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Measurements of Inequalities in Access to Higher Education:

Case of the Russian Federation[*]

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ABSTARCT

This paper focuses on the systematic investigation of the influence of the quasi-experimental projects on possible changes in inequality in access to higher education in Russia. While intuition points toward a positive effect of introduction of the standardized tests and educational vouchers on the decrease in inequality in access to higher education and more effective, efficient, and fairer distribution of the state funds in higher education, empirical evidence on this issue has yet to be found. This paper presents evaluation techniques for the experiments including introduction of the distribution index (DI) to measure income and education inequalities. The DI, the weighted DI, and the share weighted DI allow capturing changes in inequalities in income distribution, concentration of wealth, or access to higher education more precisely than does the Gini coefficient.

Key words: higher education, inequalities, access, Russia

INTRODUCTION

Higher education in Russia is under pressure because of the reduction in federal funding and the need to modernize curricular content and teaching methods in higher education institutions. The system responded to the reduced federal funding by increasing extra-budgetary and local budget sources. In Russia, a country consisting of eighty-nine regions, a population of one hundred and fifty millions and eleven time zones, there is no one universal national standardized examination for high school graduates. In order to enter any public or private higher education institution, the high school graduates must be present at the college of their choice to pass competitive entry examinations. Those not accepted have an opportunity to enter a for-tuition program at a public university or a private college that requires full tuition. 54 percent of students pay for their education, while 46 percent are paid by the government.

Some households are unable to cover travel expenses for their children to a university of their choice to take entry examinations. Some candidates with high academic potential do not accept the risk of competing for places in top schools. Observations indicate that socio-economic factors are most significant when it comes to access to higher education, especially to top schools. Three major factors are household income, place of residence, and quality of secondary education. People in poor households, rural areas, and economically depressed regions have less access to higher education. If in 1990 75 percent of students in Moscow were from the regions, in2001 they constituted only 25 percent (Kuzminov et. al., 2002).

The reform of admissions policies in Russia is needed. With the number of college students in the country all time high, reaching 327 students per every ten thousand population, and the number of higher education institutions way over a thousand, the old system of admissions is morally outdated and in many ways inadequate to the present day demands.

The projects

There are two educational projects implemented in Russia by the federal government including standardized, computer-graded test, which will be used for entrance to universities and a voucher-based system of higher education funding. The goals of the projects are as follows: establish the mechanism of financing higher education institutions on the basis of educational vouchers; increase access to professional education; adequately estimate preparation of high school graduates and equal opportunities to enter colleges; establish a closer link between secondary and professional education; maintain equivalency of the state documents (certificates) of secondary education; establish state control of quality of secondary education based on independent evaluation.

The projects were conducted in the sixteen regions that represent all different types of regions in the country. All high school graduates in the sixteen regions take the standardized test in one of the 1938 places, where the standardized test is conducted, in number of subjects, to be defined in each region. Set of the subjects included in the standardized test varies from region to region. Results of the examinations are graded on a scale from one to five. Every high school graduate, except those who receive a D, obtains an educational voucher with a value corresponding to the grade received. The vouchers are grants that can be spent only on higher education and should not be refinanced. One of the major characteristics of educational vouchers is portability. A portable voucher can be taken by a prospective student to any higher education institution that participates in the project. Anyone from non-participating regions or graduates from previous years can take the standardized test. It is set up so that the top 5 percent receive an

A+, the next 15 percent an A, next 40 percent get B, the next 25 percent a C, and the lowest 20 percent a D. No vouchers are assigned to those with a D score (Kuzminov, et. al., 2002).

There are 140 institutions participating in the projects. All of them are public higher education institutions under the authority of the Ministry of Science and Education within the participating regions. Public higher education institutions under the authority of other Ministries may apply to be considered for participation in the projects. Some quotas and restrictions are imposed. All higher education institutions that participate are allowed to enroll in all programs only applicants with educational vouchers. The number of students whose educational vouchers will cover full tuition and fees without any other extra payment should be not less than 50 per cent of all enrolled, including not less than 25 per cent in each program. Each institution indicates the admission test score and tuition three months prior to the application deadline.

All students are free to disregard their standardized test score and educational vouchers and take competitive entry examinations in higher education institutions of the non-participating regions. They are also free to retake the examination each year. The government covers the cost of the student's educational voucher to a college during four to six years of study, depending on the length of the program. It is expected that colleges will compete for better students, since they will bring vouchers with higher values. It will result in an increase in quality of higher education.

