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EXIT OF SENIOR AGE COHORTS FROM THE RUSSIAN LABOUR MARKET: A SURVIVAL ANALYSIS APPROACH[2]

Abstract. The paper examines individual exit trajectories of Russians from the labour market to economic inactivity using survival analysis methods based on the Russian Longitudinal Monitoring Survey for 1995–2015. The analysis shows that the statutory retirement age (55 for women and 60 for men) has a significant impact on the time of exit from the labour market for both sexes, but the effect is significantly higher for women, and the differences are statistically significant: the hazard rate of exit to inactivity rises by 63 percentage points when a woman reaches 55 years of age, but by only 25 percentage points when a man reaches 60. Russia shows some differences in occupational patterns of exit to pension-age inactivity: unlike many developed countries, only highly skilled staff remain in the labour market longer than others, while there is no statistically significant difference between the behaviour of middle-skilled staff and of skilled and unskilled workers. Self-employment and entrepreneurship postpone exit to inactivity as does employment at state enterprises.

1. Introduction

The ageing of the Russian population and decelerating economic growth have focused attention on the question of how to balance Russia's state pension fund, and this has added urgency to discussions of the need to raise the retirement age (see, for instance, Maleva and Sinyavskaya, 2010; Nazarov, Dormidontova and

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Lyashok, 2015). Persistently negative natural population growth means that the working-age population will continue to decline in the foreseeable future. In this context older cohorts are a potentially attractive source of much needed labour. However, little is currently known about the situation of older age groups on the Russian labour market and, in particular, about the process of their exit from the market.

The Russian pension system, unlike those in many developed countries, does not significantly penalize a person who continues to work after reaching retirement age and starting to draw a pension (the only penalty is that working pensioners lose indexation of their pensions). Changes that came into effect in 2015 encourage people to continue working rather than drawing a pension. These points, coupled with the low pension replacement rate (i.e., the proportion of wages, which are substituted by a pension), mean that the decision to leave the labour market is not an easy one, and a large number of people of retirement age remain in paid work. What determines the length of stay of older cohorts on the Russian labour market? What are the determinants of individual exit trajectories to inactivity at pension age? What is the role of the statutory retirement age in this process?

Exit from the labour market to economic inactivity at pension age has been much studied in the international economic literature. The search for statistically significant determinants of the decision to retire dates at least from Gustman and Steinmeier's structural retirement model (Gustman and Steinmeier, 1986), which used American panel data from the Retirement History Survey and was published in *Econometrica*. The key determinants, which have been highlighted by economists, are: financial motives associated with pension scheme options and the specifics of social insurance systems; health considerations; and the tendency for spouses to make joint decisions on the timing of their retirement (see, for example, the review of literature in Hurd, 1990; a study of the financial motives for retirement among US public employees by Asch, Haider and Zissimopoulos, 2005; and a study of health impact by Cai, 2010).

Existing research on Russian data has focused primarily on the factors, which affect the likelihood of remaining in employment/economic activity, using the statistical apparatus of logit and probit models (Nazarov et al., 2014; Klepikova, 2012; Gourvitch and Sonina, 2012). These studies offer some insight into the personal specifics, which make older people more likely to stay in the labour force.

However, the studies carried out to date on Russian data have not paid much attention to the rate of exit of older cohorts from the labour market at various ages, and to the factors which accelerate or slow down departure from the labour market, lengthening or shortening people's working lives. The approach, which is needed in order to answer these questions, is that of survival analysis, which is widely used by international scholars (see, for instance, García-Gómez, Jones

and Rice, 2010, on the impact of health; and Hanel, 2010, on financial motives for retirement), but is all but absent from Russian studies.

The present paper aims to fill this research gap, examining individual exit trajectories of Russians from the labour market to economic inactivity by applying survival analysis to data from the Russian Longitudinal Monitoring Survey (RLMS-HSE). The data cover a period of 21 years, from 1995 to 2015.[1]

The analysis shows that the statutory retirement age (55 for men and 60 for women) has significant impact on the time of exit from the labour market for both men and women, but the effect is greater for women to a degree which is statistically significant: the "hazard rate" of retirement[2] rises by 63 percentage points when a woman reaches 55 years, and by 25 percentage points when a man reaches 60. Self-assessment of health as poor has an effect that is comparable to that of the statutory retirement age for men, but not for women: exit by men to inactivity is accelerated by 71 percentage points, whereas for women this factor is statistically irrelevant. Russia shows some differences in patterns of exit by people in different occupational groups: in Russia, by contrast with many developed countries, only highly skilled staff remain in the labour market for substantially longer than others, while the behaviour of medium-skilled staff, skilled workers and unskilled workers shows no statistically significant differences. The fact of working at a state-owned enterprise slows down exit by women, but is not significant for men. Self-employment and entrepreneurship prolong presence in the labour force (by 41 percentage points for women).

On the one hand, these results match those for developed countries: health status is a key factor for exit by men, and financial consideration have a significant impact. But the peculiarities of the Russian labour market are visible in the differences between occupational groups in respect of labour market exit and in the fact that self-employment and entrepreneurship, and also work at state enterprises, postpone exit. The high sensitivity of women to the statutory retirement age (exceeding that of men by 2.5 times) is a new and unexpected result, particularly when it is remembered that the statutory retirement age for women in Russia is very low by international standards. This puts in doubt the "painlessness" of raising the retirement age for women, if a such a decision is finally taken.

The present paper is structured as follows: section 2 briefly discusses the empirical model and the methodology used in estimations; section 3 describes data and the construction of variables; section 4 presents the results of analysis of the averaged process of exit to economic inactivity in Russia; results of the regression analysis of individual determinants of exit from the labour market are

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[1] We have observations at 19 time points, since no survey was conducted in 1997 and 1999.

[2] The terms "conditional probability of exit" and "intensity of risk" are used in the article as synonyms. Both are new terms for the term "hazard rate"

presented in section 5; conclusions are stated in section 6, followed by a statistical annex.

2. Empirical model and methodology

The academic literature names several groups of factors that determine labour market exit by older age groups to economic inactivity (Hurd 1990; Lumsdaine and Mitchell, 1999; French, 2005; Danielyan, 2016). These factors reflect the ratio of reservation wages to labour market wages, which is also of great importance for decisions by other age groups to enter the labour market. Education, work experience and regional characteristics of the labour market are key determinants of wage levels. Marital status, state of health, the pension replacement rate and household income predetermine the reservation wage.

