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ESTIMATING INDIVIDUAL TIME PREFERENCES IN RUSSIA

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ESTIMATING INDIVIDUAL TIME PREFERENCES IN RUSSIA⁴

In order to achieve the goals of any social policy, it is necessary to select the most effective measures of government initiatives. The response of target groups to various social policy measures can be assessed with the help of the individual discount rate. This rate reflects an individual's opinion on how to distribute consumption among periods. We start with a definition of individual time preferences. Then we consider problems connected with estimating the individual discount rate. We examine different socio-economic factors that influence individual intertemporal choice in Russia and provide estimates of individual discount rates. Necessary data are obtained from a survey from the Yuri Levada Analytical Center that was conducted in 2011. Valid results are found for most of the hypotheses tested. Our findings suggest that social policy tools for different target groups should vary depending on their individual time preferences. It could help to intensify the impact of social programs and to save budget resources through the correct choice of policy measures.

JEL Classification: H39, H43

Key words: social policy, individual discount rate, time preferences, determinants of intertemporal choice, Russia.

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1. Introduction

The implementation of various programs, as part of social policy in a country, involves determining the net social benefits of such programs and choosing the most effective measure to achieve the goals. In international practice, one of the instruments to predict the reaction of target population groups to a certain social policy measure is the individual discount rate. This rate reflects individual time preferences for obtaining utility from consumption, and shows how disadvantageous future utility is when compared to utility at the present. The usefulness of the individual discount rate for decision-making and selection of social policy measures has been confirmed by many foreign studies (Grignon M., 2009; Bradford W., 2010).

The addressed nature of a social policy determines the need for a detailed investigation of individual characteristics of target population groups. Estimation results of individual time preferences enable governments to vary the measures of a particular social policy depending on the propensity of different groups of individuals to risk and on the willingness of individuals to wait for the benefits of a program.

Estimations of the individual discount rate and analyses of its determinants have been conducting abroad for some time now. However, this instrument is not being applied in Russia because of an insufficient methodological framework. Despite the fact that using estimated values of individual discount rates is not the only way to improve the effectiveness of social policies, this instrument has advantages over the main alternative method. This method is advance questioning of target population groups for clarifying their attitude to particular measures and learning the expected reaction to these measures.

The main advantage of the individual rate of time preferences is its universality. The universality of this instrument allows us to derive values necessary for assessing the effectiveness of a variety of social policy measures. Results from the individual discount rate estimation and conclusions on the rate's determinants can help to improve the targeting of social policy. It enables governments to select the most effective policy measures for different population groups. Thus, our research aims to estimate the impact of various socio-economic factors on the individual discount rate in Russia and at developing principles for selecting social policy measures for target population groups.

2. Individual time preferences and determinants of intertemporal choice

2.1. The individual discount rate and problems with its estimation

From a variety of literature on the problem of individual discount rates we outline the main points that are relevant for our research. Since the 19th century, economists have paid

attention to the problem of intertemporal choice and its determinants. Authors have examined economic aspects of intertemporal choice, as well as its sociological and psychological aspects. “A Note on the Measurement of Utility”, a paper by P. Samuelson in 1937, has become a turning point of views on intertemporal choice by describing a discounted utility model. The main assumption of this model indicates that all the motives underlying intertemporal choice can be put in a single parameter called a discount rate. Furthermore, most studies on individual intertemporal choice concentrate on the problem of evaluating individual discount rate. One more important problem is an analysis of intertemporal choice determinants. Authors who have considered determinants of individual discount rates in different countries are R. Thaler, S. Frederick, V. Fuchs, W. Viscusi, G. Chapman, G. Harrison, W. Bradford, and many others. For Russia, the time preferences of individuals have been considered by T. Kossova, M. Sheluntcova, S. Mishin, and others.

As a rule, the terms “rate of time preferences” (RTP) and “individual discount rate” (IDR) are synonyms. According to a generally accepted definition, the individual discount rate is the rate that reflects an individual’s time preference for utility derived from consumption. Thus, the aggregate utility from consumption in different periods of time is calculated as follows (Frederick et al, 2002):

$$U = \sum_{t=1}^T \frac{U(C_t)}{(1 + \rho)^t}, \quad (1)$$

where $U(C_t)$ is the utility from consumption derived by an individual in period t and ρ is the rate of time preferences (or individual discount rate).

The higher the individual discount rate, the more impatient the individual is. A high individual discount rate means that an individual prefers utility from consumption today rather than in the future. An increase in the rate of time preferences means that an individual has started to value future utility from consumption less than before (Lahava et al, 2010). It follows that the higher the individual discount rate, the stronger the shift of consumption to the present moment. Thus, any activity related to costs for an individual will be deferred to future periods (Bradford et al, 2010).

Various studies usually suggest using a survey for individual discount rate 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 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.

It is possible to formulate questions in terms of payments rather than benefits and in terms of goods rather than money (Fuchs, 1982). Questions may also be offered in the form of rising or falling cascades (West, 1978).

Estimating the individual discount rate with the help of a questionnaire faces several problems, the most important of which are listed below.

- Respondents may inaccurately predict their behavior or not give answers at all.
- Many empirical studies conclude that an individual discount rate is not constant with increases in the planning horizon (Tasset et al, 1999). The assumption of a constant rate of time preference is correct only in the short-run. Different studies consider the short-run as a period from one to three years (Frederick et al, 2002). Most economists agree that the individual discount rate decreases with time – that the discount factor increases. Individuals tend to be more patient in the long-run than in the short-run (Angeletos et al, 2001).
- The formulation of questions in the survey influences the value of the individual discount rate. Questions in terms of benefits and questions in terms of payments lead to different results (Frederick et al, 2002). This is called the “sign effect” because any payment is a negative utility for the individual. Many research papers confirm that the individual discount rate for a benefit is higher than the individual discount rate for a payment (Benzion et al, 1989; Shelley, 1993; Chapman and Elstein, 1995; Warner and Pleeter, 2001).
- The size of the proposed prize strongly influences individual time preferences. This is called the “magnitude effect”. Individuals use higher discount rates for smaller benefits than for larger ones (Thaler, 1981; Benzion U. et al, 1989; Holcomb and Nelson, 1992). In this case it is important to know an individual’s subjective opinion on the significance of the proposed prize.
- A sequence of increasing benefits and a sequence of decreasing benefits have different impacts on the individual discount rate (Chapman G., 2000). As a rule, a sequence of benefits which increase 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). A positive discount rate dictates that the net present value of increasing benefits is lower than the net present value of decreasing benefits.

- Measurement of individual discount rates should exclude the impact of market interest rates on individual time preferences. Otherwise, derived values of individual discount rates will reflect an alternative market return, rather than time preferences (Harrison et al, 2002). To eliminate the impact of market interest, rates a researcher should consider what alternative money investments are available for an individual at the moment of a response to the questionnaire (Coller and Williams, 1999).
- 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 individual discount rate 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.

Empirical studies on individual time preferences and individual health behavior demonstrate rather high values of individual discount rates. Investment in health bears a high risk for an individual because the benefits of such an investment are largely uncertain. Giving up unhealthy behavior at the present does not guarantee a healthy life without disease in the future (Fuchs, 1982).

Generally, psychologists observe the following features of individual choice. Individuals prefer certainty when considering benefits and prefer uncertainty when considering costs (Kahneman and Tversky, 1979). We can employ this conclusion in analyzing an individual's health behavior. Individuals unlikely demonstrate healthy behavior at the present time for the sake of probable health improvement in the future because of the psychological characteristics of this choice. For instance, both giving up smoking and undertaking physical exercise are present costs for an individual. However, future benefits in the form of improved health are highly uncertain for an individual, even if they are well predicted for the society as a whole. Thus, there is a high probability that an individual will refuse healthy behavior since he or she prefers certainty related to benefits and uncertainty related to costs (Fuchs, 1982).

Appendix 1 demonstrates various empirical estimates for individual discount rates. The range of values is very wide. When an individual prefers a sequence of increasing benefits to a sequence of decreasing benefits his or her rate of time preferences is negative. In any case, when

an individual is unable to delay obtaining utility from consumption, his or her rate of time preferences equals infinity.

