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THE DETERMINANTS OF EXPECTED RETURNS ON HIGHER EDUCATION IN RUSSIA: A HUMAN CAPITAL THEORY PERSPECTIVE

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THE DETERMINANTS OF EXPECTED RETURNS ON HIGHER EDUCATION IN RUSSIA: A HUMAN CAPITAL THEORY PERSPECTIVE[2]

This paper evaluates the determinants of the expected returns on higher education among students of Russian universities accounting for the variation of the socio-economic development of Russian regions. Based on the longitudinal study, 'Trajectories in Education and Careers', it is shown that the average salary in a region is positively related to the individual estimates of expected salary after graduation, but does not affect the relative returns on higher education, i.e. the expected percentage increase in wages, compared to the salary in the absence of a higher education degree. In general, the results correspond to human capital theory, and confirm the rationality of students' salary expectations. The expected salary shortly after graduation from university is positively related to the academic achievement expressed in the university entrance exam (the Unified State Exam, USE), full-time study and prior work experience. Male students expect to receive higher salaries compared to female students. Students who study for free, expect lower salaries compared to those students who cover their tuition costs. An indirect influence (through USE results) of school characteristics and parental education on expected salary was found. In addition, we discovered a direct and indirect relationship between family income and expected salaries after university graduation.

JEL Classification: I21, I24, I28

Keywords: expected returns on higher education, higher education premium, USE, students' salary expectations

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Introduction

Research on individual expectations is becoming an increasingly popular topic among economists and sociologists. It has been established that the expectations of agents in various markets (for example, financial or labor markets) influence their behavior in the future, and force them to correct their own strategies now. Thus, expectations underlie individual choices. This underscores the importance of studying the factors which influence the formation of expectations. Moreover, it has been empirically proven that, in general, the expectations of individuals are quite realistic, and can be used as predictors of their behavior in the future (Delavande et al. 2011). In other words, individual expectations can be considered rational.

Expectations in higher education also matter, as educational choice, educational trajectories, and transitions for example, from school to university (Poynton, Lapan 2017; Taylor et al. 2014; Drake et al. 2016; Hill, Wang 2015; Frischmann, Moor 2017), or from university to the labor market (Kuron et al. 2015; Roshchin, Rudakov 2017) are important steps in individual lives and all of them are driven by the expectations. The choice of educational trajectory is no less important in the system of economic preferences of individuals, than financial decisions or patterns associated with consumption, since education is an important predictor of future salaries and overall well-being (Brand, Xie 2010; Blundell et al. 2000; Moretti 2004; Brand 2010; Vedder 2004). Moreover, many studies have empirically proved the positive value of higher education (see review by Oreopoulos, Petronijevic 2013; Psacharopoulos 1994; Psacharopoulos, Patrinos 2004).

The *expected* benefits from higher education are an important element of the choice of educational level and educational trajectory. These benefits, or expectations related to the subsequent returns on education (for example, salary expectations) are crucial. In other words, these expectations characterize the value of higher education anticipated by the individual. This thesis is in line with human capital theory (Becker 1962, 1964; Schultz 1961): a rational economic agent decides to continue learning if the benefits from education exceed the associated costs. The costs associated with higher education are easily assessable, because they usually include current expenses for tuition, living expenses, as well as foregone income from work while studying. However, individuals do not have the full information about the benefits of higher education. In this regard, students are guided by their own intuitive expectations of the benefits that will be realized in the future.

Among the quantitative measures of expectations from higher education, we can single out the expected salary after graduation and the relative returns on higher education, i.e. the percentage excess of wages after graduation from higher education over wages in the absence of a higher education degree, in comparable prices. Thus, based on the importance of salary expectations in educational choice, it is interesting to study the formation of such expectations, i.e. the determinants of expected returns on higher education.

The purpose of the study is to assess the expected returns on higher education (expressed in future salaries) in Russia and to determine empirically the factors which influence the expected returns on higher education. Despite most research on the returns on higher education being based on data on *actual* returns on higher education (see review by Diagne, Diene 2011), a number of works studying the *expected* salaries among university graduates have been carried out in recent years (Anchor et al. 2011; Arcidiacono et al. 2012; Sequeira et al. 2013; Gamboa, Rodriguez 2014), including the Russian educational market (Androushchak, Natkhov 2010; Prakhov 2017). However, evidence shows that the use of the expected or actual values of returns on education does not lead to significant changes in the results (Dominitz 2001).

This study builds on the previous research on the expected returns on higher education, conducted for the Moscow higher education market in 2016 (Prakhov 2017). While previous research was limited to Moscow university students, this study scales it up by the inclusion of the interregional variation of socio-economic development in Russia. However, the previous study can be considered as a benchmark, as Moscow is the most developed higher education market, and university applicants from Moscow universities have the widest choice of educational opportunities. Moreover, this is the most developed labor market, therefore Moscow graduates have the widest choice of career paths among Russian graduates. The study of the expectations of Moscow students was due to the fact that selected students had homogeneous views on the labor market, and the education market, independent of variations in regional characteristics. Thus, the neutrality of regional characteristics in the formation of salary expectations was assumed. Nevertheless, the Russian regions are quite different from each other in terms of their socio-economic development, including the average actual regional salaries and costs of living. We assume that such discrepancies in regional development indicators may also affect salary expectations, in addition to the factors evaluated previously. Therefore, this study includes the interregional variation of socio-economic indicators in explaining the differences in graduate salary expectations in Russia.

This paper is organized as follows. The first section describes the theoretical framework of the study. A formal model of the determinants of the expected returns on higher education, taking into account individual, family, school, university and regional characteristics, is presented. The second section describes the data used in this study. The estimates of the average return on higher education by field of study are provided. In the third section, a correlation analysis is performed. The groups of highly correlated factors are shown. In the fourth section, we estimate the regressions of expected salaries and expected relative returns on higher education on individual, family, school, university and regional factors. An interpretation of the results is provided. The paper concludes with a discussion of findings.

