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Ksenia Rozhkova

**THE IMPACT OF NON-COGNITIVE SKILLS
ON SOCIAL AND ECONOMIC BEHAVIOURS**

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Academic supervisor:
Candidate of Sciences in Economics
Sergey Roshchin

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1. Motivation

Human capital has been in the research mainstream for over sixty years, starting with the seminal works of Becker (1962), Schultz (1961), and Mincer (1958). Traditionally, human capital has been viewed as knowledge, skills, and health accumulated over a lifetime that can be used to achieve socio-economic well-being for individuals and society (OECD, 2001). When analysing human capital, economists tend to focus on intelligence, education, and competences acquired during educational process. These skills are referred to as *cognitive* and reflect the ability to perceive ideas, extract knowledge from experience, think, reason, and find solutions to emerging problems (Neisser et al., 1996). Cognitive skills include basic competences (e.g., writing, reading, numeracy skills) and more complex skills (e.g., programming, foreign language proficiency). Moreover, the effect of cognitive skills has been explored by numerous studies showing a positive relationship with social outcomes, development, and well-being in different countries and contexts (Hanushek, Woessmann, 2008). However, cognitive skills alone are not sufficient to capture the diversity of human capital and to explain individual choices.

In 1962, the Perry Preschool Project was launched in the USA. 128 children aged 3-4 from disadvantaged background and with low abilities were selected as participants. They were considered to be at high risk of not completing even high school. Half of the selected children took part in a special educational programme that included daily personality development activities. They were taught independence, self-discipline, and social skills. Examining data decades after the programme was implemented, Nobel laureate economist James Heckman and co-authors noted its impressive effectiveness. In their adult lives, the participants were more likely to be college graduates, to be employed, have higher wage, and less likely to be involved in criminal activity compared to those of their peers who were not selected for the programme (Heckman et al., 2006). The experiment clearly showed that success in life does not only depend on cognitive skills, which are the main focus of educational interventions. There are other, *non-cognitive*, characteristics that change the established view of human behaviour in different socio-economic areas.

Non-cognitive characteristics, also referred to as skills, represent a way of thinking, feeling, and acting in a certain way that remain stable over time despite external circumstances (Roberts, 2009). In psychology, they are also called personality traits. In economics, researchers often refer to them as skills in order to emphasise their susceptibility to purposeful influence. The use of the term “non-cognitive” in this context may still cause disputes among professionals since the brain is responsible for both personality and cognition. Therefore, alternative terms such as

“social-emotional skills” or “21st century skills” have been used in some studies (Kautz et al., 2014). Non-cognitive skills are partly inherited genetically (Jang et al., 2006), but are mainly shaped by socialisation, family upbringing, and early education (Almlund et al., 2011). Non-cognitive characteristics are not isolated from other components of human capital and interact with cognitive skills, contributing to their development (Cunha, Heckman, 2007; 2008). The susceptibility to external influences during childhood and adolescence, as well as the association with socioeconomic inequality and well-being in adulthood, have made non-cognitive skills an attractive target for research and policy (Kautz et al., 2014).

Socio-economic behaviour refers to the system of individual actions undertaken by a person in different areas of life. These actions are influenced by various social, economic, institutional, psychological, and other factors and lead to different outcomes. From an analytical point of view, the key areas of socio-economic behaviour are the labour market, education, and health. These three components - quality of life as measured by financial abilities (for instance, labour income of employed individuals), education as a measure of one’s professional and intellectual potential, and life expectancy as a reflection of health, habits, and availability of medicine – together reflect the concept of human well-being, widely used in the research and described in the methodology of the UN Human Development Index (UNDP, 1990).

Socio-economic behaviour often serves as the subject of government policies and societal investments (e.g., providing universal access to education, increasing life expectancy, achieving gender equality in the labour market, etc.). It is therefore necessary to take account of the contribution of non-cognitive characteristics not only to explain individual socio-economic choices, but also to tailor such policies to increase their effectiveness, especially in the context of early socialisation. This explains the relevance and importance of non-cognitive characteristics in economic research.

The existing economic literature on non-cognitive skills in Russia is relatively new due to limited sources of suitable data. Including a block of 24 questions, representing the Big Five, into Russian Longitudinal Monitoring Survey (RLMS-HSE) in 2016 was a turning point that led to numerous empirical studies, demonstrating the importance of personality for socio-economic behaviour, individual choice, and well-being. However, there is still no systematic work on this topic for Russia that would generalise and systematise the variety of obtained results.

2. Brief literature review

Non-cognitive skills are relatively new to economic research. Their active discussion as a prominent component of human capital began only 15-20 years ago. Initially, personality was considered by researchers in psychology (e.g., in relation to addictive behaviour (Barnes, 1979) or

education (see De Raad, Schouwenberg, 1996), although the methodological approach in these social sciences is very different from that in economics. The introduction of non-cognitive skills into the economic research agenda was mainly achieved after the work of Heckman and co-authors (Heckman et al., 2006; Heckman, Rubinstein, 2001).

a. Tools for measuring non-cognitive skills

A key issue in this context is how to measure non-cognitive characteristics to capture them as fully and accurately as possible. Different instruments produce heterogeneous results, measure different facets of personality even when they appear to be very similar, and have different relevance for educational policy.

When measuring the contribution of non-cognitive characteristics to socio-economic behaviours and outcomes, studies rely on widely recognized valid and short psychological instruments. The most common is called the Big Five. The Big Five is a classification of personality traits that suggests that any personality can be described using five broad categories: openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism (McCrae, John, 1992). Openness comprises curiosity, creativity, and a tendency to learn and create new things. Among all the Big Five categories, openness is the closest to intelligence (Almlund et al., 2011). Conscientiousness is characterised by hard work, diligence, and discipline. Extraversion describes a person in terms of sociability. Agreeableness is also a trait related to social interactions and includes politeness, tendency to co-operate, and altruism. Finally, neuroticism is a measure of emotional instability characterised by anxiety and irritability. The Big Five inventory is included as the main instrument in most large-scale surveys that measure non-cognitive skills, such as RLMS-HSE in Russia, SOEP in Germany, STEP of the World Bank, Survey on Social and Emotional Skills of the OECD, etc.).

