Engineering and Economics Graduates: Between Supply and Demand

Elena Varshavskaya, Elena Kotyrlo

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Elena Varshavskaya
Doctor of Sciences in Economics, Professor, Human Resource Management, School of Business Administration, Faculty of Business and Management, National Research University Higher School of Economics. Email: evarshavskaya@hse.ru

Elena Kotyrlo
Doctor of Sciences in Economics, Associate Professor, Department of Applied Economics, Faculty of Economic Sciences, National Research University Higher School of Economics. Email: ekotyrlo@hse.ru

Address: 20 Myasnitskaya St, 101000 Moscow, Russian Federation.

Abstract. Microdata from the National Employment Survey of 2010–2015 Vocational and University Graduates conducted by the Russian Federal State Statistics Service (Rosstat) in April–September 2016 is used to analyze the study-to-work transition of graduates in engineering and economics. Transition success is measured as indicator the ratio of demand and supply of graduates' labor. Research methods include descriptive and regression analysis.

Statistical analysis of macro data shows that the number of skilled engineers who obtained degrees in 1990–2000 exceeded the number of engineers exiting the labor force upon reaching the age of retirement during that period. While aggregate supply of engineering workforce was growing during the post-reform era, demand for their labor was shrinking—mostly due to a considerable decline in engineering jobs.

It has been established that chances of getting a job, average time that it takes to find one, and the degree of first-job educational and skill match are pretty much the same for young qualified engineers and economists. No statistically significant difference has been observed between their starting salaries, either. Therefore, no evidence has been found to support the hypothesis about a high unmet demand for qualified engineers and oversupply of workforce in economics and management. The study demonstrates that the reported shortage of engineers has nothing to do with low aggregate supply in the industry.

Research findings could be used in the design of academic programs for higher education at national and regional scales.

Keywords: graduate labor market, study-to-work transition, demand and supply of labor, engineering shortage, oversupply of economists.

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Graduate employability has recently come under public scrutiny. Politicians, civil servants, employers, and experts often draw attention to the gap between university graduates' qualifications and the labor market demands. In particular, there is a prevailing opinion that demand for engineering workforce is largely unmet in the Russian economy, yet universities keep producing economists, managers, lawyers, and other "popular" occupations despite the obvious surplus of relevant occupations[1].

This standpoint is normally supported by higher education statistics. Indeed, total university enrollment was 4,399,500 as the academic year 2016/17 began, which is 1.6 higher than in the academic year 1991/92 (2,762,800)[2]. While growing in volumes, student flows underwent a considerable redistribution among majors and fields of study. The post-reform years witnessed a steady increase in the proportion of graduates in economics, law, social sciences, and humanities at the expense of qualified professionals in technology, pedagogy, and medicine [Varshavskaya 2016]. Only one in five graduates (21.1%) in the 1991–1995 cohort had a degree in economics, but their proportion amounted to one third (34.3%) in 2011–2015. To compare, the share of engineering graduates was 28.0% in 1991–1995 and only 22.0% two decades later[3].

There is one critical point that should be emphasized here. The estimates above and the resulting implications on the labor market imbalance are almost entirely supply-centered. "An asymmetrical approach like that lacks analytical integrity and can hardly be called unbiased. Chances are that implications for economic and education policies drawn on its basis will in many cases be counterproductive." [Kapelyushnikov 2012:52] Obviously enough, labor demand should also be considered to make any well-supported statements about occupational labor shortages or surpluses. However, while the volume and structure of labor supply are quite easy to identify, evaluation of labor demand is a much more challenging task that often requires more data than available. As a consequence, the supply-demand ratio is analyzed either at the macro-level [Korovkin 2011] or at the level of larger occupational categories [Kapelyushnikov 2012; Smirnov,

1 Debate over the shortage of engineering workers is not exclusive to Russia. In the United States and Great Britain, STEM (Science, Technology, Engineering, and Mathematics) workforce shortages were first reported in the early 1950s, and the viewpoint has been quite popular among politicians and employers ever since. Meanwhile, a number of independent studies have found STEM worker shortages in those countries to be exaggerated, at the very least, or even absent [Lowell, Salzman 2007; Metcalf 2010; Salzman 2013; Smith, Gorard 2011; Teitelbaum 2014; Xue, Larson 2015].

2 The highest total university enrollment (7,513,100 students) was observed at the start of the academic year 2008/09.

3 The changes described here are part of more long-term trends. The percentage of degreed economists and managers in Russia has been growing consistently since the early 1970s. The proportion of engineering graduates was reducing most rapidly in the 1970s-1990s, reaching a plateau in the early 2000s [Varshavskaya 2016].

Kapustin 2018]. Very few studies have approached the issue in the context of different occupations and fields of study [Gimpelson et al. 2009; Stuken 2018]. Vladimir Gimpelson and his co-authors analyzed the match between educational qualifications and current employment [Gimpelson et al. 2009]. Another example is Tatyana Stuken, who examined the quality of graduate employment in Siberian Federal District using employability indicators based on the educational and occupational levels attained [Stuken 2018]. Both studies find no evidence to support the hypothesis about unmet demand for skilled engineers and labor surplus in economics and management.

Our goal is to analyze the study-to-work transition of graduates in engineering and economics and use effectiveness of such transition to estimate the supply-demand ratio. We assume that occupational imbalance should be reflected in the way that graduates enter the labor market, expecting that shortage of skilled workers (engineers in this case) will make the transition easier, and surplus (of economists) more difficult.

The article is structured as follows. In Section 1, we explore the methodological ways of evaluating occupational shortages or surpluses, which are then used to articulate our research approach and hypotheses in Section 2. Data and research methods are described in Section 3. Sections 4 and 5 present the results of data analysis and hypothesis testing. Finally, the conclusion part presents research findings.

1. Methodology of Evaluating Occupational Shortages and Surpluses

There are two most popular methodological approaches to identifying skills and occupational shortages. The so-called *social demand model* determines that there is a shortage of members of a particular profession if the actual number is less than the number dictated by some social, political, ideological, or any other non-economic criterion or goal [Blank, Stigler 1957]. For example, one might use the criterion that the country has not enough engineers to ensure national security, achieve leadership in innovative research, catch up with other countries, etc. This approach has largely dominated the US and British discourse on STEM worker shortage for as long as 70 years (since the mid-20th century) [Smith 2017; Stevenson 2014].