1. The analytical framework of the study: the model of salary expectations

The analytical framework of the study is based on human capital theory. As mentioned above, the expected returns on higher education can be considered within this approach, since it allows us to provide links between the *expectations*, and the *actual choice* of the individual. Below, we elaborate our own analytical model of the formation of salary expectations in the context of higher education. In other words, the model based on human capital theory considers the determinants of the expected returns on higher education and their interconnections (see Fig. 1):

Model description. One of the most important predictors of university choice are **the results of the national Unified State Exam** (USE), since in most cases they constitute the main criterion for the selection of university applicants. On the one hand, USE results can have a direct impact on the expected salary: high-achievers are characterized by a high level of investment in human capital, and therefore they expect to get higher returns on these investments (Webbink, Hartog 2004; Prakhov 2017). In addition, individual USE results may be associated ('matched') with the type of university which students enroll in. There are studies that demonstrate favorable conditions for the perfect match between the quality of an applicant (her USE scores), and the quality of a university, calculated on the basis of the average USE score among admitted students (Prakhov, Sergienko 2019). In turn, the quality of higher education (and HEI) as a measure of investment in human capital after graduation, can positively influence both salary expectations (Prakhov 2017) and actual salaries after graduation (Roshchin, Rudakov 2016).

On the other hand, academic performance (in our case, USE results) can itself be a function of individual, family and **school characteristics** (Prakhov 2016a, 2016b; Prakhov, Sergienko 2019). Thus, individual USE scores can be positively associated with student performance in secondary school, with the fact of studying in **schools with special status**, or in-depth study of subjects, or in classes with a specialization in certain subjects (Prakhov 2016b; Prakhov, Sergienko 2019). In addition, the steady influence of **family characteristics** (Coleman et al. 1966), such as parental education (Leibowitz 1977; Hearn 1991; Davis-Kean 2005; Perna, Titus 2005; Sandefur et al. 2006; Okpala et al. 2001), family income (Baird 1967; White 1982; Hill, O'Neil 1994; Morris et al. 2004; Davis-Kean 2005; Dahl, Lochner 2005; Prakhov, Yudkevich 2019), and the level of cultural capital[3] has been confirmed in many studies.

[3] The indicator 'Number of books at home' used to be a proxy for the level of cultural capital, but in recent years, due to the gradual replacement of print publications with electronic resources, such an indicator is used less and less.

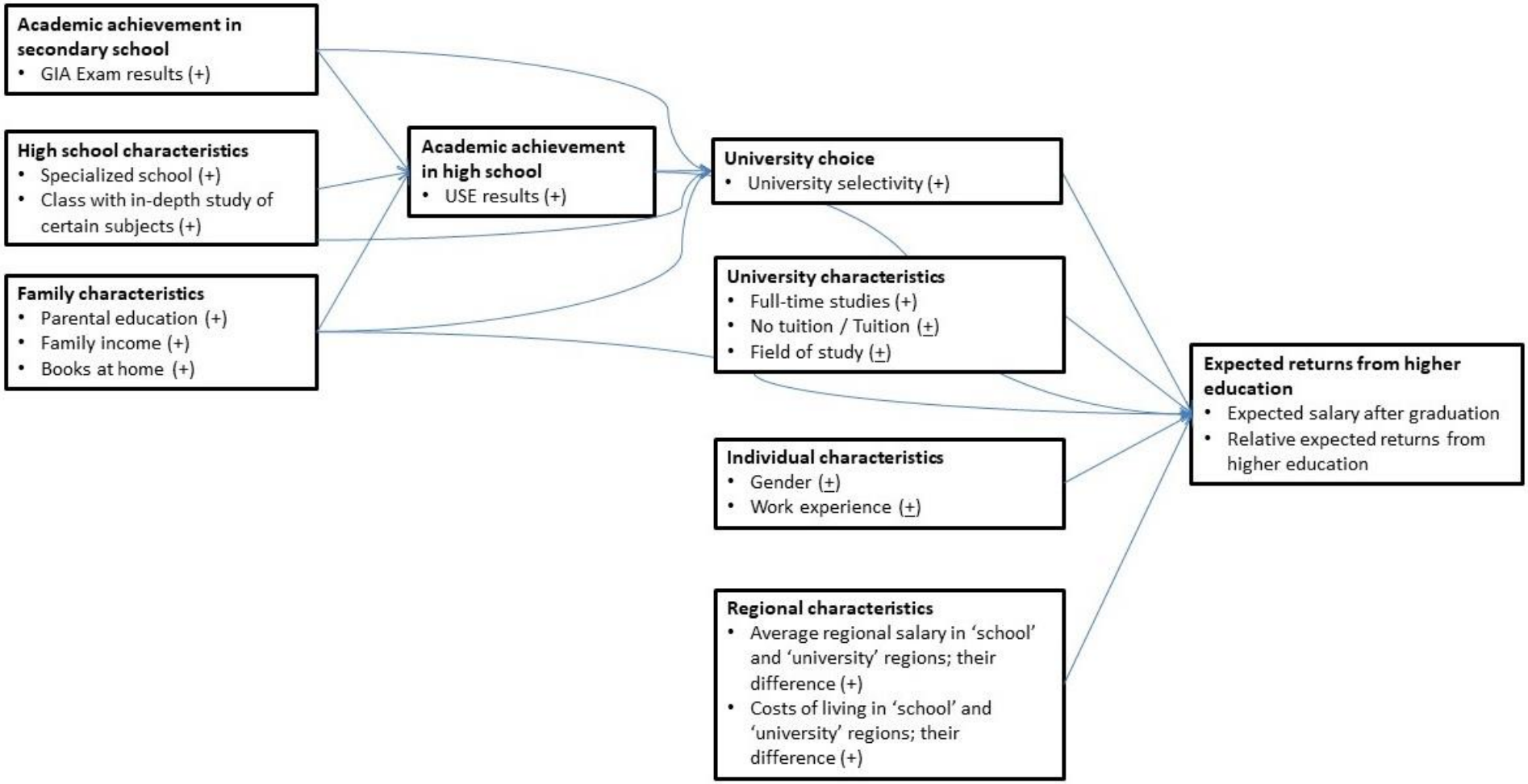

Figure 1. The model of expected returns on higher education

Thus, the family can have an indirect impact on the expected returns on higher education through USE scores (Prakhov 2017), but a direct channel of influence is also possible. Previous studies confirm the thesis that family is an important actor in the system of student choice, for example, a positive relationship has been established between **mother's education** and student's expected salaries[4] (Brunello et al. 2004), as well as between **father's education** and salary expectations (Prakhov 2017). It can be assumed that students from highly educated families expect to receive higher wages, since their parents already have a positive premium for higher education. In addition, this fact is consistent with human capital theory: as a rule, parents with higher education make larger investments in the human capital of their children (for example, through assistance and additional training), and these investments should result in higher returns.

