abstainers and medium/large drinkers. Statistical significance was however not reached (results based on our own calculations using Brenner's data — see Appendix A). Second, Ventegodt (1995) (cited by Veenhoven, 2003) reported that correlations were low and not significant, but an inverse U-pattern seemed plausible: moderate drinkers tended to be happier than abstainers and heavy drinkers. The greatest satisfaction was reached at 3–4 glasses consumed the week prior. Third, Cummins (2008) noticed not only that drinking a small amount of alcohol each day was generally associated with high well-being, but also that important differences appeared when gender and age were taken into account. More precisely, he found that females who never drank and females who drank more than three drinks per session had below normal well-being, while males who drank every day had above normal well-being, with no systematic change in male well-being with the number of drinks consumed. In terms of age, not drinking alcohol disadvantaged well-being for the 36–65 year group, as well as drinking more than three drinks per session for the 46–55 year group. Fourth, Koivumaa-Honkanen et al. (2012) found an inverse J-shaped relationship between a life satisfaction score and alcohol consumption for both men and women in their cross-sectional unadjusted analysis.

All these studies relied on unadjusted analysis, i.e. did not control for confounding variables, except Cummins (2008) who used ANOVA analysis with covariates of gender, age and income. Maybe even more importantly, they did not use individual fixed effects, which have been emphasized as crucial in life satisfaction studies (Ferrer-i-Carbonell & Frijters, 2004). We overcame these limitations in our study.

2. Material and methods

Our study was based on data from the "Russia Longitudinal Monitoring Survey, RLMS-HSE", conducted by the Higher School of Economics and ZAO "Demoscope" together with the Carolina Population Center, the University of North Carolina at Chapel Hill and the Institute of Sociology RAS (RLMS-HSE sites: http://www.cpc.unc.edu/projects/rlms-hse, http://www.hse.ru/org/hse/rlms). This is a comprehensive survey carried out on a representative sample of Russian households and individuals, almost every year since 1992. It provides detailed information on demographics, education, income, health, occupation, consumption patterns and life satisfaction, among others. The survey consists of two phases. Since only phase II contains a panel component (the same households and individuals were re-interviewed in each round to the extent possible), we restricted our analysis to this phase. It has 14 rounds (rounds 5 through 19) running from 1994 to 2010.

2.1. Life satisfaction

The question was formulated this way: "To what extent are you satisfied with your life in general at the present time?", with the following possible answers: fully satisfied, rather satisfied, both yes and no, less than satisfied, not at all satisfied. We rated "fully satisfied" 5 and "not at all satisfied" 1.

2.2. Alcohol consumption

Respondents were asked whether they had consumed any alcohol during the last 30 days. Those who answered by the negative were considered as abstainers. Those who answered by the affirmative were then asked about the frequency of consumption (once in the last 30 days, 2–3 times in the last 30 days, once a week, 2–3 times a week, 4–6 times a week, every day), the types of beverage (beer, dry wine, fortified wine, home-made liquor, vodka and other hard liquor, anything else, with multiple answers being allowed) and the quantity usually consumed (in grams per day,[1] for each type of beverage).

In the first five rounds of phase II of the survey (rounds 5 to 9), what should be considered as an alcoholic beverage was not specified in the initial filter question about any alcohol consumption in the last 30 days. This should not be problematic if everyone agrees about what an alcoholic beverage is. This might however not be the case in Russia since until July 2011 beverages containing less than 10% alcohol were officially classified as foodstuff, with no restriction on sales. As a consequence, many Russians considered beer as a soft drink. This is why from the 6th round (round 10) on, a complementary filter question was added about any beer consumption in the last 30 days. Data indicated that about 10% of respondents who spontaneously declared being non-drinkers (i.e. responded by the negative to the first filter question) did in fact drink beer (i.e. responded by the affirmative to the second filter question). This means that in rounds 5 to 9, some respondents were inappropriately excluded from the sample of drinkers. For this reason, we decided to exclude the first five rounds (rounds 5 to 9) from our analysis.

By combining the frequency of consumption and the average daily consumption, we constructed an indicator measuring the monthly quantity of pure alcohol consumed. Since different types of beverages contain different percentages of ethanol (pure alcohol), the average daily consumption was calculated as a weighted average of the ethanol typically found in each beverage. Following Baltagi and Geishecker (2006), we assumed that the amount of ethanol is 5% in beer, 10% in dry wine, 19% in fortified wine, 45% in homemade liquor, 40% in vodka and 20% for other alcoholic beverages.