The other approach, which is based on the labor supply and demand theory and could be described as economic, determines shortage as a situation where the quantity of the labor services in question that is demanded is greater than the quantity supplied at the prevailing wage. This definition, introduced in the classical paper by David M. Blank and George J. Stigler [Blank, Stigler 1957], regards relative wage rises as the criterion of shortage. Developing Blank and Stigler's ideas, Kenneth J. Arrow and William M. Capron proposed a model of dynamic shortages, which accounts for the rate of changes in demand in addition to wage response [Arrow, Capron 1959]. A dynamic shortage results from rapid and consistent growth in demand for specific skills or occupations, low labor supply elasticity, the long time it takes for the market to adjust prices, and the specific features of some socioeconomic institutions (e. g. vocational training and development). The economic approach suggests that workforce shortage can only be observed in situations where labor demand cannot be met with the available supply at the existing market wage [Cedefop 2015; McGuinness, Pouliakas, Redmond 2018; Shah, Burke 2005; Veneri 1999]. "In a number of cases, the so-called shortage is not actually a shortage, since it arises because the employer cannot pay the prevailing wage for a certain skill." [Meager 1986:240]

Supply-demand ratio is estimated using various indicators, which can be grouped into two categories. The first one embraces economic indicators reflecting the current labor market situation (usually across specific skills or occupations). The most widely used ones include employment and unemployment rates, their dynamics, changes in relative wages, job vacancy statistics and how it correlates with unemployment [Barnow, Trutko, Piatak 2013; Cohen, Zaidi 2002; Shah, Burke 2005; Veneri 1999]. In certain cases, assessment may involve data on average hours worked, labor market entry and exit, immigrant population, employee training and conversion expenses, etc. [MAC2008; Shah, Burke 2005]. The use of those indicators allows assessing the supply-demand ratio at the macro level. The second group of indicators is represented by data from employer surveys on skill and occupational shortages, vacancies and vacancy filling rates, and issues associated with recruiting workers of specific skills. These indicators reflect the labor market situation at the micro-level, providing access to information on hard-to-fill vacancies. Importantly, such indicators do not always match the results of supply-demand ratio macro-assessment [Gimpelson 2004; 2010; Cedefop 2015; Green, Machin, Wilkinson 1998]. Researchers believe that shortage estimates based on employer reports are often overstated, which should be considered when developing recommendations [Downs 2009; Meager 1986; Shah, Burke 2005; Smith 2017]. The most widespread methods of occupational shortage/surplus assessment use a set of indicators reflecting the labor market situation and complement those with employer survey findings (e. g. [MAC2008; Veneri 1999]).

2. Research Approach

Occupational supply-demand imbalances affect how different occupations are positioned in the labor market, in particular the entry conditions for graduates. Indeed, if there is an excess supply of, say, economists, graduates with economic degrees will face limited employment opportunities, consequently spend more time to find their first job and have lower chances of being employed. Being up against tough competition in the occupational labor market, graduates qualified in "wrong" (surplus) occupations will have to accept lower-skilled and/or mismatching jobs. Research has proved that graduates in an imbalanced labor market are more likely to be overqualified for their jobs [Croce, Ghignoni 2012; McGuinness, Pouliakas 2016; Verhaest, van der Velden 2013; Verhaest, Sellami, van der Velden 2017; Wieling, Borghans 2001]. Job mismatch also becomes more likely to occur under such conditions [Frenette 2004; Ghignoni, Verashchagina 2014; Robert 2014; Wieling, Borghans 2001; Wolbers 2003]. Therefore, a shortage of engineers and an excess supply of economists should translate to higher effectiveness of study-to-work transition for engineering graduates as compared to those with economics degrees.

We assessed labor market entry conditions using entry-level job characteristics, namely first-job salary, qualifications-job (vertical) mismatch, and major-job (horizontal) mismatch[4]. In addition, we measured average job search time after graduation and the probability of being employed.

The following hypotheses were proposed based on earlier findings.

Hypothesis 1. Average job search time is shorter for engineering graduates than for economics graduates.

Hypothesis 2. Employment is higher among engineers than among economists.

Hypothesis 3. Engineering graduates are more likely to fill top management positions and highly skilled jobs than economics graduates.

Hypothesis 4. Engineering graduates are less likely to be mismatched to their jobs than economics graduates.

Hypothesis 5. Recent engineering graduates are paid higher than recent graduates in economics.

If evidence is found to support these hypotheses, it will mean that Russia's labor market is experiencing a shortage of engineers and an excess of economists; otherwise, we will find evidence to reject this assumption.

3. Data and Method

Data from the Federal Employment Survey of Vocational and University Graduates was used as empirical framework for this study. This sampling survey was conducted by the Russian Federal State Statistics Service (Rosstat) in April–September 2016 as a supplementary module for monthly workforce statistics. The survey covered around 36,000 vocational and university graduates produced in 2010–2015[5]. For the purpose of this study, we selected data on the respondents with degrees in economics and engineering. Target groups were

[4] We prefer analyzing graduates' first jobs instead of their current employment because first jobs are the ones that truly reflect the labor market entry conditions.

[5] For more information on the survey, visit http://www.gks.ru/free_doc/new_site/population/trud/itog_trudoustr/index.html

shaped using the Russian National Classifier of Academic Subjects OK 009–2003[6]. Economics graduates included holders of degrees in Economics and Management, and engineering graduates were those with degrees in Engineering and Technology[7]. There were 7,040 economists (accounting for 34.3% of all university-educated respondents) and 4,489 engineers (21.8%).

Variables reflecting differences in graduate employability (y_i) include:

(1) First-job salary (logarithm);
(2) Qualifications-job match (binary variable: '1' for top management positions and highly skilled jobs, '0' for all the other cases);
(3) First-job educational match (binary variable: '1' for being matched to one's job, '0' for being mismatched);
(4) Probability of being employed at the moment of the survey—for graduates produced more than a year ago;
(5) Average job search time after graduation.

We applied a log-linear model (extended Mincer equation) to wages, Cox regression to average job search time, and linear probability model to the other dependent variables. The latter choice is explained by the need to compare assessments by a number of specifications. Coefficients in a linear probability model are represented by estimated marginal effects on the probability, which facilitates analysis and comparison considerably. Besides, the quality of probability models is sensitive to the normality assumption of regression errors—a rather rigorous requirement that very few real-world models comply with [Ai, Norton 2003].

The following variables were used as independent:

(1) Personal characteristics: gender, age, marital status (Z_2);
(2) Human capital characteristics: years of work experience, mode of study (full-time/part-time/extramural), type of funding (government-/self-funded), region of study (region of residence / other region / abroad)[8] (Z_3);
(3) First-job characteristics: sector (formal/informal), industry, job-education match (Z_4);
(4) Local labor market characteristics: type of locality (urban/rural), region of residence, industrial structure of the region (shares of

6 This version of the Classifier was in force at the moment of the survey, so we used it instead of the more recent one (OK 009–2016).

7 Engineering-related majors are described in much more detail than majors within economics in both versions of the Classifier.

8 Preliminary data analysis also took account of the form of university ownership (private/public), but the variable was later omitted from the model to avoid multicollinearity.

mining, process manufacturing, power production, and housing in the GRP above the median value and the third quartile) (Z_5).

Every indicator of study-to-work transition effectiveness was assessed using five sets of regressors. The first specification only included one binary variable (*Ingener*: '1' for Engineering and Technology, '0' for Economics and Management) to discriminate between engineers and economists, and fixed regional effects. Next, four sets of explanatory variables described above were added consecutively, both alone and multiplied by the binary "engineer/economist" variable. As a result, differences in labor market entry patterns between economists and engineers were identified by the binary variable as well as by the inhomogeneity of personal, human capital, first-job, and local labor market characteristics. Models were estimated on different subsamples. The basic subsample included respondents who had searched for a job after graduation, as those graduates had actually been entering the labor market.