Family income is another factor which can have a positive effect on students' salary expectations (Gamboa, Rodriguez 2014; Botelho, Pinto 2004; Smith, Powell 1990; Webbink, Hartog 2004; Androushchak, Natkhov 2010), both through the results of USE and directly (Prakhov 2017): first, students can focus on their parental income, and expect to receive no less after they graduate from university. Thus, family income can serve as a guideline or focal point for students. Secondly, from the human capital theory point of view, more affluent parents have more opportunities to make investments in the human capital of their children: for example, by paying for extra classes, or private tutoring, or by having more resources to cover tuition fees in highly selective universities. Consequently, students from more affluent families tend to expect higher salaries after university graduation, compared to their peers from less wealthy households.

The level of **cultural capital** can also have both a direct and indirect effect on salary expectations. Accumulated cultural capital is closely related to the human capital of the individual, so it is quite logical to expect that students with a higher level of cultural capital will expect higher returns on their investment in human capital expressed in future salaries.

In addition to USE results and their determinants, we assume a significant relationship between the characteristics of university education, and the expected salary. **Full-time students** can expect a higher return on their education, because, first, such programs offer higher quality standards of education, and second, they require a lot of time and effort from students (in our case, they require higher levels of investment in human capital), which should result in higher returns

[4] Note the studies which demonstrate the negative relationship between father's education and student's salary expectations (Brunello et al. 2004; Smith, Powell 1990), as well as between overall parental education and student's salary expectations (Androushchak, Natkhov 2010). This can be explained by the fact that children from more educated families make more realistic predictions, while children from less educated families may tend to overestimate the expected returns on studying at a university.

on such investment. Students who study for free[5], can expect a higher return on higher education, since, having entered on the basis of their USE results, they have already faced competition for **tuition-free positions**. Hence, this competition can motivate students to invest in further education, determining their academic performance at the university. As a result, this may also determine higher salary expectations. In addition, the formation of expectations can also be influenced by the **field of study**, since the labor market has a high salary variation among employees in different professions (McMahon, Wagner 1981; Betts 1996; Webbink, Hartog 2004; Androushchak, Natkhov 2010; Prakhov 2017). Students who will work in the best paid fields, tend to form higher salary expectations, while students studying in professions that usually bring a more modest income, will moderate their salary expectations.

Individual characteristics, such as **gender** and **work experience**, may also play a role in shaping the expected returns on higher education. Previous studies show that male students have higher salary expectations compared to female students (McMahon, Wagner 1981; Brunello et al. 2004; Botelho, Pinto 2004; Anchor et al. 2011; Smith, Powell 1990; Webbink, Hartog 2004; Prakhov 2017). Differences in salary expectations for female and male students can be explained by the fact that they can see their roles differently after they graduate: boys can be more inclined to build a career, and girls can also take into account other factors (for example, parenting), which may reduce salary expectations. Work experience can be a signal in the labor market: this is typical for Russia where the variation in the quality of higher education is very high, and in some cases a higher education degree cannot play the role of a signal. Consequently, university graduates who combined work and university studies, may have several advantages compared to their peers without work experience (Rudakov et al. 2017). However, this statement does not contradict human capital theory: early entry into the labor market can also be viewed as an investment in human capital, not within a university, but in the workplace. Hence, such investments mean students expect higher salaries after they graduate. On the other hand, students with work experience can make more realistic (and, as a rule, moderate) predictions of the relative returns on higher education, i.e. the percentage increase in salary after graduation, compared to wages without a degree, since such students can more accurately estimate the value of current salaries (represented by the actual salary they receive).

Finally, as mentioned above, the characteristics of regional labor markets can influence the formation of students' salary expectations. The average salary in the region, similar to the family income, can serve as a guide for the student. Consequently, university students who study in more

[5] They do not pay tuition fees as they were admitted for the state-subsidized place on the basis of USE results or because they succeeded in Olympiads for high school students, which allow for admission to university on a tuition-free basis.

economically developed regions, expect higher salaries after they graduate. From the human capital theory point of view, **the actual salaries in the region** can serve as an indicator of the expected benefits of higher education, i.e. this indicator may positively affect salary expectations.

In the previous study of the expected returns on higher education (Prakhov 2017), the determinants of expected salary after graduation and the expected relative premium for higher education for Moscow students were estimated. It was assumed that students who graduated from secondary schools in the same city and, as a rule, chose Moscow universities (HEIs of the same region with the most developed higher education and labor markets), have a system of preferences and expectations not dependent on regional variation. In addition, the majority of university graduates start or continue their work in Moscow. Consequently, a study of preferences for the same market revealed the determinants of differences in students' expectations, with no consideration of the influence of regional socio-economic development or variations in the structure of regional higher education markets. In this study, we estimate the expected returns on higher education and their determinants, taking into account the large variation in interregional income in Russia. According to the proposed model (Fig. 1) and the results of previous studies, the following hypotheses are formulated for the empirical part of the study:

Hypothesis 1. Academic performance expressed in USE results, is positively associated with the expected returns on higher education. USE scores are a reflection of investments in human capital during high school, so students with higher scores have higher salary expectations.

Hypothesis 2. The characteristics of school and schooling indirectly affect the formation of salary expectations through USE scores.

Hypothesis 3. Family characteristics (parental education, family income, the level of cultural capital) have both a direct and indirect (through USE scores) impact on the expected returns on higher education.

Hypothesis 4. Full-time students and those who study for free, expect to receive a higher salary compared to part-time students and those who pay tuition fees.

Hypothesis 5. The variation of wages in different fields of study leads to differences in the expected returns on higher education.

Hypothesis 6. Male students demonstrate higher salary expectations compared to their female peers.

Hypothesis 7. Work experience is positively associated with the expected returns on higher education, as this can serve as a signal for the employer.

Hypothesis 8. Students who study in regions with higher average salaries, and higher costs of living, expect to receive higher salaries after graduation, compared to students who study in the regions with lower average salaries.

2. Data description

This study is based on data from the project 'Trajectories in Education and Careers'[6], a longitudinal study of a representative sample of Russian students. The data analysis examines the answers of respondents from different waves: for example, questions about the family were asked to students when they were in the 9th grade, and questions about the expected salaries were asked to university students. The sample includes only those students who were studying at university at the time of the survey, when the questions about the expected returns on education were asked (Fall 2015). The expected salary at the end of the university was limited to 300,000 rubles per month[7], and unrealistic answers were excluded from further analysis.