The reform is based on the hypothesis that a decrease in inequality in access to higher education and redistribution of the state funds among public and private higher education institutions will lead to an increase in quality of students and higher education services and to more efficient and effective functioning of the system. Supporters of the new examination system argue that the reform will create equal opportunities in access to higher education, prevent corruption, and make higher education a demand-driven industry. Intervention is based

on the assumption that since low-income households, cannot afford to pay for their children to travel far from home to take entry examinations, let alone pay for tuition, and since entry examinations are corrupted, implementation of the national examinations will increase access to higher education for children from lower-income households.

Supporters of the voucher plan assume that vouchers will give real value to the academic credits and achievements of prospective students in secondary and high school in the market of higher education and will increase the quality of students because of the anticipated decrease in inequality in access to higher education. The vouchers will increase the role of personal academic achievement in obtaining higher education and decrease the role of household income. Among other expected positive effects are a decrease in corruption, better budget distribution and allocation of the state budget, and an increase in quality and adequacy of higher education.

Critics of the reform predict an increase in the educational bureaucracy and transaction costs needed to regulate voucher financing schemes and the standardized test (Kolesov, 2002, Sadovnichiy, 2001). Educational vouchers create the wrong incentives for many high school graduates. First, many think that it is better to live with a diploma than without one. Second, entering college means deferring military service. Admission to a college is considered a way to avoid draft. People who receive a voucher of certain, even if low value, would be willing to use it to enter a low-quality college, and would use it even if they had not planned to attend college.

One of the misleading assumptions being made by the supporters of the projects is that growing competition between colleges and universities will result not only in an increase in the quality of the educational programs they offer, but in the reduction of the cost of education as well. The model developed mathematically by the supporters of the projects and manifests expected decrease in inequality in access to higher education, is based on such an assumption. In

our view, the real price of education is not voucher-value-driven. It depends heavily on the costs of providing educational services. A decrease in voucher value will not push the price of higher education services down. Instead, an extra payment collected in addition to the voucher value will increase. It may result in higher extra payments in the top-ranked schools, and, as such, cut applicants from low-income households off from these higher education institutions.

<div align="center">**Measuring inequalities in access**</div>

Opportunity in access to higher education will be measured by the result, i.e. the fact of entering higher education institution. It assumes that changes in the result are an indicator of changes in the opportunity. All the measurements will be taken before and after the project's implementation in the participating and non-participating regions. Key measures should include income inequality indices, educational inequality indices, and inequalities in the educational voucher values.

Many households do not know their exact annual income, others will report it inaccurately, and many households may choose either not to report it at all. The precise determination of household income is crucially important for the purpose of identifying income thresholds and assignment of the representatives to the income deciles.

The Gini coefficient, which is normally used for measurements in income inequality and other inequalities, does not reflect what could be called internal dynamics. More specifically, it does not indicate whether income redistribution to the poorest decile has been made at the expense of the richest decile, or middle class, or upper-middle class, or any combination of those. The same problem exists when it comes to measuring other forms of inequality while using the Gini coefficient. We suggest using another way of measuring inequalities and

developing an index that will help us measure inequalities in access to higher education. The Distribution index allows capturing more precisely than does the Gini coefficient inequalities in the distribution of income or access to higher education.

The DI coefficient for household income can be calculated as follows:

$$DI = \sum_{i=1}^{N} (X_i)^2$$

where Xi is the share of ith decile in the National Income.

Based on the fact that there are ten deciles, the value of the DI will be in the range of 1000 to 10,000. If income will be distributed equally by 10 percent to each decile, the DI will be equal to 1000. If the wealthiest decile will concentrate 100 percent of total income, the DI will be equal to 10,000. Any changes in distribution will be captured based on squaring of the shares in income. An increase in income of the wealthier decile will lead to an increase in the DI. An increase in inequality will be indicated by a DI increase. Whole point is to make household income as much irrelevant in respect to access to higher education, as possible. This is based on the goal of decrease in inequality in access to higher education and should not be referred to the functioning of higher education industry overall.

One of the major assumptions is that in Russia all children have equal access to the level of educational quality in secondary education, which will allow them to pass the standardized test successfully. One of the major challenges to the project may be the question whether student performance in secondary school depends on the household income, and if yes, to what extent? If students from wealthier families perform better, it will lead to the fact that proportionally larger part of voucher money will go to the wealthier that in its turn will mean even more inequality. The assumption of the intervention is that academic achievements of high school students and their standardized test scores are more income-independent than the access to higher education.

It means that income-based inequalities in academic achievement of high school graduates are less than income-based inequalities in access to higher education. If academic achievements are more household income-dependent, than the access to higher education, inequality in access to higher education after the intervention may increase.