It is necessary to note here that we cannot directly compare estimates of individual discount rates given in various studies since studies are based on samples with significantly different characteristics. It is also interesting that there are no negative values and very high values of individual discount rates in studies from the last five years. This is mainly because of the intention to avoid overestimating individual discount rates. Individuals associate high uncertainty with future benefits from current investment in their own health. Therefore, overestimation might happen.

2.2. Determinants of the individual discount rate

The individual discount rate reflects subjective time preferences. The value of this rate depends on an individual's ability to delay the receipt of utility to future periods of time (Lahava et al, 2010). The literature on time preferences suggests various factors that influence individual time preferences. These factors include social, cultural, psychological, and economic factors, as well as others. Most frequently mentioned among them are the age of an individual, gender, income, educational level, and the current state of health. In addition, there are external factors for an individual, such as level of medicinal development and technological progress. Furthermore, all determinants of the individual discount rate should be considered in more details.

Age

Most researchers agree that there are significant differences in time preferences of individuals belonging to different age groups (Gafni, 1995; Lahava et al, 2010). From one point of view, the individual discount rate declines with age because children cannot delay utility at all. But as children get older, self-control increases (Mischel et al, 1989; Warner and Pleeter, 2001; Chesson et al, 2006). From another point of view, individual discount rate 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 should 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 discount rates than other age groups. Thus, the relation between the age of an individual and his or her rate of time preferences is not linear.

Gender

There is no consensus among economists on how gender influences on the individual discount rate. Many researchers agree that men and women have different discount rates

(Harrison et al, 2009; Bradford, 2010). Following this view, the intertemporal preferences of men and the intertemporal preferences of women should be analyzed separately (Fuchs, 1982). At the same time, there is much evidence that gender does not influence the individual discount rate (Redelmeier and Heller, 1993; Holden et al, 1998; Harrison et al, 2002; Chesson et al, 2006).

Several authors have concluded that men have higher individual discount rates than women (Kirby and Marakovic, 1996; Coller and Williams, 1999; Warner and Pleeter, 2001). On the contrary, Bradford (2010) shows that men have lower rates of time preferences than women. Scharff and Viscusi (2011) also describe that women have higher individual discount rates than men.

To get a more general view of intertemporal preferences, Khwaja (2007) constructed an impulsivity index. This index shows the ability of an individual to control oneself and to achieve goals. Khwaja concludes that the index is higher for men than for women.

Income

Various studies show that the higher the income of an individual, the lower his or her rate of time preferences (Lawrance, 1991; Poulos and Whittington, 1999). For instance, Harrison et al (2002) suggest that individuals in households with the highest income have rates of time preferences that are about ten percentage points lower than that of individuals in households with the lowest income.

Some authors analyze the impact of welfare on individual time preferences rather than the impact of income (Atmadja, 2008). However the conclusion remains the same. The higher the welfare of the individual, the more patient he or she is and the lower his or her individual discount rate for future utility from consumption (Dioikitopoulos and Kalyvitis, 2009).

Educational level

The higher the educational level of the individual, the better that individual is at controlling his or her self. A higher educational level makes it easier for an individual to refuse the utility from consumption today in exchange for health benefits in the future. Therefore, individuals with a high level of education have relatively low rates of time preferences (Fuchs, 1982; Becker and Mulligan, 1997; Dioikitopoulos and Kalyvitis, 2009).

Many authors agree that upgrading the skill level of an individual enables one to reduce his or her rate of time preferences (Harrison et al, 2002). In other words, easy access to education helps in reducing the individual discount rate. In this case, self-discipline increases, and an individual can easily give up unhealthy behavior in the present for better health in the future.

State of health

Some researchers argue that differences in an individual's state of health at the present explain the differences in values of individual discount rates (Becker and Mulligan, 1997; Dolan

Gudex, 1995; Van der Pol and Cairns, 2000). Individuals with good health assess the risk of not receiving utility from consumption in the future less than individuals with poor health assess the risk. Thus we can conclude that the better the health of an individual, the lower his or her rate of time preferences (Dioikitopoulos and Kalyvitis, 2009).

Among the determinants of individual discount rates, the *size of a household* is also mentioned in some studies. The larger the size of a household is, the higher the rate of its time preferences (Holden et al, 1998; Warner and Pleeter, 2001; Ventura, 2003). However, there is evidence that individual discount rate is independent from the size of a household (Coller and Williams, 1999; Botelho et al, 2006).

Additionally, different authors identify the factor of “race” or, in studies from India, “caste” as a determinant of individual time preferences. Authors agree that the worse the situation of a particular race or caste, the higher the rate of time preferences for an individual of this same race or caste (Cropper et al, 1992; Warner and Pleeter, 2001; Chesson et al, 2006). Nevertheless, many authors exclude from the analysis of time preferences such factors as “race” or “caste”, due to the strong correlation of these factors with the educational and income levels of an individual.

There are additional determinants of individual discount rates mentioned in various studies. These determinants are “government transfers for vulnerable groups”, “technological progress”, and “level of medical development”. Advances in medical technology can improve the lifespan of an individual to such an age that the marginal benefit from further extension of life through eating healthy food or exercising is low (Komlos et al, 2004). This leads to an increase of individual discount rates.

Social allowances and free medical assistance programs increase the expectations of getting utility from consumption immediately and, thus, increase the rate of time preferences. Advertising strategies and technological progress have similar effects. Technological progress has increased the speed of delivery of goods and services to consumers. Along with advertising, it encourages impatience and therefore increases the rate of time preferences (Komlos et al, 2004).

A brief review of the relevant literature on time preferences estimation in different countries makes it possible to formulate hypotheses on the determinants of individual intertemporal choice in Russia. In the next section, we identify important factors that influence the individual discount rates of Russians.

3. Assessing the impact of socio-economic factors on the individual discount rate in Russia

3.1 Hypotheses and data

We base our analysis on a review of empirical studies and select the following socio-economic factors that influence the individual discount rate: Age, gender, educational level, income, state of health, and size of a household. The factors mentioned above are included in hypotheses 1-6. These hypotheses are similar to those tested by other authors. However, conflicting results of their verification in different studies make testing these hypotheses on Russian data necessary.

In our opinion, it is also reasonable to check whether marital status and type of employment of an individual influence the rate of time preferences. In addition, we test one more hypothesis that has not been considered in other studies. We assume that the region in which one resides has an impact on the formation of individual time preferences for Russians. The significant differentiation of Russian regions on the level of socio-economic development leads to different time preferences of Russians. The last three hypotheses (7-9) have not been tested in the literature, and we have founded our analysis on the arguments given above.

Table 1 presents the hypotheses tested in the given study on determinants of individual time preferences in Russia.

Table 1

Hypotheses on factors determining the individual discount rates of Russians

Hypothesis №1	Gender influences the individual discount rate. We should estimate individual time preferences for men and women separately
Hypothesis №2	The individual discount rate declines with age
Hypothesis №3	The individual discount rate declines with as an individual's income increases
Hypothesis №4	The higher the education level of an individual, the lower the individual discount rate
Hypothesis №5	The better an individual's state of health, the lower the individual discount rate
Hypothesis №6	The larger the size of a household, the higher the individual discount rate
Hypothesis №7	Marital status has a significant impact on individual time preferences
Hypothesis №8	The employment status (employed or unemployed) and the type of employment have a significant impact on individual time preferences
Hypothesis №9	The region in which an individual resides has a significant impact on individual time preferences

An estimation of individual discount rates in Russia and testing the hypotheses described in Table 1 are both based on the data from a 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".

To conduct this survey we construct a multistage stratified probability sample. The sample represents the adult population of Russia aged 15 years and older.

The principles of this sampling are as follows:

I. The first stage is a preliminary stratification of settlements on a geographical basis, population, and administrative status, including 36 strata. Distribution of the total size of the sample among all strata is proportional to the weight of each stratum (number of adults).

II. The second stage is the selection of questionnaire stations. The number of questionnaire stations should satisfy the condition such that one questionnaire station gives answers of about 8-10 respondents on average. Thus, two settlements are selected in rural areas. In urban areas we utilize from 1 to 5 questionnaire stations (2-3 on average). Exceptions are Moscow and St. Petersburg, where 36 and 16 questionnaire stations are selected, respectively.