Descriptive statistics are presented in Table 1. The variables that characterize the expected returns on higher education are as follows:

w_1^e is the expected salary after graduation from university. This indicator was obtained from the answer to the question 'What salary (with no adjustment for inflation, in current terms) do you expect after graduating from the university where you are studying now?'. The mean value of this indicator is 49,679 rubles (810 USD) a month, while the average monthly nominal wages in Russia that time amounted to 34,030 rubles (555 USD)[8].

w_M^e is the expected salary adjusted to the average Moscow level of salaries. Since students who took part in the survey represent different Russian regions, which have a high variation of labor remuneration, an additional adjustment was made. As the result, expected salaries were adjusted to the Moscow level, based on the ratio of the average salary in Moscow and in the corresponding region in 2015. Note that the average monthly salary in Moscow in 2015 was 64,310 rubles, or 1,049 USD (incl. employees without higher education). In general, respondents showed quite realistic answers to the question about the expected salaries.

[6] See https://trec.hse.ru/en/. This study is conducted by the Center for Cultural Sociology and Anthropology of Education at the Institute of Education of the HSE University.

[7] According to the 2015 average exchange rate (1 USD = 61.3194 RUR), this is about 4.892 USD per month.

[8] Source: http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics/wages/. Note that this indicator is calculated for the whole Russian economy, i.e. it includes not only employees with higher education, but also less educated workers with no higher education degree.

R^e is the relative expected salary, i.e. relative expected returns on higher education. This indicator shows the relative excess of the expected salary after university graduation (w_1^e) over the expected salary in the absence of higher education[9] (w_0^e), and is calculated as $R^e = \frac{w_1^e}{w_0^e} - 1$.

Independent variables were conditionally divided into several categories. Indicators of school performance are expressed as the results of the national secondary school exit exam (GIA) in Russian, Mathematics, and the average GIA score in these subjects. On average, students demonstrated high performance on this exam, but in this study we consider only those students who were enrolled in higher education after high school, so a bias of high grades is expected. In addition to the GIA scores, academic performance is represented by the USE results in Russian (the mean value is 71%), Mathematics (53%), and the average USE score in compulsory subjects, i.e. Russian and Mathematics (62%). As for the official data for Russia as a whole, in 2014 (the year when respondents took USE), the average score was 62.5% for Russian and 46.5% for Mathematics[10]. While the scores in our sample are overestimated, not all high school graduates applied for, or were admitted to university, therefore we consider such an overestimation permissible.

Table 1. Descriptive statistics

Variable	**Obs.**	**Min**	**Max**	**Mean**	**Std. Dev.**
Expected returns on higher education					
Expected salary after university graduation (w_1^e), rubles per month	1987	6,000	300,000	49,679.19	33,902.84
Expected salary after university graduation, adjusted to the Moscow level of salaries (w_M^e), rubles per month	1921	10,000	834,200	96,206.96	66,556.68
Expected salary in the absence of higher education (w_0^e), rubles per month	1976	1000	150,000	22,157.62	13,132.04
Relative expected salary (R^e)	1976	-1	39	1.50	1.84
Academic achievement					
GIA score in Russian	1839	2	5	4.35	0.66

[9] The expected salary in the absence of higher education was obtained from the answer to the following question: 'Imagine that you departed from university and became employed on a full-time basis. What do you think, what salary could you earn?'

[10] Source: https://ria.ru/society/20150629/1100713173.html.

Variable	Obs.	Min	Max	Mean	Std. Dev.
GIA score in Mathematics	1788	2	5	4.23	0.78
Average GIA score (Russian and Mathematics)	1779	3	5	4.29	0.60
USE score in Russian	1887	4	100	70.56	12.82
USE score in Mathematics	1884	3	100	53.32	15.89
Average USE score (Russian and Mathematics)	1883	3.50	100	61.94	12.52
					School characteristics
Attended high school	1897	0	1	0.95	0.22
High school with special status	1879	0	1	0.30	0.46
Class with in-depth studies of certain subjects	1879	0	1	0.56	0.50
					Family factors
Mother's education	1361	0	1	0.49	0.50
Father's education	1134	0	1	0.43	0.50
Family income, rubles per month	1321	10,000	95,000	31,355.03	22,150.05
Number of books at home	1390	5	650	166.14	187.45
					University characteristics
Full-time student	1987	0	1	0.90	0.30
Tuition-free studies	1987	0	1	0.57	0.50
University selectivity: Admission Quality Rating (AQR)	1621	44	93	66.53	8.89
Mathematics and Natural sciences	1936	0	1	0.13	0.33
Engineering and Technology	1936	0	1	0.15	0.36
Medicine	1936	0	1	0.07	0.25
Social sciences	1936	0	1	0.03	0.18
Education and Pedagogy	1936	0	1	0.05	0.22
Humanities	1936	0	1	0.18	0.38
Arts and Culture	1936	0	1	0.07	0.25
Economics and Management	1936	0	1	0.28	0.45
Agriculture	1936	0	1	0.03	0.17

Variable	Obs.	Min	Max	Mean	Std. Dev.
Military studies	1936	0	1	0.01	0.08
Individual characteristics					
Male	1443	0	1	0.41	0.49
Employed	1987	0	1	0.22	0.41
Regional economic indicators					
Average salary in 'school' region, rubles per month	1986	18,194	74,489	31,106.30	12,707.55
Average salary in 'university' region, rubles per month	1921	18,194	74,489	33,836.94	14,085.30
Difference in regional average salaries, rubles per month	1920	-53,317	43,014	2,687.81	11,427.53
Average cost of living in 'school' region, rubles per month	1986	6,754	14,241	8,500.59	1,821.98
Average cost of living in 'university' region, rubles per month	1921	6,754	14,241	8,792.39	1,952.79
Difference in regional average costs of living, rubles per month	1920	-7,215	5,788	285.35	1,657.79

Family characteristics are represented by the level of parental education (binary variables for mother's and father's education, which equal '1', if a parent has a higher education degree, and '0' otherwise), average monthly family income (in rubles), and the number of books at home[11]. In 49% of cases, the students' mothers have higher education. In 43% of cases, the students' fathers graduated from university. The average monthly family income equals 31,355 rubles. The mean value of books at home is 166.

University characteristics are presented by whether the student is studying full-time (90% of cases) or not. Another characteristic is related to tuition fees: 57% of students study for free, and 43% pay tuition fees. To determine the quality of the university, additional indicators of the university's selectivity were obtained on the basis of the 2014 Admission Quality Rating (AQR)[12].

[11] Since the survey is longitudinal, note a decrease in the number of valid responses in this category. The decrease in the number of answers is due to the fact that questions about family characteristics were asked to the parents during the first wave with a separate questionnaire. That time the interviewers could not approach all the parents for an interview. However, even this number of valid answers is sufficient for carrying out correlation and regression analysis, and the subsamples of students whose parents answered the questions about family characteristics, and whose parents did not, are similar in other characteristics.