The model can thus be represented as follows:

$$y_i = \beta_0 + \beta_1 Ingener_i + Ingener_i \sum_j \beta_{2j} Z_{i2} + \ldots + Ingener_i \sum \beta_{5j} Z_{i5} + \\ + Territ_i + \varepsilon_i,$$

where sets of regression coefficients *b* are determined by selecting one of the specifications mentioned above with a corresponding set of variables Z_i, and dependent variable y_i is one of the indicators of successful employment. Region-specific fixed effects are included in every specification.

4. Engineering and Economics Graduates in the Labor Market

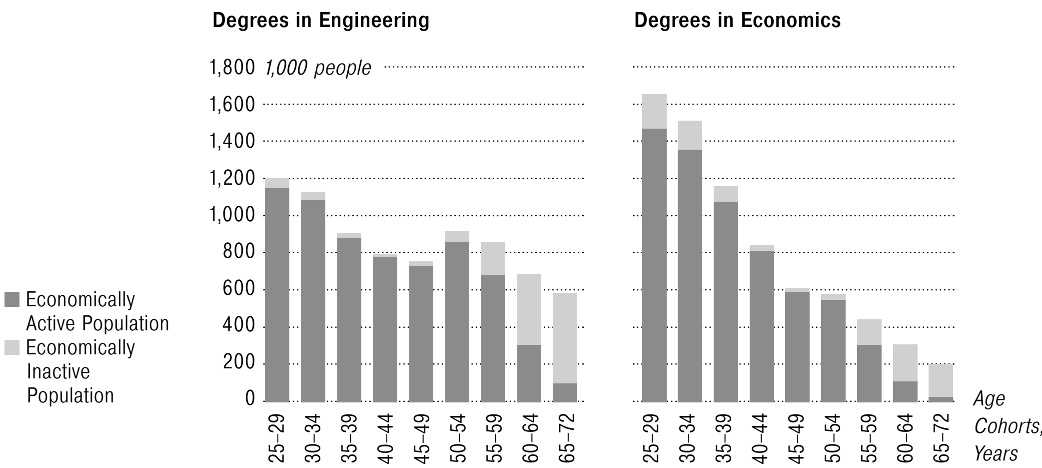
4.1. Macroeconomic Context

Our first step will be to discuss the general trends in supply and demand of engineers and economists.

A survey of workforce demonstrates that holders of degrees in engineering and technology are more numerous in younger age cohorts (Fig. 1). For example, there are 1.5 times more engineers among workers aged 25–34 than among those aged 55–64, who are exiting the labor market. The gap increases to 2.2 times when only economically active population is concerned, which shapes aggregate labor supply. This data provides no reason to argue that universities have been producing fewer qualified engineers lately, thus creating a shortage of engineering workforce. Population with degrees in economics has also been growing, its proportion being four times higher among 25–34-year-olds than among those aged 55–64. For economically active population, the gap reaches 6.5 times.

Labor demand is assessed using statistics on employment by industry, salaries, and job vacancy rates. Obviously, demand for engineering talent is largely formed by the secondary sector, first of all the manufacturing, construction, transport, and communications indus-

Figure 1. **Population with Degrees in Engineering and Economics by Age Cohorts, 2016 (1,000 people)**



tries—they are estimated to account for about two thirds of all jobs that require engineering skills. Demand for economists and managers is more diversified, being generated not only by enterprises but also by businesses, business and social services companies, and public administration organizations. Three quarters of jobs that require higher education in economics are concentrated in the service sector. Although amendments to the industrial classifiers make dynamics assessment difficult, the major trends are obvious. The number of workers employed in the secondary sector, including skilled jobs, was consistently decreasing during the post-reform period, while employment in the service sector was growing, especially in business, finance, and public administration. The total number of workers employed in the secondary sector decreased by nearly 10 million during the 1990s-2010s. Within the same period, employment increased by over 8 million in the sales and food service industries, by 2 million in public administration, and by 900,000 in finance. In addition, small business development also contributed to the growing demand for economists. It is thus not unreasonable to assume that aggregate demand for engineers was decreasing in the post-reform years, in contrast with aggregate demand for economists and managers which was increasing.

Supply and demand factors include changes in relative wages. According to Rosstat statistics, the rise in wages in 2005–2015 was on average 2–3% higher for engineers than for holders of degrees in economics, which was probably a “compensation” for the accelerated increase in economist remunerations of the 1990s. Such wage dy-

Table 1. **Sociodemographic Characteristics of Economics and Engineering Graduates** (%)

	Economics and Management	Engineering and Technology
Gender		
Male	**23,3**	**74,2**
Female	**76,7**	**25,8**
Marital status		
Married	52,8	45,9
Single	47,2	54,1
Mode of study		
Full-time	**55,8**	**69,9**
Part-time	10,3	8,5
Extramural	**33,8**	**21,5**
Type of funding		
Government-funded	**29,6**	**54,1**
Self-funded	**70,4**	**45,9**
Combining work and study		
Constantly	**37,9**	**30,1**
From time to time	13,9	18,2
Never	48,2	51,7

Note. Hereinafter, indicators are shown in bold, the difference between which is significant at the 95% confidence level.

namics provides no basis for reporting a significant unmet demand for engineers. The same is indicated by job vacancy statistics. According to Rosstat figures, the job vacancy rates in 2008–2016 were 2.2–3.0% for most engineering occupations and 1.5–2.2% for economics-related ones.

Therefore, the intermediate conclusion based on statistical data analysis is that workforce supply was growing in both engineering and economics during the 1990s-2010s, being more intensive in the latter field. However, aggregate demand for engineers was not increasing, to say the least, or probably was even shrinking, while aggregate demand for economists was growing, perhaps slightly falling behind workforce supply in the industry. That is the macroeconomic context in which graduate survey data will further be analyzed.

4.2. Graduate Characteristics[9]

Males account for only one quarter of economics graduates and females for only one quarter of engineering graduates (Table 1). Such gender imbalance reflects the existing attitudes about male- and female-dominated jobs. The respondents are on average 28.2 years old, and nearly half of them are married.

Engineering graduates were more likely than economists to have obtained their higher education degrees as government-sponsored full-time students. Regardless of the mode of study, economists had to pay for education more often than engineers. Over half (54.7%) of the full-time economics graduates had been self-funded students, as compared to only one third (32.9%) of the engineering graduates. Among the extramural graduates, 91.8% of the economists and 78.0% of the engineers had had their studies financed by the government.

Combining work and study is typical of both occupations, every other graduate having done it constantly or from time to time. Half of the economists and nearly 58% of the engineers who combined work and study had part-time jobs related to their major.