It is expected that an increase in access to higher education will result in an increase of number of representatives of poor and middle class households in higher education institutions. We cannot say that decreased inequality in opportunity entails increased number of students from poor households in higher education. It is up to the poor, whether they want to enter colleges more intensively, or not. However, we assume that since the wealthier already have an access to higher education, with existence of definite income thresholds according to tuitions in top schools and local schools, we tend to measure changes in access to higher education by changes in number of poor in higher education institutions, and top schools, in particular.

Deciles obtained from income distribution will be marked starting from 1st for the poorest to 10th for the wealthiest. All admitted in higher education institutions will be identified as representatives of one of the deciles. Calculation of the DI for education will be made as the following:

$$DI_{ed} = \sum_{i=1}^{N} (X_i)^2$$

where Xi is the percent of accepted representatives of ith decile in total places in higher education. $N = 10$ (by the number of deciles).

Several possible variations in the distribution of places in higher education among the representatives of different income-based deciles are presented in Figure 1. They depict the situation when the Gini coefficient would remain the same for all the variations, while the value of the DI would vary.

Total number of places
in higher education

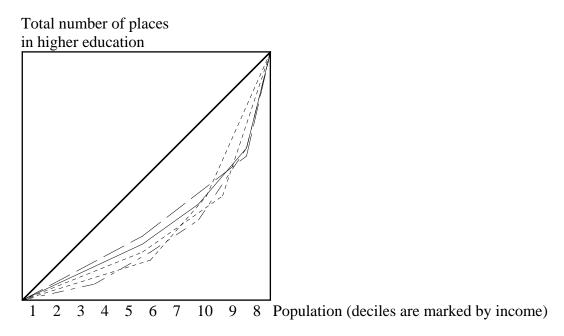1 2 3 4 5 6 7 10 9 8 Population (deciles are marked by income)

Figure 1. Distribution of places in higher education

Observation has been made that children from richest deciles do not occupy largest number of places in colleges, but representatives of middle class deciles do. Therefore, it may be suggested that income distribution does not present us with the mirror-like or symmetric reflection of distribution of places in higher education. The largest share in the National Income does not mean that the decile has the largest share of places in higher education institutions, occupied by its representatives. It is necessary to say that the share in higher education is not the same as access to higher education. Obviously, there is a threshold in terms of household income, above which access to higher education depends on willingness of parents and children to pursue study in college, rather than on the household income. Number of college age children in household and amount of tuition also play a role in defining such income threshold.

It can be speculated that despite children from wealthiest deciles do not occupy largest number of places in higher education, they may occupy largest number of places in the nation's

most elite schools, or more likely in for-tuition programs and accessed-by-bribe places of top

schools, since all the top schools are public. It would be interesting to calculate whether the

placement of the decile by income is proportional to total sum of money, spent on tuition and

fees by the representatives of this decile.

The same steps will be undertaken after the implementation of the projects. Results

obtained before and after the implementation of the projects will be compared. If decrease in the

DI for education will be indicated decrease in inequality in access to higher education will be

reported. Conversely, if increase will be indicated in the DI for education, it will be interpreted

as an increase in inequality in access to higher education. Same measures in comparison group

will control for any side effects. If the Gini coefficient for education will increase, but the DI for

education will decrease, the DI will be considered as a more precise and reliable indicator for

making conclusions. It will be concluded that despite the decrease in the overall inequality

measured externally decreased, inequality among the deciles in access to higher education

increased. The problem is that we cannot compare deciles by income and deciles by education.

Moreover, we cannot measure opportunity, but we can measure access by the result, that is how

many representatives of each decile enrolled successfully into colleges.

Since all deciles are of equal size, it does not matter which way inequality is measured: as

share of people from each decile in higher education, or as share of people in each decile, who

were accepted by colleges. By transferring shares of entered higher education in each decile into

100 percent total, the DI for education for share of 1st year college students in each decile can be

obtained by summarizing all the percentages, then dividing 100 percent over this sum, and

multiplying percentage in each decile on the coefficient obtained. The proportion coefficient may

be calculated simply by dividing total number of households over the number of entered higher

education in a given year.

The DI for education, measured on the basis of percentage of those who entered higher

education institution in each decile will be:

$$DI_{ed} = \sum_{i=1}^{N} \left(S_i \times \frac{Q}{H} \right)^2$$

where Si is a percentage of those who entered higher education in i^{th} decile,

Q is the number of households,

H is the number of people who entered higher education institutions.