Another important dimension is locus of control, which refers to the tendency to attribute responsibility for events in one's life either to their own behaviour (internal locus) or to external forces (external locus). Locus of control is more context dependent. For example, there is a separate locus of control questionnaire in health (Wallston, Wallston, 1981). Still, it is often used in economic research as a time-stable non-cognitive characteristic (Cobb-Clark, Schurer, 2013).

Some authors attribute risk preferences to non-cognitive characteristics (Lukyanova, 2021), although this interpretation may be considered controversial. Risk preferences is a classical economic preference, traditionally used in theoretical models. In turn, non-cognitive skills, which are genetically determined and influenced by upbringing, can shape the formation of preferences. Although preferences may correlate with some dimensions of non-cognitive skills (e.g., risk

aversion may be associated with external locus of control or high neuroticism), the two groups of characteristics are not fully overlapping (Becker et al., 2012).

b. Non-cognitive characteristics and socio-economic behaviour

Research has shown strong correlations between individual psychological traits and socio-economic behaviours and outcomes in the labour market, education, health in various countries, including Germany, the USA, the Netherlands, Finland, the UK, and Japan.

First, a large body of empirical findings has been accumulated in the context of the labour market. Conscientiousness, neuroticism, and openness consistently demonstrate a significant effect on labour market outcomes. Conscientiousness is positively associated with the quality of job performance, productivity, and wages (Nyhus, Pons, 2005; Lee, Ohtake, 2018). Openness is the characteristic most closely related to intellectual ability, which has been associated with higher wages (Braakmann, 2009; Mueller, Plug, 2006), regardless of the job contents (Almlund et al., 2011). In contrast, neuroticism is negatively related to labour market outcomes, measured not only with wage (Viinikainen et al., 2010) but also with unemployment duration (Uysal, Pohlmeier, 2011; Cuesta, Budria, 2017).

Second, empirical studies have shown that non-cognitive skills are significant contributors to educational choice and university entry, even when intellectual ability is controlled (Heckman et al., 2006). Conscientiousness and openness from the Big Five have a positive effect on the likelihood of university entry. Non-cognitive characteristics are especially important for adolescents from less socially advantaged families (Lundberg, 2013). Furthermore, a student's level of aspiration towards higher education is influenced by their non-cognitive skills, such as locus of control and self-esteem. Research conducted by Saltiel (2020) suggests that students with lower levels of non-cognitive skills are more likely to be placed in less selective educational institutions than their academic performance would suggest.

Finally, non-cognitive skills have been studied in health economics in the context of health inequalities. Personality determines educational choices, linking education and health (Conti and Hansman, 2013; Conti et al., 2010). Moreover, non-cognitive skills can directly influence health investments by affecting preferences for healthy lifestyles, vaccination against dangerous diseases, and habits. Empirical studies show that individuals with high levels of certain characteristics are more likely to exercise and avoid unhealthy lifestyles (Conti et al., 2010). Conscientiousness and internal locus of control have the most pronounced positive effect on health, while neuroticism has a negative impact. The effect is observed in objective measures of health such as longevity (Savelyev, Tan, 2019; Schurer, 2014) or the number of days spent on sick leave (Bellman, Hübler 2021), as well as in subjective assessments of well-being (Savelyev, Tan, 2019). The explanatory

power of non-cognitive skills for health inequalities is comparable to that of education, IQ, and other socioeconomic factors (Saveljev, Tan, 2019).

c. The issue of the stability of non-cognitive characteristics

The stability of non-cognitive characteristics is a crucial factor in studying their effect on individual well-being. It justifies the causality, running from characteristics to outcomes, but not vice versa, also helping to select the most effective period for educational interventions. The economic empirical literature suggests that non-cognitive characteristics remain relatively stable throughout working life from 20-25 years until retirement age (Cobb-Clark, Schurer, 2012). However, psychologists are more skeptical and believe that individual personality becomes fixed only by the age of 30, although changes can occur at younger or older ages (Terracciano et al., 2006).

There is empirical evidence in the literature on the stability of non-cognitive traits based on panel data. Cobb-Clark and Schurer (2012, 2013), using data from the Australian HILDA panel survey, investigate how personality changes are related to age and whether adult personality traits change in response to unfavourable life circumstances. First, the authors calculated for each respondent the difference between the Big Five measurements made in 2005 and 2009 and the locus of control measurements made in 2003 and 2007. The results showed that the mean changes in non-cognitive characteristics among working-age individuals were insignificant. Second, three variables were created to reflect the number of adverse events that occurred in the respondent's life during the same period. These events could be related to one's family (e.g. loss of a spouse, child or other relative), work (e.g. lay-off or poor financial situation) or health (e.g. being injured or diagnosed with a serious illness). OLS regressions were estimated for each non-cognitive characteristic, controlling for socio-demographic variables. Overall, the results showed there were no significant associations between the Big Five or locus of control changes and life events in the medium term. These two papers are a rare example of evaluating the widely accepted assumption of the stability of non-cognitive skills in economics.

3. Research question

The impact of non-cognitive characteristics on the socio-economic behaviour of individuals is an interdisciplinary problem at the intersection of personality psychology and applied economics (specifically labour, education, and health).

The *object* of the study is the behaviour of individuals depending on their non-cognitive characteristics.

The *subject of the study* is the impact of non-cognitive characteristics on socio-economic behaviours, including wages, educational choice, health behaviours (i.e., alcohol consumption, attitude towards vaccination, smoking, physical activity) and the resulting longevity in Russia.

The *research question* of the study is as follows: how do individuals' socio-economic behaviour and outcomes in the labour market, education and health vary according to the levels of non-cognitive skills developed early in life?

It is worth noting that in some cases, this research considers both socio-economic behaviour and the outcomes to which this behaviour leads. In the case of the labour market, only the outcome (wage levels, employment) is observable, but not the specific actions that lead to it. In the case of education, both the behaviour (such as the intention to obtain a university degree) and the outcome are observed. Finally, in the case of health, we may observe the set of actions (alcohol consumption, smoking, physical activity, vaccination) that lead to the outcome (life expectancy and subjective assessment of health).

4. Objectives

The *aim of the study* is to analyse individual behaviour in the labour market, education, and health in Russia. It also aims to investigate the influence of non-cognitive characteristics on this behaviour.