[12] Source: : https://ege.hse.ru/rating/2014/53497368/gos/.

This indicator reflects the average USE score among those enrolled on a tuition-free basis at a particular university. The sample includes universities of different selectivity with an average AQR of 66.5 points out of 100. Another variable within this research which is connected to salary expectations, is the student's chosen field of study. Integrated groups are presented in Table 1.

Individual characteristics are represented by gender (41% male and 59% female), and employment status at the time of the survey. About 22% of respondents combine work and study.

Regional economic characteristics include the average salary in the 'school' region, i.e. in the region where a student has graduated from high school (the mean value is 31,106 rubles, or 507 USD per month), the average salary in the 'university' region (33,837 rubles, or 552 USD per month), and the difference (2,688 rubles, or 44 USD). It can be concluded that, on average, university applicants choose regions with higher salaries than in the region where they graduated from high school. Additionally, we use indicators of the regional cost of living: for school regions the mean value is 8,501 rubles (139 USD) per month, in the 'university region', 8,792 rubles (143 USD) per month; a difference of 285 rubles (5 USD).

Figure 2 shows the expected returns on higher education across fields of studies. The highest values of expected salaries are shown by students engaged in Military studies and in Arts and culture[13]. Without these two fields, the highest expected salaries are in Engineering and technology, and Mathematics and natural sciences. Next come the fields Economics and management, and Social sciences. Such a distribution is somewhat different from the mean values of salaries presented in the study of Moscow students (Prakhov 2017) where the leading field of study according to the students' salary expectations was Engineering and technology, followed by Economics and management, and Social sciences, while expected salaries in Mathematics and natural sciences were in fourth place.

[13] On the one hand, this result is rather paradoxical: for example, in the 2016 study (Prakhov 2017), students in Arts showed the least modest salary expectations. Nevertheless, the obtained results are easy to interpret through the data structure. Thus, the subsample of students in Military studies includes only 11 people, so it is impossible to draw any conclusions based on such a small number of observations. The subsample for the Arts and Culture was 129 people, including some students with really high salary expectations: 10 respondents expect to earn 100,000 rubles per month, 1 respondent – 103,000 rubles, 1 – 120,000 rubles, 1 – 130,000 rubles, 4 – 150,000 rubles, 2 – 200,000 rubles. Thus, 7% of this subsample expect to receive very high salaries, which led to an overestimation of the mean value. However, it was decided not to remove such responses from the sample, since the goal of the research is to study the determinants of the expected returns on higher education, incl. high expectations too. In addition, in the regression analysis (see below) the expected salaries will be used in a logarithmic form, which will smooth very optimistic salary expectations.

Figure 2. Expected returns on higher education by field of study

The last places are occupied by Agriculture and Education and pedagogy, and students studying the latter, expect to receive less than the rest both in absolute and relative terms.

For a quantitative assessment of the determinants of the expected returns on higher education, a correlation (section 3) and regression (section 4) analysis are conducted. In the next section, paired correlations on the main variables are considered, and the fourth section will present the specifications of econometric models, and the results of the regression analysis, i.e. an empirical assessment of the model of the expected returns on higher education presented in section 1.

3. Correlation analysis

Before we introduce the specifications of the econometric models of expected returns on higher education, we present a correlation analysis of the dependent and independent variables. Based on the values of paired correlations and their statistical significance, we can draw the following conclusions.

First, the dependent variables reflecting the expected returns on higher education are highly correlated. The strongest correlation was found between the expected salary after university graduation and the salary adjusted to the Moscow level (the correlation coefficient is 0.790). In addition, we note the high positive correlation between expected salaries in absolute and relative terms (the correlation coefficient is 0.461). In both cases, the correlation coefficients are significant at the 1% significance level.

The expected salary after university graduation is positively correlated with GIA scores in Mathematics (0.095), and with studying in high schools with a special status (0.122). In addition to school characteristics, paired correlations between expected salary and family characteristics were significant for mother's education (0.097), father's education (0.089), family income (0.206) and the number of books at home (0.071). The expected salary is positively correlated with USE scores in Mathematics (0.133) and Russian (0.086). University characteristics are also correlated with salary expectations: a positive correlation was found between this dependent variable and full-time studies (0.084), as well as with AQR, i.e. the level of selectivity of the university (0.191). Males expect higher salaries than female students (the gender correlation is 0.255). All the characteristics of the socio-economic development of the regions used in the model are positively related to salary expectations. The paired correlation coefficients were as follows: for the average wages in the school region, 0.209; for the average wages in the university region, 0.311; for their difference, 0.159; for the cost of living in the school region, 0.179; for the living costs in the university region, 0.280, for their difference, 0.143. Thus, the significance of correlations supports the research hypotheses.

For the relative expected salary (i.e. the relative returns on higher education), we discovered much less significant relationships: positive correlations were found for mother's education (0.088), full-time studies (0.057), AQR (0.056), gender (0.083), average wages in the university region (0.053) and living costs in the university region (0.056). A negative significant correlation was found for being employed (-0.071). Thus, the hypotheses for the relative impact of higher education, at the stage of correlation analysis, are confirmed only partially. For example, according to the correlation analysis, the relationship between academic performance and the relative expected premium for higher education was not confirmed.

In addition to the study of paired correlations between dependent and independent variables, we pay attention to paired correlations between independent variables, in order to avoid the problem of multicollinearity when conducting regression analysis.

Parental education indicators are strongly correlated with each other: the coefficient of paired correlation between mother's and father's education is 0.384. The indicators of academic performance also show strong correlations: USE results are strongly related to GIA results. In addition, individual USE scores correlate positively with AQR (0.419 for USE score in Russian and 0.333 for USE results in Mathematics).

As mentioned above, USE results themselves are not random and represent a function of individual, family and school characteristics. This thesis is confirmed by the results of the correlation analysis: USE scores in Russian and Mathematics correlate with all family factors: mother's education (0.167 and 0.213, respectively), father's education (0.168 and 0.166), family income (0.111 and 0.075), the number of books at home (0.147 and 0.083). In addition, USE scores

are positively associated with school characteristics: studying in a high school with a special status (0.136 and 0.125), and in classes with in-depth study of certain subjects (0.141 and 0.117). These results support a separate assessment of the educational production function, i.e. the regression of USE results on these factors.

Another group of factors which show significant correlations are regional characteristics. The highest correlation coefficient is between the average wages in the school region and the costs of living in the school region (0.946). The correlation between similar indicators for the university region is also extremely high (0.931). In addition, average wages in the school and university regions show a strong correlation with a coefficient of 0.640.