In the experiment deciles may be taken in each region in both the experimental group and

the comparison group. Higher education, taken in each region is, however, not as precise, since

people move nationwide to study in colleges. One of the assumptions to be made in order to

decrease this risk in measurement is to assume that people normally move outside the region of

residence if they plan to enter top ranking that is national level schools. Otherwise they choose to

study in the local college within the region of residence. Assuming this, problem can be solved

by identifying national and local level higher education institutions.

Two segmentations will be made. First, all colleges will be classified into three groups

depend upon the tuition they charge: $3000 a year and up, $1000 to $3000, less than $1000.

Schools in the first group are the top schools. Schools in the second group are mid-level, and

schools in the third group are low-level quality. Segmentation can also be done on public and

private higher education institutions. The weighted DI coefficient for education will be

introduced in order to capture inequalities in access to higher education expressed in terms of

differences in percentage of representatives of different deciles in different groups of higher

education institutions. This measure will be used to estimate the overall inequality of a set of markets, which are colleges of groups I, II and III.

Let us assume that γ_{ik} is a share of representatives of decile i in college group k. $i = 1, 2, 3, ... N$. $N = 10$ by number of deciles. $k = 1, 2, 3$. $K = 3$ by number of the groups.

Xik is the share of the decile i in college group k within the K college groups.

$$X_{ik} = \frac{\gamma_{ik}}{\left(\sum_{i=1}^{N} \gamma_{ik} \right)}$$

L_{ik} is the share of the decile i across the K college groups.

$$L_{ik} = \frac{\gamma_{ik}}{\left(\sum_{k}^{K} \gamma_{ik} \right)}$$

The DI for education for college group k can be calculated as following:

$$DI_{ed_k} = \sum_{i=1}^{N} (X_{ik})^2$$

Weighted share of decile i can be calculated as follows:

$$WX_{ik} = \sum_{k}^{K} L_{ik} X_{ik}$$

The Weighted DI for education for decile i in all three sectors of higher education will be calculated as the following:

$$WDI_{ed_i} = \sum_{k}^{K} L_{ik} DI_{ed_k} = \sum_{k}^{K} L_{ik} \sum_{i=1}^{N} (X_{ik})^2$$

The Weighted DI for education for decile i determines the weighted sector share for the ith decile across the K sectors of higher education in which it is presented.

It will be necessary to introduce Share weighted DI to estimate the overall degree to which a decile might benefit from its specific higher education share combined with the overall sector concentration in the specific sectors it is represented.

$$SWDI_{ed_i} = \sqrt{\sum_{k}^{K} L_{ik} X_{ik} DI_{ed_k}} = \sqrt{\sum_{k}^{K} L_{ik} X_{ik} \sum_{i=1}^{N} (X_{ik})^2}$$

The weighted average of sector specific DIs multiplied by the decile's sector share in each group of colleges (or any other type of sectors, depending on segmentation) is taken across each of the K groups in which the ith decile is presented. The square root is taken to return the estimate to a range similar to the traditional DI calculation.

The hypothesis can be made that elimination of the places in higher education institutions funded by the state will cut applicants from poor households from the top schools. First, top schools will have more applicants with the highest (A+) value vouchers than they have places. This competition will lead to an increase of tuition over the value of the voucher. As a result, only those who will be able to pay extra money to cover the difference between the value of voucher and the tuition will be accepted. Applicants from poor households, unable to make extra payments in order to cover the difference, will be separated from the top quality higher education. Second, value of a voucher is supposed to be transferred to the college directly from the government. No other payments are planned, including those from the government to the students that would represent stipend. It creates a situation when higher education institutions are open for everyone, but youth from low-income households "choose" to go to the labor market instead of college. One of the major reasons for that is that their families are not able to support them during their study. Colleges do not pay stipend either.

The top schools in Russia will become completely unaffordable for the poor. Also, everyone will prefer to stay as close to home as possible, preferably attending college in ones

home town, in order to avoid extra costs of living in a different city. As a consequence, diversity

of the student body in colleges will decrease. All concentration will appear within the regions

and within the educational centers. The role of place of residence may not decrease, but even

increase. Also it will lead to weakening the ties between the regions, a negative process for the

nation building.

The other important aspect is inequalities in distribution of total value of vouchers

between the deciles. A share of prospective students entering higher education in each decile is a

fundamental indicator for measuring inequalities in access to higher education that should be

measured to evaluate changes in inequalities, caused by the projects, that is impact assessment.

Despite the fact that value of vouchers will be distributed according to academic

achievements on the standardized test, it will be interesting to follow the voucher value

distribution among the deciles. This inequality can be measured by the DI for vouchers and

calculated as follows:

$$DI_v = \sum_{i=1}^{N} (V_i)^2$$

where Vi is a share of ith decile in the total voucher fund.