To achieve this goal, the following *tasks* must be completed:

1. To systematize the main theoretical and empirical approaches to measuring the influence of non-cognitive characteristics on individual behaviour in the labour market, education, and health;
2. To empirically assess the effect of non-cognitive characteristics on wages and employment probability in Russia, as well as to assess the heterogeneous contribution of non-cognitive skills to the gender gap in the labour market, taking into account differences across the income distribution;
3. To evaluate the heterogeneous effect of non-cognitive characteristics on the probability of obtaining higher education, taking into account differences in majors and the level of university selectivity;
4. To estimate the association between non-cognitive characteristics and health behaviour, measured through addictive behaviour and attitudes towards vaccination;
5. To assess the contribution of non-cognitive characteristics to self-rated health and longevity by gender groups.

5. Data

This research is based on data from the Russian Longitudinal Monitoring Survey (RLMS-HSE), spanning from 2011 to 2021. Non-cognitive skills are measured using the Big Five, locus of control, and risk attitude. The Big Five categories are generated based on 24 behavioural questions asked in 2016 and 2020. Respondents' answers are recorded on a scale from 1 to 4, depending on the frequency of manifestation of a particular characteristic in everyday life. The value of each category is obtained as a standardised arithmetic mean of the components. This approach is well-established in economic literature and allows for the simultaneous inclusion of different personality dimensions (Ayhan et al., 2020; Heineck, Anger, 2010; Cuesta, Budría, 2017). Similarly, the internal locus of control is constructed based on 7 behavioural questions asked in the same survey in 2011. The responses are also measured on a scale from 1 to 4, and the locus of control value is obtained as the standardised arithmetic mean of the components. Finally, risk attitude is measured based on a single question with a scale from 1 to 10.

6. Structure of the dissertation and method

The objectives of the study define its structure. The results are outlined in 7 articles and 1 preprint representing the dissertation.

a. Stage 1

The first phase of the study involved examining the relationship between non-cognitive skills and individual labour market outcomes. The analysis covered the probability of employment, wages as a function of individual non-cognitive skills, and the contribution of non-cognitive skills in explaining the gender wage gap in the Russian labour market.

To assess the effect of non-cognitive characteristics on wages, a standard Mincer-type wage equation was estimated using the OLS technique with robust standard errors to correct for the heteroskedasticity. The sample comprised men and women aged 20-60 who were interviewed in 2016. The dependent variable was the natural logarithm of the hourly wage earned at the primary job in the last 30 days. The study used three groups of explanatory variables: individual characteristics (including gender, age and age squared, marital status, education level, settlement type, and federal district), job characteristics (including industry, occupation, company size, and ownership type) and non-cognitive characteristics (the Big Five). Separate regressions were conducted for men and women, different age groups, and occupational groups. A robustness check was performed on a sample with 2016-2017 survey data to ensure the accuracy of the results. A probit model was used to estimate the probability of employment.

A different approach was used to measure the contribution of non-cognitive characteristics in explaining the gender gap. First, unconditional quantile regressions (RIF regressions) for males

and females aged 20-60 were used. The equations for 2011 and for 2016 were estimated separately. The dependent variable was the natural logarithm of the real wage at the primary job in the last 30 days. Explanatory variables included individual characteristics (including education level, age and age squared, marital status, minor children dummy, and settlement type), job characteristics (including industry, ownership type, occupation, tenure, logarithm of hours worked in the last 30 days, and region), and non-cognitive characteristics (the Big Five and risk attitude in 2016, and locus of control in 2011). The results of the wage regressions were decomposed using the Oaxaca-Blinder technique with Newmark correction for the 10th, 50th and 90th percentiles of the wage distribution. This methodological approach allowed for the estimation of the average gender wage gap and the contribution of non-cognitive characteristics to it, as well as the resulting differentiation in different income groups.

The *results of solving tasks 1 and 2* are reflected in the article:

- Rozhkova K. V. The return to noncognitive characteristics in the Russian labor market // *Voprosy ekonomiki*. 2019. № 11. P. 81-107.

and in a preprint:

- Rozhkova K., Yemelina N., Roshchin S. Can non-cognitive skills explain the gender wage gap in Russia? An unconditional quantile regression approach / *NRU Higher School of Economics. Series WP BRP "Economics/EC"*. 2021. No. 252.

b. Stage 2

The research's second stage focused on studying non-cognitive skills in the context of educational choice. A comprehensive review of the theoretical and empirical literature was conducted, revealing an economic perspective on non-cognitive skills in the educational process. The review outlined the terminological distinctions between 'non-cognitive skills', 'socio-emotional skills', and 'soft skills', and systematised psychological approaches to measuring non-cognitive skills. To evaluate the contribution of non-cognitive characteristics in educational decision-making, four dimensions of educational choice were used.

The first dimension examines the intention of adolescents aged 15-19 to pursue higher education. Intention was measured using probit regressions on RLMS-HSE data from 2011 and 2016 survey waves. The dependent variable was the response to the question, "Do you intend to pursue higher education, including master's, postgraduate, doctoral studies, in the next three years?". The explanatory variables included gender, foreign language proficiency (used as a proxy for cognitive ability), characteristics of socio-economic background (including settlement type, logarithm of per capita household income, number of household members with higher education), family composition (including number of minor siblings and number of adult household

members), and non-cognitive characteristics (the Big Five in 2016 and locus of control in 2011). Separate regressions were estimated separately for the bottom and top half of the household income distribution. Furthermore, to test the robustness of the results, a model that included school characteristics (including academic performance, type of school, and number of classmates) was estimated on 2016-2018 data.

The second dimension was the completion of tertiary education among males and females aged 23-29 using a probit regression on 2011 and 2016-2018 data. The list of explanatory variables included gender, foreign language proficiency (a proxy for cognitive ability), and non-cognitive skills (either the Big Five or locus of control).

The third dimension is the probability of choosing a particular major at university. For this, a multinomial logit regression was estimated on a sample of men and women aged 23-29 in 2011 and 2016-2018. The dependent variable included five categories: 1) STEM (Science, technology, engineering, and mathematics), 2) Education and health, 3) Economics and management, 4) Humanities, social sciences, arts, and 5) Law. The list of explanatory variables included gender, foreign language proficiency (as a proxy for cognitive ability), and non-cognitive skills (either the Big Five or locus of control).