The decision of senior ages to stay in the labour market differs from that taken by other age groups, since it is a decision to end a working career. The most important determinants of exit to pension-age inactivity are the way the person's career evolved, whether they were employed or were engaged in entrepreneurial activity or self-employment, and to which occupational group they belonged for most of their career. In many developed countries, for example, there is an almost linear dependence between the exit age and occupational group: the more qualified people are, the later they leave the labour market (Rubinstein, Saure, Zoabi, 2016).

Survival or duration analysis, first proposed for use in economic research by Bane and Ellwood (1986) is the methodological basis of our analysis. This approach overcomes the problem of biased estimates when working with episode-duration data, a problem that emerges due to immanent right-censoring (Kiefer, 1988). The central idea of the approach is to evaluate the *conditional* probabilities or risk intensity (hazard functions) of the ending of the episode for closed (completed) episodes, and the survival functions for right-open (unfinished) episodes. The analysis requires longitudinal (panel) data.

In analyzing exit from the labour market to pension-age inactivity, an episode is defined as the entire episode of working life, and the determinants of completion of the episode, i.e. completion of the working career and exit from the labour market, are studied. The analytical time in this case is the age of the respondent. We limit the sample to age 45-72, because there is almost no retirement by reason of age prior to 45 years, and 72 years is the upper boundary of the definition of working age that is internationally accepted by statisticians, including Russian statisticians (Rosstat, 2016).

We evaluate proportional hazard models, which suppose that exogenous economic factors shift the baseline hazard function (reflecting the average hazard rate of completion of the episode at a certain age for the entire sample) proportionally:

$$\lambda(t,x,\beta,\lambda_0) = \varphi(x,\beta)\lambda_0(t),$$

where λ_0 is the baseline hazard rate in which $\varphi(\cdot) = 1$. The $\varphi(\cdot)$ function is assumed exponential $\varphi(x,\beta) = \exp(x'\beta)$, where x is the vector of the explanatory variables, and β is the estimates of coefficients at x. The semi-parametric Cox model specification is selected, based on goodness-of-fit analysis.

The vector of explanatory characteristics includes: education; marital status; the nature of the person's experience in the labour market (work at an enterprise with state participation, entrepreneurship versus work for wages); health (subjective and objective assessment); place of residence; and attainment of statutory retirement age. In all cases, we control for the year of the survey.

3. Data

We use the RLMS-HSE (http://www.cpc.unc.edu/rlms) panel data for 1995–2015. The RLMS-HSE sample is constructed so as to obtain nationally representative data, and the panel component plays a subordinate role. The result is an unbalanced panel, but that does not prevent us from applying the methodology, although panel attrition may result in biased estimates, since the attrition is most probably related to job search[1].

Since exit from the labour market to economic inactivity starts after 45 years, we use the sample of respondents aged between 45 and 72 years. The failure event (the moment of exit from the labour market to pension-age economic inactivity) is defined by the simultaneous fulfillment of three conditions: the respondent does not work, does not look for a job, and receives a retirement pension.

In many cases, exit from the labour market to inactivity by older people may not be final. In this paper we disregard such temporary exits from the labour market, and define our failure event as final exit from the labour market into inactivity. The study of what determines temporary exits and returns of pensioners is a separate and a very interesting task, which is not pursued in the present study. We also exclude from the sample people who drew pensions and did not work or seek work for the entire period of observation, since their decision to end their working life occurred outside the period of observation.

The construction of explanatory variables measuring education, marital status, employment at a state-owned enterprise, entrepreneurship and place of residence is standard and does not differ from that of the variables used in other studies based on the RLMS-HSE (the definitions used are presented in Table A2 in the Annex). Health is measured by the respondent's self-assessment encoded into

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[1] Table A1 in the Annex provides a comparison of the average characteristics of those who were lost from and those who remained in the sample. The analysis shows that those who were lost are younger and live in larger centers, suggesting that change of residence, probably related to job search, is the main cause of disappearance from the sample.

a binary variable of bad state of health (bad and very bad as 1, otherwise 0). We also use information that the respondent has suffered a stroke, heart attack or diabetes. The retirement age variable has the value of 1 when a woman has turned 55 and a man has turned 60.

We use the wage level at the main job before exit from the labour market as a proxy for the pension replacement rate[1]. Non-labour income is proxied by income per household member.

We use the one-digit ISCO-88 coding of professions to help identify the impact of a professional career on the process of exit from the labour market. Groups 1-3 (senior and middle managers, specialists with higher qualifications, and specialists with vocational qualifications) are put together in one group as "highly qualified". Groups 4-6 (office and customer service employees, trade and service workers) are the base category[2]. Groups 7 and 8 constitute the group of "skilled workers" and Group 9 are "unskilled workers".

Table 1 presents summary statistics (means and standard deviations) of the variables used for the total sample (columns 2 and 3), and separately for men (columns 4 and 5) and for women (columns 6 and 7)[3].

In the total sample, 43% are men and 57% are women (it should be remembered that we have limited age to the 45-72 interval). The average age of respondents in our sample is 55 years, and is the same for men and for women. 89% of the men and 59% of the women are married.

A greater share of women qualify their health as bad or very bad (18%, compared to 13% for men). However, only 2% of women report having suffered a heart attack, compared with 4% of men, while 3% of men and 2.5% of women report a stroke (these gender differences are not statistically significant), and 4% of men and 9% of women have been diagnosed with diabetes.

Table 1. Summary statistics, main variables

	Total		Males		Females	
	Mean	**St.Dev.**	**Mean**	**St.Dev.**	**Mean**	**St.Dev.**
Age	55,341	0,028	55,097	0,043	55,523	0,037
Sex: Males - 1, Females - 0	0,427	0,002				

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[1] The severe compression of pensions makes this variable as a good approximation, since discrepancy in the pension amount is significantly less than the discrepancy in wages, and the error caused by not taking into account the amount of the pension received is not very large.

[2] Group 6 (skilled workers in agriculture, forestry and aquaculture) is barely represented in the data.

[3] The means for the total sample and separately for men and women are defined across 1995-2015. Since some features of employment, income and (less often) education may have changed during the period, such averaging of indicators across respondents and years does not necessarily give a total of 100%, which would have been obtained within each year.

