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Estimating the Relationship Between Rate of Time Preferences And Socio-Economic Factors In Russia

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Abstract:

Rate of time preferences reflects an individual's opinion on how to distribute consumption over time. In this paper we examine various socio-economic factors that are related to rate of time preferences in Russia. The data are obtained from a survey from the Yuri Levada Analytical Center in 2011. Our findings suggest that time preferences of men and women should be analyzed separately in Russia. Factors such as age, income, educational level, the size of a household, marital status and place of residence have a significant impact on rate of time preferences.

Key Words: *Socio-Economic Factors, Rate of Time Preferences, Individual Discount Rate, Russia.*

JEL Classification : *D9*

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1. Introduction

Since the 19th century, economists have paid attention to the problem of intertemporal choice and its causes. Economic aspects of intertemporal choice have been examined, as well as the sociological and psychological aspects. "A Note on the Measurement of Utility", a paper by Samuelson in 1937, was a turning point for views on intertemporal choice, describing a discounted utility model. The main assumption of this model is that all the motives underlying intertemporal choice can be described in a single parameter called a discount rate. This rate (an "individual discount rate" (IDR) or a "rate of time preferences" (RTP)) reflects individual time preferences for obtaining utility from consumption, and shows how disadvantageous future utility is when compared to present utility. The higher the rate of time preference, the more impatient the individual is. A positive rate means that, all other things being equal, an individual prefers the utility from consumption now, rather than later.

Despite the broad use of the discounted utility concept, there is criticism about it. For instance, Frederick and co-authors distinguish time discounting and time preferences (Frederick et al, 2002). They emphasize that the same rate of time preferences does not apply to all forms of consumption. Despite this criticism, we support the evidence of recent empirical studies that rate of time preference reflects an individual's intertemporal choice, particularly healthy/unhealthy behavior. Many research papers confirm the relationship between rate of time preference and obesity (Komlos 2004), health care demand (Bradford 2010, Thalassinos *et al.* 2010), and smoking (Harrison 2009, Scharff and Viscusi 2011). An estimation of this rate and the analysis of relevant factors are useful for policy-makers since the economic costs of an unhealthy lifestyle are significant for society. Such analysis is frequently conducted abroad, for example, the research of Harrison for Denmark (Harrison 2002). The usefulness of the rate of time preferences for government decision-making is highlighted in many studies (Grignon 2009; Bradford 2010).

The popularity of the rate of time preferences abroad has not spread to Russia. Our research aims to measure the relationship between various socio-economic factors and rate of time preferences in Russia. The results of individual discount rate estimation and conclusions on the socio-economic factors affecting this rate can help to improve government policy through a deeper understanding of individual intertemporal choice and to achieve budget savings through improved decision-making.

2. Individual Intertemporal Choice and Socio-Economic Factors

2.1. The Rate of Time Preferences and Problems with its Estimation

Various studies suggest using a survey for rate of time preference evaluation. Here respondents choose either to receive a certain amount of money today or to postpone in exchange for a cash reward to be received at a later date. The answers show the individual time preferences of respondents. The most common ways of constructing questions are as following (Fuchs 1982):

- An experimenter offers a respondent a sum of money relating to the future and asks what smaller amount would be acceptable to receive immediately;
- An experimenter offers a respondent a sum of money today and asks what minimum amount would be acceptable in the future to compensate the delay in receiving money;
- An experimenter offers a respondent two sums of money and asks what time period would make these sums equivalent.

Estimating rate of time preferences faces several problems. First, respondents may inaccurately predict their behavior or not give answers at all. Second, the rate is not constant with increases in the planning horizon (Tasset et al. 1999). Most economists agree that the rate of time preference decreases with time. Individuals tend to be more patient in the long-run than in the short-run (Angeletos et al. 2001). Third, questions in terms of benefits and questions in terms of payments lead to different results of estimation (Frederick et al. 2002). Many research papers confirm that the rate of time preference for a benefit is higher than the rate for a payment (Benzion et al. 1989; Warner and Pleeter 2001). Fourth, the size of the proposed sum strongly influences individual time preferences. Individuals use higher rates for smaller benefits than for larger ones (Benzion U. et al. 1989). In this case it is important to know an individual's subjective opinion on the significance of the proposed sum. Fifth, a sequence of increasing benefits and a sequence of decreasing benefits have different impacts on the rate of time preferences (Chapman 2000).

As a rule, a sequence of benefits which increases with time is more attractive for an individual than a sequence of decreasing benefits. However, this does not reconcile with the concept of a positive discount rate (Frederick et al. 2002). Sixth, measurement should exclude the impact of market interest rates on individual time preferences. Otherwise, derived values of time preference rates will reflect an alternative market return, rather than time preferences (Harrison et al. 2002). To eliminate the impact of market interest rates it is necessary to consider what alternative money investments are available for an individual at the moment of a response to the questionnaire (Coller and Williams 1999). Lastly, an option to delay receiving money has the additional risk of an experimenter's default (Harrison et al. 2002). If an individual has the option to receive money immediately and an option to receive a larger amount later, the second option is riskier than the first one. The individual associates the second option with high transaction costs, and the rate of time preferences also includes compensation for high risk. In order to prevent the

overestimation of individual time preferences, it is possible to formulate questions in a way such that all options are devoted to the future. It enables us to fix transaction costs for an individual and eliminate the additional risk.

All confounding factors described above should be adequately controlled while estimating the rate of time preferences (Frederick et. al. 2002). Otherwise, the result of estimation will not reflect the pure time preference of an individual.

2.2. Socio-Economic Factors Related To The Rate Of Time Preferences

The literature suggests various factors that relate to rate of time preferences including social, cultural, psychological, and economic. Most frequently mentioned among them are socio-economic factors such as age, gender, income, education, and health. Our review focuses on significant socio-economic factors and provides evidence for including these factors in our analysis.

Gender. Many researchers agree that men and women have different rates of time preferences (Kirby and Marakovic 1996; Harrison *et al.* 2009; Bradford 2010). Several authors have concluded that men have higher rates than women (Coller and Williams 1999; Warner and Pleeter 2001 and Thalassinos *et al.* 2009). On the contrary, Bradford (2010) and Scharff and Viscusi (2011) both show that men have lower rates. The time preferences of men and women should be analyzed separately (Fuchs 1982).

