EDUCATIONAL CORRUPTION IN TRANSITION COUNTRIES

by

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Abstract

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The primary goal of this research work is to construct a reliable measure of educational corruption comparable across a sample of transition countries. Keeping this ambitious goal in mind, we assume that admission process in higher educational establishments is the most suitable moment for corrupt incentives to reveal. If such illicit actions are undertaken, then the reported percentage of newly enrolled university students should reflect the level of corruption in education.

In this paper we aim to construct the Education Corruption Index (ECI) for 13 transition countries as the difference between the actual percentage of newly enrolled students among recent graduates and the corresponding hypothetical percentage if the entrance requirements were based only on test results as in the reference ("uncorrupt") country. The distribution of mathematics test scores during TIMSS 2007 assessment provides a solid basis for this exercise. Assuming that only the ablest students with the highest test scores can be admitted to tertiary education and that TIMMS mathematics scores provide good proxy for the measure of ability, we find that Romania, Ukraine and Czech Republic are among the three most corrupt countries in the tertiary education sector. At the same time Bosnia and Herzegovina, Georgia and Turkey are among the least corrupt in the tertiary education sector.

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GLOSSARY

ECI. Educational Corruption Index

TIMSS. The Third International Math and Science Study

ARM. Armenia

AUS. Australia

BIH. Bosnia and Herzegovina

BGR. Bulgaria

CZE. Czech Republic

ENG. England

GEO. Georgia

HUN. Hungary

JPN. Japan

LTU. Lithuania

ROM. Romania

RUS. Russian Federation

SCO. Scotland

SCG. Serbia

SVN. Slovenia

SWE. Sweden

TUR. Turkey

UKR. Ukraine

USA. United States

Chapter 1

INTRODUCTION

Mutual interdependence of education and economic growth has been considerably investigated both under theoretical (Denison, 1962; Romer, 1989) and empirical framework (Krueger and Lindahl, 2001; Barro and Lee, 2001). The roots of such considerable interest go deep into those times when the growth phenomenon has been intensively explored. In recent decades theories of growth have experienced significant evolution attempting to explain continuous growth and to test the convergence hypothesis (Klenow and Rodriguez-Clare, 1997). Among these theories endogenous growth model supported by Romer (1986) and Lucas (1988) implies that unlike physical capital, human capital may be augmented by non-diminishing returns, which permits economic growth to continue indefinitely (Kibritcioglu and Dibooglu, 2001). In Lucas (1998) "On the Mechanics of Economic Development" education is specified as the major factor of sustainable growth. Therefore, economic development is largely determined by the level of investment in human capital, more precisely, investment in education, research and development and technological infrastructure, which can in turn endogenize technological progress and ensure "self-feeding growth process in the economy".

More recent studies provide further evidence on positive association between education and economic growth: "the claim that expanding education is good for economic growth seems intuitively obvious" (Pritchett, 2001).

Among the most problematic forces that intuitively undermine expected benefits of education is corruption that places itself as a global phenomenon that affects almost all aspects of social and economic life. The World Bank

estimates that over 10 billion US dollars annually are lost due to corruption, representing 5% of the world GDP (Podobnik et al., 2008).

There's a wide range of studies that report negative effect of corruption on economic and social development (Kaufmann, 1997; Aidt, 2003; Murphy et al., 1991; Tanzi, 1998; Mauro, 1995, 1997; Mo, 2001; Pellegrini and Gerlagh, 2004, 2008; Johnson et al., 1998; Rock and Bonnet, 2004; Rodrik, 1998).

Gray and Kaufman (1997) provide evidence on great economic cost that society has to bear due to corruption. It raises transaction costs and overall uncertainty in the economy, leads to inefficient economic outcomes and undercuts state revenues, provides fewer incentives for development of small enterprises due to unfair regressive taxation (Gray and Kaufmann, 1998). As a result of reduced government revenues, spending on infrastructure, health and education is also undermined. Mauro (1997) confirms this claim showing that government spending on education, measured as a ratio of GDP, is negatively and significantly correlated with corruption.