2.3. Control variables

We used standard socio-demographic variables as controls: age, gender, marital status, occupational status, real household income, health condition, education level (high school diploma), settlement type and geographical area of living, as well as smoking status and body mass index (BMI) as two other potentially important confounders. Since pregnancy is presumably related both to alcohol consumption and satisfaction in a very specific way, pregnant women were excluded from our sample.

[1] In Russia, it is common to measure alcohol consumption in grams instead of liters.

2.4. Statistical analyses

Simple descriptive statistics were first provided for all variables. The mean of the life satisfaction score and its 95% confidence interval were then computed for five different groups of drinkers (abstainers and the four quartiles of the monthly quantity consumed). Lastly, a set of regressions where life satisfaction was the dependent variable was run.

The nature of the "life satisfaction" variable has been widely debated: should it be considered as a discrete ordinal variable or as a continuous one? Put differently, should we consider that the difference in satisfaction between "fully satisfied" and "rather satisfied" is the same as between "less than satisfied" and "not at all satisfied" for any individual (as usually assumed by psychologists) or not (as usually assumed by economists)? Ferrer-i-Carbonell and Frijters (2004) have shown that assuming ordinality or cardinality of life satisfaction scores makes little difference. For this reason, we chose to consider life satisfaction scores as a continuous variable. This enabled us to estimate linear regression models. In the robustness analysis, we checked that ordinal estimation methods produced similar qualitative results.

Another important issue when dealing with life satisfaction data is that it is likely that individuals anchor their scale at different levels, making interpersonal comparisons of responses meaningless. We relied on the use of panel data and of a fixed effect estimator that makes inference based on intrapersonal, rather than interpersonal, comparison of satisfaction to avoid this problem. This implies that the sample of individuals who participated in only one round was excluded from the analyses.

In order to assess the impact of confounders and unobserved individual heterogeneity on the estimates, three sets of regressions were successively implemented: ordinary least square (OLS) regressions without controls, OLS regressions with controls and finally fixed effect (FE) regressions with controls.[2]

We used four different specifications for alcohol consumption: a simple dummy for being a drinker, the monthly quantity consumed and finally, since we suspected a non-linear relationship, a quadratic specification that included the monthly quantity consumed and its square, as well as a set of quartile dummies. In order to minimize the influence of skewed data, the natural logarithm of the monthly quantity consumed, as well as of real household income, was used in the regressions. Since a pure logarithmic transformation would exclude zero values, we applied the following transformation: Log(quantity/income + 1). Lastly, since important gender differences have been pointed out in previous studies (Alati et al., 2004; Caldwell et al., 2002; Zhan et al., 2012), we conducted separate analyses for men and women.

3. Results

3.1. Description of the final sample

In accordance with the sample restrictions previously discussed, the following observations were successively excluded from the sample: rounds 5 to 9 (N = 43,425), individuals with missing information on the two key variables, i.e. life satisfaction and alcohol consumption (N = 1946), pregnant women (N = 490) and individuals who participated once (N = 18,096). This finally left us with 17,953 individuals, providing 97,973 observations (average number of participations per individual: 5.5). The dataset covered a period of 10 years (2001–2010). Table 1 provides descriptive statistics of the sample.

[2] Note that the R-squared values that are reported for fixed effect regressions take the explanatory effects of individual fixed effects into account (*areg* approach in Stata; see Gould, 1996).

3.2. Unadjusted results

First, we looked at the correlation between being a drinker and life satisfaction through simple OLS regressions without controls. The results are reported in the first column of Table 2. We found that being a drinker was positively correlated with life satisfaction in the full sample (0.084; $p < 0.01$) and in the sample of women (0.106; $p < 0.01$), but negatively correlated in the sample of men (−0.034; $p < 0.05$). A significant linear relationship was also found between the monthly quantity of alcohol consumed and life satisfaction, of a positive sign in the full sample and among women, and of a negative sign among men (second column of Table 2). Finally, the quadratic specifications were significant in all samples, with a positive linear coefficient and a negative quadratic coefficient (third column of Table 3).