Age. Most researchers agree that there are significant differences in time preferences for different age groups (Lahav et al. 2010). The rate of time preferences declines with age because young children cannot delay utility at all and as they get older, self-control increases (Warner and Pleeter 2001). The rate of time preferences declines up to middle age and then starts rising as one gets older. This is due to the fact that older people place a high value on the risk that they might not live to see the utility from future consumption. Consequently, older people have higher rates of time preference than middle-aged individuals. For instance, Van der Pol and Cairns (1999) suggest that individuals in the 64-and-older age group have higher rates than other age groups. Thus, the relation between the age of an individual and their rate of time preferences is not linear.

Income. Various studies show that the higher the income of an individual, the lower his or her rate of time preferences. Harrison et al (2002) suggest that individuals in households with the highest income have rates of time preference that are about ten percentage points lower than those of individuals in households with the lowest income. Authors also analyze the impact of welfare on individual time preferences rather than the impact of income, although the conclusions remain the same. The

higher the welfare of the individual, the more patient they are and the lower their individual discount rate (Dioikitopoulos and Kalyvitis 2010).

Education. Individuals with a high level of education have relatively low rates of time preferences (Fuchs 1982; Becker and Mulligan 1997; Dioikitopoulos and Kalyvitis 2010). In addition, many authors agree that education enables an individual to reduce their rate of time preferences (Harrison et al. 2002). In other words, easy access to education helps reduce this rate.

Health. Differences in individual health explain the differences in values of rates of time preferences (Becker and Mulligan 1997). Individuals with good health assess the risk of not receiving utility from consumption in the future less than individuals with poor health. Thus we can conclude that the better the health of an individual, the lower their rate of time preference (Dioikitopoulos and Kalyvitis 2010).

Among the factors of individual time preferences, the ***size of a household*** is also mentioned in some studies. The larger the size of a household, the higher the rate of time preference of an individual is (Warner and Pleeter 2001).

Marital status, ***employment status*** (Bradford 2010), and ***the type of employment*** (Booij and van Praag 2009) are examples of other factors described in the literature. A brief review of the relevant literature on time preference estimation in different countries makes it possible to formulate hypotheses on the individual intertemporal choice in Russia.

3. Assessing the Impact of Socio-Economic Factors on the Rate of Time Preferences In Russia

3.1 Hypotheses and Data

We base our analysis on a review of empirical studies and put forward hypotheses on the following socio-economic factors that relate to rate of time preferences: age, gender, educational level, income, state of health, size of a household, marital status, employment status, and type of employment. Despite these hypotheses being similar to those tested by other authors, the conflicting results in different studies make testing them on Russian data necessary.

In addition, we assume that the place of residence has an impact on the formation of individual time preferences for Russians. Socio-economic development varies significantly in different parts of Russia (Solanko 2008). It leads to different time preferences for Russians. Anderson and Gugerty (2009) also provide evidence that

place of residence matters within Russia when considering intertemporal choice. These are hypotheses tested in our study:

1. Gender influences the rate of time preferences
2. The rate of time preferences declines with age
3. The rate of time preferences declines as individual income increases
4. The higher the education level of an individual, the lower the rate of time preferences
5. The better an individual's health, the lower the rate of time preferences
6. The larger the size of a household, the higher the rate of time preferences
7. Marital status has an impact on individual time preferences
8. The employment status has an impact on individual time preferences
9. The place in which an individual resides has an impact on individual time preferences

The testing of these hypotheses is based on data from the study conducted by the Yuri Levada Analytical Center entitled "A Study of the Population on the Development of Healthy Lifestyles and Specification of Government Guarantees of Healthcare in 2011".

A multistage stratified probability sample was constructed which represents the adult population of Russia aged 15 years and older. Individuals below this age were not surveyed. The principles of sampling provide its representativeness with the following parameters: gender, age, educational level, region, and size of a population settlement. The sample consists of 4001 respondents: 1378 men and 2623 women. Descriptive statistics of the main respondent characteristics are presented in table 1.

Table 1. Descriptive statistics of the sample

	Age	**Size of a household**	**Children**	**Monthly income (thousand rubles)**
Mean	44.95	2.43	0.36	10.91
Median	45.00	2.00	0.00	8.75

Maximum	93.00	10.00	6.00	166.67
Minimum	15.00	1.00	0.00	0.25
Std. Dev.	18.52	1.19	0.68	8.71

Figure 1 shows the distribution of respondent education. Here we pay attention to Russian specifics, where education is considered in terms of education levels instead of the total years of education.

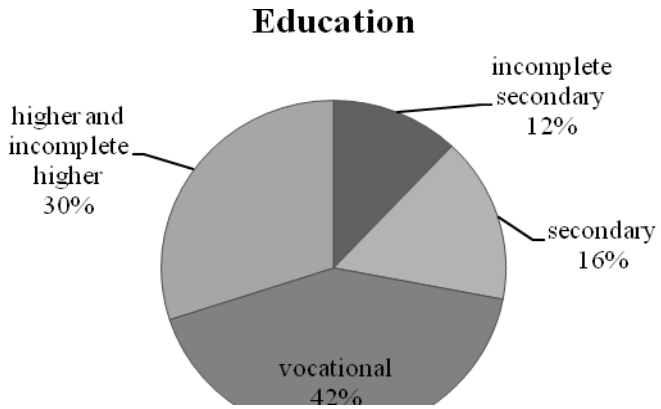


Figure 1. Distribution of respondent education level

More precisely, the sample is characterized as follows. The mean age of respondents is 45 years. About 40% of respondents have vocational education. 16% of respondents have secondary education, and 30% of respondents have higher or incomplete higher education. The percentage of respondents with higher education (27% of men and 32% of women) is slightly above the national average, which is 23% according to the 2010 census.

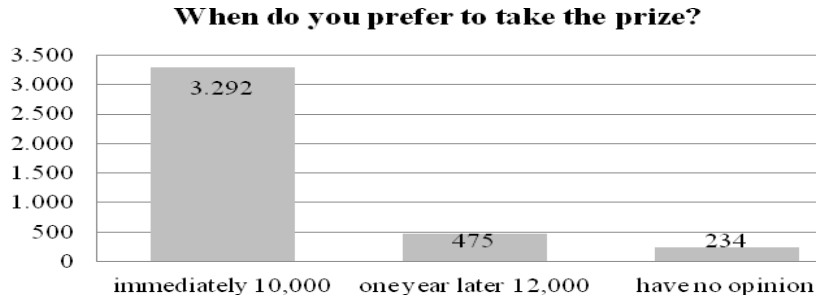
Half of all households consist of two persons. The majority of households do not include children younger than 15 years. The average per capita income in this sample is 10,915 rubles. This sum is substantially lower than the national average, which is 20,700 rubles, according to data of the Federal State Statistics Service for 2011. Therefore, we conclude that the sample is shifted down according to population income.

