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THE UNIFIED STATE EXAMINATION AND THE DETERMINANTS OF ACADEMIC ACHIEVEMENT: DOES INVESTMENT IN PRE-ENTRY COACHING MATTER?

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Abstract

This paper examines the effects of pre-entry coaching (both in terms of money and efforts) on achievement of Russian high school graduates as measured by the results of the Unified state examination (USE). Using a dataset of students from the 16 biggest Russian cities, which includes information on USE results, family background, school characteristics and patterns on pre-entry training, we estimate the factors which determine the final USE results. Parental education, family income, student's abilities and whether or not the student graduated from a gymnasium or magnet school are significant predictors of USE results in Russian, Mathematics and the average USE score. Characteristics of pre-entry courses (duration of a program as well as total fee) have positive influence on USE scores, but the effect of this kind of pre-entry training is moderate. Attending classes with tutors has a significant (but still moderate) effect only on the USE score in Russian.

Keywords: the Unified State Examination, pre-entry coaching, educational strategies

JEL Codes: I21, I24, I28

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I. Introduction

In this paper we analyze the system of pre-entry coaching before going to the university and its impact on the final results of the recently introduced national exam in Russia.

The Russian system of admission to higher education is undergoing a major institutional transformation: during the Soviet period and up to 2009 each university set its own specific entry exams, thus forcing university hopefuls to pass through exams both at high school and at higher education institution. Since 2009 all Russian universities are obliged to admit students on the basis of results of the Unified State Examination (USE), which is a system of standardized tests on different subjects.

The main idea of introduction of the USE was to make admission procedures more transparent and to give more educational opportunities for students from disadvantaged backgrounds. Besides, prospective students can now prepare for the USE without specific investment concerning any particular university, and make the choice of where to apply at a later time. This simplifies the access to university as it decreases transaction costs of pre-entry coaching. Pre-entry coaching still exists however, but now it is done for the centralized test, rather than for and by each university separately. The goal of this paper is to find out to what extent such pre-test training pays off in terms of higher test scores on the centralized test.

The literature (e.g. Juerges, Schneider and Buechel, 2005) predicts positive effects of centralized exams on student achievement as well as on teacher effort, because under this system the results are more valuable signals on the labor market than those of non-unified exams (Bishop, 1995, 1997). Second, such systems provide a set of incentives both for teachers and students for cooperation «toward the goal of students' academic progress» (Schiller, Muller, 2000, p. 74). Third, standardized tests lower the costs of monitoring associated with school performance as they can serve as indicators of the quality of teaching as well. Hence, teaching quality can be monitored, compared across schools and (possibly) rewarded. Finally, standardized testing can raise competition between high schools, because educational outcomes allow making comparisons across schools and students due to the fact that it provides uniformity across exam programs and the grading system. As a result, competition can lead to increase in quality of secondary education. Consequently, uniform requirements and scale of grading are powerful tools of analysis student achievement throughout the country, as uniform test score are comparable and avoid biases which existed before introduction of the USE.

This paper is devoted to the study and evaluation different factors that determine real USE scores. Since higher achievement in terms of scores is positively associated with the probability of successful admission, factors which determine the USE results can affect final educational outcomes.

Information about real scores can be interpreted as an output of educational production function. As the Unified State Examination and its unified scores can be considered as the 'output', we can measure and evaluate factors which determine such 'output' and compare the results among students from different socio-economic backgrounds. There is a lot of research concerning empirical evaluation of educational production function, i.e. assessment of factors which determine academic achievement (e.g. Polachek, Kniesner, 1978; Hanushek, 1997; Woessmann, 2005; Hanushek, Woessmann, 2009). The main findings are: (1) student abilities and his (her) socio-economic characteristics (such as parental education and level of income) have strong effects on achievement; (2) effects of school resources (e.g., type of school, size of class etc) are ambiguous. Relatively little is known however about the impact of preparation efforts on the actual scores on the exam, though there are some projects that study the influence of coaching on SAT scores (e.g. Bangert-Drowns et al, 1983; Becker, 1990; Powers, 1993; Powers and Rock, 1999).

In this work we will examine the significance of pre-entry efforts as factors of educational production function. In other words, the main question is "Does investment in pre-entry coaching improves the results of the USE?" The next question is concerned with family inputs. Which factors concerning family characteristics (for instance, parental education, family income, and current academic achievement) affect students' actual USE scores? If the impact of those variables is positive, as a consequence, these factors can influence college choice via actual scores, so college choice can be determined by family factors (inputs) as well.

In our analysis we use the data from the questionnaires of first year university students and their parents who live in 16 biggest Russian cities. Questions contained information on SES-characteristics, abilities, high school features, patterns of pre-entry coaching, USE results as well as characteristics of the chosen university.

Our results show that parental education, family income, student's abilities and whether or not the student graduated from a gymnasium or magnet school are significant predictors of USE results in Russian, Mathematics and the average USE score. Characteristics of pre-entry courses (duration of a program as well as total fee) have a positive influence on USE scores, but the effect of this kind of pre-entry training is moderate (coached students can gain approx. 3 points out of 100 compared to uncoached ones). Attending classes with tutors has a significant (but still moderate) effect only on the USE score in Russian.

This remainder of the paper is organized as follows. Section II describes advantages of the USE as an external mechanism for evaluating student achievement, as well as the educational production function approach towards estimation factors which determine academic success. Literature on effects of pre-entry coaching is analyzed. Data and methodology are described in

Section III. Section IV describes results of regression analysis. Section V includes concluding remarks.

II. The Unified state examination, educational production function and effects of coaching

The Unified state examination is an external examination system (an analogue of the SAT system in the U.S. or matriculation exams in Finland). This examination is uniform and intended for all Russian school graduates. Every school graduate can sit the set of exams and apply to different universities (in 2010 the maximum number of applications that one person can complete was 5, but this limitation is formal only as there are no legal authorities which monitor the application process).

Every high school graduate may sit the set of USE tests only once a year. If he (she) fails, he (she) can attempt to do this next year for free. Note, that only two subjects are obligatory: Russian (National language) and Mathematics. Other subjects are required by different universities according to their specific field of study. After collecting the requests, education institutions (universities) rank the applications on the basis of the sum of required exam scores and take a decision on matriculation. The process of admission to the university has two stages. First, the universities rank all the requests from prospective students and draw a line. After that those students who are admitted have to present to the university their certificates (scripts). Typically there will be vacant places after that, because one student can apply to several universities, so he (she) can be admitted to more than one institution as well. Having received the scripts, the universities rank students again and draw a line for the second time. Hence, there is a chance for those prospective students who were not admitted on the first stage to enter a university of their choice.

Before introduction of the USE every Russian university had its own admission procedure. The universities' autonomy in admission procedures often led to high selectivity, and school graduates were forced to adjust their strategies in regard to the specific institution in which they were interested. Graduates, who wanted to enter a university with specific entry requirements, were advised that they should be aware of the program of examinations of that university. In order to prepare for the examination properly and meet entry requirements (e.g, program and format of entry exams), prospective students were required either to attend special coaching courses provided by the university or to have additional classes with tutors, who usually worked in the same institution. In other words, they chose the direction of specific investment (both financial and temporal) in the moment when they were hardly aware about what university to

attend (up to 1 year before matriculation). This process was inefficient (in terms of timing of college choice, as students had to decide on where to attend, as well as the direction of specific investment in pre-entry coaching early before the exams) and imposed restrictions on college choice. Moreover, it created opportunities for corruption in universities, as members of admission board could influence the result of admission.

Actual test scores can be considered as values of the educational production function (Hanushek, 1971; Polachek, Kniesner, Harwood, 1978). Formally this function can be expressed as a single equation $Y = X'\beta$, where Y is a measure of output (e.g., achievement expressed in exam scores), and X is a vector (set) of factors, reflecting individual (sometimes unobservable) abilities, family inputs (usually those include, for example, socio-economic status, parental education, income, social and cultural capital), schooling resources and institutional characteristics of educational system. Usually this equation represents a linear model, so coefficients can be regarded as marginal effects ($\beta_i = \frac{\partial Y}{\partial X_i}$), reflecting the importance of one or another factor in determining academic achievement.