To investigate the shape of the relationship between the quantity of alcohol consumed and life satisfaction more accurately, we divided drinkers into four groups using quartiles. We first simply looked at the mean of the life satisfaction score in these groups. The results are reported in Table 3. They indicate that drinkers of the first three quartiles reported a significantly higher life satisfaction score than abstainers in the full sample (from 2.98 to 3.04 versus 2.90). Among men, first quartile drinkers also reported a significantly higher life satisfaction score than abstainers (3.14 versus 3.07), but fourth quartile drinkers reported a significantly smaller score (2.88). Among women, all groups of drinkers reported a significantly higher life satisfaction score than abstainers (from 2.87 to 2.96 versus 2.82). We also performed OLS regressions without controls using these groups of drinkers. The results are reported in Fig. 1 (graphs a, b, c). We found a clear hump-shaped relationship between alcohol consumption and life satisfaction in all samples, but noticed important gender differences however: the hump-shaped curve was much more plunging for men (inverse J-shaped, fourth quartile drinkers reporting a lower satisfaction level than abstainers) than for women (inverse U-shaped, fourth quartile drinkers reporting a lower satisfaction level than drinkers of the first three quartiles, but a higher satisfaction level than abstainers).

3.3. Adjusted results

Adjusted analyses are based on OLS and FE regressions with controls. Their results are reported in Table 2 (columns 4 to 9) and Fig. 1 (graphs d to i). To save space, the coefficients for control variables are not reported, except for FE regressions using the quartile specification for alcohol consumption (Table 4). Coefficients for control variables were consistent with standard results in life satisfaction studies (e.g. Blanchflower & Oswald, 2008; Clark, Diener, Georgellis, & Lucas, 2008; Graham, Eggers, & Sukhtankar, 2004): satisfaction was U-shaped with age, with the lowest level of satisfaction around the forties; being divorced, widowed, unemployed and being a smoker were negatively correlated with satisfaction; being in good health, having a high income and being a student were positively correlated with satisfaction.

Overall, when control variables and individual fixed effects were introduced, the relationship between drinking and life satisfaction became more tenuous. The dummy for being a drinker became non-significant in all samples, as well as the linear specification, except among men but at $p < 0.1$ only (−0.005). The hump-shaped curves became increasingly flattened. Among women, both quadratic and quartile specifications became non-significant. Among men, the quadratic specification remained nevertheless highly significant (0.025 and −0.004; $p < 0.01$). The specification using quartile dummies was also significant ($p < 0.01$ for the Wald test testing the null hypothesis that the set of four coefficients is equal to zero), with the last two quartiles being significantly negatively related to satisfaction (−0.04; $p < 0.1$ for the third quartile; −0.05; $p < 0.05$ for the fourth quartile). Considering their size, these coefficients were smaller than most other significant coefficients of the regression (the biggest coefficient was for being in

Table 1
Description of the sample.

	Full sample (N = 97,973)		Men (N = 41,702)		Women (N = 56,271)	
Variable	Mean	(Std. dev.)	Mean	(Std. dev.)	Mean	(Std. dev.)
Age	43.2	(18.7)	40.4*	(17.4)	45.2	(19.3)
Life satisfaction	2.95	(1.13)	3.05*	(1.13)	2.87	(1.13)
Alcohol consumption (g/month)	370	(1210)	700*	(1705)	126	(503)
Income (in thousands of rubles)	12.0	(20.5)	12.9*	(22.6)	11.4	(18.7)
Number of children	1.3	(1.1)	1.2*	(1.1)	1.4	(1.1)
BMI	25.7	(5.3)	24.9*	(4.3)	26.2	(5.8)
Variable	%		%		%	
Drank alcohol in the last 30 days						
Yes	56.4		67.9*		47.9	
No	43.6		32.1		52.1	
Marital status						
Never married	20.4		24.1*		17.6	
Married	50.3		57.7		44.9	
Living together	9.7		10.8		8.8	
Divorced	7.7		4.5		10.1	
Widowed	12.0		2.9		18.7	
Education: has a high school diploma						
Yes	56.7		53.2*		59.3	
No	43.3		46.8		40.7	
Occupation						
Student	9.9		11.5*		8.8	
Working	51.5		58.3		46.4	
Not working/looking for work	6.8		9.2		5.1	
Not working/not looking for work	30.4		19.4		38.5	
Other occupation	1.5		1.6		1.3	
Health status						
Very bad health	2.1		1.3*		2.6	
Bad health	12.5		8.8		15.2	
Average	54.3		50.0		57.4	
Good health	29.3		37.2		23.4	
Very good health	1.9		2.7		1.3	
Settlement type						
Urban	67.2		66.0*		68.1	
Semi-urban	6.1		6.2		6.1	
Rural	26.7		27.7		25.9	
Smoking status						
Smoker	66.4		58.7*		15.0	
Non-smoker	33.6		41.3		85.0	
Round						
10	9.2		9.0		9.0	
11	10.1		10.2		10.2	
12	10.4		10.5		10.5	
13	10.4		10.5		10.5	
14	10.0		10.1		10.1	
15	11.8		11.9		11.9	
16	11.9		12.0		12.0	
17	11.5		11.4		11.4	
18	11.4		11.3		11.3	
19	3.2		3.1		3.1	