With all of these, a subjective evaluation of income shows that only 315 households (8%) indicate that they "can hardly make ends meet," and "don't have enough money even for food". The largest number of respondents (50%) "have enough money for food and clothes, but buying durable goods (a TV set, a refrigerator, etc.) is a problem for them."

A representative of the sample is a woman of 45 years who has a secondary or higher education and income below the Russian subsistence minimum. She lives in a household that consists of two persons, and she does not have any children younger than 15 years.

In our research, we use two questions to estimate the individual discount rate of a respondent:
"Imagine that you win a money prize. The sum depends on the moment you take it. If you take the prize right now, the sum is 10,000 rubles. If you take the prize in a year, the sum will be 12,000 rubles. When would you prefer to receive the prize: now or in one year?"

"At what amount (at least) should the prize be increased for you to agree to receive it one year later?"Answers of respondents to the first question are presented in the figure 2.
Figure 2. Preferences for the moment of taking the prize.



As we see in the figure 2, the vast majority of respondents prefer to take the prize immediately.

The second question was asked to those respondents, who do not agree to wait for one year or have no opinion. Figure 3 shows individual responses.

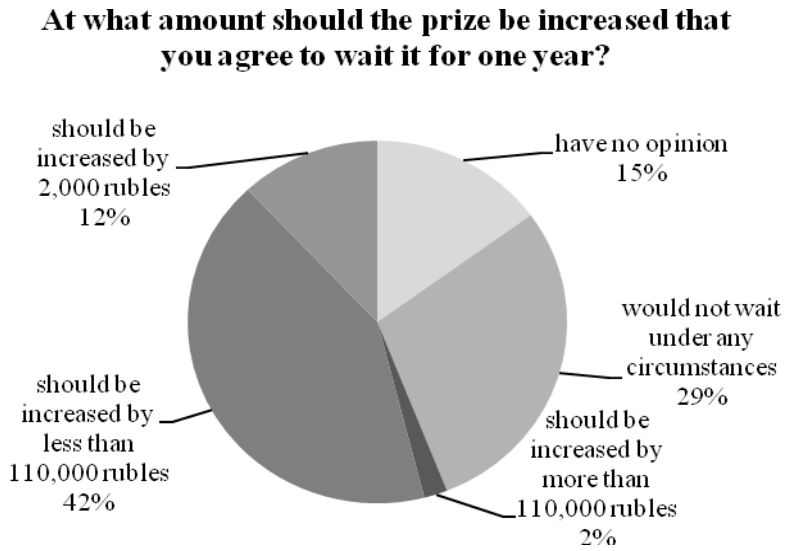


Figure 3. Preferences for the increase of the prize.

Figure 3 demonstrates that about a third of the respondents (29%) would not agree to delay the prize for a year under any conditions. Another possible case is that respondents (2%) answer unreasonably high values that are more than 110,000 rubles. This means that they desire an increase in the prize amount of more than 1,000%. A significant number of respondents (15%) could not answer this question. This result probably reflects the fact that many Russians regard the risk of experimenter default as being high. The distribution of answers from respondents who are willing to delay the prize for one year and agree to receive a sum less than 110,000 rubles is presented in figure 4.

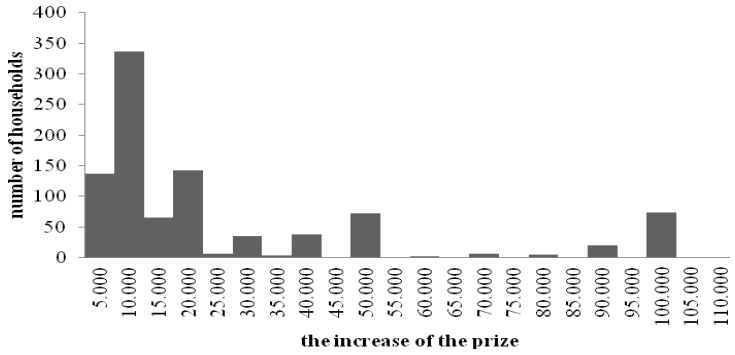


Figure 4. Distribution of respondent preferences for the increase of the prize

Figure 4 indicates that the majority of respondents in this category agree to an increase within the limits of 25,000 rubles. For most of these the size of the desired increase is in a range from 5,000 to 10,000 rubles. This corresponds to the rate of time preferences, which is from 50% to 100%. The obtained values seem to be extremely high since the alternative market return is significantly lower than these values.

The results of our survey suggest that formulating questions in terms of delaying a prize is inappropriate for estimating absolute values of rates of time preferences in Russia. At the same time, the distribution of respondent answers enables us to estimate the relation between rate of time preferences and socio-economic factors. Consequently, we use measures of rates of time preferences rather their absolute values.

Measures define the principal willingness of a respondent to defer the prize to a later date and the ordered amount of the required prize. In our research we select the following variables as measures which define the individual discount rate:

"*Now*" is a dummy variable that is 1 for respondents who prefer to take the prize immediately (10,000 rubles) and 0 for those who prefer to take 12,000 rubles one year later.

"*Never*" is a variable takes a value of 1 for respondents who are not willing to wait for one year under any conditions and for respondents who indicate an increase of more than 110,000 rubles. We assume that the individual discount rate for them is infinite. For all other respondents, the value is 0.

"*IR*" is a variable taking a value of 2,000 for respondents who agree to 12,000 rubles in one year, or equals the increase of the desired prize named by respondents in the answer to the second question. In accordance with the distribution of answers, this variable takes 53 values from 2,000 rubles to 5 million rubles. Particularly, it is 34 values from 2,000 rubles to 110,000 rubles inclusive and 19 values higher than 110,000 rubles.

"*IR_order*" is a variable which takes values from 1 to 33 in accordance with the order number of "IR" when the increase of the desired prize is lower than 110,000 rubles. This variable takes a value of 34, if the increase of the desired prize equal to or greater than 110,000 rubles or an individual does not agree to wait for one year under any conditions.

"*Order*" is a variable based on "*IR_order*". The variable "*Order*" enables us to consolidate categories in such a way that each category includes no less than 100 observations. As a result, we have 8 values of the variable instead of 34 values.

"IR^c" is a censored variable takes a value of "*IR*" if the increase of the desired prize is lower than 110,000 rubles, and a value of 110,000 if it is equal to or greater than 110,000 rubles.

"$IR^{c\infty}$" is a censored variable, which takes a value "*IR*", if the increase of the desired prize is lower than 110,000 rubles; and takes a value of 110,000, if it is equal to or greater than 110,000 rubles, or respondents do not agree to wait for one year under any conditions.