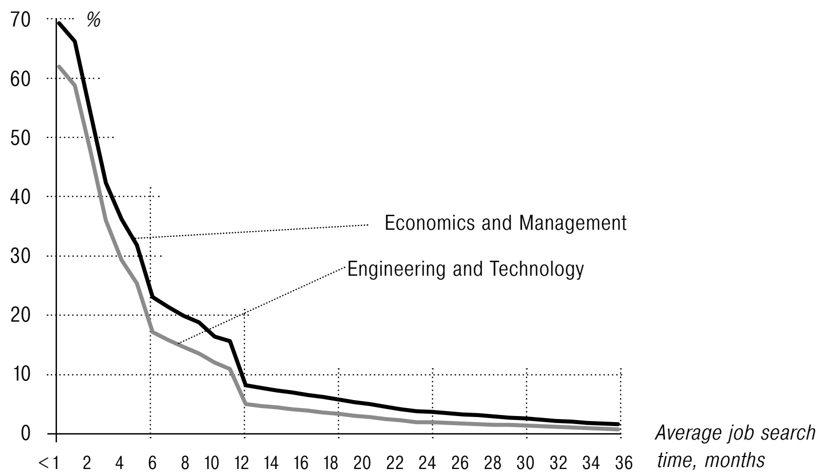
4.3. Labor Market Entry

Two thirds of the graduates searched for a job after graduation. The proportions of jobseekers are equal among economists and engineers (62.6% and 63.8%, respectively). Former full-time students were much more likely to search for a job (83.2% of the economists and 78.1% of the engineers) than their extramural counterparts (34.8% and 28.7%, respectively). The reasons for not seeking a job are the same for both occupations, yet there is a great difference between the modes of study. Nearly the only reason why extramural graduates did not search for a job was because they stayed with same employer they had been working for during their studies. This option was selected by 82.2% of the economists and 81.5% of the engineers. Former full-time students had a more varied list of reasons, though keeping the "old" job was the top choice here, too (24.5% and 26.8%, respectively). Among economics graduates from full-time programs, 22.6% referred to family reasons, 9.5% to having received a job offer, and 8.5% to having had no need to work. The reasons specified by former full-time students in engineering included being called up for military service (13.4%), receiving a job offer (12.9%), and being assigned to a job by distribution (12.5%). A closer analysis showed that differences in the reasons for not seeking a job among full-time graduates are mostly explained by the gender profiles of the two occupations.

Median length of job search was three months for economics graduates and two for degreed engineers; 30.8% of the former and 38.1% of the latter found their first jobs within one month after graduation. In general, engineering graduates tend to get employed soon-

9 In this section, data is given on all 2010–2015 graduates in relevant occupations.

Figure 2. **Percentage of Respondents Who Did Not Land a Job after Graduation**



er than holders of degrees in economics (Fig. 2). No essential gender gaps have been observed.

The overwhelming majority of graduates-90.0% of the economists and 93.0% of the engineers—got employed after graduation. Employment rates are very close for women (89.5% in economics and 88.7% in engineering) and slightly differing for men (91.5% and 94.5%, respectively).

Lack of experience was reported by three quarters of the economists and two thirds of the engineers as number one problem that graduates faced when seeking a job, followed by low salaries, unavailability of suitable jobs, and impossibility to find an education-matching career (Table 2). No critical differences were found between the two occupations. Unavailability of suitable jobs was reported somewhat more often by engineers. The problem of finding an education-matching career was experienced more often by the gender groups underrepresented in a given occupation, i. e. male economists and female engineers.

No difficulties getting the first employment were experienced by 16.5% of engineering graduates and 12.5% of economics degree holders. This is true to the same extent for men and women within each of the two occupations (16.9% of male engineers and 15.3% of female engineers; 12.2% of male economists and 12.6% of female economists). Yet, full-time graduates reported having no such difficulties three times more often than their extramural counterparts, namely 17.0% vs. 6.2% in economics and 20.6 vs. 6.4% in engineering.

Table 2. **Challenges Faced by Graduate Jobseekers** (%)

	Economics and Management			Engineering and Technology		
	Total	Males	Females	Total	Males	Females
Lack of experience	**74.6**	**70.4**	76.0	**67.2**	**64.7**	74.0
Low salaries offered	41.2	42.0	40.9	41.7	43.7	36.4
No suitable jobs available	**30.7**	32.1	30.2	**35.4**	36.0	33.9
Impossible to find an education-matching career	20.9	**24.6**	**19.6**	22.1	**20.9**	**25.1**
Unqualified for jobs	5.7	4.6	6.2	6.3	5.9	7.2
Discrimination (by gender, ethnicity, parental status, etc.)	1.7	0.9	2.0	0.8	0.1	2.7
Failed pre-employment assessment (testing computer skills, foreign language skills, etc.)	1.6	1.5	1.6	1.1	1.2	0.9
Limited abilities due to health conditions	0.4	0.7	0.2	0.6	0.7	0.5
Other	5.1	5.1	5.1	5.1	5.0	5.4
N, persons	3,392	878	2,514	2,003	1,446	557

4.4. First Job Characteristics

Top management positions and highly skilled jobs are held by 59.7% of graduates in economics and 57.4% of those in engineering (Table 3). Otherwise speaking, the proportion of workers with skills well-matched to their jobs is virtually the same in both groups. At the same time, downward mobility is much higher among engineers than among economists. Nearly one in five degreed engineers (18.6%) is employed as an unskilled worker, which is three times higher than the rate for degreed economists (6.2%).

About two thirds of the graduates in both occupations reported being matched to their first jobs. For female graduates, education-job match differs little between the occupations, but this is not the case for male graduates. Only half (52.0%) of the economists felt that their first jobs were matching their major, which is almost one third lower than the proportion among the engineers.

First-job salaries of economics graduates are 20% lower than those of their engineering counterparts (22,900 vs. 28,500 rubles), men being paid on average higher than women.

5. Transition from Study to Work: Is There a Difference Between Engineering and Economics Graduates?

In accordance with the hypotheses formulated above, regression models were estimated for log wage, probability of major-job match,

Table 3. **First-Job Employment Characteristics** (%)

	Economics and Management			Engineering and Technology		
	Total	Males	Females	Total	Males	Females
Career						
Top managers	8.8	**13.8**	**7.2**	8.1	**8.8**	**5.7**
Highly skilled professionals	50.9	**40.2**	54.2	49.3	**47.9**	53.7
Medium-skilled professionals	13.3	13.7	**13.2**	12.4	12.9	**10.9**
Public servants	**6.4**	**2.4**	7.7	**2.7**	**0.9**	8.3
Service and sales workers	**14.1**	**13.8**	14.2	**8.4**	**7.0**	12.8
Skilled agricultural workers	0.3	0.3	0.3	0.5	0.6	0.2
Skilled workers	**2.2**	**6.4**	**0.9**	**9.9**	**11.8**	**4.1**
Operators, assembly fitters, drivers	**2.2**	**5.9**	**1.0**	**6.3**	**7.2**	**3.4**
Unskilled workers	1.8	**3.6**	1.3	2.4	**2.8**	1.1
Relationship between education and job						
Match (Yes, Rather yes)	**62.6**	**52.0**	65.9	**67.0**	**68.4**	62.9
Mismatch (No, Rather no)	**37.4**	**48.0**	34.1	**33.0**	**31.6**	37.1
Wage						
Mean, thousand rubles	**22.9**	**26.5**	**21.9**	**28.5**	**30.0**	**23.3**
Median, thousand rubles	**20.0**	**25.0**	20.0	**25.0**	**28.0**	20.0

qualifications-job match, average job search time, and probability of being employed. Table 4 presents the results of testing each hypothesis by consecutively adding the sets of variables specified in Section 3. The table only contains parameter values of the "engineer/economist" variable, their significance levels, sample size, and explained variance, or the coefficient of determination. Reports with complete sets of explanatory variables for every dependent variable can be found in the Appendix.