The fourth dimension measured the likelihood of graduating from universities with varying levels of selectivity. Selectivity was determined by the average score for one standardised exam (United State Examination) of enrolled student, as reported by the Monitoring of the quality of university admission, conducted by HSE university. The name of the graduate's was obtained through an additional questionnaire module of RLMS.

Two models were estimated: a probit regression for the probability of graduating from a top university (including federal universities, universities with a special status, national research universities, participants of the "5-100" excellence project), and an ordered logit model for the probability of graduating from a university, included in one of three selectivity categories: least selective (average admission score <55 points), average (56-69), and most selective (>70 points). The explanatory variables included gender, foreign language proficiency (a proxy for cognitive ability), and non-cognitive skills (either the Big Five or locus of control). The models were estimated using a sample of males and females aged 23-29 on 2016-2017 data.

The results of *solving tasks 1 and 3* are presented in the articles:

- Rozhkova K. V., Roshchin S. Yu. Non-Cognitive Characteristics and Higher Education Choices. // *Voprosy Obrazovaniya / Educational Studies Moscow*. 2021. № 4. P. 35-73.
- Rozhkova K. V., Roshchin S. Yu. The Impact of Non-Cognitive Characteristics on the Higher Education Choice-Making: An Economist Perspective. // *Voprosy Obrazovaniya / Educational Studies Moscow*. 2021. № 3. P. 138-167.

c. Stage 3

The third stage of the study analysed the relationship between non-cognitive skills and health. Health was measured using a range of behavioural, subjective, and objective dimensions. Longevity was used as an objective measure, while self-assessed health was used as a subjective measure. Various behavioral elements, such as addictive behaviour and vaccination, were used as measures of health investments.

First, a multinomial logit regression was conducted to evaluate the impact of non-cognitive characteristics on subjective health. The analysis was performed separately for men and women aged 17 and above, using data from 2016-2021 and 2011-2021, depending on the measurement of non-cognitive skills. The dependent variable, self-rated health, was measured on a scale from 1 (indicating very poor health) to 5 (indicating very good health). The list of explanatory variables included gender, age, education, marital status, presence of children, number of family members, settlement type, employment status, year, and non-cognitive characteristics (the Big Five or locus of control). An additional specification included binary variables for health habits (smoking, alcohol consumption, and physical activity) in order to control for the direct and indirect effects of non-cognitive characteristics. To control for individual unobserved heterogeneity, standard errors were clustered at the individual level.

Second, longevity was used as an objective measure of health. This became possible due to the panel nature of the data. In RLMS, if the household participated in the previous round of the survey, the head of the household must report either the presence of all previously interviewed household members or the reasons for their absence. The absence may be due to the death of a household member. To address potential bias resulting from non-normality in the distribution of time to event and censoring on the right-hand side, a non-parametric Cox proportional hazards model was estimated by combining this information with data from previous waves. The expected risk of death at time t (age) was used as the dependent variable, while explanatory variables included gender, education, marital status, presence of children, number of family members, settlement type, employment status, and non-cognitive characteristics (the Big Five or locus of control). An additional specification included binary variables for habits (including smoking, alcohol consumption, and physical activity) as explanatory factors. The model was estimated separately for men and women aged 17 and above using data from 2016-2021 (for the Big Five) and 2011-2021 (for locus of control). Standard errors were clustered at the regional level.

Third, health behaviour was measured by examining attitudes towards vaccination during the COVID-19 pandemic. This included attitudes towards vaccination prior to the start of the vaccination campaign, as well as the decision to get vaccinated or not one year later. A multinomial logit regression was estimated on 2020 data for men and women aged 18 and above. Attitudes

towards vaccination were used as the dependent variable, taking four possible values – vaccination support, conditional support, resistance, or hesitance. Explanatory variables included gender, age and age squared, marital status, number of minor children (if any), settlement type, education level, employment status, logarithm of average per capita household income, trust in institutions, frequency of social network use, self-rated health, COVID-19 experience, self-rated risk of getting ill, and epidemiological situation in the region. The Big Five categories and risk attitudes were included in the model as non-cognitive characteristics. To assess the stability of the results, separate models were estimated for both men and women. Additionally, the base category of the dependent variable was changed from conditional support to resistance, and the sample was restricted to individuals aged between 18 and 60 years. One year later, the analysis was extended to account for vaccination decisions.

Fourth, health behaviours were measured through lifestyle habits such as smoking, alcohol consumption, and physical activity. To assess the association with non-cognitive characteristics, a set of probit regressions were estimated separately for men and women aged 17 years and above using data from 2016-2021 and 2011-2021. The explanatory variables included gender, age, education, marital status, presence of children, number of family members, settlement type, employment status, year, and non-cognitive characteristics (the Big Five or locus of control).

Alcohol consumption was analysed separately as an example of addictive health-damaging behaviour for men and women aged 20-60 using data from 2016-2018. A two-step model (double-hurdle model) was used to assess the contribution of non-cognitive characteristics. The first step involved estimating the likelihood of drinking using a panel probit model with random effects to control for individual heterogeneity in alcohol consumption. The probability of abstinence was used as the dependent variable. The second step involved estimating the contribution of non-cognitive characteristics to the volume of alcohol consumption using a tobit model with random effects and Heckman correction for self-selection into abstinence. The dependent variable was the logarithm of pure ethanol in grams consumed in the past 30 days. Explanatory variables included gender, age and age squared, ethnic group, education, logarithm of per capita household income, marital status, presence of minor children, number of adults in the household, religion, settlement type, weight, average January temperature in the region, per capita regional income, average regional beer and vodka prices, year of observation, and the Big Five to measure the contribution of non-cognitive characteristics. Standard errors were calculated using bootstrap technique. Cross-sectional probit and tobit regressions with errors clustered at individual level, as well as Heckman panel model, were estimated to assess the robustness of the results.