We consider the following characteristics as possible factors for the rate of time preferences. First, the characteristics of the individual: gender, age, education, marital status, self-reported health and chronic disease, employment status. Categorical variables are included as a set of dummy variables. The age of an individual is taken into account as both a continuous variable and a set of dummy variables for the following age groups: under 25, from 26 to 35, from 36 to 45, from 46 to 55, from 56 to 65, and over 65. For education we use the following levels: incomplete secondary, secondary, vocational, incomplete higher and higher. The factor of "marital status" includes official marriage and cohabitation, as well as "not married" and "widow/widower"[4].

Second, we consider household characteristics: the size and structure of a household, the total number of people, the number who are employed, the number of children younger than 15 years, and the self-assessed household income. We choose "self-assessed household income" as an indicator of "income" instead of "personal income", because less than half of respondents answer the question about their personal income.

Third, we examine the place of residence of the individual: Federal District and type of population center. Population centers are divided into 4 categories: Moscow and St. Petersburg, large cities (more than 300,000 people), medium and small cities (less that 300,000 people), and rural settlements.

3.2 Model Description

[4] The term "cohabitation" is of little use in Russia because of negative emotional tone. The questionnaire includes the more acceptable term for Russia which is "unofficial marriage". Unofficial marriage involves more serious relations than cohabitation and often has all attributes of the official marriage except for legal registration.
We use the term "not married" instead of "single", because cohabitants who do not have any commitments to each other are likely to answer that they are "not married".

We estimate three types of models based on the available data with the help of the maximum-likelihood method: binary choice models, ordered models, and tobit models.

1. Probit models

We consider a dependent variable "Y_i" which is an indicator of event. We assume that:

$$P(Y_i = 1) = \Phi(x_i'\beta) \quad (1)$$

The log-likelihood for the probit model is

$$\ln(L) = \sum_{y_i=1} \ln \Phi(x_i'\beta) + \sum_{y_i=0} \ln(1 - \Phi(x_i'\beta)) \quad (2)$$

where x_i' is the row vector of values for an individual characteristics and characteristics of the individual's household,
β is the vector of parameters of the model,
$\Phi(t)$ the standard normal distribution.

In model 1 the dependent variable Y = "*Now*". This model allows us to identify those factors affecting the probability such that the rate of time preferences for an individual will be more than 20% per year.

In model 2 the dependent variable Y = "*Never*". This model enables us to determine the characteristics of individuals who do not agree to wait for one year under any conditions and therefore have an infinite rate of time preferences.

Signs of the coefficients in these models coincide with the direction of the impact of relevant variables on the probability that an indicator of heightened or infinite rate of time preferences equals 1, since

$$\frac{\partial P(Y_i = 1)}{\partial x_k} = \varphi(x_i'\beta)\beta_k,$$

where $\varphi(t)$ is the standard normal density function.

2. Ordered probit models

Here we assume that the sum required by respondents reflects only the order of the desired reward. This assumption is supported by the fact that respondents evaluate the increase of the prize approximately. As a rule, the increase is equal to an integer of a thousand rubles. As we can see from figure 3, half of the respondents indicate an increase of up to 10,000 rubles (inclusive). 75% of respondents chose the following values: 5,000 (n=194), 10,000 (n=543), 20,000 (n=240), 50,000 (n=119), 100,000 (n=162) rubles.

The dependent variable "*Y*" is the following ordered variables: "*IR_order*" (model 3) which takes 34 values, and "*Order*" (model 4) which takes 8 values. The use of ordered variables allows us to assume that there is a latent variable "IR^*" which is the true sum of the desired prize:

$$IR_i^* = x_i'\beta + \varepsilon_i \qquad (3)$$

Then

$$Y_i = \begin{cases} 1, & if \quad IR_i^* \le \alpha_1 \\ 2, & if \quad \alpha_1 < IR_i^* \le \alpha_2 \\ & \ldots \\ s, & if \quad IR_i^* > \alpha_{s-1} \end{cases}$$

The log-likelihood for the ordered probit model is

$$\ln(L) = \sum_{k=1}^{s} \sum_{y_i = k} \left(\ln \Phi(\alpha_k - x_i'\beta) - \Phi(\alpha_{k-1} - x_i'\beta) \right), \qquad (4)$$

where *s* is the number of categories (34 for model 3; 8 for model 4), $\alpha_0 = -\infty, \quad \alpha_s = +\infty$.

x_i' is the row vector of values for individual characteristics and the characteristics of the individual's household,

β is the vector for parameters of the model with unknown coefficients of the explanatory variables, α is the vector for auxiliary parameters of boundaries, $\Phi(t)$ is the standard normal distribution. We can write for this model the following:

$$\frac{\partial E(IR_i^*)}{\partial x_k} = \beta_k$$

$$\frac{\partial P(Y_i = k)}{\partial x_k} = (\varphi(\alpha_{k-1} - x_i'\beta) - \varphi(\alpha_k - x_i'\beta))\beta_k, \quad 1 \le k \le s \qquad (5)$$

The sign of the coefficient β_k enables us to examine in what direction the variable x_k influences the true increase of the desired prize (and, consequently, the rate of time preferences), and the probability of belonging to the category *s*, which indicates the highest rate of time preferences.

3. Tobit models

In these models the dependent variables are logarithm of "IR^c" (model 5) and logarithm of "$IR^{c\infty}$" (model 6).

These variables are censored, as they are based on the variable "*IR*" which is also censored. The variable "*IR*" is censored from below by the value of 2,000. It is so, since we do not know the true rate of time preferences for those respondents who

agree to receive 12,000 rubles in one year. We only notice that their rate of time preferences equals or lower than 20%.

Variables "IR^{c}" and "$IR^{c\infty}$" are censored from above by the value of 110,000. We choose such this construction, because 2% of respondents indicate unfeasibly large amounts of money. The difference between model 5 and model 6 lies in observations that are included in the estimation. For model 5 we use observations where respondents agree to the proposed sum of the prize or indicate an exact increase of the desired prize. For model 6 we use the entire sample. If an individual has an infinite rate of time preferences, we assign a value of 110,000 to the dependent variable "$IR^{c\infty}$". For censored data we choose Censored Regression (Tobit) Model.

We assume that there is a latent variable "IR^{*}". This variable can be interpreted as the true amount of the desired prize. For this variable:

$$Ln(IR_i^*) = x_i'\beta + \varepsilon_i \qquad (6)$$

Random errors ε_i are independent and identically distributed. They have normal distribution with zero expectation and variance σ^2. As before, x_i' *is* row vector of the values of individual characteristics and characteristics of individual's household, β is the vector of the parameters of the model.