The selection of questionnaire stations in urban areas and rural settlements is made by a probabilistic approach from complete lists of polling stations of the city (settlements of the specified rural area). In total, the survey was conducted in 320 settlements, including 174 cities and towns, and 146 villages.

III. The third stage is the selection of households by systematic approach with three obligatory visits of selected addresses.

IV. The fourth stage is the selection of respondents. In a selected household one respondent is polled. The research is conducted at the respondent's home by personal interview. The selection of respondents into the sample is made by the nearest birthday. The survey is carried out on working days in the evening, and all day on weekends. Thus, it is an equal probability of inclusion in the sample of employed and unemployed population.

The proposed design provides a statistical error of the sample estimates for the investigated variables (for dichotomous traits) of not more than 2.3% at a confidence level of 95%. The principles of sampling mentioned above should provide its representativeness with the following parameters: gender, age, educational level, region, and size of a population settlement.

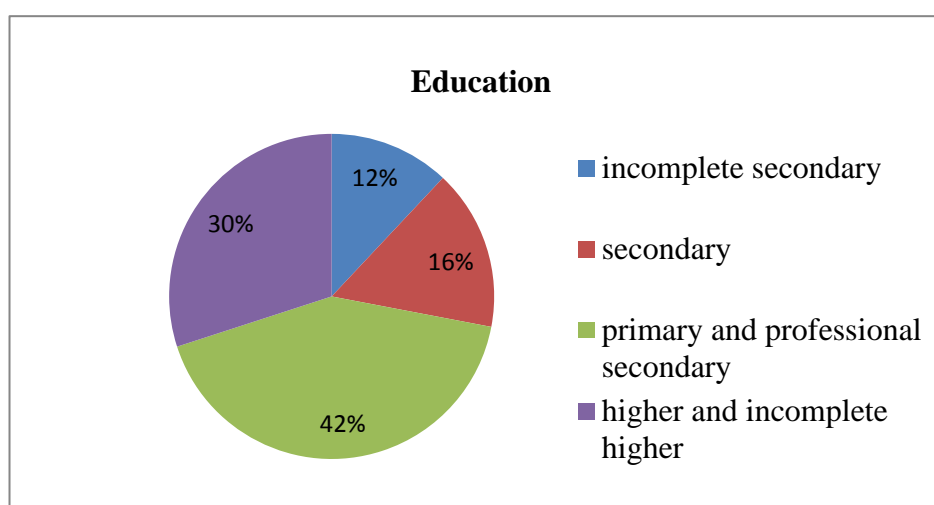
The sample totally consists of 4001 respondents: 1378 men and 2623 women. It is true that women dominate in the sample. However it cannot affect the results of estimation using econometric models since we estimate models for men and for women separately according to hypothesis 1. Descriptive statistics of the main respondents' characteristics are presented in table 2.

Descriptive statistics of the sample

	Age	Size of a household	Children	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

Diagram 1 shows the distribution of respondent education level.

Diagram 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 a primary education and a professional secondary education. 16% of respondents have a secondary education, and 30% of respondents have a higher or an 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 population census.
- Half of all households consist of two persons.
- The majority of households do not include children younger than 15 years.
- More than half of households have received income per capita in August 2011 that is below the Russian subsistence minimum, and about one-third of households reported an income below 1000 rubles. The average per capita income in this sample is 10,915 rubles. This sum is substantially lower than average per capita income, 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.”

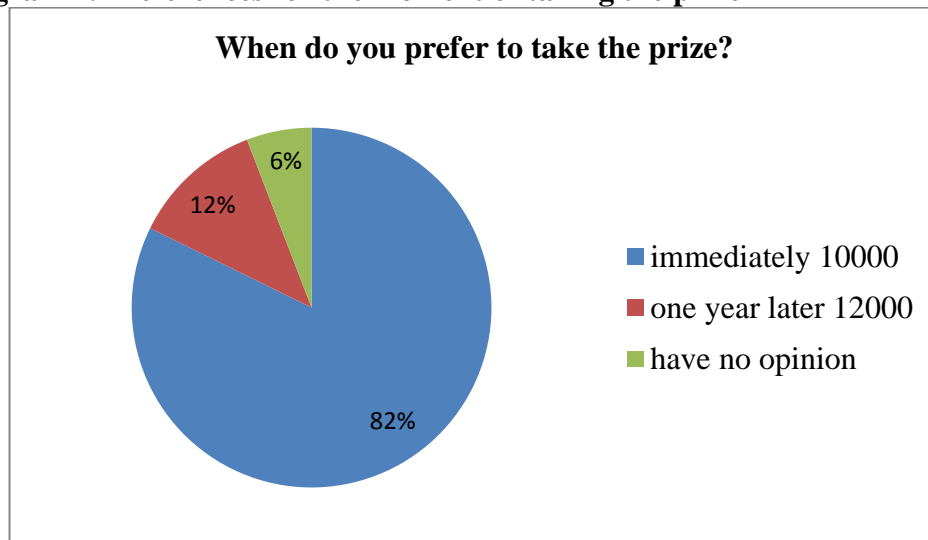
Thus, a representative of the sample is a woman of 45 years who has a secondary or higher education and income below the Russian subsistence minimum. She lives in a household that consists of two persons, and she doesn’t have any children younger than 15 years.

In our research, we use two questions to estimate the individual discount rate of a respondent:

1. “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 one year later, the sum will be 12,000 rubles. When would you prefer to receive the prize: now or in one year?”
2. “To 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 diagram 2.

Diagram 2. Preferences for the moment of taking the prize



As we see in the diagram 2, the vast majority of respondents prefer to take the prize immediately. Answers of these respondents to the second question are shown in the diagram 3.

Diagram 3. Preferences for the increase of the prize

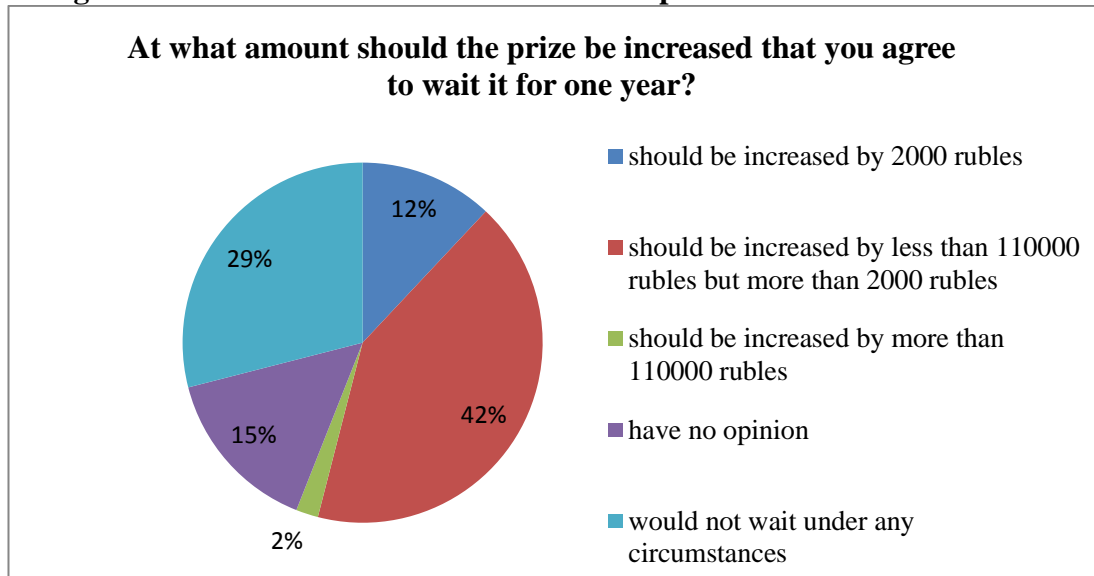
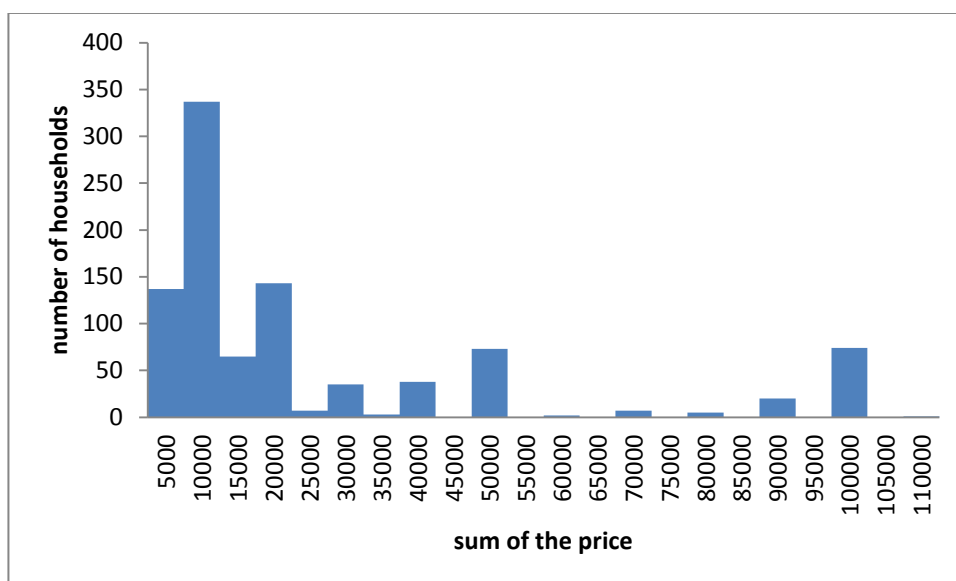