5.1. Wages

The results of assessing an extended Mincer equation with the listed sets of factors added consecutively show that wages of engineers are significantly higher than those of economists only in the models with fixed regional effects (Table 4). However, when personal, human capital, first job, and local labor market characteristics are controlled for, it turns out that engineering graduates are not paid higher than holders of degrees in economics; in fact, they are paid even lower, although the gap is not significant in most specifications. Assessment of the regression models with complete sets of variables reveals that

Table 4. **Parameter Values of the "Engineer/Economist" Binary Variable**

Dependent Variable	Regional fixed effects included (1)	Personal characteristics added (2)	Human capital characteristics added (3)	First job characteristics added (4)	Local labor market characteristics added (5)
LN(wage)	0.194*** (0.013)	−0.195* (0.107)	−0.177 (0.121)	−0.282 (0.183)	−0.247 (0.186)
N of observations	3,939	3,939	3,939	3,939	3,939
R-squared	0.336	0.379	0.404	0.424	0.430
Major-job match	0.047*** (0.013)	−0.050 (0.113)	−0.009 (0.129)	0.022 (0.148)	−0.017 (0.150)
N of observations	6,540	6,540	6,540	6,540	6,540
R-squared	0.053	0.063	0.098	0.182	0.187
Qualifications-job match	0.014 (0.014)	0.178 (0.114)	0.190 (0.129)	0.170 (0.149)	0.187 (0.151)
N of observations	6,936	6,936	6,936	6,540	6,540
R-squared	0.054	0.056	0.108	0.359	0.361
Probability of being employed	0.015** (0.007)	0.015 (0.069)	0.098 (0.078)	−0.006 (0.080)	0.001 (0.079)
N of observations	6,936	6,936	6,936	6,936	6,936
R-squared	0.067	0.075	0.161	0.269	0.271
Average job search time	0.113*** (0.023)	0.100 (0.191)	0.395* (0.224)	−0.007 (0.233)	−0.056 (0.240)
N of observations	6,936	6,936	6,936	6,936	6,936
Pseudo R-squared	0.004	0.005	0.009	0.012	0.013

Standard errors in parentheses.
Significance: *** $p<0.01$, ** $p<0.05$, * $p<0.1$

wage levels are affected by graduates' sociodemographic characteristics, the mode of study, and the specific features of the local labor market (Appendix, Column 1), whereas educational qualifications are found to play a small role. Public administration is the only career field where engineering graduates are paid higher than economists.

5.2. Education-Job Match

Our findings do not support the hypothesis about significant differences in job-matching probability between engineers and economists (Table 4; Appendix, Column 2). Industry of the first job and specific aspects of regional economy are what matters for getting an education-matching employment. Engineering graduates employed in sales and public administration are mismatched to their jobs 27–31% and

18–22% more often, respectively, than economists in the same sectors. Recent engineering graduates living in regions with high levels of process manufacturing and power engineering activity have better chances of matching their skills and qualifications to their jobs. Female engineers are 10% less likely to be employed in their field of study than female economists, the gap being even broader (14–15%) for married women. Most probably, these findings reflect the existing perception of engineering as a male-dominated field.

5.3. Qualifications-Job Match

The probability of finding a qualifications-matching job is more or less the same for both engineers and economists (Table 4; Appendix, Column 3). Young engineers matched horizontally are about 10% more likely to be mismatched vertically at their first jobs than recent economics graduates. It could be assumed that engineering graduates often start their careers from relatively low positions so as to rise through the ranks as they gain experience. Such career trajectories are primarily typical of enterprises with relatively high wage levels. This finding is indirectly confirmed by the observation that engineers employed in process manufacturing and power engineering are 24% and 21% less likely, respectively, to be matched to their jobs vertically. Besides, when graduates fill major-matching jobs which do not require a university degree (for engineers, those are mostly unskilled worker positions), it often means that the use of modern technology requires a high level of professional skills while offering formally low positions in the job hierarchy. Therefore, vertical educational mismatches do not always mean that demand for higher school knowledge and skills is low.

5.4. Average Job Search Time[10]

Significant differences between engineers and economists in average time it takes to find a job are observed among those who looked for (and found) employment in the formal economy (Table 4; Appendix, Column 4). Engineers tend to spend 19% more time than economists seeking for a job in the formal sector, which may indicate a limited number of engineering jobs in the corporate world. This is not so much about the lack of vacancies for recent engineering graduates; rather, it means that graduates do not find the available jobs suitable, in particular good-paying. Engineering graduates may also spend more time searching for a job because they expect higher returns on their education (in both absolute and relative terms) [Prakhov 2017] and often find their competencies to be inadequate to new technology requirements [Myagkov 2016].

[10] Average job search time was modelled within a two-year period and was restricted to two years for those who spent more time than that. We assume that active job searching was suspended in two years and graduates quit the labor market for some time.

5.5. Probability of Being Employed[11]

No significant differences are observed in the probability of being employed for economists and engineers (Table 4; Appendix, Column 5), with the exception of engineers who combined work and study from time to time—their chances of being employed were approximately 3% lower than those of economists with the same work-and-study patterns.

As we can see, descriptive statistics and regression analysis results reveal no significant differences between engineering and economics graduates in the probability of being employed and finding a job matching their level of education and field of study. No significant differences were found in average entry-level job salaries. That is to say, labor market entry patterns are virtually the same for recent graduates in both occupations.

6. Conclusion

In contrast to widely held assumptions, the population of engineering graduates produced in the 1990s-2000s exceeded the number of professional engineers retiring from the labor force. As aggregate supply of engineering workforce was growing during the post-reform period, demand for engineers was shrinking, mostly due to a considerable decline in secondary sector employment. Therefore, analysis of macro statistical data casts doubt on the relevance of perceived engineering skills shortage.

Neither does assessment of the study-to-work transition support the commonly held belief that there is a shortage of engineering graduates and a surplus of economists. Chances of finding a job, average job search time, and vertical/horizontal educational mismatch statistics are more or less the same for recent graduates in both occupations. Their starting salaries do not differ to a statistically significant extent, either. In other words, there are no signs of supply-demand imbalance in any of the two occupations. This conclusion is largely consistent with the findings of other Russian researchers [Gimpelson et al. 2009; Stuken 2018].

The problem of engineering workforce shortage, so persistently reported by employers, has little to do with low supply at the macro-level. Non-competitive wages, often inconsistent with engineering graduates' expectations, are one of the reasons for the skills shortage, yet not the only one. This study did not take into account transaction costs. It might be that special engineering skills, which are usually narrower than competencies of economics graduates, face low demand due to high mobility costs and unawareness of narrow career options available in local labor markets.