For those respondents who agree to wait for the prize, the value of the latent variable "*IR**" equals "*IR*".
We define the dependent variable Y = "IR^{c}" for a model 5, and Y = "$IR^{c\infty}$" for a model 6.
The log-likelihood for the censored regression model is the following:

$$\ln(L) = \sum_{\ln(2000)<y_i<\ln(110000)} \ln\left(\frac{1}{\sigma}\varphi\left(\frac{y_i - x_i'\beta}{\sigma}\right)\right) + \sum_{y_i=\ln(2000)} \ln\Phi\left(\frac{\ln(2000) - x_i'\beta}{\sigma}\right) + \\ + \sum_{y_i=\ln(110000)} \ln\left(1 - \Phi\left(\frac{\ln(110000) - x_i'\beta}{\sigma}\right)\right) \qquad (7)$$

where $\Phi(t)$, $\varphi(t)$ are the standard normal distribution function and the density function respectively.

The signs of the coefficients coincide with the direction of the influence of the relevant factors on the true "IR^{*}" and on the observable sum of the prize *Y*, since marginal effects in the Censored Regression Model are:

$$\frac{\partial(E(\ln(IR_i^*))}{\partial x_k} = \beta_k$$

$$\frac{\partial(E(Y_i))}{\partial x_k} = \beta_k * \left(\Phi\left(\frac{\ln(110000) - x_i'\beta}{\sigma} \right) - \Phi\left(\frac{\ln(2000) - x_i'\beta}{\sigma} \right) \right) \quad (8)$$

3.3 Results

First of all we compare the advantages and disadvantages of the six models described above. Model 1 and model 2 use less information than other models and consider only those indicators of events when the rate of time preferences is heightened or infinite. At the same time these models are estimated with the maximum possible number of observations. Moreover, models 1 and 2 contain no assumptions on the form of the distribution of respondents' answers.

Models 3 and 4 use ordered dependent variables. As these models differ only in the grouping of respondents' answers they should give similar results. As a dependent variable we use the ordered number of the increase of the desired prize instead of the absolute value of the prize. It enables us to avoid bias of estimation caused by a rough determination of the increase of the desired prize. Such consolidation serves to increase the reliability of estimates. However, it might lead to the loss of information.

It is interesting to examine whether it is necessary to take into account the rates of time preferences of those respondents who do not agree to wait for one year under any conditions. It is reasonable to include them in the estimation, because about one-third of respondents would not wait. In order to take such respondents into account, we assume that their desired prize is finite but unfeasibly large. That is why they indicate that they are not able to wait for one year and demonstrate an infinite rate of time preferences. However the inclusion of these respondents could lead to situation when the assumption of a normal distribution of errors in the Tobit model is unrealistic. For this reason we estimate the model on two samples, including and excluding respondents with an infinite rate of time preferences.

We estimate the model (3) at the maximum possible number of observations. A serious limitation of this model is an assumption that the logarithm of the increase of the desired prize should have a censored normal distribution. When interpreting the results of model 5, it is necessary to remember that we estimate the conditional expectation of increase of the prize in the case when an individual indicates a finite rate of time preferences.

One of the hypotheses raised in our research is the effect of gender on the rate of time preferences. We base our estimations on Fuchs's arguments to run regressions for men and women separately (Fuchs 1982). However, we take into account the debate on this point, and we run Likelihood ratio test about integration of men and women into one model with a dummy variable *gender*. This hypothesis is rejected for all models 1-6 (Prob(LR)<0.01), except model 2 (Appendix 1). Therefore, we estimate model 2 on the basis of the joint sample of men and women.

Table 2 presents estimation results of five models (1, 2, 3, 5, 6) for women. Results of estimating model 4 are very similar to the results of estimating model 3, and we do not present them.

Table 2. The relation between socio-economic factors and the rate of time preferences for women

Models	(1)	(2)	(3)	(5)	(6)
Variables	Now	Never	IR_order	$\ln(IR^c)$	$\ln(IR^{c\infty})$
Age≤ 25	-	-0.159**	-	-	-
		(0.0676)			
25<Age≤ 35	-0.270***	-0.103	-	-	-
	(0.0935)	(0.0646)			
45<Age≤ 55	-	-	-	-	-
55<Age≤ 65	-	-0.204**	-	0.506***	-
		(0.0846)		(0.178)	
Age>65	-	0.398***	0.176***	-0.674***	0.405**
		(0.0827)	(0.0575)	(0.160)	(0.172)
Secondary education	-	-0.123	-0.174**	-	-0.505**
		(0.0888)	(0.0804)		(0.234)
Vocational education	-	-0.164**	-0.174**	-	-0.505**
		(0.0790)	(0.0804)		(0.234)
Higher and incomplete Higher education	-	-0.240***	-0.230***	-	-0.716***
		(0.0823)	(0.0867)		(0.252)
Cohabitation	-	-	-	0.362*	-
				(0.220)	

Official marriage	-	-	-	-	-
Widow	-	0.211***	-	-	-
		(0.0761)			
Children under 15 years	0.295***	-	0.102*	0.270**	0.344**
	(0.0836)		(0.0556)	(0.126)	(0.162)
Number of household members	-	-	-	0.109**	-
				(0.0482)	
Number of workers in a household	-	-	-	-	-
Self-reported health: good	-	-	-	-	-
No chronic disease	-	0.0959**	-	-0.275***	-0.236*
		(0.0488)		(0.0996)	(0.143)
Self-assessed income: have enough money only for food	0.186**	-	-	-	-
	(0.0780)				
Self-assessed income: have enough money for food and clothes, but not durables	-	-	-0.187***	-0.309***	-0.549***
			(0.0512)	(0.105)	(0.149)
Self-assessed income: have enough money for durables, but not expensive items	-	-	-0.187***	-0.309***	-0.549***
			(0.0512)	(0.105)	(0.149)
Self-assessed income: have enough money for expensive items	-0.620*	0.637**	-0.506*	-1.335**	-1.541*
	(0.341)	(0.269)	(0.302)	(0.579)	(0.870)
Student	-0.232**	-	-0.200**	-	-0.523**
	(0.112)		(0.0893)		(0.259)
Employed	-	-	-	-	-
Moscow	-	-	-	-	-

Saint-Petersburg	-	-	-	-	-
Large cities	-	-	-	-	-
Medium and small cities	-	-	-	-	-
Central Federal District	-	-0.163**	-0.259***	-	-0.742***
		(0.0680)	(0.0731)		(0.213)
Southern Federal District	-0.486***	-0.226***	-0.587***	-0.239*	-1.668***
	(0.0883)	(0.0771)	(0.0820)	(0.129)	(0.240)
Volga Federal District	-0.315***	-0.283***	-0.560***	-0.275**	-1.601***
	(0.0807)	(0.0714)	(0.0753)	(0.111)	(0.220)
Ural Federal District	-	-	-	-	-
Siberian Federal District	-	-0.362***	-0.316***	-	-0.916***
		(0.0794)	(0.0831)		(0.242)
Far Eastern Federal district	-0.381**	-0.385***	-0.766***	-	-2.125***
	(0.153)	(0.120)	(0.129)		(0.374)
Constant	0.983***	0.261***		9.127***	12.24***
	(0.111)	(0.101)		(0.192)	(0.388)
Observations	2474	3,388	2216	1435	2216
LR	82.73	173.89	150.93	78.64	151.23
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000

Standard errors are in parentheses; *** p<0.01, ** p<0.05, * p<0.1
Symbol "-" means that a variable was included in the initial model specification. However, results of LR-test on insignificant variables lead to exclusion of this variable from a model.