Diagram 3 demonstrates that about a third of the respondents (29%) would not agree to delay the prize for a year under any conditions. Another possible case is that respondents (2%) answer unreasonably high values that are more than 110,000 rubles. This means that they desire an increase in the prize 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’s 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 diagram 4.

Diagram 4. Distribution of respondent preferences for the sum of the prize



The diagram 4 indicates that the majority of respondents in this category agree to a sum within the limits of 25,000 rubles. For most of them the size of the desired prize 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.

Thus, the results of our survey suggest that formulating questions in terms of delaying a prize is inappropriate for estimating absolute values of individual discount rates in Russia. At the same time, the distribution of respondent answers enables us to estimate determinants of individual time preferences.

All the arguments determine the reasonability of using instruments of the individual discount rate in models rather than its absolute values. The instruments define the principal willingness of a respondent to defer the prize to a later date and the relative (ordered) amount of the required prize. In our research we select the following variables as instruments that 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 able to wait for one year under any conditions and for respondents who indicate a sum more than 110,000 rubles. We can assume that the individual discount rate for them is infinite. For all other respondents, the value of the dependent variable is 0.
- “IR_order” takes values equal to the sum named in the answer to the second question, equaling any of 29 categories from 3,000 rubles to 110,000 rubles.
- “Ln(IR)” is the logarithm of the sum named by respondents in the answer to the second question.

We consider the following characteristics as possible determinants of the individual discount rate:

- Characteristics of the individual: age, gender, marital status, educational level, type of employment, type of activity, salary for the last month (for the employed), self-reported health, chronic diseases, care for healthy eating (based on the answer to the question: “Do you read information about a product’s composition included on its packaging when buying groceries in a store?”);
- Characteristics of an individual’s household: size and structure of a household, what is the total number of household members, number of employees, number of children younger than 15 years, per capita household income, and subjective household income;

- The region of residence for the individual: Federal District and type of a population center. Population centers are divided among Moscow and St. Petersburg, large cities (more than 300,000 people), medium and small cities (less than 300,000 people), and rural settlements.

Values for the characteristics mentioned above are based on respondent answers to the questionnaire in the Appendix 2. It is important to note that categorical variables are included as a set of dummy variables. The age of an individual is taken into account as both a discrete 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. Similarly, an individual's income is included in the analysis as both a continuous variable and as five equally probable income groups.

3.2 Model description

We estimate three types of models based on the available data with the help of the maximum-likelihood method:

1. Binary choice (probit) models

The contribution of each observation to the likelihood function is the following:

$$P(Y_i = 1) = \Phi(x_i' \beta), \quad (2)$$

where Y_i is a dependent variable that takes the value 1 or 0,

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.

Model 1.1

In model 1.1 the dependent variable $Y_i = \text{"Never"}$. This model enables us to determine the characteristics of individuals who have an infinite discount rate and who do not agree to wait for one year under any conditions.

Model 1.2

In model 1.2 the dependent variable $Y_i = \text{"Now"}$. 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.

2. Ordered (probit) models

Model 2

In model 2 we assume that the sum required by respondents reflects only the order of desired reward. This assumption is supported by the fact that respondents evaluate the sum of the

prize approximately. As a rule, the sum is equal to an integer of a thousand rubles. As we can see from the diagram 3, half of the respondents indicate a sum up to 10,000 rubles (inclusive). 75% of respondents point out the following values: 5,000 (n=194), 10,000 (n=543), 20,000 (n=240), 50,000 (n=119), 100,000 (n=162) rubles. Overall, respondents indicate 29 different values.

The contribution of each observation to the likelihood function is the following:

$$P(Y_i = k) = \Phi(\alpha_k - x_i' \beta) - \Phi(\alpha_{k-1} - x_i' \beta), \quad (3)$$

where Y_i is a dependent variable that is equal to “IR_order”. It takes values equal to the indicated sum in any of 29 categories from 3,000 to 110,000 rubles.

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

β and α are vectors for parameters of the model with unknown coefficients of the explanatory variables and auxiliary parameters of boundaries.

$\Phi(t)$ is the standard normal distribution .

3. Models with a truncated sample

Model 3

In this model the dependent variable is a logarithm of the amount indicated by respondents in answering question 2. Estimation of this model is based on a subsample of respondents who do not agree to take 12,000 rubles one year later and who indicate in question 2 a sum less than 110,000 rubles. Respondents who do not agree to wait one year for 12,000 rubles are excluded from the subsample in order to avoid displacement. The fact is that these respondents do not independently mention the additional 2,000 rubles. Therefore this sum is imputed. We also exclude respondents who show a sum higher than 110,000 rubles, since we try to avoid possible displacements caused by extremely high values. As it has been mentioned above, we suppose that these respondents have an infinite individual discount rate. We take into account these observations in model 1.1.

In that case it is necessary to choose a cutoff level for the observations. The questionnaire clearly defines a left boundary for the observations. The minimum amount by which the prize has to be increased is 2,000 rubles. The right boundary is more difficult to set. On the one hand, lowering the boundary improves the approximation by selected distribution (normal, logistic, or extreme value distribution). On the other hand, lowering the boundary causes significant loss of information. In the given research we estimate models with different right boundaries. It varies from 40,000 rubles to 120,000 rubles. Estimation results do not substantially differ for various boundaries and distributions. Therefore we can conclude that revealed relationships are stable.

Thus, we assume that the dependent variable Y_i is defined as:

$$Ln(IR_i) = x_i' \beta + \varepsilon_i$$

$$\ln(Y) = \begin{cases} \ln(IR), & \text{if } \ln(2000) < \ln(IR) < \ln(110000) \\ \text{is not observed, if } \ln(IR) \notin (\ln(2000), \ln(110000)) \end{cases} \quad (4)$$

The random error ε has a normal distribution with zero expectation and a variance of σ^2 . As before, x_i' is the row vector of values for an individual characteristics and characteristics of the individual's household and β is the vector for parameters of the model.

The contribution of the i -th observation to the likelihood function is described by the formula:

$$f(y_i | \ln(2000) < \ln(Y_i) \leq \ln(110000)) = \sum_i \left[\begin{array}{l} \ln\left(\frac{1}{\sigma} \varphi\left(\frac{y_i - x_i' \beta}{\sigma}\right)\right) - \ln\left(\Phi\left(\frac{\ln(2000) - x_i' \beta}{\sigma}\right)\right) - \\ - \Phi\left(\frac{\ln(110000) - x_i' \beta}{\sigma}\right) \end{array} \right], \quad (5)$$

where $\Phi(t)$, $\varphi(t)$ is a standard normal distribution function and density function.

Comparison of the results has shown that conclusions from estimating models 1-3 are coordinated with each other. However models differ in composition and quantity of significant explanatory variables. Appendix 3 presents a summary table of estimation results for models 1-3. For further analysis and interpretation, we choose model 3 since this model gives the most appropriate results and has quite good statistical characteristics.