End of table 1

	Total		Males		Females	
	Mean	**St.Dev.**	**Mean**	**St.Dev.**	**Mean**	**St.Dev.**
Marital status: Married	0,714	0,002	0,886	0,002	0,586	0,003
Health						
Self assessed health: poor and very poor	0,159	0,001	0,133	0,002	0,178	0,002
Diagnosed heart attack	0,030	0,001	0,044	0,001	0,020	0,001
Diagnosed stroke	0,026	0,001	0,028	0,001	0,024	0,001
Diagnosed diabetus	0,069	0,001	0,037	0,001	0,093	0,001
Education						
Below secondary school	0,167	0,001	0,205	0,002	0,139	0,002
Secondary school	0,172	0,001	0,186	0,002	0,162	0,002
Junior professional	0,161	0,001	0,203	0,002	0,130	0,002
Secondary professional	0,253	0,002	0,180	0,002	0,307	0,002
Higher professional and above	0,246	0,002	0,226	0,002	0,262	0,002
Labour Market						
Employed at state enterprise	0,343	0,002	0,321	0,003	0,360	0,002
Entrepreneur or self-employed	0,016	0,000	0,019	0,001	0,014	0,001
Occupational groups						
High skilled (ISCO 1-3)	0,245	0,002	0,177	0,002	0,296	0,002
Mid-skilled (ISCO 4-5)	0,125	0,001	0,085	0,002	0,154	0,002
Skilled workers (ISCO 7-8)	0,180	0,001	0,347	0,003	0,055	0,001
Unskilled workers (ISCO 9)	0,055	0,001	0,031	0,001	0,074	0,001
Settlement type						
Regional center	0,402	0,002	0,384	0,003	0,415	0,003
Large city	0,264	0,002	0,260	0,003	0,266	0,002
Small town	0,070	0,001	0,069	0,002	0,071	0,001
Rural	0,264	0,002	0,287	0,003	0,247	0,002
Income						
Logarithm income from the main job	8,037	0,010	7,983	0,017	8,077	0,013
Logarithm per capita household income	8,112	0,003	8,090	0,005	8,129	0,004

Source: Author's calculations based on RLMS-HSE 1995-2015 data

Our data confirm that women have higher levels of education than men: the shares of women with higher and secondary professional education are 26% and 31%, compared with 23% and 18% for men[1].

About a third of the sample (32% of men and 36% of women) are employed at enterprises and organizations where the state is the owner or co-owner. About 2% of men and 1.5% of women (the differences in averages are statistically significant) describe entrepreneurship or self-employment as their main activity.

There are also statistically significant differences between men and women in the sample as regards occupational groups. Nearly 30% of the working women are in highly qualified jobs, while 16% are in medium-level occupations, 6% are skilled workers and 7.5% are unskilled workers. By contrast, over a third of the working men (35%) are employed as skilled workers, 18% are managers and specialists with higher and secondary professional qualifications, 8.5% are in medium-level occupations and 3% are unskilled workers.

Women are more likely to live in regional centers (42%, compared with 38% of men), while men are slightly more represented in rural areas (29% compared with 25% of women).

Income at the main place of work is statistically almost identical, but the average income per capita of households for the women in the sample is slightly higher than for the men.

4. Averaged process of labour market exit

Before moving on to regression analysis, it is useful to investigate the dependent variable, represented either as the hazard rate of inactivity at age t or as the conditional probability of remaining in the labour market at age t.

The averaged process of leaving the labour market depending on age can be conveniently described through Kaplan-Mayer's survival function. As can be seen from Table 2 and Figure 1, 25% of Russians in older ages groups leave the labour market by age 60. By the age of 65 some 50% of Russians have left the labour market. At 71, the figure rises to 75%, but nearly 25% remain economically active (employed or seeking work). The process of exit prior to age 55 for women and 60 for men is very slow, after which the rate of exit is nearly even and slows down only after 70 years (Figure 1).

The group of older Russians is heterogeneous as regards the impact of socio-economic factors and preferences on the decision to retire. We reflect these

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[1] Young people in Russia may leave secondary school at age 16 or complete the full secondary school curriculum to age 18 (ages are approximate). Education for young people beyond school divides into junior professional education (training for blue collar jobs), secondary professional education (training for occupations such as nursing and primary school teaching) and higher education (university and equivalent).

differences in our analysis to the extent that they are measurable. Figures 1-5 and Table 2 show average characteristics of labour market exit for the most relevant sub-groups and corresponding confidence intervals. It should be noted that, in the present section, we are dealing with average heterogeneity for one variable at a time, without controlling for the other variables. The results of the comparison when controlling for the remaining observable features are shown below, when the results of regression analysis are discussed.

Men stay in the labour market for longer: 25% of women have left the labour market by the age of 58 years, whereas the 25% level is only attained for men at age 60. The boundary at which 75% of the sample have left the labour market is reached by age 70 for women and 71 for men (Figure 1 and Table 2).
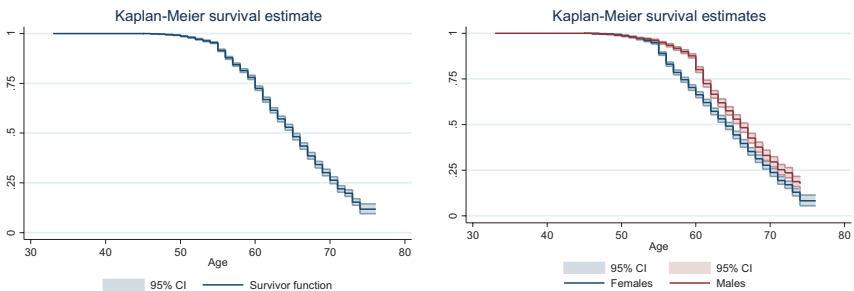

Figure 1. Survival functions: for the sample as a whole (left panel), and separately for men and women (right panel).

Source: Author's calculations based on RLMS-HSE 1995-2015 data

The analysis of differences in labour market exit for people with different levels of education shows that people with higher education remain in the labour market the longest (25%, 50% and 75% retirement levels are reached at ages 62, 68 and 74, respectively). They are followed by those who have less than full secondary education and those who have secondary professional (vocational) education. These two groups are statistically indistinguishable as regards labour market exit (Figure 2 and Table 2).

People with full secondary school or junior professional (vocational) education withdraw from the labour market earliest and earlier than the average for the entire sample: 25% of this group leave the labour market by 59, 50% by 63, and 75% by 69 years of age.