For women there is a complex relationship between the rate of time preferences and the factor of age. Here, this factor is a set of dummy variables for age groups. As a reference group we use respondents from 36 to 45 years. The joint

model 2 shows that respondents older than 65 years are more likely not to agree to wait the prize under any conditions. That is why the coefficients for this age group are positive in models 3 and 4. These models include respondents with an infinite rate of time preferences. This conclusion concurs with results of Van der Pol and Cairns (1999). Older people have less need than young people, and they are not able to delay consumption because of the risk that they might not live to see the utility from future consumption. At the same time, if an older respondent indicates a finite sum of the desired prize, this sum is lower than young respondents show (model 5).

In order to obtain more information about the relationship between the rate of time preferences and the factor of age, we estimate models 5 and 6 once again with age as a continuous variable. In these models the dependent variable (logarithm of the sum of the desired prize) is continuous. In model 5 we reveal a negative relation of respondent age and the increase of the desired prize. In model 6 we take into account those respondents who do not agree to wait for the prize and, therefore, have an infinite rate of time preference. Here, we explore a positive relation of respondent's age and the increase of the desired prize. It can be explained by the increase of the probability of revealing an infinite rate of time preferences for individuals of 65 years and older.

The factor of education is significant in three of the five models. The reference group for this factor is "incomplete secondary education". We conclude that women whose level of education is higher than "incomplete secondary education" have lower rate of time preferences than other women. Respondents who have vocational and higher education less frequently show an infinite rate of time preferences compared to those with secondary and incomplete secondary education. We note that in probit model 1, ordered model 3, and the Tobin model (4) the impact of higher education is slightly higher than the impact of vocational and secondary education.

We reveal the relationship between marital status and the rate of time preferences in model 5. Women who cohabit indicate a higher sum of a desired prize than women who are not married and women in official marriages. Widows and widowers are more likely to refuse the delay in receiving the prize, than other respondents (model 2).

Considering children, we conclude that this factor is significant in all models except model 2. Respondents from a household with children under 15 years have higher rates of time preferences in comparison with respondents who do not have young children.

Respondents from large households, all other things being equal, indicate greater amounts of the desired prize. This conclusion is true when a respondent has a finite rate of time preferences (model 5).

The relationship between health and the rate of time preferences is revealed in models 2, 5 and 6. Respondents who do not have chronic diseases indicate a lower increase of the desired prize than respondents who have chronic diseases. However, they are more likely to refuse a one-year delay in receiving the money.

The impact of self-assessed income on the rate of time preferences for women is shown in all models. Models 3, 5, and 6 show that respondents with enough income for buying clothes and durables indicate lower sum of the desired prize than respondents with enough income only for making ends meet. Respondents with enough income for buying expensive items indicate an increase less than others. Therefore, we conclude that respondents with the highest income in our sample have lower rate of time preferences than other respondents. However, these respondents are more likely to have an infinite rate of time preferences than other respondents (model 2).

Table 2 shows that students in the sample have lower rates of time preferences, than other respondents. Moreover, students are less likely than others to refuse a one-year delay in receiving the prize.

We conclude with the relationship between the place of residence and the rate of time preferences. Residents of the North-Western Federal District (the reference district) have higher rates of time preferences than residents of all other regions. The greatest difference exists between the reference district and the Far Eastern Federal district, and the smallest difference is between the reference district and Central Federal District. This fact reflects significant differences in socio-economic levels in Russian regions.

Table 3 presents estimation results of models 1-6 for men. Similarly to the analysis for women, model 4 gives results that are very close to the results of estimating model 3, and hence are not presented.

Table 3. The relation between socio-economic factors and the rate of time preferences for men

Models	(1)	(2)	(3)	(5)	(6)
Variables	Now	Never	IR_order	$\ln(IR^{c}$	$\ln(IR^{c\infty})$
Age≤ 25	-0.240	-0.159**	-0.145*	-	-0.398

	(0.194)	(0.0676)	(0.0869)		(0.245)
25<Age≤ 35	0.215	-0.103	-	-	-
	(0.171)	(0.0646)			
45<Age≤ 55	-0.283**	-	-0.255***	-0.633***	-0.768***
	(0.130)		(0.0947)		(0.265)
55<Age≤ 65	-	-0.204**	-	-	-
		(0.0846)			
Age> 65	-0.272**	0.398***	-0.149*	-0.831***	-0.485*
	(0.116)	(0.0827)	(0.0890)	(0.164)	(0.248)
Secondary education	-	-0.123	-	-	-
		(0.0888)			
Vocational education	-	-0.164**	-	-	-
		(0.0790)			
Higher and incomplete Higher education	-	-0.240***	-	-	-
		(0.0823)			
Cohabitation	-	-	-	-	-
Official marriage	-	-	-	-	-
Widower	-	0.211***	0.424**	-	1.023**
		(0.0761)	(0.169)		(0.471)
Children under 15 years	-	-	-	-	-
Number of household members	-	-	-	-	-
Number of workers in a household	-	-	-	-	-
Self-reported	-	-	-	-	-

health: good					
No chronic disease	-0.349***	0.0959**	-0.203***	-0.558***	-0.570***
	(0.106)	(0.0488)	(0.0700)	(0.139)	(0.196)
Self-assessed income: have enough money only for food					
	-	-	-	-	-
Self-assessed income: have enough money for food and clothes, but not durables					
	-	-	-	-	-
Self-assessed income: have enough money for durables, but not expensive items					
	-	-	-	-	-
Self-assessed income: have enough money for expensive items	-	0.637**	-	-	-
		(0.269)			
Student	-	-	-	-	-
Employed	-	-	-	-	-
Moscow	-0.361**	-	-0.311***	-	-1.015***
	(0.168)		(0.119)		(0.332)
Saint-Petersburg	-	-	-	-	-
Large cities	-	-0.0769	-0.189**	-	-0.521**
		(0.0515)	(0.0738)		(0.207)
Medium and	0.265***	-	-	-	-