There is still a controversy about educational production function approach and almost no clear opinion about what factors do really matter. First of all, any production function should reflect the productivity of any given input. But what should be a measure of output? At least two questions arise here. First, what is the best measure of productivity? Following Woessmann (2005) and other authors, we will use exam scores as a proxy. Second, which level of aggregation should be chosen: city, school, class, or student? In this paper we will rely on micro-data on individual students, as we should capture direct links between student achievement and resources spent as investment in pre-entry coaching (Hanushek, Rivkin and Taylor, 1996).

Depending on the structure of the sample and the particular dataset, researchers have drawn different conclusions. Most of this research is concentrated on impact of schooling resources on student achievement. Hanushek (1997) summarized the results on schooling resources and academic achievement and draw a conclusion that only 9 to 29 percent of articles reveal positive effects of schooling resources on student achievement. Fowler and Walberg (1991) examined this issue using data from 293 schools of New Jersey. As a result, such factors as percentage of students from low-income households, size of school, number of schools in a district, percentage of teachers with bachelor's degree, number of teachers per pupil, average teacher's salary, and socio-economic status of a district, were significant. In contrast, Ehrenberg and Brewer (1994), using panel data from *High School and Beyond*, found no relationship between teachers-per-pupil ratio and achievement. Gamoran (1996) examined effects of different types of school on final scores. It was shown from *National Education Longitudinal Study of*

1988 data that students from private schools perform almost the same as students from public schools. Students from catholic schools scored higher than those of public schools only in Mathematics. Students from magnet schools got higher scores than other students. However, the relationship between schooling resources is still ambiguous.

One of the problems concerning evaluation of educational production function is endogeneity, as students' assignment to schools is not random, because parents can choose schooling institutions and corresponding resources. In order to avoid biases the method of instrumental variables is commonly accepted (Woessmann, 2005; Häkkinen et al, 2003), however it is not always possible to find proper instruments. One of attempts to get data without endogeneity effects was *Project STAR* (*the Tennessee Student/Teacher Achievement Ratio experiment*). During this natural experiment, cohorts of pupils were randomly assigned between classes of different sizes and teachers. The result of this experiment was that students who studied in small classes performed better than those of bigger classes (Krueger, 1999).

Despite the ambiguity of results concerning schooling resources and student performance, there is evidence that achievement can be related to the family inputs, i.e. social background, income and level of parental education (Häkkinen et al, 2003; Woessmann, 2005), so final results and, consequently, college choice can be determined by family factors.

Hanushek and Woessmann (2010) argue that cross-country data can reveal significant institutional effects, which do not exist within country. Moreover, such analysis helps to avoid biases because of endogeneity problem. Another comparative study devoted to differences in schooling quality in Eastern European Countries (Ammermueller et al, 2005). It draws significant differences in achievement between countries explained by different institutional settings. However, this study neglects the effects of pre-entry coaching. While cross-country analysis can be very useful, this paper focuses on Russian high school graduates' achievement. However, this could be a promising extension of the current research.

Pre-entry coaching is widespread not only in Russia, but in other countries with well-developed and highly competitive systems of higher education. The problem of the effect of coaching is not new. There is not so much literature on the effects of coaching, however there are some articles about significance of coaching process on achievement, where the measure of achievement is SAT score (as it was stated above, the USE in Russia has almost the same format as SAT in the U.S.). The most general conclusion is that coached students do perform better than their uncoached counterparts: on average, those students who attend special coaching programs get 15-25 SAT-points on the verbal and on the mathematical blocks more than other students (Powers, 1993). In the review of results from a meta-analysis of a set of papers concerning effectiveness of coaching it is stated that in most cases effects of coaching are positive (although

there are several studies which show negative effects), but the effect is small (Bangert-Drowns et al, 1983). However, longer programs have greater effects compared to shorter ones. Drill and practice on such tests yield greater returns as well. Becker (1990) pays attention to variation in results of different studies concerning the SAT effectiveness. In her review, she included both published and unpublished results. In general, effects of item practice and instruction (coaching content) are positive. The importance of program duration is ambiguous, and coaching effects are stronger for Math test than to Verbal one. The study of the data of a College Board-sponsored survey reveals moderate effects of coaching, far less than promised by coaching entrepreneurs (Powers and Rock, 1999). The authors applied different models, but the result was almost the same.

The need for coaching can be justified by the gap between secondary education and entry requirements. Card (2005) describes the nervous process of national examination in South Korea (*CSAT*) and mentions the features of market of higher education: “The result of the perceived shortcomings of the public school system created a massive market for private education that takes the form of tutoring, "cram schools" and coaching classes that are designed with the ultimate goal of maximizing the highest possible CSAT score”. Those classes are expensive, and there is evidence that richer kids (who can afford those courses) get higher *CSAT* scores.

The system of higher education in Brazil has more in common with Russian system of higher education. There are top (prestigious) public universities, which offer competitive state-subsidized positions for students, and there exist private universities of lower quality where students have to pay tuition (McCowan, 2007). The system of exams (*vestibular*) is similar to one which existed in Russia before the introduction of the USE, but recently new *ENEM* exam has emerged, however not all the universities admit students on the basis of this exam. Expensive preparatory courses (*pré-vestibulares*) help students in coaching for the exam and raise chances of being admitted to selective university.

Hence, even though most of the researchers conclude that the effects of coaching are positive, the importance of coaching (and its real influence) varies from study to study and depends on the concrete dataset (Kulik et al, 1984). This fact drives towards the study of the effect of pre-entry coaching in Russia under new institutional conditions and standardized requirements.

III. Methodology and data description

The empirical data was obtained through the inquiry of first year university students (who were successfully admitted) and their parents in the fall 2010, i.e. at the moment when school

graduates have passed all the exams and were admitted to the universities. During the inquiry 1600 households were interviewed.

The inquiry took place in 16 big Russian cities (with population more than 800 000 people): Moscow, St. Petersburg, Volgograd, Voronezh, Yekaterinburg, Kazan, Krasnoyarsk, Nizhny Novgorod, Novosibirsk, Omsk, Perm, Rostov-on-Don, Samara, Saratov, Ufa and Chelyabinsk. The number of households interviewed in every city was 100. After removing profiles with missing answers (to the questions about family income, as well as characteristics of pre-entry coaching, which are crucial for our goals), the size of the sample diminished to 1165 households[1]. Then the sample was weighted proportionally to the number of school graduates in the above cities in 2005.

There were two different questionnaires for children (school graduates) and their parents. One prospective student and one parent in each household were interviewed. They answered proposed questions separately from each other in order to avoid biases in their answers.

As it was stated before, family, student and school characteristics can affect scores. Moreover, features of pre-entry coaching can influence the final outcome. Hence, to analyze the impact of investment in pre-entry coaching on academic achievement, we propose linear model (the analogue of educational production function), which includes patterns of the process of pre-entry training. The main idea of the model is to analyze and evaluate factors which determine actual student achievement (in terms of USE scores), i.e. to evaluate the following regression (1):

$$T_i = \alpha + \beta A_i + \gamma F_i + \lambda S_i + \mu I_i + \varepsilon, \text{ where} \qquad (1)$$

Dependent variables: T_i - USE scores of student i in Russian, Mathematics, and the average USE score.

Independent variables:

A_i – academic achievement before pre-entry training (measure of abilities);

F_i – vector of socio-economic (family) characteristics: level of income, parental education, family composition, gender;

S_i – vector of school characteristics: type of school;

I_i – vector of characteristics of pre-entry training: characteristics of school learning (extra-classes) and pre-entry coaching (ex.: both temporary and financial investment),

[1] In the models evaluating the impact of coaching on the average USE score we have appropriate information on average USE result for 901 households only, but still these students are representative by the main socio-demographic characteristics. Questionnaires as well as data collection were prepared by Center of Institutional Studies with financial support of Centre for Fundamental Studies (Higher School of Economics).