* Statistically different from women at $p < 0.05$ (*t*-test for continuous variables; Chi-square test for categorical variables).

very good health: 1.02; see Table 4). They were similar to the coefficient for being a smoker (−0.06).

3.4. Robustness checks

We verified the robustness of our results to several different specifications. First, we performed collinearity tests to check for possible redundancy between independent variables, especially between health condition, smoking status and BMI. Correlation coefficients were computed between these three variables. They were low (<0.25 in absolute value). Variance inflated factors (VIF) were computed for OLS regressions. They were also low (<1.5). Moreover, the results remained stable when re-running fixed effect regressions by alternatively dropping the health condition dummies and the couple of variables "smoking status-BMI". Second, we introduced the number of children as an additional control variable. The number of children is a typical control variable in life satisfaction studies. In our dataset, it was easily available only from round 13 on. Introducing it in the regressions thus constituted a quite large sacrifice (3 rounds of observations). When re-running all regressions including the number of children as a control variable, the

Table 2
Regression results for the alcohol consumption variables.

		Dependent variable: life satisfaction								
		OLS no control			OLS with controls			FE with controls		
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Full sample	Drinker	0.084***			0.019*			0.002		
		(0.011)			(0.010)			(0.010)		
	Log(quantity + 1)		0.009***	0.076***		−0.001	0.031***		−0.003	0.017***
			(0.002)	(0.006)		(0.002)	(0.005)		(0.002)	(0.005)
	Log(quantity + 1)^2			−0.010***			−0.005***			−0.003***
				(0.001)			(0.001)			(0.001)
	Num. of observations	97,973	97,973	97,973	83,749	83,749	83,749	84,076	84,076	84,076
	Num. of individuals							17,457	17,457	17,457
	R-squared	0.001	0.001	0.003	0.167	0.167	0.167	0.531	0.531	0.532
Men	Drinker	−0.034**			0.005			−0.001		
		(0.017)			(0.015)			(0.016)		
	Log(quantity + 1)		−0.016***	0.083***		−0.004*	0.039***		−0.005*	0.025***
			(0.003)	(0.008)		(0.002)	(0.008)		(0.003)	(0.008)
	Log(quantity + 1)^2			−0.014***			−0.006***			−0.004***
				(0.001)			(0.001)			(0.001)
	Num. of observations	41,702	41,702	41,702	36,350	36,350	36,350	36,489	36,489	36,489
	Num. of individuals							7721	7721	7721
	R-squared	0.000	0.002	0.008	0.170	0.170	0.171	0.518	0.518	0.518
Women	Drinker	0.106***			0.031**			0.008		
		(0.014)			(0.013)			(0.012)		
	Log(quantity + 1)		0.017***	0.079***		0.004	0.027***		0.000	0.007
			(0.003)	(0.008)		(0.003)	(0.008)		(0.003)	(0.008)
	Log(quantity + 1)^2			−0.011***			−0.004***			−0.001
				(0.001)			(0.001)			(0.001)
	Num. of observations	56,271	56,271	56,271	47,399	47,399	47,399	47,587	47,587	47,587
	Num. of individuals							9736	9736	9736
	R-squared	0.002	0.001	0.003	0.160	0.160	0.160	0.539	0.539	0.539

Note: Robust standard errors in parentheses (clustered at the individual level). Control variables in regressions (2) are: gender (for the full sample only), 7 age categories, health condition categories, Log(income + 1), a dummy for having a high school diploma, marital status categories, occupational status categories, settlement type, a dummy for being a smoker, BMI, round dummies and region dummies. Control variables in regressions (3) are the same, except time-invariant variables (gender, settlement type, region dummies, high school diploma), which are excluded (see Table 4).

* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

results were qualitatively unchanged. Third, to take into account the fact that life satisfaction may be considered as a discrete ordinal variable instead of a continuous one, we re-ran all regressions using a statistical technique that respects the ordinality of the dependent variable. To this aim, we recoded life satisfaction into a binary variable: 1–2 vs. 3–5, and used conditional fixed-effect logits. The results were qualitatively unchanged (the only difference was that the coefficient of the linear specification in the full sample was significantly negative). Fourth, it has been argued that differentiating between life-long abstainers and abstainers recovering from drinking problems ('sick-quitters') was critical when studying the shape of the relationship between alcohol consumption and well-being (Alati et al., 2005; Skogen et al., 2009). In our dataset, we had no information about former drinking behavior of respondents. We were therefore unable to identify lifetime abstainers. We nevertheless re-ran all regressions after having excluded abstainers who were drinkers in a previous round of the survey. The results were qualitatively unchanged. Fifth, and finally, implementing individual fixed effects required excluding the sample of individuals who participated in only one round from the analyses. Re-running OLS regressions without excluding these individuals did not change the results.

Table 3
Mean life satisfaction scores in relation to alcohol consumption.

Alcohol use (g/month)	N	LS mean	95% CI
Full sample			
0	42,718	2.90	[2.89–2.92]
1–62.5	14,222	2.98	[2.96–3.00]
63–200	13,945	3.04	[3.02–3.07]
201.25–562.5	13,467	3.01	[2.99–3.04]
≥563.75	13,621	2.91	[2.89–2.93]
Men			
0	13,390	3.07	[3.05–3.10]
1.5–162.5	7187	3.14	[3.11–3.18]
164–412.5	6991	3.11	[3.08–3.14]
414–1000	7071	3.02	[2.99–3.06]
≥1004	7063	2.88	[2.85–2.92]
Women			
0	29,328	2.82	[2.81–2.84]
1–38	6786	2.94	[2.91–2.98]
38.3–100	7810	2.94	[2.91–2.97]
101–240	5722	2.96	[2.93–3.00]
≥241.25	6625	2.87	[2.84–2.91]

Note: Groups of drinkers were defined using the quartiles of the monthly quantity of alcohol consumed, abstainers being excluded.

4. Discussion

We used data from the RLMS-HSE to study the links between alcohol consumption and self-reported life satisfaction. The hypothesis of a hump-shaped relationship was tested using regressions that incorporated control variables and individual fixed effects, which had never been done before.

Our results not only confirmed the existence of a hump-shaped relationship when conducting unadjusted analyses, as suggested by previous literature (Brenner, 1967; Cummins, 2008; Koivumaa-Honkanen et al., 2012; Ventegodt, 1995), but also showed that controlling for possible confounders and individual heterogeneity was of importance when studying this issue. Indeed, the shape of the relationship between