3.3 Results of estimation

Hypothesis 1 assumes that gender has a significant effect on the rate of time preferences, and we estimate models for men and for women separately. As described above, model 3 is estimated by a subsample of respondents who indicated in the questionnaire an additional compensation for the one-year delay in taking the prize of more than 2,000 rubles, but less than 110,000 rubles. These respondents are 42% of the sample. Since we use truncated models in our analysis, evaluation results are consistent. Finally, models are estimated using 1,085 observations for women and 399 observations for men.

A preliminary analysis has shown the necessity of separate estimations of models for employed men and unemployed men. However the number of unemployed men in the sample is not sufficient to obtain reliable results. Therefore we present estimation results only for employed men and for all women in the subsample.

Table 2

Impact of socio-economic factors on an individual discount rate for men and women			
Women		Men	
N=1,085		N=399	
Variable	Coefficient	Variable	Coefficient
Age			
AGE younger than 35	0.254413***	AGE	-0.013002***
AGE older than 64	-0.450832***		
Size and structure of a household			
Single	-0.257119***		
Number of Workers 4 and more	0.461828*		
Number of Children/Number of Workers	0.279724***		
Marital status			
Unofficial marriage	0.398094**		
Income			
Quintile №2 and №3	-0.217493***	Quintile №2	-0.372676**
Subjective income: food and clothing + durable goods	-0.386082***	Earnings	1.78E-10**
Health			
No chronic disease	-0.276897***		
Do not read information about products	0.192503**	Do not read information about products	0.193875*
Education			
Incomplete secondary education	0.385743***	Secondary education	-0.373738***
Higher education	0.280093***		
Status and type of employment			
Individual is not employed and do not look for work	-0.714446**		
Laboring pensioner	0.372095*		
Entrepreneur	0.483622*	Entrepreneur	0.457791**
Employee (technical and service staff)	0.259021**		
Sector: agriculture	-0.534605**		
Sector: trade, repairs	-0.303925***		
Place of residence			
		City (neither Moscow nor St. Petersburg)	-0.203524*
		North Caucasus Federal District	0.385171***
Constant	9.873695***	Constant	10.26983***

* coefficient is significant at a 0.1 level of significance.

** coefficient is significant at a 0.05 level of significance

*** coefficient is significant at a 0.01 level of significance

Based on the estimation results presented in table 2, we can conclude whether the hypotheses tested are correct. Key findings on the hypotheses are given below.

Hypothesis №1. Estimations of econometric models confirm that gender does have a significant impact on the individual discount rate. According to estimation results, men have higher individual discount rates than women in Russia on average. Despite the fact that models constructed for men and women differ, the main trends of individual intertemporal choice are similar.

Hypothesis №2. Our hypothesis that the individual discount rate decreases with age is entirely proven true for men. We have determined that male respondents have individual discount rates that decrease linearly with age. It is important to note that the lower age boundary in this study is 15 years; individuals below this age were not surveyed. All things being equal, the individual discount rate for female respondents in the under-35 age group is higher than for other age groups. We reveal lower individual discount rates for women in the over-65 age group than for other female respondents. For women of the age from 35 to 65 years there is no statistically significant relationship between age and the individual discount rate.

Hypothesis №3. The hypothesis that the individual discount rate decreases as income increases is confirmed only partially. In the given research we discover that the dependence of the individual discount rate on income is U-shaped for both men and women.

When analyzing the influence of income level on time preferences for women, it is better to use ordinal characteristics of income. These characteristics are quintile groups and subjective evaluations of income. In our research we find that the individual discount rate is lower for the second and third quintiles relative to other quintiles. Furthermore, the individual discount rate is lower for female respondents who have enough money to buy food, clothing, and durable goods. Our results suggest that “poor” respondents, who have money only for food, and “rich” respondents, who can afford expensive purchases, have higher individual discount rates relative to the average income group. High individual discount rates for “poor” respondents are explained by the fact that they suffer from severe money shortages. These respondents can hardly refuse receiving utility from consumption at the present moment. High individual discount rates for “rich” respondents can be explained by the supposition that the prize of 10,000 rubles is insignificant for them. The unimportance of the prize leads to a high discount rate.

Individual discount rates for male respondents increase with income. However, individual discount rates are lower for the second quintile related to the first quintile. Thus, the dependence of individual time preferences for men based on the level of their income has a U-shaped form. Though it is worth noting that the U-shaped form is more symmetric for women than for men.

Hypothesis №4. Our hypothesis that the individual discount rate decreases as an individual's education level increases is not confirmed in this research. For women, the dependence of the individual discount rate on the education level is U-shaped. More precisely, women with a low education level (incomplete secondary education) and women with a higher education level have higher individual discount rates than other female respondents. We see that the effect of incomplete secondary education is more significant than the effect of higher education.

Therefore, women with a secondary education have lower individual discount rates than other groups. A similar effect occurs for men. The only difference is that the effect of higher education and the effect of an incomplete secondary education are the same for men. It should be noted that the coefficients of the relevant explanatory variables in the models for men and women are almost identical.

Hypothesis №5. The hypothesis about the inverse relationship between the individual discount rate and the state of one's health is confirmed. Among the determinants that characterize the state of health of an individual there is only one significant variable – that of chronic diseases. This variable has a significant effect on the individual discount rate only for women. Women without chronic diseases have lower individual discount rates than other female respondents.

The questionnaire used in the given study includes a question that characterizes an individual's attitude towards health and healthy food: "Do you read the information about a product's composition that is provided on its packaging when buying groceries in the store?" It is interesting that both men and women who do not read information about a product's composition have higher individual discount rates than other groups. The coefficients in the models for men and women are equal. Overstated individual discount rates for these respondents are explained by a greater tendency towards risky behavior.

Hypothesis №6. The size and structure of a household have a significant impact on the individual discount rate. However, this conclusion is correct only for women. For example, single women have a lower rate of time preferences than other women. Perhaps single women consider the suggested amount of the prize as a substantial one and agree to delay it for a year.

Estimation results show that respondents who live in a household with a number of workers higher than three persons have higher individual discount rates than other respondents. Respondents who live in a household with more than three workers probably have a higher income than others. They do not regard the amount by which the prize has to be increased as an essential one and do not agree to delay it for a year. In addition, the individual discount rate

increases as the number of children as a ratio of the total number of working members in a household increases.

Hypothesis №7. The results of our study suggest that the marital status of men does not influence their individual time preferences. Considering marital status, we observe an interesting effect for women: Women who live in an unregistered marriage have higher individual discount rates than other female respondents, which can be explained by the fact that women regard an unregistered marriage as a vulnerable position associated with high risks. Consequently, these respondents should have higher discount rates than others.

Hypothesis №8. Testing our hypothesis regarding the impact of an individual's activity on his or her rate of time preferences shows that entrepreneurs have higher individual discount rates than other respondents. This conclusion is correct for both men and women, and the coefficients of relevant dummy variables are virtually equal. In this case, we should interpret this finding with caution since the number of entrepreneurs in the sample is indeed small. It is the only characteristic of employment status that has an impact on the individual discount rate for men. An initial inclination for risk-taking explains the high individual discount rate for entrepreneurs.

For women, a status of “economically inactive” has a downward effect on the individual discount rate. We observe this same effect with women who work in such sectors as agriculture, trade, and repairs. The amount of 2,000 rubles in one year is probably important for these individuals, and they are willing to delay receiving it.

In contrast, employees and working pensioners have relatively high individual discount rates. Most likely, the relatively high level of income for these respondents generates heightened expectations of receiving a deserved reward for delaying the utility from consumption.

Hypothesis №9. According to the estimation results, one's region of residence has a significant impact on individual time preferences for men only. Table 2 shows that respondents who do not live in capitals have lower individual discount rates than other respondents. In addition, respondents from the North Caucasus Federal District have higher rates of time preferences than others. The significance of the constructed models confirms the need for further study of the individual time preferences in a regional context.

Thus, the results of estimating models allow us to conclude that most of the hypotheses set forward in this research are correct for Russia. All these important conclusions regarding the determinants of individual time preferences and individual propensity to risky behavior can be used to form a set of effective measures for social policy that targets different groups of the Russian population.