small cities	(0.102)				
Central Federal District	-	-0.163**	-	-0.442***	-
		(0.0680)		(0.148)	
Southern Federal District	-	-0.226***	-	-	-
		(0.0771)			
Volga Federal District	-0.572***	-0.283***	-0.376***	-0.855***	-1.129***
	(0.106)	(0.0714)	(0.0784)	(0.158)	(0.220)
Ural Federal District	-	-	-	0.494**	-
				(0.246)	
Siberian Federal District	-	-0.362***	-	-	-
		(0.0794)			
Far Eastern Federal district	-0.625***	-0.385***	-0.442***	-	-1.075***
	(0.186)	(0.120)	(0.147)		(0.416)
Constant	1.622***	0.261***		10.241***	11.80***
	(0.121)	(0.101)		(0.479)	(0.227)
Observations	1,293	3,388	1,172	784	1,172
LR	59.78	173.89	63.57	65.45	64.62
Prob > chi2	0.0000	0.0000	0.0001	0.0000	0.0000

Standard errors are in parentheses; *** p<0.01, ** p<0.05, * p<0.1
Symbol "-" means that a variable was included in the initial model specification. However, results of LR-test on insignificant variables lead to exclusion of this variable from a model.

Models estimated for men contain fewer significant variables than models for women. Similarly to results for women, dummy variables for age do not allow to make a clear conclusion about the influence of this factor on the rate of time preferences. According to model 2 for the entire sample, there is an increase of probability to reveal an infinite rate of time preferences for individuals of 65 years

and older. However, model 1 has negative coefficients for this age group. Such coefficients are also negative in models 3, 5 and 6. Thus, we conclude that there is a decrease in the rate of time preferences for men 65 years and older in comparison with the reference group. This conclusion is supported by model 5 with a continuous variable age. If a respondent indicates a finite rate of time preferences, there is a negative relationship between the increase of the desired prize and the age of a respondent.

We note that the impact of higher education is more significant than the impact of vocational education (model 2). Marital status is significant only for widowers who are more likely to have an infinite rate of time preference (model 2). They indicate larger increase of the desired prize than other respondents (models 3, 6). In contrast to the results for women, children do not influence the rate of time preferences of men. The status "no chronic diseases" has a downward effect on the rate of time preferences of male respondents (models 3-6). At the same time this status positively influences the probability that a male respondent have an infinite rate (model 2).

There is a relation between self-assessed income and the rate of time preferences only in model 2. Respondents, who have enough money for buying expensive items, are more likely to have an infinite rate of time preferences. Models for men and women show the same relations between the place of residence and their rate of time preferences. Men in the Ural Federal District indicate a higher increase than by residents of other regions.

Table 3 shows that male respondents who live in large cities have lower rates of time preferences, than respondents from medium and small cities (models 3, 6). Moreover, they are less likely to have an infinite rate. It is worth noting, that these effects are stronger for Moscow residents than for others (models 1, 3 and 6). Overall, key findings on the hypotheses are given below.

Hypothesis №1. Econometric models confirm that gender does have a significant impact on the rate of time preferences. Socio-economic factors influence the rate of time preferences of men and women differently.

Hypothesis №2. Our hypothesis that the rate of time preferences decreases with age is accepted for men, who have rates that decrease linearly with age. This conclusion is correct for women if they indicate a finite rate of time preference. If we take into account women with an infinite rate, those rates increased with the age of the respondent. A possible reason is that the probability of identifying an infinite rate higher for women over 65.

Hypothesis №3. The rate of time preferences decreases with the growth of income only for women. Female respondents with the lowest rates assess their income as enough to buy expensive items. For both men and women, richer respondents are more likely to have an infinite rate than poorer respondents. We assume that the prize of 10,000 rubles is insignificant for wealthy individuals.

Hypothesis №4. We accept that the rate of time preferences decreases as an individual's education level increases for women. For women higher education has the most significant effect. For both men and women an increase in educational level reduces the probability to have an infinite rate.

Hypothesis №5. We accept the hypothesis that there is an inverse relationship between the rate of time preferences and health. Among the factors that characterize the state of health of an individual there is only one significant variable which is the absence of chronic disease. Respondents without chronic diseases have lower rates than other respondents.

Hypothesis №6. The impact of the size and structure of a household on the rate of time preferences is significant only for women. The increase of the desired prize increases with household size, and the individual discount rate increases if the household includes children under 15. The size of the household or the presence of children under 15 does not influence the rate of time preferences for men.

Hypothesis №7. The hypothesis about the impact of marital status on the rate of time preferences is only partially accepted. Our results show that the marital status of men does not influence their individual time preferences. Women who live in an unregistered marriage have higher rates than other female respondents. This could be explained by the fact that women regard an unregistered marriage as a more vulnerable position. Widows and widowers are more likely to have an infinite rate of time preferences than other respondents.

Hypothesis №8. We reject the hypothesis regarding the impact of employment status on the rate of time preferences.

Hypothesis №9. The place of residence has a significant impact on the rate of time preferences for both men and women in Russia. We reveal a significant relationship between the rate and the district of residence as well as the type of population center.

4. Conclusion

Our study confirms that the time preferences of men and women should be analyzed separately in Russia, since the influence of socio-economic factors on the rate of time preferences is different for men and women. Significant factors affecting the

rate of time preferences in Russia are the age of an individual, the size and structure of the household, marital status, self-assessed income, health status, educational level, and a place of residence. Since the place where an individual resides has a significant impact on the rate of time preferences in Russia, our study can be continued by a detailed analysis of individual time preferences in Russian regions. An investigation of regional differences could help to intensify the impact of government initiatives in particular regions of the country.