$\alpha, \beta, \gamma, \lambda, \mu$ – coefficients of the regression,

ε – error term.

When running the regression, we use sample weights.

We do not have the direct measure of abilities. It is expressed in the level of achievement before starting the preparation. This indicator can be affected by family factors as well, so we propose the second model, which evaluates the improvement in achievement in 11th grade (difference between final USE scores and achievement in 9th grade: $\Delta_i = T_i - A_i$), so it can measure the net effect of preparation. Therefore, we regress the following equation (2):

$$\Delta_i = \alpha + \gamma F_i + \lambda S_i + \mu I_i + \varepsilon. \qquad (2)$$

Variables description.

Dependent variables. *USE score in Russian* (USE_Rus) – USE result of student in Russian (1 – 100 points). More than a half of students (58.7%) achieved good results in Russian, getting from 61 to 80 points (see Table 1). The proportion of those who have lowest results (40 points and less) is very small (2.0%). More than 10% of interviewed high school graduates have excellent results (more than 80 points).

USE score in Mathematics (USE_Math) – USE result of student in Mathematics (1 – 100 points). Results for Mathematics are lower than those for Russian. Only 43% of school graduates scored more than 60 points. More than 10% of students have very low result (40 points and less).

Average USE score (USE_Average) – the sum of USE scores divided by number of exams taken (1 – 100 points). More than a half of students (52.7%) have «fair» marks (from 41 to 60 points). There are only 4.3% of students whose average USE score is higher than 80 points.

Gain in achievement in Russian (Δ_{RUS}) – difference between USE result in Russian and GPA in the 9th grade[2].

Gain in achievement in Mathematics (Δ_{MATH}) – difference between USE result in Mathematics and GPA in the 9th grade.

[2] USE scores can vary from 1 to 100 points, and GPA varies from 3 (lowest possible mark for getting the Certificate at the end of the 9th grade) to 5 (highest mark). For reasons of comparability of results all GPAs were recoded into 100-points scale using the following correspondence. First, USE marks were grouped to the following intervals: 40-60 points are associated with fair marks, 61-80 points are associated with good marks, and 81-100 points are associated with excellent marks. For the first two intervals, we took a middle of the interval, hence, 3 points out of 5 equal 50 points out of 100; 4 points out of 5 equal 70 points out of 100. For the last two intervals we use the following rule: 4.5 points out of 5 equal 80 points out of 100; and 5 points out of 5 equal 90 points out of 100.

Average gain in achievement (Δ_{AVE}) – difference between average USE result in and GPA in the 9th grade.

It is not surprising that mean gains in achievement are negative: requirements for the Unified state examination are stricter than those for exams in the 9th grade, and the USE is more difficult to pass.

Table 1.

Description of dependent variables

Score	Subject		
	Russian	**Mathematics**	**Average score**
1 - 40 points	2.0%	11.2%	3.9%
41 - 60 points	29.0%	45.9%	52.7%
61 - 80 points	58.7%	34.8%	39.1%
81 - 100 points	10.3%	8.1%	4.3%
Total	**100.0%**	**100.0%**	**100.0%**
Mean	**67.10**	**61.17**	**62.14**
Standard deviation	**12.48**	**15.38**	**12.37**
Number of observations	**1165**	**1165**	**901**
	Δ_{RUS}	Δ_{MATH}	Δ_{AVE}
Mean	-9.25	-15.18	-14.82
Standard deviation	11.78	14.73	12.26
Number of observations	**1165**	**1165**	**901**

Independent variables. Descriptive statistics is presented in Table 2.

Characteristics of pre-entry coaching. Most of the students used various methods of pre-entry coaching: the majority (46.0%) attended classes with tutors, 33.7% of school graduates visited special courses, 40.0% used other methods of coaching (for example, extra-classes in high school). More than 8% of enrollees coached by themselves (they used textbooks and solved the tasks at home, with no external preparation), and 18.3% of students stated that they didn't use any type of pre-entry coaching. Average duration of coaching was 7.5 months, average frequency of classes was from 2 to 2.3 times a week. Average fee for pre-entry coaching was 5851 rubles per month (approx. 195 US dollars per month), and pay for the tutors was 5647 rubles per month (approx. 188 US dollars per month).

Family characteristics are parental education, type of family and the level of income. *Parental education* was coded as dummy variable which equals 1 if at least one of the parents (father or mother) has higher education or incomplete higher education. Otherwise this variable equals zero. There are 66.0% of households with higher education and 34.0% – with secondary education in the sample.

Level of income. Level of income means the sum of money (in rubles) per person per month. The largest group are households with income 10000 – 14999 per person per month. For the regression analysis this variable was taken in logarithms.

Type of family. There are 80.6% complete families (where both parents lived with their child, when he/she was at high school) and 19.4% incomplete families (where at least one parent lived separately). This variable was coded as dummy, which equals 1 in the case of incomplete family.

Gender. There are 41.7% of boys and 58.3% of girls in the sample. This variable equals zero for girls, and one for boys.

Student abilities (before attending programs of pre-entry coaching), or *academic achievement* is expressed in the average scores in the Certificate of Education in 9th grade. About 53% of high school graduates have only «good» and «excellent» marks in their Certificates (such GPA was coded as 4.5 out of 5 points). More than 34% of students have mostly «good» marks (GPA is 4 out of 5). More than 8% of students have only «excellent» marks (GPA is 5 out of 5), and less than 4% of children have mostly «fair» marks (GPA is 3 out of 5). These marks are those from exams which pupils pass at the end of the 9th grades. The program of the exam is uniform, although unlike the USE, it is taken at the same schools where pupils study, but still we can compare the results of 9th graders across schools. Schools and student body are different, thus grading standards in more selective high schools can be stricter. However, the validity of the comparative analysis across different types of high schools can be justified, as we control for the type of school.

Type of school. Most of high school graduates attended comprehensive schools (61.7%). More than 17% of students graduated from gymnasiums, colleges of lyceums. More than 11% have Certificates from comprehensive schools with special classes, rest of students attended magnet schools.

Table 2.

Description of independent variables

Variable	Mean	Standard deviation	Min	Max
Pre-entry courses (=1 if yes)	0.34	0.47	0	1
Classes with tutors (=1 if yes)	0.46	0.50	0	1
Other types of coaching (=1 if yes)	0.37	0.48	0	1
Self-coaching (=1 if yes)	0.08	0.27	0	1
Length of coaching (in months)*	6.90	4.63	0	25
Total duration of pre-entry courses (in months)*	7.89	4.49	0	25
Total duration of classes with tutors*	7.51	4.49	0	25
Fee for pre-entry courses (rubles per month)*	5850.89	7918.40	200	60000
Fee for classes with tutors (rubles per month)*	5646.82	5958.93	400	50000

Parental education (=1 if higher education)	0.66	0.47	0	1
Income (rubles per person per month)	13302.32	5900.48	1500	22500
Incomplete family (=1 if the child lives with only one parent)	0.19	0.40	0	1
Gender (=1 if male)	0.41	0.49	0	1
Achievement (average score out of 5)	4.32	0.39	3	5
Comprehensive school with special classes (=1 if yes)	0.11	0.31	0	1
Gymnasium (=1 if yes)	0.18	0.38	0	1
Magnet school (=1 if yes)	0.10	0.30	0	1

* counted for only those who did corresponding types of coaching

IV. Results

Results of the analysis of distributions of dependent variables. Before estimation the effects of different factors on USE results, we can look at the distributions of dependent variables (USE scores in Russian, Mathematics and the average score on all the subjects passed) depending on characteristics of pre-entry coaching, as well as student's socio-economic background, his (her) abilities, and type of high school.

First of all, before controlling for other factors, the USE results vary between different cities. If we compare mean scores in Russian, Mathematics and the average exam score, we may see that lowest achievement in the terms of the USE in Russian is in Yekaterinburg (mean score is 59.04 points), in Mathematics – in Saratov (mean score equals 50.06 points). Lowest mean of average score is in Yekaterinburg as well (52.14 points). Graduates from Samara have got highest scores (corresponding means are 73.33 points in Russian, 71.80 points in Mathematics, and average score is 70.26 points)[3].