4. Application of the individual discount rate in social policy

The derived values for individual discount rates enable one to develop social policy measures for various target groups in Russia. Overall, we formulate the following principles of choice for social policies based on the value of individual discount rates for one target group or another:

1. If the target group has higher individual time preferences than other individuals, this indicates the propensity of this target group to risky behavior and the unwillingness to bear present costs in order to receive future benefits. Social policy measures for such groups should be based on selection of non-monetary incentives since the significance of the proposed sums for them is lower than for other individuals. According to the results of our research, an example of such target groups is entrepreneurs. With limited budget resources, it is necessary to shift the emphasis from providing higher compensation for delayed utility towards increasing future benefits in the opinion of these individuals. In that case they will start to appreciate expected benefits more than now and will be willing to wait for them.

2. For population groups with relatively high individual rates, it is appropriate to use restrictive or prohibited measures along with non-monetary incentives. For example, it may be the time limit of alcohol sales and the prohibition of smoking in public areas. In general, the higher the individual rate of time preferences the lower the probability that this individual will demonstrate wise health behavior. For these population groups, the implementation of restrictive measures may be more efficient than monetary incentives.

3. When the target group has relatively low individual discount rates, we should select social policy measures with a maximum emphasis on risks for unhealthy behavior in the present moment. This is due to the fact that individuals with low rates of time preferences are averse to risk. They are willing to wait for the benefits of the government programs. Our analysis of individual time preference determinants in Russia allows us to mention the group of respondents who are most concerned about healthy nutrition. According to our research, elderly people, as well as non-working women and those women who are not looking for work are more willing to wait for the benefits of social policy than other groups. For such groups, long-term social programs aimed at creating distant benefits can be implemented. A high importance of the expected future benefits determines the possibility of the effective use of monetary incentives in social policy.

Thus, derived values of individual discount rates for different population groups and determinants of individual time preferences enable governments to strengthen the targeting of social policy in Russia and to achieve budgetary savings. In addition to the conclusions presented

in various research papers on the problem under consideration, we have obtained the following new results:

- For the first time an extensive study of individual time preferences on Russian data have been conducted and the determinants of individual discount rates have been defined. Significant factors of individual intertemporal preferences in Russia are the age of an individual, the size and structure of a household, marital status, income level and educational level of an individual, type of employment, and region of residence. Our study confirms that the time preferences of men and women should be analyzed separately in Russia. It is interesting to note that the confirmation of a majority of the hypotheses in our research allows us to make assumptions regarding the similarity of trends in the formation of individual time preferences in Russia and in other countries. However, this assumption should be supported by careful juxtapositions.
- Suggestions on the principles of selecting social policy measures have been made. The basis of our recommendations is the values of individual discount rates for different population groups that may be the target for a particular program.
- It is determined that the region in which an individual resides has a significant impact on time preferences in Russia. The hypothesis on importance of a region of residence has not been tested until now in foreign and Russian studies. Thus, our research can be continued by a detailed analysis of individual time preferences in Russia's regions. An investigation of regional differences can help to strengthen the targeting of social policy not only in the country as a whole, but also in particular regions.

References

1. Angeletos, G.-M., Laibson, D., Repetto, A., Tobacman, J., & Weinberg, S. The hyperbolic consumption model: Calibration, simulation, and empirical evaluation // *Journal of Economic Perspectives*, 15(3), 2001, pp. 47-68.
2. Becker G., Mulligan C. The endogenous determination of time preference // *Quarterly Journal of Economics* 112(3), 1997, pp. 729–758.
3. Benzion U., Rapoport A., Yagil J. Discount Rates Inferred from Decisions: An Experimental Study // *Management Science* 35, 1989, pp. 270–284.
4. Botelho A., Harrison, G.W., Pinto, L.M.C., Rutström, E.E. and Veiga, P. Discounting in Developing Countries: Experimental Evidence from Timor-Leste. Faculty Working Paper No. 31. Economics Department, University of Central Florida. Orlando, FL., 2006.
5. Bradford W.D., Zoller J., Silvestri G.A. Estimating the Effect of Individual Time Preferences on the Use of Disease Screening // *Southern Economic Journal* 76(4), 2010. - pp. 1005–1031.
6. Cairns J., van der Pol M. Valuing future private and social benefits: the discounted utility model versus hyperbolic discounting models // *Journal of Economic Psychology* 21, 2000. – pp. 191–205
7. Castillo M., Paul J. Ferraro b, Jeffrey L. Jordan c, Ragan Petrie. The today and tomorrow of kids: Time preferences and educational outcomes of children // *Journal of Public Economics* 95, 2011. - pp. 1377–1385.
8. Chapman GB, Elstein AS. Valuing the future: temporal discounting of health and money // *Medical Decision Making* 15, 1995, pp. 86-373.
9. Chapman GB. Preferences for improving and declining sequences of health outcomes // *Journal of Behavioral Decision Making* 13, 2000, pp. 203–218.
10. Chesson H.W., Leichliter J.S., Zimet G.D., Rosenthal S.L., Bernstein D.I., Fife K.H. Discount rates and risky sexual behaviors among teenagers and young adults // *Journal of Risk and Uncertainty* 32(3), 2006. – pp. 217-230.
11. Coller M., Williams M. Eliciting individual discount rates // *Experimental Economics* 1999, 2(2), pp. 27-107.
12. Cropper, M.L., Aydede, S.K. and Portney, P.R. (1992). Rates of Time Preference for Saving Lives // *American Economic Review* 82(2), 1992. – pp. 469-72.
13. Dioikitopoulos E. V., Kalyvitis S. Endogenous Time Preference and Public Policy: Growth and Fiscal Implications, 2009.
14. Dolan P, Gudex C. Time preference, duration and health state valuations // *Health Economics* 4, 1995, pp. 289–299.

15. Frederick S., Loewenstein G., O'Donoghue T. Time Discounting and Time Preference: A Critical Review // *Journal of Economic Literature*, Vol. XL, 2002, pp. 351-401.
16. Fuchs V. R. Time preference and health: An exploratory study. In V. R. Fuchs (Ed.), *Economic Aspects of Health* (pp. 93-120). University of Chicago Press for the NBER, 1982.
17. Fuchs V. Time preference and health: an exploratory study. In Culyer, A. J. (ed.) *The Economics of Health*, Vol. I. Edward Elgar Publishing, Great Yarmouth, 1991, pp. 93–150.
18. Gafni A. Time in health: can we measure individuals' pure time preferences? // *Medical Decision Making* 15, 1995. – pp. 31–37.
19. Grignon M. An empirical investigation of heterogeneity in time preferences and smoking behaviors // *The Journal of Socio-Economics* 38, 2009. – pp. 739–751.
20. Harrison G.W, Lau M.I, Williams M.B. Estimating individual discount rates in Denmark: A Field Experiment // *The American Economic Review* 92, 2002.
21. Harrison G.W., Lau M.I., Rutström E. Individual Discount Rates and Smoking: Evidence from a Field Experiment in Denmark. *Newcastle Discussion Papers in Economics*: ISSN 1361 – 1837, No. 3, 2009.
22. Holcomb J.H., Nelson P.S. Another Experimental Look at Individual Time Preference // *Rationality and Society* 4, 1992, pp.199–220.
23. Holden, S.T., Shiferaw, B., Wik, M. Poverty, market imperfections and time preferences: of relevance for environmental policy? // *Environment and Development Economics* 3(1), 1998. – pp. 105-130.
24. Kahneman D., Tversky A. Prospect theory: an analysis of decision under risk // *Econometrica* 47, 1979, pp. 263-91.
25. Khwaja A., Silverman D., Sloan F. Time Preference, Time Discounting, and Smoking Decisions // *Journal of Health Economics* 26, 2007, 927–49.
26. Kirby K., Marakovic N. Modeling Myopic Decisions: Evidence for Hyperbolic Delay-Discounting with Subjects and Amounts // *Org. Behav. Human Decision Proc.* 64, 1995. – pp. 22-30.
27. Komlos J., Smith P.K., Bogin B. Obesity and the rate of time preference: Is there a connection? // *Journal of Biosocial Science* 36, 2004, pp. 209-219.
28. Kossova T., Sheluntcova M. Towards a social discount rate in Russia: methodology and regional differences // *Proceedings of the Finance and Economics Conference 2012*. Munich: The Lupcon Center for Business Research, 2012, pp. 194-199.
29. Kovacs K.F., Larson D.M. Identifying Individual Discount Rates and Valuing Public Open Space with Stated-Preference Models // *Land Economics*, 84 (2), 2008. – pp. 209-224.