4. Regression analysis

According to the analytical framework of the study and the results of the correlation analysis, the following models are estimated:

$$\ln\left(w_1^e\right) = f_{OLS}\left(USE, School, Family, University, Individual, Regional\right) \quad (1),$$

$$R^e = g_{OLS}\left(USE, School, Family, University, Individual, Regional\right) \quad (2),$$

where $f_{OLS}(\cdot)$, $g_{OLS}(\cdot)$ are linear functions of the following variables, estimated using the OLS method:

USE – USE results (since USE results in Russian and Mathematics are highly correlated with each other, the average USE score in compulsory subjects is used for the regression analysis);

School – a vector of school characteristics (schools with a special status, classes with in-depth study of subjects);

Family – a vector of family characteristics (mother's education[14], family income, the number of books at home);

University – the characteristics of the university[15] (full-time studies, tuition-free studying, field of study);

[14] Only this variable, reflecting the level of education of the parents, will be used in the regression analysis, since mother's and father's educational levels are strongly correlated with each other.

[15] Regression analysis will not involve AQR variable for the following reasons. First, this rating is calculated only for universities with tuition-free positions. Thus, when using this indicator, students of private universities would be excluded. Secondly, we have no data on this indicator for a number of universities, mostly concentrated on Arts and Military disciplines. However, in the previous section, it was shown that individual USE results are strongly correlated with AQR (i.e., when these indicators are used together, a multicollinearity problem may arise), and previous studies (Prakhov, Sergienko 2019) showed that in general, individual USE scores correspond to AQR for each institution (perfect match). Therefore, the average USE score in compulsory subjects may be used in regressions, and can be interpreted as an indicator of university selectivity.

Individual – individual characteristics (gender, employment during studies);

Regional – regional factor (average monthly salary in the university region)[16].

As noted above, USE scores themselves are a function of the indicators of previous performance, as well as family and school characteristics, i.e. they are not exogenous. To solve the problem of endogeneity, which can lead to biased estimates of the regression coefficients, the systems of simultaneous equations are estimated by using 2SLS. At the first stage, the regression of the average USE score in compulsory subjects on the GIA results (the average GIA score in Russian and mathematics, *GIA*), family and school characteristics are assessed, and the predicted value of the USE average score is obtained ($\hat{USE}$). Then we estimate the regressions of expected returns on higher education on a set of factors, using the predicted USE value. Thus, the following systems of simultaneous equations are evaluated:

$$\begin{cases} USE = h_{2SLS}\left(GIA, School, Family\right) \\ \ln\left(w_1^e\right) = f_{2SLS}\left(\hat{USE}, Family, University, Individual, Regional\right) \end{cases} \quad (3),$$

$$\begin{cases} USE = h_{2SLS}\left(GIA, School, Family\right) \\ R^e = g_{2SLS}\left(\hat{USE}, Family, University, Individual, Regional\right) \end{cases} \quad (4).$$

Equations (3) and (4) allows us, in particular, to determine the indirect influence of school on salary expectations, and the direct and indirect (through USE results) influence of family characteristics on the expected returns on higher education.

The results of the regression analysis are presented in Table 2. Models 1–4 reflect the estimated determinants of the expected salary after university graduation: the first three correspond to equation (1), and the fourth, to equation (3). We note the similarity of results, obtained by the OLS and 2SLS methods. This may indicate that the problem of endogeneity in this sample is exaggerated. Expected salaries after university graduation are positively related to USE results: high-achievers (who have made larger investments in their own human capital) expect to receive higher salaries after graduation, which is consistent with human capital theory. Thus, hypothesis 1, for expected salaries, was confirmed. Full-time students have higher salary expectations compared to other students. Students who study for free expect to receive less than students who pay tuition fees. Thus, hypothesis 4 is confirmed only partially.

[16] In the previous section it was shown that all indicators of the regional socio-economic development are statistically interconnected. Therefore, in order to avoid the problem of multicollinearity and bias of the regression estimates, a single indicator representing the development of regions was chosen.

Table 2. The results of regression analysis of the determinants of the expected returns on higher education

Model (equation)	**1 (1)**	**2 (1)**	**3 (1)**	**4 (3)**	**5 (2)**	**6 (2)**	**7 (2)**	**8 (4)**
Dependent variable	$\ln\left(w_1^e\right)$	$\ln\left(w_1^e\right)$	$\ln\left(w_1^e\right)$	$\ln\left(w_1^e\right)$	R^e	R^e	R^e	R^e
Method / Independent variables	**OLS**	**OLS**	**OLS**	**2SLS**	**OLS**	**OLS**	**OLS**	**2SLS**
Average USE score in compulsory subjects	0.004*** (0.001)	0.004*** (0.001)	0.004*** (0.001)	0.005*** (0.002)	0.006*** (0.002)	0.004 (0.002)	0.004 (0.003)	0.004 (0.005)
High school with a special status			0.036 (0.030)				0.005 (0.060)	
Class with in-depth studies of certain subjects			-0.020 (0.028)				-0.076 (0.055)	
Mother's education			0.006 (0.029)	0.003 (0.031)			0.010 (0.058)	0.003 (0.061)
Family income / 1000			0.003*** (0.001)	0.003*** (0.001)			0.002 (0.001)	0.001 (0.001)
Number of books at home / 1000			0.021 (0.074)	-0.001 (0.076)			-0.122 (0.147)	-0.084 (0.151)
Full-time studies	0.092* (0.052)	0.098 (0.060)	0.111* (0.063)	0.121** (0.057)	0.141 (0.094)	0.075 (0.113)	0.102 (0.125)	0.126 (0.114)
Tuition-free studies	-0.156*** (0.030)	-0.137*** (0.034)	-0.116*** (0.036)	-0.089*** (0.034)	-0.144*** (0.054)	-0.121* (0.064)	-0.142** (0.070)	-0.103 (0.068)
Mathematics and Natural sciences	0.114* (0.069)	0.011 (0.075)	-0.013 (0.079)	0.005 (0.080)	0.242* (0.124)	0.165 (0.138)	0.216 (0.152)	0.200 (0.154)
Engineering and Technology	0.204*** (0.068)	0.056 (0.073)	0.014 (0.077)	0.026 (0.078)	0.297** (0.121)	0.176 (0.134)	0.263* (0.146)	0.219 (0.149)
Medicine	-0.083 (0.075)	-0.131 (0.082)	-0.156* (0.085)	-0.140 (0.087)	0.418*** (0.139)	0.433*** (0.154)	0.562*** (0.167)	0.532*** (0.171)
Education and Pedagogy	-0.288*** (0.079)	-0.293*** (0.086)	-0.341*** (0.089)	-0.327*** (0.090)	-0.268* (0.148)	-0.342** (0.164)	-0.287 (0.176)	-0.280 (0.182)
Humanities	-0.070 (0.068)	-0.039 (0.073)	-0.058 (0.077)	-0.044 (0.077)	0.052 (0.122)	0.021 (0.133)	0.080 (0.146)	0.110 (0.149)