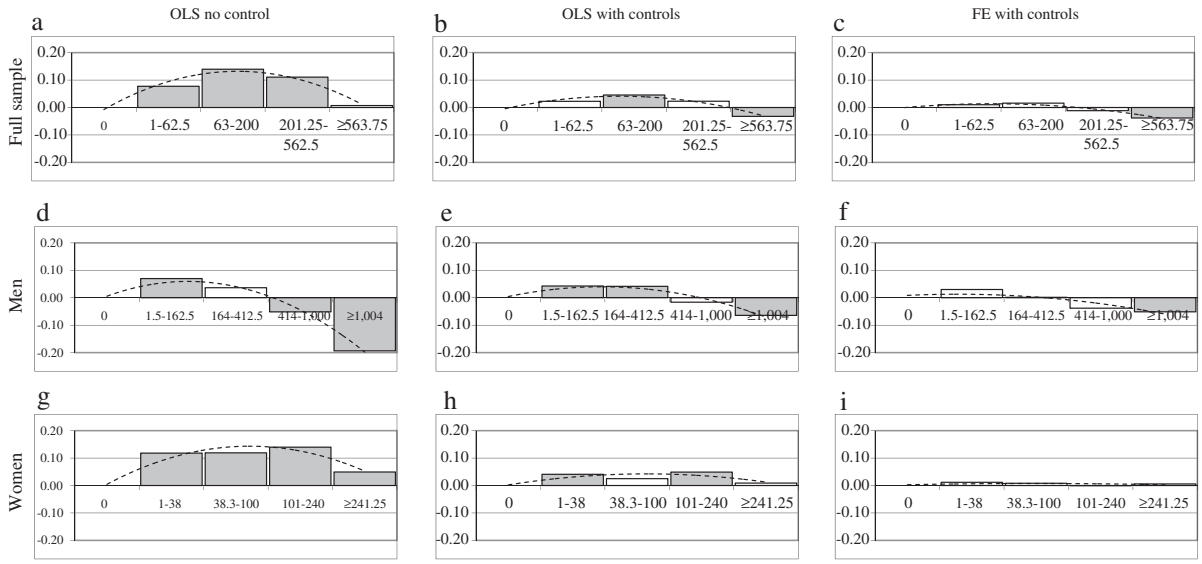

Fig. 1. Results of regressions based on alcohol consumption quartile dummies. Note: quartile values in grams of pure alcohol per month on the x-axis (abstainers were excluded when computing quartile values); coefficient values of the alcohol consumption quartile dummies on the y-axis. Same control variables and same N as in Table 2. Gray bars indicate that the coefficient is significant ($p < 0.05$). Wald tests for the null hypothesis that the set of coefficients for the four alcohol dummies is equal to zero are significant ($p < 0.05$) in all regressions except the last one (subsample of women, FE with controls). Dotted lines are polynomial tendency curves.

alcohol consumption and life satisfaction was significantly modified by inclusion of these controls. Especially, we found that the hump-shaped relationship became increasingly flattened in adjusted analyses. It completely vanished among women and, even though the quadratic specification remained significant among men, the first two quartiles of drinkers turned non-significant in the quartile specification. This result could be due to the arbitrary division of drinkers into quartiles and could mean that only a very small group of drinkers (smaller than the first quartile) was significantly happier than abstainers.

This paper also adds a piece of evidence to the importance of gender differences in this issue. Indeed, in adjusted analyses, we found a negative correlation between being a fourth quartile drinker and well-being among men and no correlation between drinking and well-being among women. While elucidating the reasons for these gender differences is a hard task, the most obvious possible explanation seems to be linked to the differences in the quantities of alcohol consumed by men and women. From Table 1, it is clear that women reported far less drinking than men (700 g/month on average for men versus 126 for women). This could mean that women simply did not drink enough to reach the threshold from which satisfaction decreases.

It should be noted that national specificities concerning gender differences in the relationship between alcohol use and well-being would be worth being considered. Indeed, the pictures depicted by previous studies in other countries are quite different from what we found in Russia. Considering unadjusted analyses, we found an inverse U-shaped relationship among women and inverse J-shaped relationship among men. In contrast, Koivumaa-Honkanen et al. (2012) found an inverse J-shaped relationship for both men and women in Finland. In Australia, Cummins (2008) found that females who drank more than three drinks per session had below normal well-being, but did not find below normal well-being levels among male drinkers. The reasons for such differences should be explored.

Our study has several limitations. First, there are good reasons to believe that alcohol consumption was under-reported in our data. Tapilina (2007) estimated that per capita pure alcohol consumption was about 15 l in 2000 in Russia. With our data, we obtained an annual average of only 5.6 l. The fact that individual alcohol consumption may be under-reported in Russian surveys and, more specifically, that the RLMS-HSE may underestimate total population drinking has already been underlined (Laatikainen et al., 2002; Nemtsov, 2004). Memory bias and voluntarily under-reporting are two possible explanations for a low figure among respondents. Importantly, the determinants of reporting would not be expected to vary within individuals. Hence, under-reporting among respondents is unlikely to be very problematical in fixed-effect regressions. Sample bias due to exclusion of socially marginalized, heavy-drinking individuals could have more dramatic consequences on estimates. Unfortunately, there seems to be no easy way to overcome this problem. As pointed out by Perlman (2010), it is yet worth noticing that consumption in RLMS-HSE was consistent with, and often higher than, other Russian surveys. One unfortunate consequence of this under-reporting is that it is delicate for us to determine the threshold for excessive drinking accurately since the scale we used seems inappropriate for measuring actual quantities consumed. Calculations using the coefficients from the quadratic specification of the fixed effect regressions with controls in the men sample indicated that maximum satisfaction was reached for a consumption of 22 g/month. This is low, but in all likelihood this figure underestimates the actual quantity. This point remains a challenge for future research.