30. Lahava E., Benziona U., Shavitb T. Subjective time discount rates among teenagers and adults: Evidence from Israel // *The Journal of Socio-Economics* 39, 2010, pp. 458–465.
31. Lawrance E. Poverty and the rate of time preference: evidence from panel data // *Journal of Political Economy* 99(1), 1991, pp. 54–77.
32. Madden G, Bickel WK, Jacobs EA. Discounting of delayed rewards in opioid-dependent outpatients: exponential or hyperbolic discounting function? // *Experimental Clinical Psychopharmacology* 7, 1999, pp. 93-284.
33. Maital S., Maital, S. Time preference, delay and gratification and the intergenerational transmission of economic inequality: a behavioral theory in income distribution In Ashenfeltar, O. & Oates, W. (eds) *Essays in Labor Market Analysis in Memory of Yochanan Peter Comay*. Wiley Publishing, New York, 1997. - pp. 179–200.
34. Mischel, W., Shoda, Y., Rodriguez, M.L. Delay of Gratification in Children *Science* 244 (4907), 1989. – pp. 933–938.
35. Mishin S.I. Intertemporal Preferences in Decision-making: An Experimental Test in Russia // *HSE Economic Journal*, volume 16, №3, 2012, pp. 404 – 426.
36. Poulos C, Whittington D. Time preferences for life-saving programs: evidence from six less developed countries // *Environmental Science and Technology* 34(8), 1999. – pp. 1445-1455.
37. Redelmeier D.A., Heller D.N. Time preference in medical decision making and cost-effectiveness analysis // *Medical Decision Making* 13(3), 1993. – pp. 212–217.
38. Samuelson P. A Note on Measurement of Utility // *Review of Economic Studies*, 1937. – pp. 61-155.
39. Scharff R.L., Viscusi W.K. Heterogeneous rates of time preference and the decision to smoke // *Economic Inquiry* Vol. 49, No. 4, 2011, pp. 959–972.
40. Shelley M.K. Outcome Signs, Question Frames and Discount Rates // *Management Science* 39, 1993, pp. 806–815.
41. Tasset A, Nguyen VH, Wood S, Amazian K. Discounting: technical issues in economic evaluation of vaccination // *Vaccine* 17, 1999. – pp. 75–S80.
42. Thaler R.H. Some Empirical Evidence on Dynamic Inconsistency // *Economics Letters* 8, 1981, pp. 201–207.
43. Van der Pol M., Cairns J. Individual Time Preferences for Own Health: Application of a Dichotomous Choice Question with Follow Up // *Applied Economic Letters* 6:10, 1999. – pp. 54-649.
44. Ventura L. Direct Measures of Time Preference // *Economic and Social Review* 34(3), 2003. – pp. 293-310.

45. West R. W. The rate of time preference of families in the Seattle and Denver income maintenance experiment. Research Memorandum 51, SRI International, 1978.
46. Atmadja S. Discount Rate Estimation and the Role of Time Preference in Rural Household Behavior: Disease Prevention in India and Forest Management in the US, 2008. URL: http://gateway.proquest.com/openurl%3furl_ver=Z39.88-2004%26res_dat=xri:pqdiss%26rft_val_fmt=info:ofi/fmt:kev:mtx:dissertation%26rft_dat=xri:pqdiss:3329210
47. Bradford W.D. The Association between Individual Time Preferences and Health Maintenance Habits. Medical Decision Making, 2010. URL: <http://mdm.sagepub.com/content/30/1/99>
48. Fuchs V.R. Time Preference and Health: An Exploratory Study, University of Chicago Press, 1982, pp. 93-120. URL: <http://www.nber.org/chapters/c6546>

Appendix 1

Empirical estimates of individual discount rates*

Authors	Year	Time period	Annual discount rate
Gilman	1976	undefined	< 20%
Maital S. & Maital S.	1978	1 year	70%
Hausman	1979	undefined	5% - 89%
Gateley	1980	undefined	45% - 300%
Thaler	1981	from 3 months to 10 years	7% - 345%
Cylke et al	1982	undefined	15% - 18%
Ainslie & Haendel	1983	undefined	96000% - ∞
Houston	1983	1 - 20 years	22.5%
Black	1984	undefined	10.3% - 12.5%
Ruderman et al	1986	undefined	17% - 243%
Loewenstein	1987	0 - 10 years	-6% - 212%
Moore & Viscusi	1988	undefined	10% - 12%
Benzion et al	1989	from 6 months to 4 years	7.5% - 60%
Viscusi & Moore	1989	undefined	11,7%
Moore & Viscusi	1990a	undefined	2%
Moore & Viscusi	1990b	undefined	1% - 14%
Lawrance	1991	undefined	12% - 19%
Cropper	1992	5 - 100 years	31%
Shelley	1993	from 6 months to 4 years	8% - 27%
Redelmeier & Heller	1993	from 1 day to 10 years	0%
Cairns	1994	5 - 20 years	14% - 25%
Shelley	1994	from 6 months to 2 years	4% - 22%
Groenland & Nyhus	1994	1 year	3.7%
Chapman & Elstein	1995	from 6 months to 12 years	11% - 263%
Dolan & Gudex	1995	from 1 month to 10 years	0%
Dreyfus & Viscusi	1995	undefined	11% - 17%
Kirby & Marakovic	1995	3 - 29 days	3678% - ∞
Chapman	1996	1 - 12 years	From a negative value to 300%
Kirby & Marakovic	1996	0 - 70 days	500% - 1500%
Pender	1996	from 7 months to 2 years	26% - 91%
Wahlund & Gunnarson	1996	from 1 month to 1 year	18% - 158%
Agee & Crocker	1996	undefined	4.7%
Cairns & van der Pol	1997	2 - 19 years	13% - 31%
Green, Myerson & McFadden	1997	from 3 months to 20 years	6% - 111%
Johannesson & Johannesson	1997	6 - 57 years	0% - 3%

Kirby	1997	from 1 day to 1 month	159% - 5747%
Madden et al	1997	from 1 week to 25 years	8% - ∞
Chapman & Winqvist	1998	3 months	426% - 2189%
Holden, Shiferay & Wik	1998	1 год	28% - 147%
Enemark	1998	undefined	5.3% - 19.4%
Holden et al (Indonesia)	1998	1 год	93%
Holden et al (Ethiopia)	1998	1 год	104% - 116%
Holden et al (Zambia)	1998	1 год	53%
Chapman, Nelson & Hier	1999	1 - 6 months	13% - 19000%
Coller & Williams	1999	1 - 3 months	15% - 25%
Kirby, Petry & Bickel	1999	7 - 186 days	50% - 55700%
Van der Pol & Cairns	1999	5 - 13 years	7.3%
Poulos, Whittington (Ethiopia)	1999	2 – 10 years	28% - 49%
Poulos, Whittington (Mozambique)	1999	2 – 10 years	15% - 46%
Poulos, Whittington (Uganda)	1999	2 years	46%
Poulos, Whittington (Indonesia)	1999	2 – 5 years	45% - 57%
Poulos, Whittington (Ukraine)	1999	2 years	206%
Poulos, Whittington (Bulgaria)	1999	2 – 5 years	38% - 45%
Chesson & Viscusi	2000	1 – 25 years	11%
Prestemon & Wear	2000	undefined	2% - 18%
Ganiats et al	2000	from 6 months to 20 years	From a negative value to 116%
Hesketh	2000	from 6 months to 4 years	4% - 36%
Van der Pol & Cairns	2001	2 – 15 years	6% - 9%
Warner & Pleeter	2001	0 – 22 years	0% - 71%
Harrison, Lau & Williams	2002	1 – 37 months	28%
Kirby et al	2002	7 – 157 days	4380% - 5110%
Curtis	2002	8 years	30% - 40%
Johnson	2002	undefined	3.39%
Ventura	2003	1 – 2 years	10,6%
Frederick	2003	25 – 100 years	0 – 3.8%
Kirby & Santiesteban	2003	undefined	548%
Anderson et al	2004	from 1 day to 1 year	0.6% - 67%
Kirby & Petry	2004	from 1 week to 6 months	475% - 3030%
Shapiro	2005	1 – 30 days	335%
Botelho et al	2006	1 – 25 months	12.7%
Andersen et al	2006	1 – 7 months	14.3%
Kovacs and Larson	2008	undefined	approximately 30%
Harrison, Lau & Rutström	2009	0 – 3 years	9.2% - 72.8%
Bradford	2010	undefined	24%
Bradford, Zoller J. & Silvestri G.	2010	undefined	25.1%
Castillo M. et al	2011	undefined	20% - 140%
Scharff & Viscusi	2011	undefined	8.1% - 13.8%

* The following sources from the bibliography were used for constructing the table: [5], [7], [15], [20], [21], [29], [39], [43], [44], [46], [47].