Model (equation)	**1 (1)**	**2 (1)**	**3 (1)**	**4 (3)**	**5 (2)**	**6 (2)**	**7 (2)**	**8 (4)**
Dependent variable	$\ln\left(w_1^e\right)$	$\ln\left(w_1^e\right)$	$\ln\left(w_1^e\right)$	$\ln\left(w_1^e\right)$	R^e	R^e	R^e	R^e
Method / Independent variables	**OLS**	**OLS**	**OLS**	**2SLS**	**OLS**	**OLS**	**OLS**	**2SLS**
Arts and Culture	0.226**	0.168**	0.101	0.111	0.223*	0.216	0.292*	0.251
	(0.076)	(0.084)	(0.089)	(0.090)	(0.135)	(0.154)	(0.170)	(0.173)
Economics and Management	-0.051	-0.110	-0.143*	-0.127*	-0.125	-0.207	-0.148	-0.126
	(0.067)	(0.071)	(0.075)	(0.076)	(0.119)	(0.130)	(0.143)	(0.145)
Agriculture	-0.046	-0.112	-0.128	-0.123	0.114	-0.061	0.039	0.049
	(0.090)	(0.100)	(0.101)	(0.102)	(0.160)	(0.182)	(0.191)	(0.194)
Military studies	0.628***	0.415**	0.459**	0.468***	0.844***	1.001***	1.300***	1.291***
	(0.161)	(0.181)	(0.187)	(0.185)	(0.292)	(0.343)	(0.373)	(0.374)
Male		0.228***	0.190***	0.178**		0.064	0.030	0.024
		(0.029)	(0.031)	(0.031)		(0.055)	(0.060)	(0.062)
Employed	0.055*	0.052	0.075**	0.089***	-0.036	-0.011	-0.043	-0.040
	(0.030)	(0.034)	(0.036)	(0.035)	(0.055)	(0.065)	(0.071)	(0.070)
Average salary in ‘university’ region, rubles per month / 1000	0.013***	0.011***	0.010***	0.011***	0.001	0.000	-0.000	0.001
	(0.000)	(0.000)	(0.000)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Constant	9.956***	9.918***	9.890***	9.740***	0.803***	1.048***	1.010***	0.865***
	(0.098)	(0.108)	(0.114)	(0.152)	(0.177)	(0.202)	(0.221)	(0.300)
R^2	**0.20**	**0.23**	**0.26**	**0.26**	**0.06**	**0.07**	**0.08**	**0.07**
Number of observations	**1825**	**1319**	**1131**	**1089**	**1631**	**1177**	**1019**	**983**

Standard errors in parentheses. Significance levels: *** – 1%, ** – 5%, * – 10%.

The results of the regression analysis show that students of different fields of study build different salary expectations (hypothesis 5). We use the category of social sciences as a base. In the first specification, students studying Mathematics and natural sciences, as well as Engineering and technology, expect higher wages, but in other specifications the relationship becomes statistically insignificant. Students studying Education and pedagogy expect the lowest salaries in all specifications, whereas students studying in Military fields, have the highest expectations (but do not forget the limitations associated with the structure of the subsample in this field of study).

Male students are more optimistic about the absolute returns on higher education, and the difference in expectations is up to 23% (hypothesis 6 is confirmed). Students who combine work and study, in all specifications except the second, expect higher salaries after graduation than students who do not have work experience. This confirms hypothesis 7, and is consistent with both human capital and signaling theories.

An important result is that the average salary in the university region is positively interconnected with individual salary expectations, and a strong statistically significant result is maintained regardless of the specification of the model and the method of estimation. A positive change in the average salary in the region by 1,000 rubles contributes to an increase in the expected salary by 1–1.3 percentage points. Thus, the variation in the regional economic situation is interconnected with the formation of individual salary expectations (hypothesis 8 is confirmed).

Let us return to the fact that USE scores themselves depend on the prior academic performance, family and school factors. A similar relationship was statistically confirmed at the first step of 2SLS (Table 3).

The results of this auxiliary regression model suggest, that the average USE score in compulsory subjects is significantly related to student achievement in secondary school (the average GIA score in the 9^{th} grade). In addition, students of schools with a special status and classes with in-depth study of certain subjects demonstrate higher USE results, which is positively associated with salary expectations. Thus, we can talk about the indirect effect of school characteristics on salary expectations through USE scores (hypothesis 2 is confirmed). With regard to the characteristics of the family, mother's education and family income are also significantly correlated with USE results. Mother's educational level has an indirect effect on the expected salary after university graduation through USE results, and family income is linked to salary expectations both directly and indirectly (hypothesis 3 is confirmed). The number of books at home is insignificant in all the specifications studied, however, the limitations associated with the use of this indicator were discussed earlier.

Table 3. Evaluation of the USE scores in compulsory subjects (educational production function, the first step of 2SLS)

Independent variables	**Coefficient**
Average GIA score	10.391*** (0.507)
High school with a special status	1.726*** (0.653)
Class with in-depth studies of certain subjects	1.785*** (0.608)
Mother's education	3.073*** (0.621)
Family income / 1000	0.032** (0.014)
Number of books at home	0.002 (0.002)
Constant	12.538*** (2.212)
R^2	**0.34**
Number of observations	**1091**

Standard errors in parentheses. Significance levels: *** – 1%, ** – 5%, * – 10%.

For relative returns on higher education (for the regression analysis, the maximum value of R^e was limited to 4), the results are less consistent and the number of significant coefficients decreases with the inclusion of new factors in the model and the corresponding decrease in the number of observations due to missing responses. In model 5 (the specification with the largest number of observations), USE scores are positively related to the expected returns on higher education, but in subsequent specifications, the statistical significance of this variable is lost. Students who do not pay tuition fees expect to receive less relative returns on higher education, compared with students who pay tuition fees. In the context of the field of study, medical and military students expect to receive the highest relative premium after university graduation (but do not forget the limitations of the latter group). Medical students believe that university study will give them a wage increase of 42–56%, compared to not going to university and instead starting work immediately. Gender, employment and average regional salary are insignificant. Thus, for relative expected wages, only hypothesis 5 was confirmed, and hypothesis 1 was confirmed only partially.