People living in regional centres are slower to withdraw from the labour market than the other three groups (large cities, small towns, rural areas). Those living in rural areas withdraw from the labour market the fastest. The difference between the two groups is significant: in rural areas, 25% of the sample withdraw from the labour market by 58 years, while that level is only reached at age 61 in regional centers; and 75% have left the rural labour markets by 68 years, while
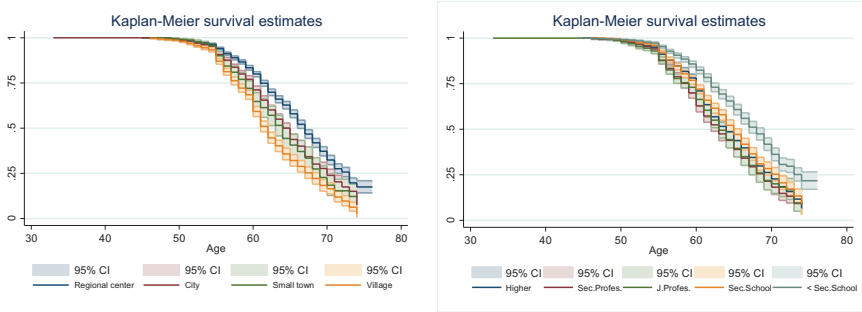
Figure 2. Labour market exit (survival functions): by place of residence (regional center, large city, small town, rural area) and by education group (right panel: less than full secondary education, secondary education, junior professional education, secondary professional education and higher education).

at regional centers that level is reached at 73 years[1]. There is little significant difference between the inhabitants of large cities and small towns, who are intermediate between those living in regional centers and in the countryside (Table 2 and Figure 2). These geographical differences in labour-market exit reflect differences in the jobs that are available in the different types of localities rather than differences between the skills and motivations of residents.

Marital status also influences the exit process, and this effect is asymmetrical: married women leave the labour market earlier, but exit into inactivity for married men is not much different from that for unmarried men (Figure 3). These differences reflect the impact of high opportunity costs for married women.
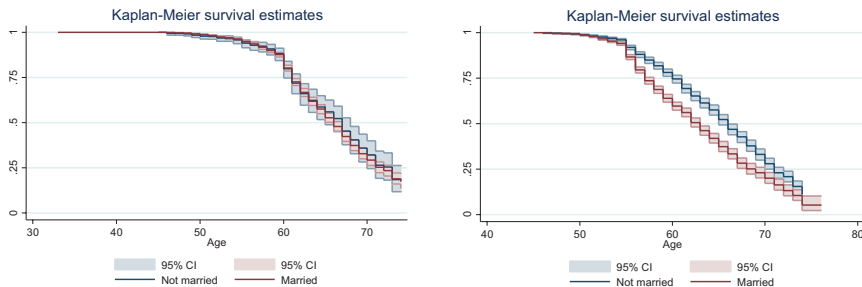
Figure 3. Survival functions by marital status: men (left panel), women (right panel).

Source: Author's calculations based on RLMS-HSE 1995-2015 data

Poor health speeds up exit from the labour market for older people: the respective boundaries are reached at 57, 63 and 70 years, respectively, which

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[1] Kaplan-Meyer's survival functions are estimates that simulate the completion of episodes and are data-tuned. In rare cases, estimates go beyond the age range of the data.

is three years earlier than the average for the sample in each case (Table 2). The impact of health on exit varies considerably between men and women: statistically, differences in exit between men who do and men who do not consider their health to be poor or very bad are large and statistically significant, but the respective differences are small and close to statistical insignificance for women (Figure 4).
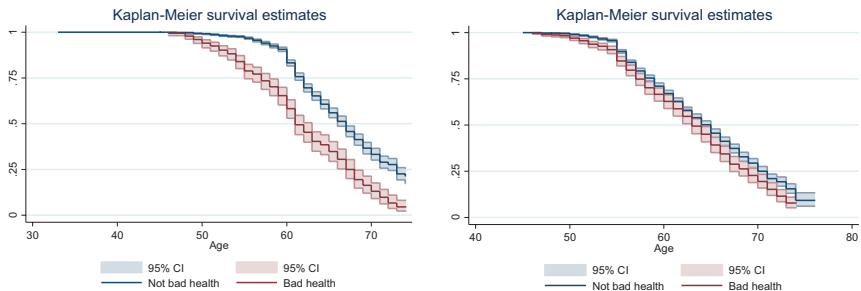
Figure 4. Labour market exit (survival functions) for health reasons: self-assessment of health as bad and as not bad, men (left panel), women (right panel).
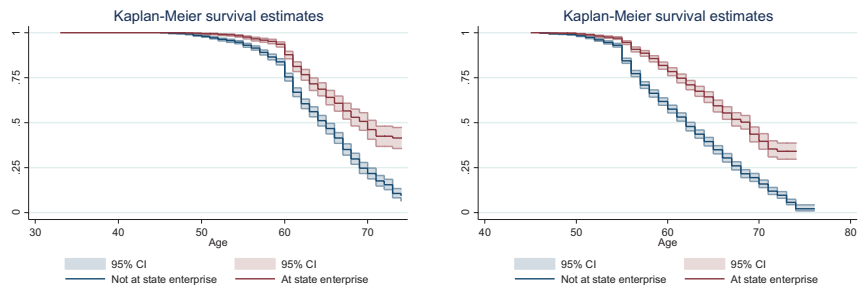
Source: Author's calculations based on RLMS-HSE 1995-2015 data

We can also test the impact of certain specific labour market situations on the exit process. It is found that employment at enterprises with state ownership slows down the exit process for both men and women, and the gap increases with age (Figure 5 and Table 2). The difference for attainment of the 50% boundary is as much as six years. By age 69 only 50% of the sample of older persons employed at enterprises with state ownership have retired, while 75% of those employed at private enterprises have quit the labour market.

Figure 5. Labour market exit (survival functions) for employees at enterprises with state ownership and other employees, men (left panel), women (right panel).

Source: Author's calculations based on RLMS-HSE 1995-2015 data

It is interesting to see how labour market exit is influenced by whether people are employees, on the one hand, or entrepreneurs (self-employed), on the other hand. We identify the latter group based on self-identification as an entrepreneur when answering the question about main occupation. Table 2 shows that entrepreneurs reach the 50% exit boundary at age 69 years, whereas for non-entrepreneurs this occurs at age 65.