The study results provide the basis for concluding that cutting government-funded university places for economists and increasing the

[11] Probability of being employed was assessed for the respondents who had graduated at least one year before the survey.

number of vacant places for engineering applicants will hardly improve job filling for engineering positions. Increased accessibility of engineering education may promote negative selection of engineers and positive selection of economists. Making engineering degrees accessible to underprepared candidates will boost government spending on pre-employment training, which will not yield expected returns in the future at either individual or national level. Universities face the need to develop education models allowing for the structure and specific aspects of regional economy, coordinate educational activities with employers on all fronts, and build a graduate employment monitoring system reflecting graduates' position in the labor market. An important national goal is to create institutional conditions to encourage coordination and interaction among the labor market actors as well as to provide them with adequate information.

References

Ai C., Norton E. C. (2003) Interaction Terms in lLogit and Probit Models. *Economics Letters*, vol. 80, no 1, pp. 123–129. doi.10.1016/S0165–1765(03)00032–6

Arrow K. J., Capron W. (1959) Dynamic Shortages and Price Rises: The Engineer-Scientist Case. *Quarterly Journal of Economics*, vol. 73, no 2, pp. 292–308.

Barnow B. S., Trutko J. W., Piatak J. S. (2013) *Occupational Labor Shortages: Concepts, Causes, Consequences, and Cures*. Kalamazoo, MI: W. E. Upjohn Institute for Employment Research.

Blank D. M., Stigler G. J. (1957) *The Demand and Supply of Scientific Personnel*. Cambridge, MA: National Bureau of Economic Research.

Cedefop (2015) *Skill Shortages and Gaps in European Enterprises: Striking a Balance between Vocational Education and Training and the Labour Market*. Luxembourg: Publications Office. http://dx.doi.org/10.2801/042499.

Cohen M. S., Zaidi M. A. (2002) *Global Skill Shortages*. Northampton, MA: Edward Elgar.

Croce G., Ghignoni E. (2012) Demand and Supply of Skilled Labour and Overeducation in Europe: A Country-Level Analysis. *Comparative Economic Studies*, vol. 54, no 2, pp. 413–439. doi: 10.1057/ces.2012.12.

Downs A. (2009) Identifying Shortage Occupations in the UK. *Economic and Labour Market Review*, vol. 3, no 5, pp. 23–29. doi: https://doi.org/10.1057/elmr.2009.73.

Frenette M. (2004) The Overqualified Canadian Graduate: The Role of the Academic Program in the Incidence, Persistence, and Economic Returns to Overqualification. *Economics of Education Review*, vol. 23, no 1, pp. 29–45. doi: 10.1016/S0272–7757(03)00043–8.

Ghignoni E., Verashchagina A. (2014) Educational Qualifications Mismatch in Europe: Is It Demand or Supply Driven? *Journal of Comparative Economics*, vol. 42, no 3, pp. 670–692. doi: 10.1016/j.jce.2013.06.006.

Gimpelson V. (2004) Defitsit kvalifikatsii i navykov na rynke truda: nedostatok predlozheniya, ogranicheniya sprosa ili lozhnye signaly rabotodateley [Shortage of Skills in the Labor Market: Limited Supply, Lack of Demand, or False Signals from Employers?]. *Issues of Economics*, no 3, pp. 76–93.

Gimpelson V. (2010) Nuzhny li nashey promyshlennosti kvalifitsirovannye rabotniki? Istoriya poslednego desyatiletiya [Does the Russian Industry Need Skilled Labour? Evidence from Recent History]. *Economic Sociology*, vol. 11, no 4, pp.24–69.

Gimpelson V., Kapelyushnikov R., Karabchuk T., Ryzhikova Z., Bilyak T. (2009) Vybor professii: chemu uchilis' i gde prigodilis' [Occupational Choice: What We Learn and Where We Work]. *HSE Economic Journal*, no 2, pp. 172–216.

Green F., Machin S., Wilkinson D. (1998) The Meaning and Determinants of Skills Shortages. *Oxford Bulletin of Economics and Statistics*, vol. 60, no 2, pp. 165–187.

Kapeliushnikov R. (2012) Spros i predlozhenie vysokokvalifitsirovannoy rabochey sily v Rossii. Chast 1 [Demand and Supply of Skilled Labor in Russia: Who Ran Faster? Part I]. *Issues of Economics*, no 2, pp. 52–66.

Korovkin A. (2011) Problemy soglasovaniya sprosa na rabochuyu silu i yeye predlozheniya na rossiyskom rynke truda [The Problems of Matching Workforce Demand and Supply in Russia's Labor Market]. *Studies on Russian Economic Development*, no 2, pp. 103–123.

Lowell B. L., Salzman H. (2007) *Into the Eye of the Storm: Assessing the Evidence on Science and Engineering Education, Quality, and Workforce Demand. Research Report.* Urban Institute. Available at: http://ssrn.com/abstract=1034801 (accessed 20 April 2019).

MAC (2008) *Skilled Shortage Sensible: The Recommended Shortage Occupation Lists for the UK and Scotland*. Available at: www.ukba.homeoffice.gov.uk/sitecontent/documents/aboutus/ workingwithus/mac/macreport2008 (accessed 20 April 2019).

McGuinness S., Pouliakas K. (2016) *Deconstructing Theories of Overeducation in Europe: A Wage Decomposition Approach. IZA Discussion Paper no 9698*. Bonn: Institute for the Study of Labor. http://ftp.iza.org/dp9698.pdf

McGuinness S., Pouliakas K., Redmond P. (2018) Skills Mismatch: Concepts, Measurement and Policy Approaches. *Journal of Economic Surveys*. https://doi.org/10.1111/joes.12254.

Meager N. (1986) Skill Shortages Again and the UK Economy. *Industrial Relations Journal*, vol. 17, no 3, pp. 236–248.

Metcalf H. (2010) Stuck in the Pipeline: A Critical Review of STEM Workforce Literature. *InterActions: UCLA Journal of Education and Information Studies*, vol. 6, no 2. Available at: https://escholarship.org/uc/item/6zf09176 (accessed 20 April 2019).

Myagkov A. (2016) Studenty tekhnicheskogo vuza: professionalnye kompetentsii i ozhidaniya na rynke truda [Technical University Students: Professional Competences and Expectations on the Labour Market]. *Sociological Studies*, no 6, pp. 102–109.

Prakhov I. (2017) Determinanty ozhidaemoy otdachi ot vysshego obrazovaniya v Moskve [Determinants of Expected Return on Higher Education in Moscow]. *Voprosy obrazovaniya / Educational Studies Moscow*, no 1, pp. 25–57. doi: 10.17323/1814-9545-2017-1-25-57

Robert P. (2014) Job Mismatch in Early Career of Graduates under Post-Communism. *International Journal of Manpower*, vol. 35, no 4, pp. 500–513. https://doi.org/10.1108/IJM-05-2013-0113.

Salzman H. (2013) What Shortages? The Real Evidence about the STEM Workforce. *Issues in Science and Technology*, vol. 29, no 4, pp. 58–67. http://www.jstor.org/stable/43315795.