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Appendix 1. Results of joint models for men and women

Models	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Now	Never	IR_order	Order	$\ln(IR^c)$	$\ln(IR^{c\infty})$
Age≤ 25	-0.0452	-0.190**	-0.0508	-0.0541	0.287*	-0.127
	(0.119)	(0.0967)	(0.0814)	(0.0815)	(0.157)	(0.234)
25<Age≤ 35	-0.0603	-0.126	-0.0461	-0.0494	0.210	-0.0992
	(0.0986)	(0.0782)	(0.0664)	(0.0665)	(0.131)	(0.191)
45<Age≤ 55	-0.0440	-0.0545	-0.0762	-0.0825	-0.0898	-0.230
	(0.104)	(0.0824)	(0.0701)	(0.0702)	(0.138)	(0.202)
55<Age≤ 65	-0.0819	-0.177**	-0.102	-0.103	0.330**	-0.262
	(0.104)	(0.0867)	(0.0747)	(0.0747)	(0.160)	(0.215)
Age>65	-0.0208	0.289***	0.0981	0.0916	-0.473**	0.230
	(0.138)	(0.112)	(0.0959)	(0.0961)	(0.198)	(0.276)
Secondary education	0.0654	-0.135	-0.0797	-0.0782	-0.0842	-0.201
	(0.107)	(0.0896)	(0.0764)	(0.0765)	(0.158)	(0.220)
Vocational education	0.0151	-0.169**	-0.0943	-0.0930	0.0338	-0.262
	(0.0969)	(0.0815)	(0.0697)	(0.0697)	(0.145)	(0.200)
Higher and incomplete Higher education	-0.00745	-0.243***	-0.145**	-0.146**	0.0467	-0.443**
	(0.103)	(0.0859)	(0.0732)	(0.0732)	(0.150)	(0.210)
Cohabitation	-0.0455	-0.150	-0.0818	-0.0892	0.0942	-0.249
	(0.131)	(0.109)	(0.0908)	(0.0909)	(0.174)	(0.261)
Official marriage	-0.0195	-0.0673	-0.0613	-0.0577	-0.0928	-0.199
	(0.0739)	(0.0594)	(0.0504)	(0.0504)	(0.0998)	(0.145)
Widow/widower	-0.00878	0.146*	0.0869	0.0927	-0.229	0.219
	(0.106)	(0.0861)	(0.0741)	(0.0742)	(0.158)	(0.213)
Children under 15 years	0.201**	-0.0482	0.101*	0.0980	0.202*	0.245
	(0.0899)	(0.0719)	(0.0608)	(0.0609)	(0.118)	(0.175)
Number of household members	0.00579	-0.0147	0.00949	0.00917	0.0812	0.0532
	(0.0413)	(0.0331)	(0.0282)	(0.0282)	(0.0558)	(0.0812)
Number of workers in a household	0.0484	-0.00636	0.0152	0.0156	0.0259	0.0329
	(0.0499)	(0.0408)	(0.0346)	(0.0346)	(0.0680)	(0.0998)
Self-reported health: good	-0.0258	0.00390	-0.0257	-0.0273	-0.163*	-0.0549

	(0.0676)	(0.0559)	(0.0472)	(0.0473)	(0.0919)	(0.136)
No chronic disease	-0.140**	0.100*	-0.0894***	-0.0881***	-0.347***	-0.314**
	(0.0627)	(0.0516)	(0.0436)	(0.0436)	(0.0860)	(0.125)
Self-assessed income: have enough money only for food	0.235**	-0.0959	0.0814	0.0890	0.110	0.214
	(0.109)	(0.0915)	(0.0782)	(0.0782)	(0.162)	(0.226)
Self-assessed income: have enough money for food and clothes, but not durables	0.112	-0.109	-0.0450	-0.0419	-0.154	-0.171
	(0.104)	(0.0882)	(0.0753)	(0.0754)	(0.155)	(0.217)
Self-assessed income: have enough money for durables, but not expensive items	0.0380	-0.103	-0.0720	-0.0641	-0.0800	-0.194
	(0.121)	(0.102)	(0.0867)	(0.0868)	(0.174)	(0.250)
Self-assessed income: have enough money for expensive items	-0.420	0.548*	-0.185	-0.181	-1.267**	-0.683
	(0.285)	(0.282)	(0.234)	(0.234)	(0.492)	(0.668)
Student	-0.115	-0.118	-0.171*	-0.173*	-0.0369	-0.512*
	(0.137)	(0.117)	(0.0979)	(0.0980)	(0.186)	(0.282)
Employed	0.00809	-0.0559	-0.0115	-0.0134	0.124	0.00168
	(0.0902)	(0.0730)	(0.0622)	(0.0623)	(0.124)	(0.179)
Moscow	-0.213*	-0.0470	-0.0908	-0.0938	0.00736	-0.341
	(0.127)	(0.104)	(0.0886)	(0.0886)	(0.176)	(0.254)
Saint-Petersburg	-0.109	-0.0562	-0.115	-0.119	-0.529*	-0.559
	(0.215)	(0.164)	(0.143)	(0.143)	(0.310)	(0.410)
Large cities	-0.00671	-0.0918	-0.0872	-0.0820	-0.0228	-0.249
	(0.0779)	(0.0647)	(0.0549)	(0.0549)	(0.110)	(0.158)
Medium and small cities	0.00152	-0.0333	-0.0285	-0.0253	0.0125	-0.0693
	(0.0694)	(0.0575)	(0.0489)	(0.0490)	(0.0996)	(0.141)
Central Federal District	-0.214	-0.228**	-0.295***	-0.288***	-0.350*	-0.873***
	(0.142)	(0.106)	(0.0928)	(0.0929)	(0.205)	(0.269)
Southern Federal District	-0.512***	-0.313***	-0.487***	-0.485***	-0.282	-1.401***
	(0.143)	(0.110)	(0.0956)	(0.0956)	(0.208)	(0.277)
Volga Federal District	-0.567***	-0.354***	-0.596***	-0.598***	-0.597***	-1.757***
	(0.139)	(0.106)	(0.0920)	(0.0921)	(0.201)	(0.267)
Ural Federal District	0.00693	-0.140	-0.0532	-0.0515	0.0880	-0.0952
	(0.167)	(0.121)	(0.106)	(0.106)	(0.234)	(0.308)
Siberian Federal District	-0.0736	-0.443**	-0.319**	-0.307**	-0.0772	-0.962**

		*	*	*		*
	(0.152)	(0.111)	(0.0965)	(0.0966)	(0.210)	(0.280)
Far Eastern Federal district	-0.590***	-0.466***	-0.729***	-0.721***	-0.376	-1.999***
	(0.170)	(0.143)	(0.122)	(0.122)	(0.246)	(0.352)
Gender	**0.0319**	**0.0153**	**0.0339**	**0.0381**	**0.0363**	**0.0850**
	(0.0593)	**(0.0485)**	**(0.0412)**	**(0.0413)**	**(0.0821)**	**(0.118)**
Constant	1.177***	0.694***			9.320***	12.11***
	(0.241)	(0.192)			(0.346)	(0.478)
Observations	3767	3388	3388	3388	2219	3388
LR	106.77	185.43	193.59	195.16	133.18	192.65
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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