Table 2. Average survival time: total sample and by subgroups

	Survival time (years)			Observations (subjects)
	25% of sample	**50%** of sample	**75%** of sample	
Sample mean	60	65	71	12307
Sex				
Females	58	64	70	6711
Males	60	65	71	5596
Education				
Below secondary school	60	64	70	2361
Secondary school	59	63	69	2658
Junior professional	59	63	69	2886
Secondary professional	60	65	71	3546
Higher professional (university and more)	62	68	74	3603
Labour Market				
Emplyed at state enterprise	62	69	.	6818
Employed at enterprise with no public share or does not work for wages	59	63	69	9188
Entrepreneur or self-employed	62	69	.	531
Not entrepreneur nor self-employed	60	65	71	12167
Health				
Self assessed health "Bad"	57	63	68	3159
Self assessed health "Not Bad"	60	66	71	11659
Family circumstances				
Married	60	65	71	9510
Not married/Divorced/Widow/Do not live together	61	66	71	3972
Settlement type				
Regional center	61	67	73	5826
Big city	60	64	70	3227
Small town	59	64	69	726
Rural/Village	58	62	68	2542

Source: Author's calculations based on RLMS-HSE 1995-2015 data

5. Individual determinants of exit from the labour market

So far we have discussed differences in exit from the labour market of sub-groups formed on the basis of one criterion, without controlling for the remaining observable differences. Table 3 shows the results of regressions that assess impact of the factors discussed on the hazard rate of exit into inactivity (i.e., the conditional probability of leaving the labour market at, for instance, 66 years, provided that the respondent was in the labour market before 66 years of age), controlling for all other variables. All the variables by which we built the division into sub-groups are used as explanatory variables. We also control for reaching the statutory retirement age (55 for women and 60 for men), for belonging to one of the four occupational groups, for total income from the main job and also for per capita household income (in logarithms). Each regression also includes controls for the year of the survey, intended to reflect changes over time in both labour market and pension regulations. Year dummies are also applied to all other time trends common to all respondents, including inflation, which is important since the variable for total income from the main place of work is in nominal terms.

In view of the differences between behaviour of men and women in the labour market, the regression analysis is carried out separately for the sub-samples of men and women (columns 1 and 2 in Table 3). In order to determine the statistical significance of the difference in the returns to exogenous factors across the regressions, the regression on the full sample with interaction terms[1] was measured. The last column in Table 3 contains information on statistically significant differences in βs between men and women and the level of this statistical significance, based on the results of the full sample regression.

The semi-parametric Cox regression is estimated, in which the basic exit function remains parametrically unspecified[2]. In order to take the specifics of the data into account, we use robust estimates with clustering by individuals, which entails a conservative estimation of standard errors.

The results of the regression analysis show that the main differences discussed above remain. However, there are exceptions.

The statutory retirement age[3] has a significant impact on the time of exit from the labour market for both men and women. The effect is higher for women, and the differences are statistically significant at the 10% level: the hazard rate of exit increases by 63 percentage points when a woman reaches 55 years of age, and

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[1] An example of such a cross-term: work at an enterprise with state ownership (provided that the worker is a man).

[2] Parametric setting of the baseline hazard function as a function from Weibull's distribution or generic Gamma distribution loses to the Cox specifications in terms of the quality of specification selection criteria.

[3] The statutory retirement age of 55 years for women and 60 years for men is used, and the possibility of early retirement of certain categories of employees is not taken into account.

by 25 percentage points when a man reaches 60[1]. This result is consistent with empirical economic literature, which acknowledges the impact on individual behavior of the statutory time for entitlement to retirement payments. However, the stronger response of women, as compared to men, upon reaching their statutory entitlement age is an interesting and unexpected result, given the five-year difference in statutory retirement age (to the disadvantage of men) and given that we control for the situation on the labour market and the composition of households.

It should be noted that, in the regression on the full sample, the sex variable becomes statistically insignificant when there is control for the statutory retirement age and control is also operated for other observable variables. In other words, non-observable differences in motivation and preferences between men and women play only a minor role in the decision to terminate working lives.

Education remains an influential factor when remaining observable factors are controlled for. People with higher education stay in the labour market for longer than those with only secondary school education: the hazard rate is nearly 30 percentage points lower for the former, and there is no statistical difference in the role of this factor for men and women. However, women who did not complete secondary school education stay in the labour market for longer than those who did complete secondary school (the hazard rate is higher by 18 percentage points), whereas for men this factor is irrelevant. For men junior professional education produces no statistically significant difference compared with secondary school education, and for women it is even associated with greater likelihood of leaving the labour market earlier (the hazard rate is lower by 17 percentage points). Secondary professional education is indistinguishable from secondary school in terms of its impact on the length of working life.

These results are largely a reflection of the nature of demand for labour in Russia. Only higher education and, to a lesser degree, secondary professional education, pay in the form of higher wages, while junior professional education does not offer a wage gain in comparison with mere secondary education (see, for instance, Denisova and Kartseva, 2007). However, our study has produced a number of new findings: that people with secondary professional education take retirement at the same rate as those who only completed secondary school, that people with junior professional education retire earlier, and that women who did not complete the full secondary school curriculum stay on the labour market for longer than those who did. These new findings need to be interpreted in the context of the Russian labour market.

However, differences in what might be called "professional status" are not only, and not so much, a matter of the level of education, which a person has

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[1] The conversion of the coefficient to the marginal effect with respect to the baseline function is calculated by the $e(\beta)$ formula. This is a consequence of the model specification, from which it follows that $\partial \ln(\lambda / \lambda_0) / \partial x = \beta$.

obtained. To a large extent, they are determined by the occupation, in which the person is employed (this is particularly true in economies such as Russia, which have experienced major structural changes) We investigated how labour market exit to economic inactivity in Russia differs between employees in different occupational groups. What we found was that in Russia, in contrast with many developed economies, only people working in highly qualified jobs remain in the labour market for longer than others, while the behaviour of those in jobs requiring medium-level qualifications and of skilled and unskilled workers is not statistically distinguished. The hazard rate of exit to economic inactivity among those in highly qualified jobs is 24-28 percentage points lower than the medium-level group, and this is true for both men and women.