Despite the fact that the government preserves the right to define total value of voucher

fund and value of different categories of vouchers, the DI for vouchers still is valid for making

comparisons in time. There are four types of vouchers by value, according to A+, A, B, and C

grades on the standardized test. Shares of the deciles in these four types of vouchers can be

measured by analogy with the DI for education by the share weighted DI for vouchers.

It may be found, for instance, that the poorest 1st decile receives larger voucher value in

the lowest C-grade vouchers, while the middle-class deciles or wealthiest 10th decile receives

larger voucher value in highest A+ grade vouchers, or may be vise versus. The share weighted

DI for vouchers will present an exposure of internal changes of shares of the deciles in different types of vouchers.

From one perspective the goal of the policy experiments in Russia is to reduce inequality in access to higher education overall by distributing the state educational funds through the mechanism that involves educational vouchers assigned according to academic achievements of the applicants, not their financial need. A decrease in inequality in access to higher education will not indicate at the expense of which decile such redistribution has occurred. It will not show whether the poorest obtained more places in colleges thanks to redistribution from the wealthiest decile, or one or several of the middle class deciles, or both, or any other combination. It is expected that an increase in access to higher education will result in an increase of number of representatives of poor and middle class households in higher education institutions. We cannot say that decreased inequality in opportunity is the same as increased number of students from poor households in higher education. It is up to poor, whether they want to use the newly-created or increased opportunity of entering colleges.

From another perspective, we assume that since the wealthier citizens already have access to higher education, with existence of definite income thresholds according to the size of tuition in top schools and local schools, we measure changes in access to higher education by tracing changes in the number of representatives of poor households in higher education institutions, and top schools, in particular.

These two positions are mutually exclusive when the number of places in higher education is fixed. This paper assumes that the supply of higher education is determined by the demand on higher education services, and does not impose the limitation of exclusiveness. It allows accepting Rawls's principle of maximizing position of the most disadvantaged by

establishing both the goal of a general decrease in inequality in access to higher education and the goal of an increase in the number of poor people in higher education institutions.

Insufficiency of voucher funds may be compensated by educational loans. If a potential applicant did not receive a voucher, or if the value of the voucher is not enough to cover the costs of education in the college of his choice, he should be able to receive educational loan to cover the difference and the living costs. It will be useful to start from the state loans, including those provided by the federal government and by local administrations and municipalities. Ways of funding education based on educational loans can vary depend on structure of the economy. The instruments are repayments, interest rates, taxation, and combination of the above. Adequacy in financing is also necessary. All applicants independently of their household income should have an access to the amount of educational loans that combined with the voucher value will be sufficient to cover all costs of education, including tuition and fees, textbooks, room and board, and transportation. Equity in access to higher education will be realized through the diversified system of financing. All households, including most disadvantaged, should have equal access to higher education through the equal access to educational loans.

CONCLUSION

The reform of higher education in Russia, based on the introduction of standardized tests and educational vouchers, is a response to the rapidly changing socio-economic environment in the country and in the region. Higher education is recognized as one of the major engines for potential economic growth. Economic effectiveness of higher education should be followed by increasing quality of educational services and internal efficiency of the industry. There are number of validity threats to measurements of the projects' impact and challenges to the reform

itself, and possibility of adverse effects of the reform, including an increase in inequality in access to higher education. The Distribution Index (DI), the Weighted DI, and the Share Weighted DI can indicate changes in inequalities in access to higher education, as a result of impact of the reform. A decrease in inequality in access to higher education is one of the key sources of improvement of higher education and future economic development.

The reform presents the dilemma between decreasing inequality in general and improving position of the most disadvantaged groups of population. This dilemma is partially resolved based on Rawls's difference principle. This paper relies on the assumption that the higher education industry in Russia is demand-driven, and therefore does not impose the limitation of exclusiveness. The supply of educational services in the country matches the demand presented by the public. It allows accepting Rawls's principle of maximizing position of the most disadvantaged groups of population by establishing both the goal of a general decrease in inequality in access to higher education and the goal of an increase in the number of poor people enrolled in colleges and universities.

Standardized tests present everyone with an opportunity to apply in several colleges and universities and makes academic achievements in secondary school significant for entering university. Educational vouchers serve as a venue for distribution of the state funds among public and private colleges according to their attractiveness for the prospective students. They give real value to academic achievements of high school students who apply to higher education institutions. Insufficiency of voucher funds may be compensated with educational loans. All households, including the economically disadvantaged, should have equal access to higher education through the equal access to educational loans.

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