Second, in our analyses, age was used as a simple control variable. It would be of interest for future studies to investigate differences in the relationship between drinking and life satisfaction over the life cycle more precisely. Cummins (2008) indeed noticed that not drinking alcohol disadvantaged well-being during the middle ages 36–65 years, maybe because alcohol consumption could be an important coping strategy during this stressful period of life. He also found that drinking more than three drinks per session was correlated with low well-being for the 46–55 year group, but not for the 18–25 year group for which well-being remained high. It would be interesting to know whether such results hold when controlling for a large set of variables and individual heterogeneity, and if they can be replicated using other surveys.

Third, R-squared values obtained from OLS regressions without controls were low (0.003 for the full sample in the quadratic specification). This means that drinking is a marginal contributor of life satisfaction. This may be attributable to the fact that we used a very general approach both in terms of the population studied (general Russian population)

Table 4
Full results for the fixed effect regressions with controls.

	Dependent variable: life satisfaction		
	Full sample	Men	Women
First quartile of drinkers	0.010	0.030	0.012
	(0.012)	(0.018)	(0.016)
Second quartile of drinkers	0.016	0.002	0.008
	(0.013)	(0.020)	(0.016)
Third quartile of drinkers	−0.012	−0.038*	−0.001
	(0.014)	(0.021)	(0.019)
Fourth quartile of drinkers	−0.038**	−0.051**	0.006
	(0.016)	(0.023)	(0.021)
Age 20–29	−0.155***	−0.179***	−0.129***
	(0.028)	(0.040)	(0.038)
Age 30–39	−0.192***	−0.201***	−0.173***
	(0.037)	(0.055)	(0.051)
Age 40–49	−0.176***	−0.200***	−0.144**
	(0.047)	(0.069)	(0.064)
Age 50–59	−0.133**	−0.217***	−0.060
	(0.056)	(0.084)	(0.075)
Age 60–69	−0.066	−0.170	0.023
	(0.067)	(0.104)	(0.088)
Age≥70	0.017	−0.049	0.080
	(0.077)	(0.122)	(0.100)
Bad health	0.392***	0.386***	0.391***
	(0.036)	(0.069)	(0.042)
Average health	0.623***	0.651***	0.600***
	(0.038)	(0.074)	(0.044)
Good health	0.778***	0.792***	0.764***
	(0.040)	(0.075)	(0.046)
Very good health	1.036***	1.017***	1.078***
	(0.052)	(0.086)	(0.073)
Student	0.019	0.027	0.003
	(0.028)	(0.042)	(0.038)
Not working/looking for work	−0.362***	−0.464***	−0.253***
	(0.019)	(0.026)	(0.027)
Not working/not looking for work	−0.148***	−0.258***	−0.092***
	(0.017)	(0.031)	(0.020)
Other occupation	−0.071**	−0.144***	−0.013
	(0.032)	(0.047)	(0.043)
Never married	−0.146***	−0.069	−0.176***
	(0.029)	(0.045)	(0.039)
Living together	−0.015	−0.038	0.004
	(0.024)	(0.036)	(0.032)
Divorced	−0.198***	−0.172***	−0.201***
	(0.029)	(0.052)	(0.035)
Widowed	−0.175***	−0.283***	−0.161***
	(0.032)	(0.097)	(0.034)
Log(income + 1)	0.054***	0.047***	0.059***
	(0.005)	(0.007)	(0.007)
Smoker	−0.068***	−0.064***	−0.071**
	(0.019)	(0.024)	(0.030)
BMI	0.007***	0.004	0.010***
	(0.002)	(0.003)	(0.003)
Constant	1.676***	1.928***	1.456***
	(0.084)	(0.132)	(0.111)
Num. of observations	84,076	36,489	47,587
Num. of individuals	17,457	7721	9736
R-squared	0.531	0.518	0.539

Robust standard errors in parentheses (clustered at the individual level). Round dummies included. Reference categories: abstainer, age ≤ 19; very bad health; working; married; non-smoker.
* p < 0.1.
** p < 0.05.
*** p < 0.01.

and of the type of well-being indicator used (life satisfaction). It is very likely that alcohol consumption would be a greater contributor of well-being in some specific sub-populations and using more specific well-being indicators. This could be investigated in future studies.