The result of solving *tasks 1, 4 and 5* are presented in the articles:

- Rozhkova K. Does personality predict health? Non-cognitive skills, health behaviours, and longevity in Russia // *Population and Economics*. 2024. Vol. 8. No.1. P.132-155;
- Rozhkova K., Roshchin S., Roshchina Y. Do non-cognitive skills matter for alcohol consumption? Evidence from Russia // *Journal of Comparative Economics*. 2023. Vol. 51. No. 2. P. 564-576;
- Roshchina Y., Rozhkova K., Roshchin S. Between nudges and mandates: the drivers of COVID-19 vaccination intentions and subsequent uptake in Russia // *Vaccine*. 2023. Vol. 41. No. 34. P. 5053-5062;
- Roshchina Y., Roshchin S., Rozhkova K. Determinants of COVID-19 vaccine hesitancy and resistance in Russia // *Vaccine*. 2022. Vol. 40. No. 39. P. 5739-5747.

d. Endogeneity

The stability assumption is essential for the empirical evaluation of the impact of non-cognitive characteristics on socio-economic behaviour. Violating this assumption results in endogeneity due to the inverse causality between socio-economic outcomes and the observed level of non-cognitive characteristics. Furthermore, endogeneity may arise from the omission of significant variables related to the level of cognitive ability, which interacts with non-cognitive characteristics in the process of personality formation. Although it is not possible to fully overcome endogeneity in this topic without the use of experimental methods, the study took several steps to reduce the severity of the problem and establish the direction of causality.

First, when investigating the effect of non-cognitive characteristics on educational trajectory, this study considered estimates for both the education received and adolescents' intention to study at university. The same non-cognitive characteristics were found to be significant in both cases. To compensate for the omission of significant variables related to cognitive ability, foreign language skills were controlled for.

Second, when investigating the effect of non-cognitive characteristics on health, an objective measure of longevity was used in addition to subjective estimates, eliminating the potential for reversed causality.

Finally, when investigating the contribution of non-cognitive characteristics to addictive behaviour, a series of measures were employed to determine the direction of causality. A panel data design was used, incorporating lags of control variables (including marital status, weight, and per capita household income) from the previous waves of the survey. In addition, the model estimation was conducted on a sample of respondents aged 30-60, as this age is recognized by psychologists to be when personality is most stable. In order to eliminate the influence of age on non-cognitive characteristics, an approach outlined in (Heineck, Anger, 2010; Ayhan et al., 2020)

was applied. Instead of using the Big Five categories directly, the residuals of the OLS models were used in the estimation, where each of the categories was regressed on age and its square. Overall, the undertaken methods did not significantly change the effect of non-cognitive characteristics, suggesting that endogeneity has a limited impact on the results.

7. This dissertation in the context of the Russian research field

Non-cognitive skills are a relatively new area of economic research in Russia. This field emerged during the creation of this thesis in 2019-2024, due to the recent availability of necessary data. Although questions regarding locus of control have been present in RLMS-HSE since 2002, the Big Five were only introduced in 2016. This research produced one of the first papers in Russia dedicated to non-cognitive characteristics in the labour market (Maksimova, 2019; Rozhkova, 2019) and in a broader socio-economic context (Gimpelson et al., 2020). Empirical results for Russia, including the results of this study, suggest that there are robust associations between non-cognitive characteristics, socioeconomic behaviour and educational, health and labour market outcomes (see Tables 1-2).

Of the Big Five categories, conscientiousness, which is characterised by discipline and conformity, is consistently associated with all socially endorsed practices and outcomes. Individuals with high conscientiousness are more likely to be employed (Rozhkova, 2019; Lukyanova, 2021) and to have higher wages (Rozhkova, 2019; Maksimova, 2019). Additionally, higher conscientiousness, which is more commonly observed among women, helps to reduce the gender gap in the labour market (Rozhkova et al, 2021). Individuals who exhibit greater conscientiousness are more likely to have educational plans during adolescence, pursue higher education, and graduate from selective universities (Rozhkova and Roshchin, 2021). Moreover, they are less likely to become NEET (Not in Education, Employment or Training) (Zudina, 2022), more likely to be healthy, have longer lives (Rozhkova, 2024), a lower likelihood of addictions, including alcohol consumption (Rozhkova et al, 2023), and a higher likelihood of positive attitudes towards COVID-19 vaccination (Roshchina et al., 2022; 2023). Finally, conscientiousness is associated with persistence and self-efficacy, which are measured in the international PISA (Programme for International Student Assessment) survey and reduce the likelihood of poor academic outcomes among Russian students (Avanesyan et al., 2022).

Internal locus of control shows similar positive associations with socioeconomic outcomes. On average, externality, which is more commonly observed among women, explains a significant portion of the gender gap in the Russian labour market (Rozhkova et al., 2021). Furthermore, internal locus of control is associated with a greater likelihood of pursuing higher education (Rozhkova, Roshchin, 2021) and is linked to longevity and better self-rated health. This is partly

due to positive lifestyle habits such as regular physical exercise, abstaining from smoking, and limiting alcohol consumption (Rozhkova, 2024).

Neuroticism has been found to work in the opposite direction. Neurotic individuals, who tend to be impulsive and anxious, on average earn lower wages (Rozhkova, 2019; Maksimova, 2019) and are less likely to be employed (Rozhkova, 2019; Lukyanova, 2021), including in higher-paying private sector (Lukyanova, 2021). Since women on average possess less emotional stability, neuroticism tends to increase the gender wage gap, especially at the top of the wage distribution. This could be attributed to the underrepresentation of women in managerial and higher-paying jobs where stress tolerance is highly valued (Rozhkova et al., 2021). Neuroticism is associated with increased odds of informal employment lacking social guarantees (Zudina, 2023) and of being part of NEET-inactive youth (Zudina, 2022). This may be due to neuroticism decreasing the likelihood of continuing higher education, particularly among adolescents from less socially advantaged families (Rozhkova, Roshchin, 2021), and reducing the chances of achieving high academic success (Nye et al., 2013). Individuals with neurotic tendencies have lower self-rated health and longevity and are more likely to engage in unhealthy behaviours such as smoking (Rozhkova, 2024) and consuming alcohol as a form of stress management (Rozhkova et al., 2023). Furthermore, neurotics tend to express negative attitudes towards vaccination (Roshchina et al., 2022; 2023). However, neurotics who pursue higher education are more likely to graduate from the most selective universities (Rozhkova, Roshchin, 2021).