Shah C., Burke G. (2005) Skill Shortages: Concepts, Measurement and Policy Responses. *Australian Bulletin of Labour*, vol. 31, no 1, pp. 44–71.

Smirnov S., Kapustin A. (2018) Otsenka strukturnykh razryvov mezhdu sprosom i predlozheniem na rynkakh truda regionov Rossijskoy Federatsii [Evaluation of Structural Gaps Between Supply and Demand on the Labour Markets in the Regions of the Russian Federation]. *Voprosy statistiki*, no 10, pp. 28–36.

Smith E., Gorard S. (2011) Is There a Shortage of Scientists? A Re-Analysis of Supply for the UK. *British Journal of Educational Studies*, vol. 59, no 2, pp. 159–177. doi: 10.1080/00071005.2011.578567

Smith E. (2017) Shortage or Surplus? A Long-Term Perspective on the Supply of Scientists and Engineers in the USA and the UK. *Review of Education*, vol. 5, no 2, pp. 171–199. doi: 10.1002/rev3.3091.

Stevenson H. J. (2014) Myths and Motives behind STEM (Science, Technology, Engineering, and Mathematics) Education and the STEM-Worker Shortage Narrartive. *Issue in Teacher Education*, vol. 23, no 1, pp. 133–146.

Stuken T. (2018) Kachestvo zanyatosti vypusknikov na regionalnykh rynkakh truda [The Quality of Employment of Graduates on Regional Labour Markets]. *Bulletin of Kemerovo State University. Series: Political, Sociological and Economic Sciences*, no 1, pp. 33–39. doi:10.21603/2078-8975-2018-1-33-39.

Teitelbaum M. S. (2014) *Falling Behind? Boom, Bust, and the Global Race for Scientific Talent*. Princeton: Princeton University.

Xue Y., Larson R. C. (2015) STEM Crisis or STEM Surplus? Yes and Yes. *Monthly Labor Review*, vol. 138, no 5, pp. 1–13.

Varshavskaya E. (2016) Rossijskie rabotniki s vysshim obrazovaniem: analiz obrazovatelnykh spetsialnostey [Russian Employees with Higher Education: Analysis of Areas of Study]. *Voprosy statistiki*, no 9, pp. 31–39.

Veneri C. (1999) Can Occupational Labour Shortages Be Identified Using Available Data? *Monthly Labor Review*, vol. 122, no 3, pp. 15–21.

Verhaest D., van der Velden R. (2013) Cross-Country Differences in Graduate Overeducation. *European Sociological Review*, vol. 29, no 3, pp. 642–653. doi: 10.1093/esr/ jcs044.

Verhaest D., Sellami S., van der Velden R. (2017) Differences in Horizontal and Vertical Mismatches across Countries and Fields of Study. *International Labour Review*, vol. 156, no 1, pp. 1–23. doi: 10.1111/j.1564–913X.2015.00031.x.

Wieling M., Borghans L. (2001) Discrepancies between Supply and Demand and Adjustment Processes in the Labour Market. *Labour*, vol. 15, no 1, pp. 33–56. doi: 10.1111/1467–9914.00154.

Wolbers M. H. (2003) Job Mismatches and Their Labour-Market Effects among School-Leavers in Europe. *European Sociological Review*, vol. 19, no 3, pp. 249–266. doi: 10.1093/esr/19.3.249

Appendix Regression Models with Complete Sets of Variables

Variable	LN (wage)	Horizontal education-al match	Vertical education-al match	Average job search time	Probability of being employed
	(1)	(2)	(3)	(4)	(5)
Engineer (base = economist)	−0.247 (0.186)	−0.017 (0.150)	0.187 (0.151)	−0.056 (0.240)	0.001 (0.079)
Age	0.006** (0.003)	−0.003 (0.003)	−0.0003 (0.002)	−0.024*** (0.005)	0.003** (0.002)
Female (base = male)	−0.138*** (0.025)	0.062** (0.024)	−0.019 (0.021)	0.067* (0.039)	−0.004 (0.012)
Female, married	−0.068* (0.037)	0.091** (0.040)	0.008 (0.036)	−0.026 (0.064)	0.008 (0.021)
Married (base = single)	0.065** (0.033)	−0.035 (0.036)	0.001 (0.032)	0.072 (0.057)	0.020 (0.020)
Years of experience	0.029*** (0.009)	0.028*** (0.008)	0.016** (0.007)	0.149*** (0.022)	0.032*** (0.004)
Years of experience squared	−0.002** (0.001)	−0.002*** (0.001)	−0.001* (0.001)	−0.010*** (0.002)	−0.003*** (0.001)
Mode of study: (base = full-time) Part-time	−0.020 (0.039)	−0.044 (0.039)	0.019 (0.033)	−0.104* (0.061)	−0.046** (0.022)
Extramural	−0.072** (0.033)	−0.069** (0.032)	−0.052** (0.026)	−0.166*** (0.053)	−0.063*** (0.021)
Combining work and study (base = never): Constantly	0.062* (0.035)	−0.076** (0.034)	−0.046* (0.027)	−0.049 (0.055)	0.013 (0.018)
From time to time	0.025 (0.024)	−0.085*** (0.025)	−0.042** (0.021)	0.0812** (0.039)	0.036*** (0.012)
Region of studies (base = region of residence): Other region	0.097*** (0.029)	−0.033 (0.029)	0.054** (0.025)	0.032 (0.043)	−0.009 (0.016)
Abroad	−0.121* (0.065)	0.136 (0.141)	−0.056 (0.105)	0.034 (0.257)	0.015 (0.069)
Type of funding (base = government-funded): self-funded	−0.042** (0.017)	−0.058*** (0.018)	−0.021 (0.016)	−0.138*** (0.030)	0.0003 (0.009)
Employment in the formal sector (base = informal sector)	0.036 (0.030)	0.113*** (0.025)	0.0303 (0.021)	0.608*** (0.046)	0.238*** (0.015)
Top manager, highly skilled professional (base = other groups)	0.071*** (0.023)				
Industry (base = unspecified): Agriculture		0.526*** (0.084)	0.121 (0.090)		
Mining	0.189* (0.0108)	0.410*** (0.099)	0.128 (0.099)		