The analysis of distributions of USE scores sheds light on a number of significant relationships between student achievement and SES characteristics, as well as schooling and coaching.

First of all, the type of pre-entry coaching determines the distribution of the USE results. Table 3 represents the distribution of final USE scores depending on the coaching program: pre-entry courses, classes with tutors, other types of coaching, self-coaching, as well as no coaching at all. We can see that enrollees, who attended pre-entry courses and classes with tutors, gain more than other high school graduates. Lowest results are for those respondents, who stated that there was no coaching for the USE at all (even no self-coaching).

[3] In regression analysis we use control variables for regions.

Table 3.

Distributions of USE scores depending on type of pre-entry coaching

Score	Type of pre-entry coaching														
	Russian					Maths					Average score				
	Pre-entry courses	Classes with tutors	Other types of coaching	Self-coaching	No coaching	Pre-entry courses	Classes with tutors	Other types of coaching	Self-coaching	No coaching	Pre-entry courses	Classes with tutors	Other types of coaching	Self-coaching	No coaching
1 – 40	2.6%	0.2%	0.5%	2.1%	4.2%	6.6%	9.5%	11.6%	13.5%	11.2%	3.8%	1.9%	1.5%	3.0%	6.2%
41 – 60	20.9%	18.8%	27.8%	33.3%	34.1%	34.9%	36.9%	40.6%	52.1%	36.4%	33.6%	37.3%	48.9%	47.8%	46.9%
61 – 80	61.0%	67.5%	60.2%	55.2%	50.5%	44.3%	44.5%	39.0%	26.0%	41.6%	51.7%	54.2%	44.3%	44.8%	42.0%
81 – 100	15.6%	13.4%	11.6%	9.4%	11.2%	14.2%	9.1%	8.8%	8.3%	10.7%	11.0%	6.6%	5.2%	4.5%	4.9%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Family factors, such as parental education, parental income, complete/incomplete family, as well as gender, vary between different levels of achievement. The first factor of significance is the level of parental education. In the households where parents have higher education, children get higher USE scores than in households where parents do not have higher education, i.e. they have only secondary education. Furthermore, the proportion of school graduates who get only «good» (61-80 points) and «excellent» (81-100 points) scores is higher in well-educated households and lower in other households.

The next significant factor of distinction between different groups of enrollees is family structure (complete or incomplete family). In households where both parents live with their children, high school graduates are more successful in terms of the USE results than those who live only with one parent. Indeed, the proportion of students who got «good» and «excellent» scores is higher in complete families (for example, more than 74% of children from complete families get more than 61 points in Russian, while only 63.4% of children from incomplete families reach the same result).

The USE results positively depend on parental income: the higher is the income of the household – the higher are the scores. If the majority of school graduates from low-income households received «poor» (1-40 points) and «fair» (41-60 points) marks as the average USE score, approximately a half of the students from high-income families received «good» marks. The same relationship is true for test results in Russian and Mathematics. Moreover, the

proportion of school graduates who get only «good» and «excellent» marks is very high in «wealthy» households and substantially lower in «poor» ones. Hence, as higher USE scores represent better chances to enter the university, prospective students from high-income households have more chances for successful admission to the universities of high quality.

Gender is another factor of significance. Girls are more successful in Russian, and boys get higher scores in Mathematics. For example, more than 75% of girls get 61-100 points in Russian, while only 67.4% of boys achieve the same result. And vice versa, 58.2% of boys and only 45.1% of girls get «good» and «excellent» USE marks in Mathematics. However, difference between boys and girls becomes insignificant in terms of average results.

Student abilities (expressed as the level of school achievement in 9^{th} grade, i.e. 2 years before admission to the university) as well as type of school can affect final USE results. It is not surprisingly that there is a very strong positive relationship between USE scores and the level of school achievement. More than a half of those pupils who mostly had «fair» (GPA is 3 out of 5) marks in their Certificates of Education in 9^{th} grade, get the same marks (scores from 41 to 60 points) as the result of the Unified State Examination (57.5% and 58.5% in Russian and Mathematics respectively). The absolute majority of those who had mostly «good» and «excellent» marks (GPA is 4 or 4.5 out of 5) in their Certificates achieved the same results during the USE. More than ¾ of high-achievers in 9^{th} grade got «good» and «excellent» marks (i.e. more than 61 points) again.

The type of high school which students graduated from influences their final results of the Unified State Examination. Pupils who attend magnet schools usually receive higher scores than those who attend other types of high schools. Studying in (ordinary) comprehensive school without any specialization is concerned with lowest USE scores.

Hence, USE results of high school graduates can be determined by methods of pre-entry coaching, family inputs (parental education, structure of family, family income), ability (school achievement) and school inputs (type of school), as well as gender and city. In order to measure the impact of different inputs we run regression models.

Results of regression analysis.

A. Educational production function. The results of regression analysis are represented in Table 4.

To evaluate the effect of different inputs on the USE results, with the special emphasis on characteristics of pre-entry coaching, we propose different linear models, where we will use the

USE scores in Russian, Mathematics and the average USE score as dependent variables. The following characteristics of pre-entry programs will be included in corresponding models:

(1) Dummy variables, whether or not high school graduate attended pre-entry courses (Courses = 1 if «yes», = 0 if «no»), classes with tutors (Tutors = 1 if «yes», = 0 if «no»), other types of pre-entry coaching (Other = 1 if «yes», = 0 if «no»), self-coaching (Self-coaching = 1 if «yes», = 0 if «no»); length of coaching (in months). These variables are included in the models 1 to 3 (see Table 4).

(2) Total length of pre-entry courses and classes with tutors (expressed in total number of classes, i.e. frequency per week · 4 weeks in a month · length of coaching in months; taken both in linear and quadratic forms) are included in the models 4 to 6 instead dummy variables Courses and Tutors, and length of coaching. Total length of pre-entry coaching reflects temporary investment in the process of preparation for the university.

(3) Total amounts of tuition on courses and by tutors (expressed in the amount of tuition fee per month multiplied by the length of pre-entry coaching in months) are included in the models 7 to 9 instead of total length of pre-entry courses and classes with tutors to avoid multicollinearity. These new independent variables reflect both temporary and monetary investment in pre-entry process. Moreover, price of courses and classes with tutors can be used as a proxy of «quality» of corresponding lessons.

Pre-entry coaching. Let's start with concrete model specifications including factors of pre-entry training. Models 1 to 3 reflect the importance of separate types of pre-entry coaching, neglecting the fact that those programs differ by time and by price. However, this specification allows for understanding the overall effect of pre-entry coaching. Effect of pre-entry courses is significant and positive for USE scores in Russian and Mathematics, as well as for the average USE score. However, this effect is very moderate: the fact of attending such courses improves USE result in Russian by 2.3 points (18% of standard deviation of USE score in Russian), in Mathematics – by 3.2 points (21% of standard deviation of the corresponding score), and the average USE result by 3.7 points (30% of standard deviation correspondingly). Classes with tutors are effective only for Russian language: students who attend individual lessons, get 3.8 USE points more than those who do not. Other types of coaching decrease USE results by 2.1 – 2.5 points, and self-coaching as the main form of pre-entry training has insignificant effect. Overall effect of pre-entry coaching is relatively small.

Models 4 to 6 deal with temporary investment in pre-entry courses and classes with tutors. Duration of pre-entry courses (expressed as total number of classes) has significant and positive impact on USE scores in Russian, Mathematics, and average score. Imagine that a student has attended courses for 8 months, with 2 classes per week. Then, total number of classes is 8 months · 2 times per week · 4 weeks in a month = 64 classes[4]. This temporary investment adds to the final USE score in Russian only 4 points, to the USE score in Mathematics – 3.8 points, and to the average USE score – 4.7 points. Note, that the coefficients are significant both in linear (positive) and squared (negative) forms. It means that too long or intensive coaching can diminish the return. We may conclude that investment in pre-entry courses in terms of time has positive, but modest effect on USE score. Duration of classes with tutors, like in the previous specification, has significant effect only on the USE score in Russian.