Openness is closely related to education and the labour market, where its complementarity with cognitive skills plays a significant role. Openness has stable associations with academic achievement (Nye et al. 2013) and the likelihood of pursuing higher education, particularly for adolescents from low-income families (Rozhkova & Roshchin, 2021). Openness is also associated with higher wages in the labour market (Rozhkova, 2019; Maksimova, 2019), narrowing the gender gap in the bottom half of the wage distribution (Rozhkova et al., 2021), and predicting early career entry (Maltseva and Rosenfeld, 2022). Meanwhile, it is weakly related to objective health indicators, attitudes towards vaccination, or habits (Rozhkova, 2024).

Extraversion demonstrates mixed results. While extroverts tend to develop better social skills, which are highly valued in the Russian labour market (Volgin and Gimpelson, 2022), this characteristic does not have a significant impact on average labour market wages (Rozhkova, 2019; Maksimova, 2019). However, higher level of extraversion, observed among women, reduces the gender gap at the top of the wage distribution (Rozhkova et al., 2021). NEET-extroverted young men are more likely to be unemployed but less likely to be economically inactive (Zudina, 2022). Although extraversion is not directly related to longevity or self-rated health, it may have

an indirect effect through habits: extraverts tend to drink alcohol more often (Rozhkova et al., 2023) and smoke more frequently. However, they also exercise more often (Rozhkova, 2024).

Finally, agreeableness displays the least impressive results among all the Big Five categories. High levels of agreeableness are significantly negatively associated with employment probability (Rozhkova, 2019, Lukyanova, 2021) and working in the private sector (Lukyanova, 2021). In education, agreeableness is positively associated with the probability of choosing humanities as a major (Rozhkova, Roschin, 2021), but not with the probability of graduating from university. In the health domain, agreeable individuals with their tendency to altruism are more likely to get vaccinated (Roshchina et al., 2022; 2023) and to consume higher volumes of alcohol (Rozhkova et al., 2023).

Although risk attitudes are more related to economic preferences rather than non-cognitive skills, it is worth mentioning the results obtained for this characteristic. Risk inclination, more commonly observed among men, explains a portion of the gender wage gap, particularly at the top of the wage distribution (Rozhkova et al., 2021). Additionally, positive attitudes towards risk increase the likelihood of private sector employment (Lukyanova, 2021) and self-employment (Gromova, 2021). Regarding health-related outcomes, individuals inclined to risk are less likely to be vaccinated against COVID-19 (Roshchina et al., 2022; 2023). However, there is no research on the impact of risk attitudes on other outcomes, such as education, in the Russian context

Таблица 1. Empirical results based on RLMS data

	The Big Five					Internal locus of control	Risk attitudes
	Conscientiousness	Openness	Extraversion	Agreeableness	Neuroticism		
Facets Socio-economic outcome/behaviour	Responsible, disciplined, hardworking, conformist	Curious, creative, receptive to beauty	Active, sociable, energetic	Friendly, kind, willing to help, trustworthy	Impulsive, anxious, emotionally unstable	Takes responsibility for what happens in his or her life	Tends to take risks in different aspects of life (driving, health, career investments, etc).
<i>Labour market</i>							
Employment (Rozhkova, 2019; Lukyanova, 2021)	+	~	~	-	-		
Wage (Rozhkova, 2019; Maksimova, 2019)	+	+	~	~	-		
Gender wage gap (Rozhkova et al., 2021)	- (reduces the gap on average)	- (reduces the gap at the middle and bottom of the income distribution)	- (reduces the gap in the middle and upper part of the income distribution)	~	+ (increases the gap everywhere except at the bottom of the income distribution)	+ (widens the gap everywhere)	+ (widens the gap at the middle and top of the income distribution)
Employment in public sector (Lukyanova, 2021)	+	~	~	~	~		~
Employment in private sector (Lukyanova, 2021)	+	~	~	-	-		+
Employment in informal sector (Zudina, 2023)	~	~	~	~	+		
Entrepreneurship and self-employment (Gromova, 2021)							+
<i>Education</i>							

	The Big Five					Internal locus of control	Risk attitudes
	Conscientiousness	Openness	Extraversion	Agreeableness	Neuroticism		
Probability of pursuing higher education (intention and fact) (Rozhkova, Roshchin, 2021)	+	+	~	~	- (more important at lower socio-economic status of the family)	+	
Major choice (Rozhkova, Roshchin, 2021)	~	~	~	+ (Humanities, social sciences, art)	+ (Economics and management) - (Law)	+ (STEM) - (Economics and management)	
Graduation from a selective university (Rozhkova, Roshchin, 2021)	+	~	~	~	+		
Belonging to NEET unemployed youth (Zudina, 2022)	- (Female)	- (Male)	+ (Male)	~	~		
Belonging to NEET-inactive youth (Zudina, 2022)	- (Male)	~	- (Male)	~	+ (Female)		
<i>Health and health behaviours</i>							
Longevity (Rozhkova, 2024)	+	~	~	~	-	+	
Self-assessed health (Rozhkova, 2024)	+	-	+/-	~	-	+	
Probability of physical exercise (Rozhkova, 2024)	~	+	+ (Male)	~	~	+	
Probability of smoking (Rozhkova, 2024)	- (Female)	~	+ (Female)	~	+	- (Female)	
Probability of alcohol consumption	-	~	+	~	~		

	The Big Five					Internal locus of control	Risk attitudes
	Conscientiousness	Openness	Extraversion	Agreeableness	Neuroticism		
(Rozhkova et al., 2023)							
Volume of consumed alcohol (Rozhkova et al., 2023)	~	- (Male) + (Female)	+	~	+ (Female)		
Vaccination intentions and attitudes (Roshchina et al., 2022; Roshchina et al., 2023)	+	~	~	+	-		-

Note: '+' indicates a statistically significant positive relationship, '-' indicates a statistically significant negative relationship, and '~' indicates the absence of a statistically significant relationship. Cells with no corresponding estimates are highlighted in grey.