	(1)	(2)	(3)	(4)	(5)
Process manufacturing	0.042 (0.074)	0.444*** (0.059)	0.194** (0.079)		
Electricity generation and distribution	0.154 (0.102)	0.380*** (0.086)	0.197** (0.093)		
Construction	0.124 (0.082)	0.501*** (0.065)	0.146* (0.082)		
Sales, food service, hospitality	0.052 (0.073)	0.330*** (0.056)	−0.005 (0.077)		
Transport and communications	0.055 (0.076)	0.420*** (0.061)	0.026 (0.081)		
Finance, real estate	0.061 (0.073)	0.542*** (0.056)	0.132* (0.078)		
Public administration	−0.089 (0.074)	0.535*** (0.058)	0.216*** (0.079)		
Education and healthcare	−0.066 (0.077)	0.449*** (0.062)	0.211*** (0.080)		
Other	−0.049 (0.090)	0.295*** (0.078)	0.088 (0.094)		
Matched to job	0.060*** (0.022)		0.513*** (0.017)		
Share of mining in the GRP (base = below the median): Above the median	0.489*** (0.140)	−0.066 (0.138)	−0.056 (0.117)	−0.902*** (0.218)	−0.123 (0.110)
Above the 3rd quartile	0.172* (0.097)	0.083 (0.105)	−0.082 (0.101)	0.244 (0.206)	0.110** (0.055)
Share of process manufacturing in the GRP (base = below the median): Above the median	0.656*** (0.111)	−0.195* (0.111)	−0.136 (0.115)	0.407 (0.255)	0.218*** (0.069)
Above the 3rd quartile	−0.012 (0.065)	−0.208*** (0.061)	−0.196*** (0.056)	0.692*** (0.176)	0.202*** (0.055)
Share of generated electricity in the GRP (base = below the median): Above the median	0.374*** (0.071)	−0.139* (0.076)	−0.174** (0.077)	0.425** (0.206)	0.211*** (0.057)
Above the 3rd quartile	−0.086 (0.108)	−0.354*** (0.086)	−0.082 (0.078)	0.098 (0.191)	0.198*** (0.060)
Deliverable housing (sq.m/ruble GRP) (base = Below the median): Above the median	−0.545*** (0.109)	0.056 (0.109)	−0.146 (0.109)	0.225 (0.203)	0.071 (0.059)
Above the 3rd quartile	−0.728*** (0.161)	0.034 (0.136)	−0.043 (0.125)	0.270 (0.253)	0.078 (0.069)
Type of locality (base = urban): rural	−0.033 (0.022)	−0.027 (0.022)	−0.007 (0.019)	−0.051 (0.035)	−0.024* (0.014)
Engineers: benefit/losses					
Age	0.008* (0.005)	0.004 (0.005)	−0.004 (0.005)	−0.002 (0.009)	0.001 (0.003)

	(1)	(2)	(3)	(4)	(5)
Female (base = male)	−0.003 (0.038)	−0.094** (0.038)	0.049 (0.033)	−0.118* (0.064)	0.011 (0.018)
Female, married	−0.048 (0.059)	−0.147** (0.059)	0.028 (0.054)	0.138 (0.102)	0.014 (0.029)
Married	−0.021 (0.040)	0.073* (0.043)	−0.005 (0.040)	0.024 (0.071)	−0.007 (0.022)
Years of experience	0.011 (0.015)	−0.005 (0.013)	−0.008 (0.013)	−0.015 (0.039)	−0.001 (0.007)
Years of experience squared	−0.001 (0.002)	0.0003 (0.001)	0.001 (0.001)	−0.0004 (0.005)	0.0004 (0.001)
Mode of study: (base = full-time) Part-time	−0.082 (0.066)	−0.047 (0.065)	−0.006 (0.056)	0.062 (0.110)	0.0289 (0.034)
Extramural	0.029 (0.060)	−0.032 (0.060)	−0.060 (0.051)	−0.054 (0.103)	−0.036 (0.036)
Combining work and study (base = never): Constantly	−0.014 (0.065)	0.009 (0.056)	−0.038 (0.046)	0.027 (0.099)	0.009 (0.028)
From time to time	0.033 (0.033)	0.067* (0.035)	0.066** (0.032)	−0.125** (0.060)	−0.031* (0.016)
Region of studies (base = region of residence): Other region	−0.047 (0.043)	0.062 (0.041)	−0.086** (0.038)	0.178*** (0.067)	0.023 (0.022)
Abroad	0.040 (0.095)	−0.167 (0.195)	0.241* (0.142)	−0.179 (0.339)	0.028 (0.115)
Type of funding (base = government-funded): self-funded	0.030 (0.027)	0.067** (0.027)	0.017 (0.025)	0.018 (0.046)	-0.016 (0.013)
Employment in the formal sector (base = informal sector)	0.001 (0.051)	−0.039 (0.040)	0.026 (0.036)	0.192** (0.079)	-0.007 (0.026)
Industry Agriculture		−0.135 (0.131)	−0.101 (0.137)		
Mining	0.032 (0.156)	0.140 (0.126)	−0.243* (0.137)		
Process manufacturing	0.047 (0.127)	0.032 (0.091)	−0.134 (0.109)		
Electricity generation and distribution	−0.028 (0.147)	0.142 (0.114)	−0.220* (0.124)		
Construction	0.082 (0.132)	−0.056 (0.096)	−0.131 (0.112)		
Sales, food service, hospitality	0.095 (0.127)	−0.308*** (0.090)	−0.140 (0.108		
Transport and communications	0.104 (0.129)	−0.055 (0.094)	−0.124 (0.111)		

	(1)	(2)	(3)	(4)	(5)
Finance, real estate	0.085 (0.127)	−0.049 (0.089)	0.021 (0.109)		
Public administration	0.236* (0.130)	−0.220** (0.095)	−0.091 (0.114)		
Education and healthcare	0.031 (0.138)	−0.094 (0.100)	−0.088 (0.114)		
Other	0.145 (0.168)	−0.124 (0.129)	−0.081 (0.139)		
Matched to job	0.001 (0.033)		−0.098*** (0.029)		
Share of mining in the GRP (base = below the median): Above the median	−0.051 (0.034)	0.018 (0.035)	0.051 (0.033)	0.086 (0.061)	−0.005 (0.017)
Above the 3rd quartile	0.049 (0.036)	−0.032 (0.034)	−0.017 (0.031)	0.046 (0.059)	0.019 (0.017)
Share of process manufacturing in the GRP (base = below the median): Above the median	−0.035 (0.035)	0.023 (0.035)	0.010 (0.033)	0.070 (0.062)	−0.020 (0.017)
Above the 3rd quartile	0.028 (0.030)	0.078** (0.031)	0.022 (0.028)	0.022 (0.053)	−0.022 (0.015)
Share of generated electricity in the GRP (base = below the median): Above the median	−0.029 (0.029)	0.034 (0.030)	0.007 (0.028)	−0.035 (0.054)	−0.014 (0.014)
Above the 3rd quartile	0.046 (0.033)	0.063* (0.035)	−0.049 (0.032)	−0.135** (0.058)	−0.022 (0.017)
Deliverable housing (sq.m/ruble GRP) (base = Below the median): Above the median	−0.037 (0.033)	−0.069** (0.032)	−0.005 (0.030)	0.063 (0.057)	0.024 (0.016)
Above the 3rd quartile	0.021 (0.037)	0.050 (0.036)	0.020 (0.033)	0.016 (0.060)	0.019 (0.017)
Type of locality (base = urban): rural	−0.051 (0.035)	−0.022 (0.034)	−0.035 (0.031)	0.0793 (0.054)	0.016 (0.019)
N of observations	3,939	6,540	6,540	6,936	6,936
R-squared	0.430	0.187	0.361	0.0126	0.271

Fixed regional effects are omitted in the report.
Robust standard errors in parentheses.
Significance level: *** p<0.01, ** p<0.05, * p<0.1