Models 7 to 9 represent the results of estimation of both temporary and monetary investment in pre-entry training. The main variable here is natural logarithm of total fee paid by parents for pre-entry courses and classes with tutors. This value was calculated as length of coaching (in months) multiplied by fee per month. Again, only investment in pre-entry courses has significant and positive effect for all examined USE marks. Imagine a student who pays 6000 rubles per month for pre-entry courses during 8 months[5]. Such strategy will add 2.2 points to the USE score in Russian, 2.8 points to the USE score in Mathematics and 2.8 points to the average USE score. The amount of tuition fee for classes with tutors is positive, but significant only for USE results in Russian.

Hence, the effects of pre-entry coaching are small (compared to variables of achievement and type of school, see below). The main type of coaching that can improve USE results is pre-entry courses. But even though the effect is moderate, at the same time it is similar to effect of parental education or gymnasium effect – so in relative sense it is not that small.

Family inputs. First, note that characteristics of socio-economic background, such as parental education and family income are statistically significant and have positive effects on USE scores. Largest effects are for the USE score in Mathematics: *ceteris paribus*, children from families where parents have a diploma of higher education gain up to 8 points more than children whose parents do not have higher education. Increase of income (per month per person) also leads to improvement of USE results: children from more wealthy families have more chances to get higher USE scores. Gender is important for results in Mathematics (boys get up to 4.4 points more than girls) and average result (boys score up to 1.9 points more than girls). Type of family

[4] Here we use average meanings for duration and frequency of pre-entry courses.

[5] These values represent approximated means for corresponding variables. 6000 rubles equal 200 US dollars approx.

has significant effect in all presented models only on average USE score: children from complete families are more successful in the terms of average score and get up to 2.2 points more than children who live either only with mother or with father.

Student's abilities and school inputs. Student's abilities (expressed as the achievement in 9th grade) have strong significant influence on USE results in all regression models. One-point increase in GPA in the Certificate of Education in 9th grade leads to 12.5-14.0 points increase in USE results in Russian, 13.8-15.9 points increase in USE results in Mathematics, and 8.4-10.1 points increase in average USE score.

Studying in comprehensive schools with special classes insignificantly differ from studying in ordinary comprehensive schools when we compare results in Russians, comprehensive schools improve results in Mathematics, but decrease the average USE score. Attending gymnasiums has significant positive effects on USE results in Russian (the effect is 4.1-4.2 points), Mathematics (3.1-4.2 points of increase) and on average USE result (the effect is 6.3-6.7 points). Enrollees who graduated from magnet schools have a gain of 1.8-1.9 points in Russian, 2.8-5.0 points in Mathematics, 5.2-6.1 points on average (compared to those students who attended ordinary comprehensive schools).

Control variables also included dummies for cities. Corresponding estimates of coefficients are presented in Table A1 in the Appendix in order not to overload the table with the main results of regression analysis.

Table 4.

Estimates of coefficients of educational production function with factors of pre-entry coaching (results of regression analysis)

	Coefficients								
Model →	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Dependent variables →	**USE_Rus**	**USE_Math**	**USE_ Average**	**USE_Rus**	**USE_Math**	**USE_ Average**	**USE_Rus**	**USE_Math**	**USE_ Average**
Independent variables ↓									
Constant	**-15.787* (9.737)**	**-58.201*** (11.780)**	**-36.890*** (10.904)**	**-27.427*** (9.109)**	**-72.041*** (11.036)**	**-49.338*** (10.568)**	**-17.372* (9.292)**	**-62.944*** (11.295)**	**-37.511*** (10.473)**
Pre-entry courses	**2.306*** (0.764)**	**3.247*** (0.924)**	**3.722*** (0.801)**	-	-	-	-	-	
Classes with tutors	3.750*** (0.715)	0.259 (0.865)	0.544 (0.776)	-	-	-	-	-	
Other types of coaching	**-2.124*** (0.722)**	**-2.292*** (0.874)**	**-2.492*** (0.758)**	**-2.253*** (0.685)**	**-2.940*** (0.830)**	**-3.194*** (0.757)**	**-2.188*** (0.711)**	**-2.454*** (0.864)**	**-2.451*** (0.755)**
Self-coaching	0.060 (1.546)	-0.509 (1.870)	3.077 (1.860)	-0.210 (1.461)	-1.140 (1.770)	2.359 (1.812)	0.169 (1.520)	-0.199 (1.847)	3.138 (1.830)
Length of coaching	-0.010 (0.078)	-0.120 (0.095)	-0.008 (0.086)	-	-	-	-	-	-
Total duration of pre-entry courses	-	-	-	**0.125*** (0.021)**	**0.124*** (0.026)**	**0.136*** (0.027)**	-	-	-
Total duration of re-entry courses, squared / 1000	-	-	-	**–0.980*** (0.151)**	**–1.012*** (0.183)**	**–0.975*** (0.210)**	-	-	-

Total duration of classes with tutors	-	-	-	0.007 (0.016)	-0.114*** (0.020)	-0.037** (0.017)	-	-	-
Total duration of classes with tutors, squared / 1000	-	-	-	**0.346*** (0.089)**	**0.875*** (0.108)**	**0.365*** (0.090)**	-	-	-
Ln (Total fee for pre-entry courses)	-	-	-	-	-	-	**0.208*** (0.069)**	**0.262*** (0.084)**	**0.352*** (0.074)**
Ln (Total Fee for classes with tutors)	-	-	-	-	-	-	0.405*** (0.067)	0.008 (0.082)	0.049 (0.072)
Parental education	**4.050*** (0.757)**	**7.859*** (0.916)**	**3.316*** (0.800)**	**3.432*** (0.729)**	**7.040*** (0.884)**	**2.667*** (0.803)**	**4.035*** (0.754)**	**7.897*** (0.916)**	**3.393*** (0.799)**
Ln (Income)	**2.583*** (0.937)**	**5.560*** (1.133)**	**6.428*** (1.044)**	**3.261*** (8.873)**	**6.184*** (1.058)**	**7.032*** (1.001)**	**2.752*** (0.899)**	**5.966*** (1.092)**	**6.451*** (1.005)**
Incomplete family	**1.864** (0.898)**	**0.193 (1.087)**	**-2.091** (1.008)**	**2.142** (0.865)**	**0.476* (1.048)**	**-1.745* (0.991)**	**1.935** (0.895)**	**0.203 (1.088)**	**-2.156** (1.002)**
Gender	**-0.149 (0.675)**	**4.356*** (0.817)**	**1.854** (0.730)**	**-0.544 (0.649)**	**3.957*** (0.787)**	**1.452** (0.732)**	**-0.334 (0.674)**	**4.366*** (0.819)**	**1.860** (0.737)**
Achievement	**12.535*** (0.912)**	**13.787*** (1.104)**	**8.378*** (1.020)**	**14.029*** (0.900)**	**15.895*** (1.091)**	**10.134*** (1.049)**	**12.528*** (0.908)**	**13.908*** (1.103)**	**8.466*** (1.019)**
Comprehensive school with special classes	**0.568 (1.049)**	**2.652** (1.269)**	**-2.377** (1.272)**	**-0.372 (0.990)**	**2.358** (1.200)**	**-2.825** (1.225)**	**0.370 (1.020)**	**2.279* (1.240)**	**-2.568** (1.213)**
Gymnasium	**4.210*** (1.197)**	**3.304** (1.448)**	**6.404*** (1.426)**	**4.703*** (1.149)**	**4.210*** (1.392)**	**6.734*** (1.401)**	**4.098*** (1.186)**	**3.093** (1.441)**	**6.295*** (6.295)**
Magnet school	**1.853* (1.158)**	**3.856*** (1.401)**	**5.590*** (1.179)**	**1.836* (1.130)**	**4.981*** (1.369)**	**6.088*** (1.170)**	**1.235 (1.024)**	**2.797** (1.244)**	**5.185*** (1.026)**
R^2	**0.292**	**0.326**	**0.364**	**0.349**	**0.378**	**0.384**	**0.297**	**0.324**	**0.364**
Observations	**1165**	**1165**	**901**	**1165**	**1165**	**901**	**1165**	**1165**	**901**

Standard errors in parentheses

*** p < 0.01, ** p < 0.05, * p < 0.1.

In the previous models we have described the impact of the fact of attending pre-entry programs, duration of program, as well as total fee on the USE results. Models 1-3 do not reflect neither temporary nor monetary investment in pre-entry coaching, models 4-6 deal only with temporary expenditures on courses or classes with tutors, while models 7-9 regard total fee for preparation (this indicator includes duration and monthly fee, but their effects are not separated from each other). That is why we offer an alternative specification of regression model, where we include total number of classes (at pre-entry courses or with tutors) and fee per class (that is, monthly fee divided by number of classes per month). This specification allows for analysis of temporary and monetary investment separately. The results of regression analysis are presented in Table 5.