Table 2. Summary of empirical findings for Russia based on other non-cognitive measurement tools and/or other databases

Paper	Measure of non-cognitive characteristics	Data	Outcome	Conclusion
Avanesyan et al., 2022	Growth mindset, self-efficacy, persistence, motivation to master tasks, self-confidence, sense of belonging in school	PISA	Academic achievement	Developing a growth mindset, self-efficacy, and persistence reduce the likelihood of poor academic outcomes, with the effect stronger for families of low socioeconomic status
Volgin, Gimpelson, 2022	Personal and social skills	job portals (hh.ru)	Demand for skills	Social skills are the most in demand on the Russian labour market
Maltseva, Rosenfeld, 2022	Closed-mindedness, conscientiousness, neuroticism	Longitudinal data «Trajectories in education and profession», TIMSS-2011, PISA-2012	Educational trajectories	Inclusion in early career trajectories is associated with openness to new experiences
Nye et al., 2013	The Big Five	Single university data (case study)	Results of the Unified State Examination (USE) as a measure of success in entering a university, and the average score during the study period as an indicator of current academic performance	Introversion, Agreeableness, Neuroticism and Openness to Experience are significant predictors of academic achievement in Russian university students

8. Main findings

1. Non-cognitive characteristics are significantly related to individual behaviour and performance in the labour market across all socio-demographic and professional groups. The contribution of personality in explaining wage heterogeneity is comparable to the effect of education and amounts to 5%. Openness and neuroticism have the most stable effect on wage, while conscientiousness, agreeableness, and neuroticism are related to the probability of employment. Non-cognitive characteristics account for up to 8% of the gender wage gap in the Russian labour market, with the contribution varying across the wage distribution. Extraversion, neuroticism, and risk attitude are more relevant in explaining the gender gap at the top of the wage distribution.
2. Non-cognitive characteristics are significantly associated with the choice of educational trajectory. Graduation probability is positively related to openness and negatively related to neuroticism. Neuroticism is positively associated with studying economics and management, but negatively related to studying law. Agreeableness, on the other hand, is positively associated with studying humanities, while internal locus of control increases the probability of graduating from a STEM field and decreases that of graduating from Economics and management. Finally, conscientiousness and neuroticism are positively associated with the likelihood of graduating from a leading and selective university. Conscientious and diligent individuals tend to have better academic results, which in turn increase their chances of entering top universities. Similarly, high levels of neuroticism are associated with higher anxiety and fear of failure, which may have a positive effect on academic performance under pressure in the face of strict deadlines and high learning complexity.
3. Non-cognitive characteristics are significant predictors of alcohol consumption in Russia for both men and women. Extraversion is positively associated with alcohol consumption and the volume of alcohol consumed. In contrast, conscientiousness is negatively related to the probability of alcohol consumption and the volume of alcohol consumed, which correlates with the overall protective effect of conscientiousness on health reported in the literature. Openness and neuroticism only show statistically significant effects for the volume of alcohol consumed, which varies across gender groups. While openness reduces the volume of alcohol consumed for men, the opposite effect is observed for women. High neuroticism suggests an increase in alcohol consumption, but only among women.
4. Non-cognitive characteristics have a significant correlation with vaccination attitudes. Neuroticism is negatively associated with vaccination, including voluntary vaccination, but positively associated with vaccination hesitancy. Risk inclination is consistently associated

with anti-vaccination attitudes for both mandatory and voluntary vaccination. Non-cognitive characteristics are hypothesised to influence individual susceptibility to vaccination policies and the choice of information resources.

5. Conscientiousness and internal locus of control have a consistently positive association with both subjective measures of health and objective longevity for both men and women. A 1 standard deviation increase in conscientiousness reduces the risk of death by 20 percentage points among men and 12 percentage points among women, while internal locus of control reduces the risk by 11 percentage points for men and 10 percentage points for women. Neuroticism and openness also show statistically significant effects which can be only partially explained by health habits and the propensity towards a certain lifestyle.

9. Contribution

1. The study establishes the impact of non-cognitive characteristics to wages and employment probability in Russia. It also investigates the contribution of non-cognitive characteristics to the gender wage gap, revealing for the first time in Russia that it accounts for 8% of the gap. The study employs decomposition techniques and accounts for heterogeneity across the wage distribution. The effect of different measures of non-cognitive characteristics appears to be bidirectional.
2. For the first time in Russia, it has been empirically proved that non-cognitive skills, such as openness, conscientiousness, emotional stability, and internal locus of control, positively contribute to the formation of educational trajectory. This is measured both by the intention to obtain higher education and the actual educational choices made, including the obtained diploma, choice of major, and level of university selectivity.
3. For the first time, estimates of the contribution of non-cognitive characteristics to addictive behaviour in Russia were obtained. Conscientiousness and extraversion have a bidirectional effect on the probability of alcohol consumption and the volume of alcohol consumed, which is similar for both men and women. Openness and neuroticism only affect the volume, and the observed effect varies across genders.
4. For the first time, empirical evaluations are received, indicating a robust effect of non-cognitive characteristics on attitudes towards COVID-19 vaccination in Russia. Conscientiousness is associated with a decrease in vaccination hesitancy, while risk inclination is associated with an increase in vaccination resistance. Finally, neuroticism is associated with a decrease in hesitance and an increase in resistance.
5. For the first time, the effect of non-cognitive characteristics on self-assessed health and longevity was established for Russia, using a wide arsenal of methods. Conscientiousness and

internal locus of control demonstrate a predominantly positive effect on health, while neuroticism has a negative association. The observed effects are similar for both men and women.