Table 3. Estimation of hazard rate, Cox model, 1995–2015

	Hazard rate		Statistically different at
	Males	**Females**	
	0.221**	0.486***	**
Statutory pension age dummy	(0.111)	(0.080)	
Education: Secondary school - reference category			
Below secondary school	-0.056	-0.195**	**
	(0.095)	(0.084)	
Junior Professional	-0.062	0.155*	*
	(0.104)	(0.088)	
Secondary Professional	-0.067	-0.102	
	(0.106)	(0.071)	
Higher Professional (University and above)	-0.344***	-0.294***	
	(0.105)	(0.078)	
Labour Market			
Entrepreneur or self-employed as the main occupation	-0.762	-0.529*	
	(0.572)	(0.317)	
Employed at state enterprise	0.046	-0.134*	
	(0.091)	(0.078)	
Occupational group: ISCO 4-6 - reference group			
Hig Skilled (ISCO 1-3)	-0.270*	-0.335***	
	(0.151)	(0.088)	
Qualified Workers (ISCO 7-8)	0.135	0.014	
	(0.125)	(0.134)	

End of table 3

	Hazard rate		Statistically different at
	Males	**Females**	
Unskilled Workers (ISCO 9)	0.057	0.007	
	(0.221)	(0.102)	
Does not work or works not for wages	1.060***	0.756***	
	(0.133)	(0.088)	
Income			
Logarithm of Income from the main job	–0.013	–0.010	*
	(0.010)	(0.010)	
Logarithm of per capita household income	–0.099***	–0.070**	
	(0.038)	(0.032)	
Health			
Self-assessed health as poor or very poor	0.535***	0.064	***
	(0.084)	(0.064)	
Dignosed Heart Attack	0.218*	–0.323**	***
	(0.133)	(0.150)	
Diagnosed Stroke	0.264*	0.278**	
	(0.158)	(0.139)	
Diagnosed Diabetus	0.221*	–0.002	*
	(0.129)	(0.079)	
Family Cicumstances			
Married	0.227**	0.382***	*
	(0.099)	(0.050)	
Small children (below 7) in household	–0.034	0.188**	
	(0.098)	(0.074)	**
Settlement type: Large city - reference category			
Regional center	–0.304***	–0.216***	
	(0.080)	(0.061)	
Small town	–0.042	0.229**	
	(0.125)	(0.091)	*
Rural/Village	0.181**	0.300***	
	(0.087)	(0.067)	
Year Dummies	Yes	Yes	
Observations	22927	27709	

Standard errors in brackets: * significant at 10%; ** significant at 5%; *** significant at 1%

The form of ownership of the employer has an impact on exit to economic inactivity. Women employed at enterprises where the state is the owner or co-owner remain in the labour market for considerably longer than women employed at non-state enterprises or women who are self-employed or entrepreneurs: their exit hazard rate is 13 percentage points lower. By contrast, the form of ownership of the employer has no effect on the process of male exit to inactivity.

People who name entrepreneurship or self-employment as their main occupation also remain in the labour market for longer, and the scale of this effect is large for women: their hazard rate of exit to inactivity falls by 41 percentage points. For men, the effect is only significant at a level of 18%, which does not permit certainty as to its presence.

Higher income from the main place of employment has no statistically significant effect when two income measures are included, and this is true for both men and women[1]. However, higher per capita household income postpones exit from the labour market. Both of these variables indirectly reflect the pension replacement rate. The fact that one of the variables is statistically significant in reducing the likelihood of exit (while the influence of the latter is at an extended boundary of statistical significance) is indirect confirmation that people in the top part of the income distribution in Russia remain on the labour market for longer because they are inadequately insured.

Poor health (by self-assessment) greatly accelerates the process of exit from the labour market for men: the hazard rate of exit to inactivity increases by 71 percentage points. By contrast, self-assessment of health as bad or very bad is statistically irrelevant for women. A diagnosed heart attack increases the hazard rate of inactivity for men by 24 percentage points, but does not accelerate exit for women. The presence of a diagnosed stroke speeds up exit from the labour market for both men and women: the hazard rate increases by 30 percentage points, and there is no statistically significant difference between men and women. It is interesting that diagnosed diabetes speeds up exit from the labour market for men, raising the hazard rate by 25 percentage points, but has no statistically significant impact for women.

Marital status retains statistical significance when other observable features are controlled for. Married workers leave the labour market sooner than those who are unmarried and married women leave sooner than married men (the respective increases in the hazard rate are 25 percentage points for men and 47 for women). This result points to a higher opportunity cost for women, who are generally more adapted to running the household, especially in the context of lack of flexibility of forms of employment in Russia (work from home, flexitime, etc.).

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[1] In the specification including only one variable of income (income from work at the main place of work), the coefficient is negative and significant at 17% in the sample of men and at 13% in the sample of women.

　　　The presence of children under seven years of age in the household adds to incentives for women to withdraw from the labour market earlier, increasing the hazard rate by 21 percentage points. This reflects traditional close involvement of Russian grandmothers in child care. The factor has no effect on men's behaviour.

　　　The statistical significant of place of residence also survives control for other variables. People who live in a regional center remain in the labour market for longer than those who live in a large city (the hazard rate is 20-25 percentage points lower) and there are no statistically significant differences between men and women in this regard. Symmetrically, people living in rural areas exit sooner (hazard rates are higher by 20-35 percentage points compared to large cities), with no difference between men and women. Women living in small cities quit the labour market earlier than women living in large cities (the hazard rate is 26 percentage points higher), but there is no observable difference for men. These distinctions reflect general differences in demand for labour between regional centers, large and small towns and rural areas, although specific attitudes towards older workers may also play a role.

　　　The estimates above can be interpreted not only in terms of increase or decrease of the hazard rate or survival function with respect to the baseline (average) hazard or survival, but also in terms of lengthening or shortening of the duration of people's working careers under various combinations of factors. For this purpose we draw predicted survival curves (based on estimates of the Cox model), which compare the conditional probabilities of remaining in the labour market for respondents with different sets of factors. Examples of such predicted survival curves are shown in Figure 6.

　　　Comparing men who consider their health to be poor or very poor with those who consider themselves healthy (all other variables at average level), we find that exit from the labour market due to ill health accelerates by about a year prior to the age of 60, by about 2 years from 60 to 62, and by 3-4 years up to 70 years of age (Figure 6, panel A). The difference between labour market exit for men with higher professional qualifications (groups ISCO1-3) and those who do not have such qualifications is almost insignificant (for this factor alone) up to 65 years of age, after which there is a difference of 1 year, followed by a difference of two years after 68 years (Figure 6, panel B).