Table 5.

Separate estimation of temporary and monetary investment in pre-entry coaching

	Coefficients		
Dependent variables →	**USE_Rus**	**USE_Math**	**USE_ Average**
Independent variables ↓			

Constant	-27.695*** (9.106)	-70.076*** (10.926)	-50.079*** (10.599)
Total duration of pre-entry courses	**0.119*** (0.023)**	**0.126*** (0.027)**	**0.116*** (0.029)**
Total duration of pre-entry courses, squared / 1000	**–0.929*** (0.155)**	**–0.986*** (0.186)**	**–0.772*** (0.219)**
Fee per class (courses) / 1000	0.161 (0.342)	–0.394 (0.410)	0.190 (0.441)
Total duration of classes with tutors	-0.016 (0.017)	-0.160*** (0.021)	**-0.055*** (0.018)**
Total duration of classes with tutors, squared / 1000	**0.361*** (0.089)**	**0.923*** (0.107)**	**0.343*** (0.091)**
Fee per class (tutors) / 1000	**2.707*** (0.611)**	**4.888*** (0.733)**	**2.425*** (0.645)**
Self-coaching	0.973 (1.431)	0.276 (1.717)	3.832** (1.785)
Parental education	**3.045*** (0.736)**	**6.261*** (0.883)**	**2.598*** (0.810)**
Ln (Income)	**3.111*** (0.872)**	**5.823*** (1.046)**	**6.948*** (1.005)**
Incomplete family	2.063** (0.868)	0.689 (1.042)	**-1.939* (1.004)**
Gender	**-1.147* (0.646)**	**2.994*** (0.775)**	0.901 (0.744)
Achievement	**14.114*** (0.901)**	**15.802*** (1.081)**	**10.074*** (1.053)**
Comprehensive school with special classes	0.514 (0.998)	3.996*** (1.198)	-2.003 (1.257)
Gymnasium	**5.069*** (1.148)**	**4.931*** (1.377)**	**7.464*** (1.414)**
Magnet school	**2.894** (1.145)**	**7.007*** (1.374)**	**6.878*** (1.208)**
R^2	**0.354**	**0.395**	**0.382**
Observations	**1165**	**1165**	**901**

Standard errors in parentheses

*** p < 0.01, ** p < 0.05, * p < 0.1.

The coefficients show that total duration (number of classes) of pre-entry courses as well as total duration of classes with tutors (overall effect) positively affect USE scores in Russian, Mathematics and the average USE score, although the effects are small and correspond with the previous findings. Fee per class at pre-entry courses is statistically insignificant, while monetary investment in lessons with tutors positively affect scores. We can explain this fact in the following way: usually pre-entry courses are offered by the universities, and tuition fees are almost independent of the quality of preparation program, while the fee charged by the tutor can reflect teaching quality. However, the effects of pre-entry coaching are modest.

Control variables (family characteristics, achievement, and type of high school) have the same impact as it was described above. Such variables, as parental education, level of income, achievement (GPA in the 9^{th} grade), and the fact of graduation from gymnasium or magnet

school positively affect all regarded USE scores. Gender is significant for USE results in Russian and Mathematics, and incomplete family matters for the average USE score. Coefficients for cities are shown in Table A2 in the Appendix.

B. The net effect of pre-entry coaching. Real abilities of high school graduates are unobservable. That is why in previous models we used their achievement in the 9th grade as a proxy for ability. However, one can argue that scores before starting preparatory process can be regarded not as independent variables, but as an output of educational production function, because they can be related to family inputs, school resources and so on. That is why we have constructed the variable that represents difference in achievement during the preparatory period: $\Delta_i = T_i - A_i$, i.e. difference between USE score and GPA in the 9th grade. This measure can be described as gain in achievement, and education production function in differences can provide more precise effects of pre-entry coaching. Next we run 9 regression models in specifications described above.

As we can see in Table 6[6], the net effects of pre-entry coaching are almost the same as described before. The most relevant models are those where dependent variable is the difference between average USE score and GPA, because (1) it describes average improvement in results, and (1) we do not know the scores in Russian and Mathematics in the 9th grade for more precise comparison (models 12, 15, 18).

In these models the fact of attendance of pre-entry courses can improve the average result by 3.6 points (model 12). Temporary investment matters both for pre-entry courses and classes with tutors, but in different directions: if we consider 64 classes at preparatory courses (as in previous models 4-6), this can improve the result by 4.8 points, while 64 classes with tutors can lead to decrease in results by 1.8 points (model 15). Both temporary and monetary investment (expressed in logarithm of tuition fee for the whole period of coaching) matter only for pre-entry courses and are insignificant for classes with tutors. Expenditures of 48000 (as in the previous models, we take 6000 rubles per month · 8 months) rubles can improve the average result only by 3.8 points (model 18). Consequently, in these specifications effects of coaching still seem to be very moderate, and only pre-entry courses have positive effect in all models presented in Table 6. Other types of coaching have significant negative (but moderate) effect on the gain in achievement.

Again, control variables have significant effect on the fact of improving the result. Parental education and income are significant factors which positively affect the gain in achievement in all models. Family structure (complete or incomplete family) matters only for the difference in

[6] For dummy variables for cities see in Table A3 in the Appendix.

results in Russian (students from incomplete families perform better), while gender matters for the gain in Mathematics and average score (boys perform better than girls). Studying in gymnasiums can improve the gain in all models, while studying in magnet schools can raise the result in Mathematics as well as the average result.

Hence, we did not found any significant contradiction with the previous models of educational production function.

Table 6.

Estimates of coefficients of educational production function with gain in achievement (results of regression analysis)