5. Conclusion

In this study, we proposed an analytical model for the formation of the expected returns on higher education, under the assumptions of human capital theory. Based on the data of a large-scale longitudinal study of Russian students, hypotheses about the determinants of salary expectations were empirically tested. The most consistent results were obtained for the indicator of expected salary after university graduation. First, salary expectations of university students are positively associated with their school performance. This conclusion, consistent with the proposed model, is in line with human capital theory, and also with the results of previous studies (Webbink, Hartog 2004; Prakhov 2017). USE is a 'high-stakes examination', because its results are the main criterion for university admission. Therefore, students are motivated to invest in USE preparation in order to be admitted to their chosen university. Such investments, both cognitive and financial, represent investments in human capital, so after high school graduation, students with higher USE scores expect higher returns on the costs of time, effort and money (e.g. for of private tutoring) they incurred in high school. In addition, USE scores can determine academic performance at university (Zamkov, Peresetsky 2013; Peresetsky, Davtyan 2011; Poldin 2011), i.e. students accustomed to investing during school years, often continue to invest in their own human capital at the next level of education.

Second, we found direct (for family income) and indirect (for parental education and family income) influences of family on the formation of salary expectations, which is also consistent with the results of previous studies (for example, Brunello et al. 2004; Gamboa, Rodriguez 2014; Botelho, Pinto 2004; Smith, Powell 1990; Webbink, Hartog 2004; Androushchak, Natkhov 2010; Prakhov 2017). It was shown that maternal education can influence salary expectations indirectly, i.e. through USE scores. Family income may have both direct and indirect effects. The relationship between academic performance and the expected returns on higher education mainly reflects individual cognitive investments in student's human capital, while for family factors, there are investments made by parents. However, in essence, they also represent investments in student's individual human capital: better educated parents have more opportunities for additional activities when raising a child, as well as more opportunities to help them with the choice of educational institution, making intangible investments in the child's human capital. More affluent families have greater opportunities for making financial investments in the human capital of their children, for example, by hiring tutors during school, or paying tuition at a selective university. In addition, family income can serve as a good guide for the child's future expected salary. On the other hand, children from poorer families have more modest salary expectations, which can act as a barrier when looking for work. This can create potential risks of spreading inequality among university graduates, when students from high-income families become more demanding of their future jobs and salary conditions than students from poorer backgrounds.

Third, full-time students have higher salary expectations, because, as a rule, full-time departments are more selective (and therefore students need to make more effort to invest in their human capital) and these departments offer educational programs of higher quality. The returns on such programs should also be reflected in future salaries. However, we did not confirm the hypothesis that students who study for free have higher salary expectations compared to those who pay tuition fees. Usually, students who do not pay tuition fees have higher USE scores, which suggests higher salary expectations. However, the universities represented in our sample have a wide variation in AQR (the average USE score among those enrolled for a tuition-free position varies from 44 to 93), therefore the admission criteria are not the same. Hence, it is possible that in such a situation another factor comes into effect: students who cover tuition fees while studying at a university, in addition to their cognitive investments in human capital (efforts), make material investments (tuition fees). Therefore, they believe that these monetary costs should pay off in terms of higher salary after university graduation; this logic does not contradict human capital theory.

Fourth, it was shown that salary expectations differ depending on the field of study, which indicates variation in expectations regarding the labor market and can indirectly explain the differences in demand for various higher education programs. The lowest salaries are expected by students of medical, agricultural and pedagogical fields of study. Given the importance of these areas for society, special attention should be paid to supporting graduates of such areas. This could stimulate demand for studies related to agriculture and teaching and improve the quality of admission to relevant universities (currently AQRs in agricultural universities are some of the lowest, and the level of selectivity of pedagogical universities is at an average level).

Male students demonstrate higher salary expectations compared to their female peers. Although this fact corresponds to a number of earlier studies (McMahon, Wagner 1981; Brunello et al. 2004; Botelho, Pinto 2004; Anchor et al. 2011; Smith, Powell 1990; Webbink, Hartog 2004; Prakhov 2017), gender differences in the expected returns on higher education require a separate study (in particular, the analysis of differences in determinants of the expectations of males and females), since the revealed differences in the expected salaries at the university stage of education may cause risks of gender pay inequality in the future.

Students who are employed while studying expect higher salaries after graduation, and this result was also obtained for the Moscow sample of students (Prakhov 2017). This is a feature of the Russian education system, when students begin to invest in human capital in the workplace, in addition to university (human capital theory), so later, together with a degree, they can send a signal to the employer about their work experience (signaling theory). Moreover, the situation when employers require work experience from recent graduates is very common in Russia, therefore employed students hope that their investments related to combining work and study will

result in positive returns after graduation. However, it is still questionable how much the additional efforts at a working place should compensate for the reduced efforts related to their studies.

Finally, we demonstrated a steady, positive relationship between the regional average levels of wages and student salary expectations. In other words, in addition to microeconomic indicators (individual characteristics, family SES), macro-indicators, such as the average regional salary, affect salary expectations. Such variation in actual wages may contribute to the flow of students to regions with higher wages, and, as a result, will adversely affect future trends in regional development (for example, see Prakhov, Bocharova 2019).

As for the relative returns on higher education (the expected percentage increase in salaries compared to salaries without higher education), less consistent results were obtained: a significant positive relationship between USE scores and the relative returns was found only in one specification, but a number of models found a negative relationship between studying on a tuition-free basis and the relative returns on higher education. The highest relative premium for higher education is expected to be received by students of medical and military fields of study. These results can be explained by a number of limitations associated with the use of the relative returns on higher education. Firstly, this is an even noisier factor than the expected salary indicator, because it includes two variables related to uncertainty: expected salaries after university graduation and salaries in the absence of higher education. Students, especially those who do not have work experience, may have little idea of the returns on work without higher education, since they will no longer be in such a situation. Secondly, the insignificance of regional characteristics can be explained by the fact that the adjustment for regional wages in this indicator is included both in the numerator (w_1^e) and in the denominator (w_0^e), therefore the combined effect of the two expected values can level the regional effect.

Thus, in this study we obtained consistent estimates for the determinants of *expected salary after university graduation*. In the next stage of this study, we single out the accuracy of salary expectations of Russian students, and identify the factors can explain the discrepancies between the expected and actual salaries of university graduates.

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