　　　People living in rural areas become economically inactive earlier, and in the case of men with poor health who have suffered a stroke, the difference between time of exit from the labour market for rural areas and regional centers is about one year initially and about two years by 70 years of age *due only to the place of residence* (Figure 6, panel C). This reflects differences in living conditions, including differences in access to health services and the quality of health services.
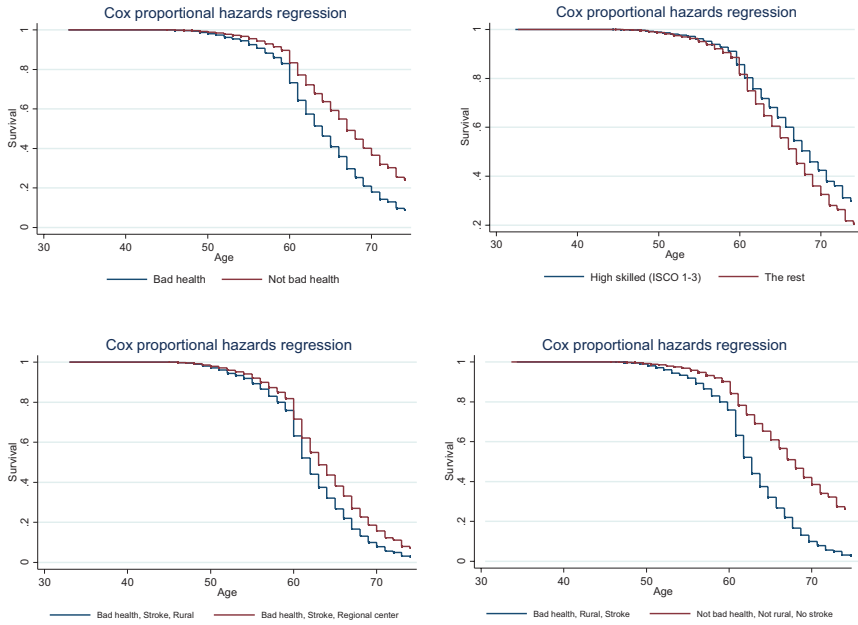
Figure 6. Model predicted survival functions for male subsamples: A. Respondents with poor health compared to respondents who judge their health to be good (top left panel); B. Highly qualified group compared to other occupational groups (top right panel); C. Rural respondents with poor health and who have suffered a stroke compared to equivalent respondents who live in a regional center (bottom right panel); D. Rural respondents with poor health and who have suffered a stroke compared to respondents who do not live in rural areas, have good health and have not suffered a stroke (bottom left). In all cases, all other variables are fixed at average level.

Source: Author's calculations based on RLMS-HSE 1995-2015 data

The cumulative difference in working life expectancy obtained by combining several factors is even higher. A man with poor health who has suffered a stroke and lives in a rural area leaves the labour market much earlier than a man in good health who has no stroke history and lives in a regional center. The difference is 3 years in the range from 52 to 55 years, then increases with age and exceeds 5 years by age 60, and 7 years after age 63 (Figure 6, panel D).

6. Conclusions

The analysis of exit of older cohorts from the labour market, using survival methods, confirms important determinants of the process which were previously identified in the literature, and enables their impact to be quantified, including the impact of health and financial incentives.

The specifics of exit to pension-age inactivity by Russians in older age groups are of major interest. In contrast with many developed countries, only highly qualified persons remain in the labour market for substantially longer than other occupational groups, while the behaviour of groups with medium-level qualifications and of skilled and unskilled workers show no statistically significant differences. Entrepreneurial activity and self-employment are associated with longer working lives as compared with work as an employee. It is found that employees who work at enterprises with state ownership stay longer in the labour market than employees in the private sector. There is indirect evidence that workers in the upper part of the wage distribution are inadequately insured and remain in the labour market longer for this reason.

The most surprising result is high sensitivity of women to the legally established retirement age (2.5 times higher than for men). The fact that the Russian statutory retirement age for women is five years below that for men and is low by international standards might encourage optimism that (gradual) increase in the retirement age for women would be socially acceptable. But our result shows that the statutory retirement age has a decisive influence on choice by women of their time of exit from the labour market, even controlling (as far as data permit) for differences in education, situation in the labour market and family circumstances. This suggests that any move to raise the retirement age could provoke strong opposition from women, since the current retirement age is a decisive factor for their life plans.

References

1. *Asch B.*, *Haider S. and Zissimopoulos J.* 2005. Financial incentives and retirement: evidence from federal civil service workers, *Journal of Public Economics*, 89, 427–440.
2. *Bane M. J. and Ellwood D. T.* 1986. Slipping Into And Out Of Poverty: The Dynamics of Spells, *Journal Of Human Resources*, pp. 2–23.
3. *Cai L.* 2010. The relationship between health and labour force participation: Evidence from a panel data simultaneous equation model, *Labour Economics*, 17, 77–90.
4. *Denisova I. A.* 2010. Adult Mortality in Russia: a microanalysis, *Economics of Transition*, 18(2), 2010, 333-363.
5. *French E.* 2005. The Effects of Health, Wealth, and Wages on Labour Supply and Retirement Behaviour, Review of Economic Studies, 72, 397–427.
6. *García-Gómez P., Jones A. M. and Rice N.* 2010. Health effects on labour market exits and entries, *Labour Economics*, 17, 62–76.
7. *Gustman A. L.* and *Steinmeier T. L.* 1986. A Structural Retirement Model, *Econometrica*, Vol. 54, No. 3, pp. 555–584.
8. *Hanel B.* 2010. Financial incentives to postpone retirement and further effects on employment - Evidence from a natural experiment, *Labour Economics*, 17, 474–486.
9. *Hurd M.* 1990. Research on the Elderly: Economic Status, Retirement, and Consumption and Saving, *Journal of Economic Literature*, XXVIII (2), 565–637.
10. *Kiefer N.* 1988. Economic Duration Data and Hazard Function, *Journal of Economic Literature*, XXVI, 646–679.

11. *Lumsdaine R. L., and Mitchell O. S.* 1999. New Developments in the Economic Analysis of Retirement, *Handbook of Labor Economics* (Ashenfelter O. and Card D., ed..), Vol. 3C. Amsterdam: North-Holland: 3261−3307.

12. *Gourvitch E.*, *Sonina Y.* 2012. Microanalysis of the Russian pension system. *Issues of Economics,* No. 2, pp. 27−51.

13. *Danielyan V. A.* 2016. Determinants of retirement age: review of studies, preprint No. WP/2016/319. Moscow: CEMI RAS.