10. Publications

1. Rozhkova K. Does personality predict health? Non-cognitive skills, health behaviors, and longevity in Russia // *Population and Economics*. 2024. Vol. 8. No.1. P.132-155 DOI: 10.3897/popecon.8.e108813.
Characteristics: Scopus Q3; HSE Journal List C; Size – 2,3 copyright sheets; author's contribution – 2,3 copyright sheets.
2. Roshchina Y., Rozhkova K., Roshchin S. Between nudges and mandates: the drivers of COVID-19 vaccination intentions and subsequent uptake in Russia // *Vaccine*. 2023. Vol. 41. No. 34. P. 5053-5062. DOI: 10.1016/j.vaccine.2023.06.067
Characteristics: Scopus Q1; HSE Journal List A; Size – 1,2 copyright sheets; author's contribution – 0,6 copyright sheets.
3. Rozhkova K., Roshchin S., Roshchina Y. Do non-cognitive skills matter for alcohol consumption? Evidence from Russia // *Journal of Comparative Economics*. 2023. Vol. 51. No. 2. P. 564-576. DOI: 10.1016/j.jce.2022.11.005
Characteristics: Scopus Q1; HSE Journal List A; Size – 2 copyright sheets; author's contribution – 1,4 copyright sheets.
4. Roshchina Y., Roshchin S., Rozhkova K. Determinants of COVID-19 vaccine hesitancy and resistance in Russia // *Vaccine*. 2022. Vol. 40. No. 39. P. 5739-5747. DOI: 10.1016/j.vaccine.2022.08.042
Characteristics: Scopus Q1; HSE Journal List A; Size – 1,1 copyright sheets; author's contribution – 0,55 copyright sheets.
5. Rozhkova K., Yemelina N., Roshchin S. Can non-cognitive skills explain the gender wage gap in Russia? An unconditional quantile regression approach / NRU Higher School of Economics. Series WP BRP "Economics/EC". 2021. No. 252. <http://dx.doi.org/10.2139/ssrn.3938065>
Characteristics: preprint; Size – 1,5 copyright sheets; author's contribution – 1,05 copyright sheets.

6. Rozhkova K., Roshchin S. Non-Cognitive Characteristics and Higher Education Choices // *Voprosy Obrazovaniya / Educational Studies Moscow*. 2021. № 4. P. 35–73. (In Russ.) DOI: 10.17323/1814-9545-2021-4-35-73
Characteristics: Scopus Q2; HSE Journal List B; Size – 1,7 copyright sheets; author’s contribution – 1,36 copyright sheets.
7. Rozhkova K., Roshchin S. The Impact of Non-Cognitive Characteristics on the Higher Education Choice-Making: An Economist Perspective // *Voprosy Obrazovaniya / Educational Studies Moscow*. 2021. № 3. P. 138–167. (In Russ.) DOI: 10.17323/1814-9545-2021-3-138-167
Characteristics: Scopus Q2; HSE Journal List B; Size – 1,3 copyright sheets; author’s contribution – 1,04 copyright sheets.
8. Rozhkova K. The return to noncognitive characteristics in the Russian labor market. // *Voprosy Ekonomiki* 2019. № 11. P. 81–107. (In Russ.) DOI: 10.32609/0042-8736-2019-11-81-107
Characteristics: Scopus Q2; HSE Journal List B; Size – 2 copyright sheets; author’s contribution – 2 copyright sheets.

11. Conference and seminar presentations

The results of the thesis research were presented at 7 international conferences in Russia and abroad:

1. October 25–27, 2023 - XIV International Conference on Higher Education (ICHE) (Moscow, Russia). Topic: The Impact of Non-Cognitive Skills on Plans to Pursue Higher Education: Evidence from Russia (with K. Avanesyan).
2. May 26-27, 2023 - 6th International RLMS-HSE User Conference (online). Topic: Between Nudges and Mandates: The Drivers of COVID-19 Vaccination Intentions and Subsequent Uptake in Russia (with Ya. Roshchina and S. Roshchin).
3. September 22, 2022 - Joint conference of Centre for Labour Market Studies (HSE university) and Human Capital Multidisciplinary Research Centre “Social and non-cognitive skills and the labour market” (online). Topic: Non-cognitive skills and health investments.
4. September 22-23, 2022 - II International Scientific Conference "Applied Economics Conference: Labour, Health, Education and Welfare" (Belgrade, Serbia). Topic: Can Non-

cognitive Skills Explain the Gender Wage Gap in Russia? An Unconditional Quantile Regression Approach.

5. December 6-10, 2021 - SRHE International Research Conference - (Re)connecting, (Re)building: Higher Education in Transformative Times (online). Topic: Non-cognitive Skills and Educational Choices in Higher Education.
6. September 23–25, 2021 - III International science and education forum «Mission of university teaching education in XXIst century» (Southern Federal University, online). Topic: The effect of non-cognitive skills on the choice in higher education”.
7. May 28-29, 2021 - 5th International RLMS-HSE User Conference. Topic: Do Non-cognitive Skills Matter for Alcohol Consumption? Evidence from Russia (with Ya.Roshchina and S.Roshchin).

The results of the thesis research were also discussed at 6 scientific seminars:

1. February 28, 2023 - Laboratory for Studies in Economic Sociology, Seminar Series "Sociology of Markets" (HSE university). Topic: Between nudges and mandates: the drivers of COVID-19 vaccination intentions and subsequent uptake in Russia (with Ya. Roshchina and S. Roshchin).
2. December 16, 2021 - FES Workshop for Junior Economists (HSE university). Topic: The Determinants of COVID-19 vaccine hesitancy and resistance in Russia.
3. November 16, 2021 - Laboratory for Studies in Economic Sociology, Seminar Series "Sociology of Markets" (HSE university). Topic: COVID-19 vaccine hesitancy and its determinants in Russia (with Ya. Roshchina and S. Roshchin).
4. October 12, 2020 - Human Capital Multidisciplinary Research Centre joint seminar with the World Bank (HSE university). Topic: Gender Gap in the Russian Labor Market: Meta-Analysis, Educational Segregation and Non-Cognitive Characteristics (with N. Yemelina S. Roshchin);
5. October 13, 2020 - Laboratory for Studies in Economic Sociology, Seminar Series "Sociology of Markets" (HSE university). Topic: The effect of non-cognitive characteristics on alcohol consumption (with Ya. Roshchina and S. Roshchin).
6. April 23, 2019 - Laboratory for Labour Market Studies joint seminar with Centre for Labour Market Studies (HSE university). Topics: The return to non-cognitive characteristics in the Russian labour market.

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2. Avanesian G.A., Borovskaya M.A., Ryzhova V.S., Kirik V.A., Egorova V.A., Bermous A.G. (2022) Can We Improve Learning Outcomes of Schoolchildren from the Poorest Families by Investing into Their Non-Cognitive Skills? Causal Analysis Using Propensity Score Matching. *Voprosy obrazovaniya / Educational Studies Moscow*, no 1, pp. 13–53. (in Russ.) DOI: 10.17323/1814-9545-2022-1-13-53
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