	Coefficients								
Model →	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
Dependent variables →	Δ_{RUS}	Δ_{MATH}	Δ_{AVE}	Δ_{RUS}	Δ_{MATH}	Δ_{AVE}	Δ_{RUS}	Δ_{MATH}	Δ_{AVE}
Independent variables ↓									
Constant	-34.430*** (9.346)	-72.040*** (11.140)	-70.573*** (10.934)	-40.364*** (8.584)	-77.813*** (10.269)	-77.980*** (10.214)	-35.037*** (8.913)	-75.499*** (10.666)	-70.175*** (10.457)
Pre-entry courses	**1.952** (0.785)**	**2.953*** (0.935)**	**3.560*** (0.858)**	-	-	-	-	-	-
Classes with tutors	**3.226*** (0.732)**	-0.177 (0.873)	-0.089 (0.829)	-	-	-	-	-	-
Other types of coaching	**-1.674** (0.741)**	**-1.917** (0.883)**	**-1.700** (0.808)**	**-2.038*** (0.697)**	**-2.793*** (0.834)**	**-2.868*** (0.794)**	**-1.703*** (0.729)**	**-2.059** (0.872)**	**-1.635** (0.805)**
Self-coaching	1.420 (1.581)	0.623 (1.884)	4.354** (1.989)	0.739 (1.481)	-0.488 (1.771)	3.227* (1.898)	1.516 (1.555)	0.899 (1.860)	4.425** (1.954)
Length of coaching	0.013 (0.080)	-0.101 (0.096)	0.003 (0.093)	-	-	-	-	-	-
Total duration of pre-entry courses	-	-	-	**0.115*** (0.021)**	**0.117*** (0.026)**	**0.137*** (0.028)**	-	-	-
Total duration of re-entry courses, squared / 1000	-	-	-	**–0.907*** (0.153)**	**–0.963*** (0.183)**	**–0.974*** (0.000)**	-	-	-
Total duration of classes with tutors	-	-	-	-0.013 (0.016)	**-0.128*** (0.019)**	**-0.066*** (0.017)**	-	-	-
Total duration of classes with tutors, squared / 1000	-	-	-	**0.485*** (0.088)**	**0.971*** (0.106)**	**0.589*** (0.091)**	-	-	-
Ln (Total fee for pre-entry courses)	-	-	-	-	-	-	**0.193*** (0.071)**	**0.249*** (0.085)**	**0.356*** (0.079)**
Ln (Total Fee for classes with tutors)	-	-	-	-	-	-	0.357*** (0.069)	-0.031 (0.082)	-0.011 (0.077)
Parental education	**3.810*** (0.778)**	**7.659*** (0.927)**	**3.467*** (0.857)**	**3.167*** (0.742)**	**6.858*** (0.887)**	**2.609*** (0.842)**	**3.787*** (0.775)**	**7.695*** (0.927)**	**3.537*** (0.855)**
Ln (Income)	**2.169** (0.962)**	**5.216*** (1.146)**	**5.634*** (1.116)**	**2.944*** (0.888)**	**5.966*** (1.062)**	**6.530*** (1.048)**	**2.234** (0.922)**	**5.544*** (1.104)**	**5.586*** (1.073)**
Incomplete family	**2.379*** (0.922)**	0.621 (1.099)	-1.122 (1.075)	**2.673*** (0.877)**	0.841 (1.050)	-0.589 (1.032)	**2.449*** (0.919)**	0.623 (1.099)	-1.169 (1.069)
Gender	0.451 (0.690)	**4.856*** (0.823)**	**2.600*** (0.778)**	-0.122 (0.658)	**4.247*** (0.788)**	**1.941** (0.766)**	0.290 (0.689)	**4.875*** (0.824)**	**2.649*** (0.001)**
Comprehensive school with special classes	-0.063 (1.076)	2.127* (1.282)	-4.920*** (1.341)	-0.812 (1.007)	2.055* (1.204)	-4.993*** (1.262)	-0.201 (1.047)	1.813 (1.253)	-5.083*** (1.276)
Gymnasium	**4.147*** (1.231)**	**3.251** (1.467)**	**6.278*** (1.527)**	**4.705*** (1.170)**	**4.211*** (1.400)**	**6.772*** (1.470)**	**4.066*** (1.220)**	**3.066** (1.460)**	**6.249*** (1.501)**

Magnet school	1.714 (1.191)	**3.740** (1.420)	**5.405*** (1.263)	1.591 (1.150)	**4.812*** (1.376)	**5.592*** (1.226)	1.272 (1.053)	**2.828** (1.260)	**5.064*** (1.098)
R^2	**0.127**	**0.220**	**0.269**	**0.212**	**0.291**	**0.321**	**0.132**	**0.219**	**0.270**
Observations	**1165**	**1165**	**901**	**1165**	**1165**	**301**	**1165**	**1165**	**901**

Standard errors in parentheses

*** p < 0.01, ** p < 0.05, * p < 0.1.

V. Conclusion

The Unified State Examination is a new institution of admission to higher education. Before its introduction, in the absence of national testing system each university had its own admission procedure. That system of exams was highly selective and forced students to make additional efforts in specific pre-entry coaching in order to improve their chances of successful admission. Nowadays the need for pre-entry coaching should be caused by other factors then before, as the exam is uniform (standardized) and there is a lot of literature on this test. However, the majority of high school graduates still attends extra classes and pay tuition for them. We have made an attempt to measure the effectiveness of such preparation strategies under the new examination system by estimating the influence of pre-entry coaching on final USE results.

In this paper we have identified and evaluated the set of factors which affect actual USE scores, with special emphasis on characteristics of pre-entry coaching. USE results are primarily determined by high school achievement before beginning of additional preparation. However, there are other significant factors but their magnitude on the final result is moderate. Pre-entry coaching matters, but only investment in pre-entry courses can improve USE results in Russian, Mathematics and the average score. However, the effect of courses is rather small and varies (on average) from 1.5 to 3.6 points.

In the models of educational production function there can a problem of endogeneity. One can argue that coaching choices are not random: for example, brighter students feel more secure about their final result, so they need less coaching than low-achievers. Hence, weaker high school graduates would tend to attend pre-entry courses or classes with tutors more often than high-achievers. On the other hand, brighter students can be more motivated for extra training than weaker ones. That is why they will have more incentives to attend pre-entry courses and classes with tutors. Our data show that there is no significant difference in choice of patterns of pre-entry coaching between different groups of students (some of preparations are similar regardless of scores in the 9^{th} grade). Hence, we can say that endogeneity effect is potentially

overestimated, as the distributions of students by their achievement before starting the preparation between different types of coaching programs look similar[7].

USE scores are determined by family inputs, as well as by type of school. Gender matters for USE results in Russian in Mathematics. The same results were obtained in the models, where temporary and monetary efforts were estimated separately.

We have built models where we estimated the gain in achievement between the 9th and 11th grades (during the period of pre-entry coaching). The results are almost the same as in analysis of educational production function: pre-entry courses matter and have a positive impact on the increase in achievement, but the effect is not large, and it is comparable to the effects obtained when analyzing the initial specification.

As a consequence, such factors as investment in pre-entry coaching, abilities, SES as well as type of high school can influence college choice via scores, so college choice can be determined not only by student abilities. However, we cannot say that those who invest more in pre-entry coaching have far more chances for successful matriculation.

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[7] One way to solve the problem of endogeneity is to find the instruments for characteristics of pre-entry coaching. However, it is rather difficult to find appropriate substitutes for temporary and monetary investment in classes with tutors and preparatory courses. We have made an attempt to look for an instrument and run 2SLS regression using number of siblings in the equation, but unfortunately this attempt was unsuccessful.