Appendix 2

Questionnaire for identification of individual time preference determinants

1. *What is your gender?*
2. *How old are you? (Age of respondents is 15 years and older)*
3. *What is your education?*
 - 1 primary education or less (not completed 7-9 years)
 - 2 incomplete secondary / basic secondary education (graduated from incomplete school: 7-9 years)
 - 3 complete secondary education (graduated from school, lyceum, gymnasium: 10-11 years)
 - 4 vocational technical training / primary vocational based on incomplete secondary education
 - 5 vocational technical training / primary vocational based on complete secondary education
 - 6 specialized secondary / secondary vocational education (graduated from technical school, college with a specialized secondary / secondary vocational education)
 - 7 incomplete higher education, higher education (graduated from one higher education institution: institute, university, academy)
 - 8 post-graduate education, second higher education including another institution, business-school
4. *What is your health?*
 - 1 very good health
 - 2 good health
 - 3 middle health
 - 4 poor health
 - 5 very poor health
 - 6 it is difficult to answer
5. *What is your weight in kilograms?*
6. *What is your height in centimeters?*
7. *Do you know what your blood cholesterol level is?*
8. *Can you say that you take regular medical examinations irrespective of the way you feel?*
9. *Can you say that you maintain a healthy lifestyle?*
10. *Do you have any chronic diseases? If so, which diseases?*
11. *Are you in a disability group? If so, which group (first, second, third)?*
12. *Do you take any prescription drugs regularly? Please, take into account courses of medical treatment with breaks.*
13. *Do you read the information about a product's composition included on its packaging when buying groceries in the store?*

- 14.** *What is your marital status?*
- 15.** *How many people are in your family? Please, take into account all people who live with you and have a common household, including yourself, your husband / wife, all you children, and temporarily absent persons.*
- 16.** *How many children under 15 years live with you in your family (including those who are temporarily absent)?*
- 17.** *How many people currently work in your family?*
- 18.** *Do you currently work? If so, what terms of a contract do you have in your main job?*
- 1 do not work
 - 2 employed on a permanent job (have a contract for an indefinite period)
 - 3 employed by contract for a certain period or for a certain job
 - 4 employed on the basis of a verbal agreement (without official registration)
 - 5 work on your own business or farm; engaged in business with employees. Please, do not take into account members of your family who work without salary
 - 6 self-employed, private entrepreneurship without employees
 - 7 am in active military service (in the bodies of internal affairs or in the security service) or am a professional soldier
 - 8 other _____
- 19.** *Do you only work, or do you combine your work with studies? Are you a working pensioner?*
- 20.** *What was the size of your salary (income from main work) gained in the last month, including bonuses, holiday pay, and other payments (after taxes)? Please, convert income earned in a foreign currency into rubles at the current exchange rate.*
- 21.** *Which group of employees do you belong to at your main place of work?*
- 1 administrator, chief expert, including administrators and chief experts in agriculture enterprises
 - 2 head of a structural division of an organization/department/laboratory, including managers of departments at agricultural enterprises.
 - 3 specialist (position requires a higher education or a specialized secondary education, including the officers)
 - 4 employee from the technical and service staff
 - 5 qualified worker (excluding agriculture)
 - 6 qualified worker in agriculture
 - 7 unskilled worker (excluding agriculture)
 - 8 unskilled worker in agriculture
 - 9 soldier in the army, a police officer, traffic police, an officer in the security service

10 other group _____

22. *What type of enterprises are you employed in (considering your main job)?*

- 1 government agency, administration, a military unit (budget organization)
- 2 government unitary enterprise, municipal enterprise
- 3 private enterprise: public corporation, closed joint-stock company, limited liability company, individual enterprise
- 4 cooperative, entrepreneur without a legal entity
- 5 public organization or nonprofit institution
- 6 other _____

23. *What type of economic activity does the enterprise of your main job relate to? If you are self-employed, what type of economic activity are you involved in?*

24. *What is your main occupation?*

- 1 studying in school
- 2 studying at a university or attending a college, technical secondary school, etc., full-time.
- 3 retired or long-service pension
- 4 disability pension
- 5 housekeeping
- 6 on maternity leave / in child care leave
- 7 unemployed, do not work but am looking for a job
- 8 do not work and am not looking for a job
- 9 other _____

25. *Have you had any work in the last month (besides your main job) that has brought you extra income?*

26. *Please calculate the last month's total income of all your family members who live with you. Convert income earned in a foreign currency into rubles at the current exchange rate.*

27. *In which of the following groups could you most likely classify yourself?*

- 1 we can hardly make ends meet, we don't have enough money even for food
- 2 we have enough money for food, but buying clothes is a serious problem for us
- 3 we have enough money for food and clothes, but buying durables (a TV set, a refrigerator) is a problem for us
- 4 we can easily buy durables, but it is difficult to purchase really expensive items
- 5 we can buy really expensive items: an apartment, a cottage, and many others

Appendix 3

Summary table of estimation results for models 1-3

This summary table presents signs of the coefficients for the explanatory variables. For comparability of results, the table shows the overall impact of the variables. For example, the negative effect of age on the value of the individual discount rate is the general conclusion, although the variable “age” could be included as a discrete value in one model and as a set of dummy variables for age groups in another model.

In each model, a positive sign of the coefficient indicates an unwillingness to wait or, respectively, an increase in the individual discount rate with an increase of the relevant variable.

The symbol \cap is used to indicate dependence when initially the individual discount rate increases with the increase of an explanatory variable and, after that, the individual discount rate starts to decrease. The symbol \cup reflects a situation when the individual discount rate initially decreases with the increase of an explanatory variable and then later starts to increase. In addition, it is important to note that the higher the values of variables for health and education, the better the health and education an individual has.

Models for men

Variable	Model 1. (would not wait under any conditions)	Model 1.2 (prefer 10,000 now to 12,000 one year later)	Model 2 (the sum of the prize is the ordinal variable)	Model 3 (logarithm of the prize – truncated sample)
Age	+	\cap	-	-
Children			+	
Income	-	-	\cup	\cup
Good health			-	
Do not read information about products			+	+
Education			+	\cup
Do not work			+	
Entrepreneur			+	+
Medium and small cities		-	-	-
Large cities (not capitals)			-	-
North Caucasus Federal District				+
Volga Federal District		-		

Models for women

Variable	Model 1. (would not wait under any conditions)	Model 1.2 (prefer 10,000 now to 12,000 one year later)	Model 2 (the sum of the prize is the ordinal variable)	Model 3 (logarithm of the prize – truncated sample)
Age	+	U	–	–
Size of a household			+	+
Children		+	+	+
<i>Marital status</i>				
Married	–			
Unofficial marriage			+	+
Income	∩	–	U	U
<i>Health</i>				
Good health	–			–
Has no chronic disease			–	–
Do not read information about products			+	+
Education	–	–	U	U
<i>Status and type of employment</i>				
Do not work		–	–	–
Employee (technical and service staff)			+	+
Entrepreneur	–		+	+
Agriculture and trade			–	–
<i>Place of residence</i>				
Medium and small cities	+			
North Caucasus Federal District		–		
Volga Federal District		–		
Far Eastern Federal District	–			

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