Fourth, in this study, we analyzed the shape, and not the direction, of the relationship between alcohol consumption and life satisfaction. Since the hump-shaped relationship remained significant in the sub-sample of men after controlling for a large number of confounders and individual heterogeneity, there must be a causal effect between these two variables — but we don't know which way. Especially, we were unable to determine whether the low satisfaction of male drinkers of the fourth quartile was mainly justified by a negative causal impact of alcohol consumption on well-being, or by a selection effect of unhappy people into this level of alcohol consumption. The use of lagged variables could be a first step in the resolution of this causality issue. This strategy however raises a slightly different question than that of the concomitant relationship between alcohol use and well-being. Moreover, with our data (we ran a set of regressions using lagged alcohol consumption as independent variable), this strategy led to inconclusive results. More elaborated strategies seem necessary to isolate causal effects in this relationship.

Existing evidence tends to suggest a causal linkage between alcohol use disorders and major depression, such that increasing involvement with alcohol increases risk of depression (Boden & Fergusson, 2011). It remains however unclear how causality links work along the whole spectrum of the alcohol consumption and well-being relationship. For instance, we could imagine that the upper part of the inverse U-shaped relationship among men would be explained by a selection effect of happy people into light/moderate use, while the lower part could be explained by a negative impact of alcohol abuse on well-being (or by a bi-directional relationship, as suggested by Koivumaa-Honkanen et al., 2012).

Further evidence about the causal relationship between alcohol consumption and psychological well-being would have important implications. From a public health perspective, it could help understand the complex and debated relationship between alcohol consumption and mortality (Fillmore, Kerr, Stockwell, Chikritzhs, & Bostrom, 2006; Fuller, 2011; Marmot, Shipley, Rose, & Thomas, 1981), which could be mediated by psychological factors. From a more conceptual point of view, it would also be a useful tool to assess the quality of the decision process made by alcohol drinkers. The quantitative evaluation of the relationship between choices and well-being has gained great interest in the field of economics recently, due to the increasing recognition, through the influence of behavioral economists, that individuals can be subject to imperfect rationality in their decisions because of systematic anomalies and biases (Camerer, Loewenstein, & Rabin, 2003; Graham, 2008). Measuring the causal impact of alcohol consumption on well-being would help validate some recent theoretical contributions describing substance abuse, or addiction, as a temporally inconsistent behavior, in which addicts are involuntarily stuck in consumption patterns that reduce their well-being (Bernheim & Rangel, 2004; Gruber & Köszegi, 2001; O'Donoghue & Rabin, 1999). As suggested by our results, gender differences should be examined carefully when investigating these issues.

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Contributors

SM and PK designed the study. SM performed the statistical analysis and wrote the first draft of the manuscript. PK reviewed the manuscript. All authors contributed to and have approved the final manuscript.

Conflict of interest

The authors declare no conflicts of interest.

Appendix A. Calculations of the mean score of happiness using Brenner's data (Brenner, 1967)

The statistical analysis conducted by Brenner (1967) did not provide a direct account of the shape of the relationship between alcohol consumption and happiness. We used the number of observations and percentage distribution reported in Table 1 of his paper to make our own calculations of the mean, standard deviation and 95% confidence interval of a "score" of happiness in three groups of drinkers.

	Score of happiness					
	3 ("very happy")	2 ("pretty happy")	1 ("not too happy")	Mean	Std. dev.	95% CI
Abstainers	133	221	81	2.12	0.69	[2.05–2.19]
Small amounts	255	373	118	2.18	0.68	[2.13–2.23]
Medium or large amounts	77	156	38	2.14	0.63	[2.06–2.22]

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