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VII. Appendix

Table A1. Coefficients of educational production function for cities

	Coefficients								
Model →	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Dependent variables →	**USE_Rus**	**USE_Math**	**USE_ Average**	**USE_Rus**	**USE_Math**	**USE_ Average**	**USE_Rus**	**USE_Math**	**USE_ Average**
Volgograd	-3.432 (3.503)	-5.586 (4.238)	-4.435 (3.541)	-4.209 (3.360)	-5.994 (4.071)	-4.230 (3.477)	-3.418 (3.847)	-5.351 (4.238)	-4.361 (3.530)
Voronezh	1.948 (4.397)	2.767 (5.320)	1.099 (4.411)	0.337 (4.222)	1.098 (5.116)	0.410 (4.338)	1.894 (4.379)	2.947 (5.322)	1.187 (4.401)
Yekaterinburg	-9.327*** (2.828)	-3.996 (3.422)	-13.673*** (2.933)	-9.745*** (2.712)	-4.049 (3.286)	-13.444 (2.892)	-9.154*** (2.814)	-3.787 (3.421)	-13.552*** (2.930)
Kazan	-4.793* (2.891)	-7.860** (3.498)	-5.824** (3.048)	-5.533** (2.764)	-8.323** (3.349)	-5.953 (2.975)	-4.696 (2.868)	-7.382** (3.486)	-5.664* (3.021)
Krasnoyarsk	-1.605 (3.173)	-,952 (3.839)	-3.962 (3.268)	-2.672 (3.044)	-1.397 (3.688)	-4.103 (3.217)	-1.484 (3.158)	-0.736 (3.839)	-3.834 (3.264)
N.Novgorod	-1.555 (3.021)	0.906 (3.655)	-4.314*** (2.870)	-0.806* (2.896)	2.234 (3.509)	-3.211 (2.822)	-1.351 (3.003)	1.319 (3.650)	-4.084 (2.859)
Novosibirsk	-3.920* (2.174)	2.813 (2.630)	-7.655 (2.181)	-3.978 (2.062)	2.883 (2.498)	-7.310 (2.118)	-3.744* (2.142)	3.299 (2.604)	-7.617*** (2.146)
Omsk	-2.785 (2.958)	-3.875 (3.578)	-3.165 (2.929)	-2.762 (2.835)	-3.444 (3.435)	-2.342 (2.884)	-2.571 (2.943)	-3.574 (3.577)	-3.052 (2.923)
Perm	1.512 (3.691)	-1.637 (4.465)	-1.960 (3.584)	1.544 (3.539)	-1.303 (4.288)	-1.159 (3.527)	1.686 (3.673)	-1.323 (4.465)	-1.813 (3.576)
Postov-on-Don	2.912 (3.072)	1.933 (3.717)	1.035 (3.201)	2.632 (2.946)	2.204 (3.269)	1.632 (3.151)	3.009 (3.059)	2.150 (3.718)	1.124 (3.197)
Samara	6.367** (2.932)	12.044*** (3.547)	7.524** (3.235)	6.488** (2.811)	13.184*** (3.406)	8.361 (3.182)	6.553** (2.914)	12.494*** (3.542)	7.721** (3.224)
St. Petersburg	-2.547** (0.995)	-,608 (1.204)	-2.641** (1.186)	-2.812*** (0.954)	-0.348 (1.156)	-2.544 (1.164)	-2.527** (0.988)	-0.460 (1.201)	-2.654** (1.182)
Saratov	-5.370 (4.295)	-7.769 (5.196)	-8.026* (4.179)	-5.297 (4.125)	-6.910 (4.998)	-7.389 (4.120)	-5.167 (4.277)	-7.569 (5.199)	-7.899* (4.175)
Ufa	3.382* (1.744)	5.197* (2.110)	4.154 (3.248)	3.406** (1.666)	5.053** (2.019)	5.502 (3.204)	3.603** (1.723)	5.649*** (2.094)	4.313 (3.235)
Chelyabinsk	0.530 (3.168)	1.542 (3.833)	-0.561 (3.116)	0.767 (3.039)	2.105 (3.692)	0.306 (3.072)	0.576 (3.155)	1.572 (3.835)	-0.550 (3.113)

Table A2. Coefficients of monetary and temporary investment models for cities

	Coefficients		
Dependent variables →	**USE_Rus**	**USE_Math**	**USE_ Average**
Volgograd	-3.489 (3.350)	-4.766 (4.020)	-3.774 (3.489)
Voronezh	1.762 (4.209)	3.337 (5.050)	1.946 (4.351)
Yekaterinburg	-8.992*** (2.709)	-3.003 (3.250)	-12.967*** (2.911)
Kazan	-4.648* (2.759)	-7.052** (3.310)	-5.087* (2.988)
Krasnoyarsk	-1.651 (3.039)	0.066 (3.647)	-3.072 (3.239)
N.Novgorod	-0.613 (2.886)	2.589 (3.463)	-3.146 (2.830)
Novosibirsk	-2.783 (2.047)	4.656* (2.456)	-5.949*** (2.118)
Omsk	-2.723 (2.826)	-3.448 (3.391)	-2.599 (2.895)

Perm	1.321 (3.524)	-1.662 (4.229)	-1.771 (3.534)
Postov-on-Don	3.077 (2.938)	3.098 (3.526)	1.886 (3.163)
Samara	6.959** (2.805)	14.017*** (3.366)	8.486*** (3.194)
St. Petersburg	-2.747*** (0.952)	-0.154 (1.142)	-2.311** (1.173)
Saratov	-4.371 (4.117)	-5.473 (4.940)	-6.590 (4.139)
Ufa	4.151** (1.648)	5.923*** (1.978)	5.651* (3.213)
Chelyabinsk	1.002 (3.029)	2.565 (3.635)	0.283 (3.080)

Table A3. Coefficients of function of gain in achievement for cities

	Coefficients								
Model →	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
Dependent variables →	Δ_{RUS}	Δ_{MATH}	Δ_{AVE}	Δ_{RUS}	Δ_{MATH}	Δ_{AVE}	Δ_{RUS}	Δ_{MATH}	Δ_{AVE}
Volgograd	-4.080 (3.602)	-6.125 (4.293)	-5.407 (3.792)	-4.752 (3.422)	-6.368 (4.093)	-4.999 (3.647)	-4.109 (3.586)	-5.914 (4.291)	-5.385 (3.776)
Voronezh	1.708 (4.523)	2.567 (5.391)	1.019 (4.725)	-0.139 (4.301)	0.771 (5.144)	-0.216 (4.550)	1.627 (4.505)	2.730 (5.391)	1.069 (4.710)
Yekaterinburg	-8.840*** (2.909)	-3.590 (3.467)	-12.786*** (3.141)	-9.234*** (2.761)	-3.697 (3.303)	-12.504*** (3.032)	-8.702*** (2.895)	-3.419 (3.464)	-12.738*** (3.134)
Kazan	-4.906* (2.974)	-7.954** (3.545)	-6.016* (3.266)	-5.698** (2.816)	-8.437** (3.368)	-6.186** (3.121)	-4.891* (2.951)	-7.541** (3.531)	-5.914* (3.233)
Krasnoyarsk	-1.924 (3.263)	-1.217 (3.890)	-4.211 (3.500)	-2.865 (3.101)	-1.530 (3.709)	-4.251 (3.374)	-1.848 (3.249)	-1.032 (3.888)	-4.135 (3.493)
N.Novgorod	-1.356 (3.107)	1.071 (3.704)	-3.878 (3.074)	-0.485 (2.950)	2.454 (3.529)	-2.505 (2.959)	-1.248 (3.090)	1.402 (3.697)	-3.750 (3.060)
Novosibirsk	-3.362 (2.235)	3.277 (2.664)	-6.601*** (2.335)	-3.553* (2.099)	3.175 (2.511)	-6.262*** (2.219)	-3.265 (2.204)	3.690 (2.637)	-6.613*** (2.295)
Omsk	-3.098 (3.042)	-4.135 (3.626)	-3.249 (3.137)	-2.877 (2.888)	-3.523 (3.454)	-2.123 (3.025)	-2.950 (3.027)	-3.883 (3.623)	-3.222 (3.128)
Perm	1.205 (3.796)	-1.892 (4.524)	-2.220 (3.839)	1.423 (3.605)	-1.386 (4.312)	-1.043 (3.700)	1.325 (3.779)	-1.618 (4.522)	-2.138 (3.827)
Postov-on-Don	2.127 (3.159)	1.279 (3.765)	0.017 (3.427)	2.046 (3.000)	1.801 (3.589)	0.907 (3.304)	2.167 (3.145)	1.463 (3.763)	0.056 (3.420)
Samara	6.436** (3.016)	12.101*** (3.595)	7.407** (3.466)	6.659** (2.864)	13.301*** (3.425)	8.489** (3.337)	6.533** (2.998)	12.478*** (3.588)	7.535** (3.450)
St. Petersburg	-1.905* (1.020)	-0.073 (1.216)	-2.787** (1.271)	-2.191** (0.968)	0.080 (1.157)	-2.526** (1.221)	-1.926* (1.014)	0.030 (1.213)	-2.840** (1.264)
Saratov	-4.369 (4.416)	-6.936 (5.263)	-6.591 (4.474)	-4.292 (4.200)	-6.219 (5.024)	-5.842 (4.318)	-4.217 (4.399)	-6.794 (5.264)	-6.545 (4.466)
Ufa	4.372** (1.790)	6.021*** (2.133)	11.549*** (3.410)	4.199** (1.693)	5.599*** (2.025)	12.024*** (3.282)	4.516** (1.769)	6.393*** (2.117)	11.588*** (3.393)
Chelyabinsk	1.232 (3.257)	2.126 (3.883)	0.797 (3.335)	1.475 (3.094)	2.592 (3.701)	1.782 (3.218)	1.280 (3.245)	2.146 (3.883)	0.777 (3.329)