14. *Denisova I. A.*, *Kartseva M. A.* 2007. The returns on levels, types and quality of education in Russia, *Wages in Russia* (Gimpelson V. E. and Kapelyushnikov R. I, ed.). Moscow: SU-HSE Publishing house.

15. *Klepikova E. A.* 2013. Modelling the labour supply of Russian citizens of retirement age on RLMS panel data, *Compendium of Best Theses*. Moscow: SU-HSE Publishing house, pp. 365−395.

16. *Maleva T. M.*, *Sinyavskaya O. V.* 2010. Raising the retirement age: pro et contra, *Journal of the New Economic Association*, No. 8, pp. 117−139.

17. *Nazarov V. S.*, *Dormidontova Y. A.*, *Lyashok V. Y.* 2014. Analysis of factors influencing the retirement decision, *Journal of the New Economic Association,* vol.4, No. 24, pp. 66−86.

18. *Nazarov V. S.*, *Dormidontova Y. A.*, *Lyashok V. Y.* 2015. Analysis of the effect of changes in the pension formula on the decision to retire, *Journal of the New Economic Association,* vol. 1, No. 25, pp. 57−75.

19. Rosstat. 2016. Labour force, employment and unemployment in Russia (according to the results of the Labour Force Survey). Moscow: Rosstat.

ANNEX

A1. Studying attrition selection bias: comparison of observables for subjects lost from the panel and those who remained in the panel.

Table A1 shows mean and standard deviations for those who remained in the sample up to 2015[1] and those who dropped out of the sample earlier. Specifications for the former are shown for 2015 and for the latter at the time of their last appearance in the sample.

Table A1. Average specifications of those who were lost from the sample and those who remained.

	Mean		Standard deviation	
	Always in sample	Drop-outs	Always in sample	Drop-outs
Age	58,564	54,910	0,115	0,089
Sex: Males - 1, Females - 0	0,403	0,494	0,007	0,006
Marital status: Married - 1	0,671	0,705	0,006	0,006
Health				
Self assessed health: poor and very poor	0,170	0,177	0,005	0,005
Education				
Below secondary school	0,142	0,153	0,005	0,005
Secondary school	0,160	0,151	0,005	0,005
Junior professional	0,170	0,167	0,005	0,005
Secondary professional	0,264	0,246	0,006	0,005
Higher professional and above	0,265	0,283	0,006	0,006
Settlement type				
Regional center	0,403	0,525	0,007	0,006
Large city	0,257	0,269	0,006	0,006
Small town	0,073	0,048	0,004	0,003
Rural	0,267	0,159	0,006	0,005

Source: Author's calculations based on RLMS-HSE 1995-2015 data

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[1] Entry into the sample occurs in different years, reflecting the principles of sample construction. For the purposes of our analysis, it is sufficient that we observe a person between 45 and 72 years, especially as we leave only those who have been economically active for at least one period during the observation in the sample. An analysis of the entry age shows that 90% appear in the sample aged under 60 and 99% under 70 years of age.

As can be seen from the table, people who dropped out of the sample are younger on average with a higher share of men. There is some statistical evidence that the lost subjects are more educated on average, although statistical differences at a level of 95% occur only among those with higher education. The share of people living in regional centers is significantly higher among the lost subjects, which supports the thesis that a large part of the drop-out is related to change of place of residence (such mobility is higher in regional centers and large cities). Self-assessment of health is not statistically different between those who were lost and those who remained in the sample.

In general, comparison of the observable characteristics of those who were lost from the sample and those who remained suggests that the main reason for loss is change of address by the more mobile part of the population. Death is certainly a factor in loss from the sample (see, for instance, Denisova, 2010), but does not determine the average features of all those who were lost. Introduction in the model of the risk of death as an alternative risk of the end of working life is technically possible. It would clarify the analysis and could be one way to improve the study in the future.

A2. Definitions of variables used

Table A2. Definitions of variables used

Name of variable	Construction
Exit into economic inactivity (defines the end of labor episode)	Respondent does not work now, gets retirement pension and is not in search for work
Age	In years
Dummy for reaching statutory pension age	Binary variable: 1 — if female is 55 or male is 60, 0 — in all the rest cases
Sex	Binary variable: 1 — male 0 — female
Marital status	Binary variable: 1 — married (registered or not), 0 — other
Health	
Self assessed health: poor and very poor	Binary variable: 1 — poor or very poor health (self-assessed), 0 — neither good nor poor, rather good, good
Diagnosed heart attack	Binary variable: 1 — had been diagnosed heart attck, 0 — no
Diagnosed stroke	Binary variable: 1 — had been diagnosed sttoke, 0 — no
Diagnosed diabetes	Binary variable: 1 — had been diagnosed diabetus, 0 — no
Education	
Below secondary school	Binary variable: 1 — no secondary school degree (the highest level), 0 — other
Secondary school	Binary variable: 1 — secondary school degree (the highest level), 0 — other

End of table A2

Название переменной	Построение
Junior professional	Binary variable: 1 — junior professional degree, completetd or not (the highest level), 0 — other
Secondary professional	Binary variable: 1 — secondary professional degree, completetd or not (the highest level), 0 — other
Higher professional and above	Binary variable: 1 — higher professional degree, completetd or not, and above (the highest level), 0 — other
Labour Market	
Employed at state enterprise	Binary variable: 1 — employed at enterprise or in organisation where the state is a co-owner, 0 — other
Entrepreneur or self-employed	Binary variable: 1 — entrepreneurship or self-employement are chosen as the main occupation, 0 — other
Occupational groups	
High skilled (ISCO 1-3)	Binary variable: 1 — work in occupation group with 1-3 codes according to ISCO-88, 0 — other
Mid-skilled (ISCO 4-5)	Binary variable: 1 — work in occupation group with 4-6 codes according to ISCO-88, 0 — other
Skilled workers (ISCO 7-8)	Binary variable: 1-work in occupation group with 7-8codes according to ISCO-88, 0-other
Unskilled workers (ISCO 9)	Binary variable: 1-work in occupation group 9 according to ISCO-88, 0-other
Settlement type	
Regional center	Binary variable: 1 — lives in regional center, 0 — other
Large city	Binary variable: 1 — lives in large city, 0 — other
Small town	Binary variable: 1 — lives in small town, 0 — other
Rural	Binary variable: 1 — lives in rural area/village, 0 — other
Income	
Logarithm income from the main job	Logarithm income from the main job (as reported by respondent)
Logarithm per capita household income	Logarithm per capita real household income (constructed variable provided by UNC PC)