Therefore, it can be concluded that corruption in education represents an interesting avenue for further investigation. Nevertheless, it is highly important to distinguish environments in which corruption phenomenon occurs. Transition economies have provided a unique surrounding to investigate this issue, especially in the sphere of educational system. On the one hand, they are entirely different from developed Western economies due to exceptional economic and political transformations that have taken place during transition from socialism to market economy (Piplica, 2011). On the other hand, the puzzling feature of most transition economies is that "standard measures of educational attainment are as high or even higher than in the world's richest

countries yet the typical transition economy has a per capita GDP similar to that of a middle income developing country" (Spagat, 2002).

However, the experience of most transition economies, especially the one of the former Soviet successor states (Spagat, 2002) shows that resistance of highly bureaucratic and corrupt educational institutions slows down this transformation of educational system towards comprehensive and balanced Western-style regulation (Pleskovic et al, 2002). As a result, the rate of enrollment, completion rates, scores obtained, diplomas issued may not have expected effect on economic growth. Moreover, if we compare the countries that demonstrate approximately the same values of the abovementioned indicators, but different levels of corruption, then we should not expect the same impact of these indicators on growth, since corruption may lead to less efficient use of human capital.

Corruption in education may have even larger consequences for intergenerational transmission of human capital. In a corrupt society newly graduated "teachers" as a result are poorly trained and ill-prepared for what awaits them in schools, many of them quit their jobs, filling the cohort of "educated unemployed".

Murphy et al. (1991) argues that high level of corruption perception in a society leads to dominating rent-seeking behavior, which in turn leads to a problem of talent misallocation. Obviously, people tend to choose jobs that offer them the highest possible returns to their abilities. The ablest ones, so called "superstars", are even more demanding: they seek occupations that are capable to provide them increasing returns to their talent. As a result, they form their career aspirations on the basis of a material gain, becoming rent-seekers, rather than producers. This misallocation of talent leads to slowdown

in economic growth and distorts the overall wealth distribution (Murphy et.al., 1991).

The trust of employers and society in the country's colleges and universities is also undermined. For example, in Russia and in Ukraine some employers require their candidates to be graduates from specific universities that don't have the reputation of highly corrupt institutions (Rumyantseva, 2005). "If the public does not trust the education system to be fair or effective, more may be sacrificed than economic growth" (Heyneman, 2004). Education system is almost the only surrounding, apart from family, which accompanies us throughout the whole life-time. It forms our values and attitudes, mental abilities and perceptions. Therefore, education plays the most prominent role in the overall process of economic formation and development. Without adequately educated generation it is impossible to build competitive and sustainable economic system, especially in the framework of transformation processes. Corruption in education is destructive; it undermines foundations for further development and hinders growth.

Although, the claim that corruption is a negative factor that transition economies have to overcome is widely accepted by academic community, its penetration into education system in have not been sufficiently investigated either in developed or in transition countries. Lack of both theoretical and empirical literature regarding this specific topic provided motivation for the current research. Therefore, filling this research gap is the main purpose of this thesis.

To do so, we construct a new measure of corruption in education, namely, Educational Corruption Index (ECI). We build the index from the components that measure three aspects of educational process: (a) the distribution of 8th grade

students' mathematics TIMSS scores as a comprehensive measure of ability; (b) secondary school graduation rates; (c) tertiary education enrolment rates. We evaluate this index in the following way. First, according to the list of countries that participated in international evaluation, we identify the benchmark country that has the following attributes: (a) the lowest level of corruption by the date; (b) tuition-free higher education. Further, we compare the number of students newly enrolled in tertiary education with the number of secondary school graduates. Associating this percentage value with the distribution of 8th grade students' abilities in the benchmark country and assuming that only the ablest get into universities, we identify the cut-off test score and apply it to the distribution of grades in the countries of interest. A significant difference between the percentage of the ablest secondary graduates obtained from the corresponding score in the benchmark country and the percentage of students who have actually got enrolled into universities provides the evidence of corrupt incentives during admission process. Based on this evidence we construct the Educational Corruption Index.

The data is taken from the EuroStat and TIMSS 2007 databases. The analysis is focusing on 13 transition countries using Sweden as a benchmark country and USA, England, Scotland, Japan, and Australia as a basis for a composite reference country. The number of observations at the individual level ranges around 4000 per country.

The remainder of the paper is organized as follows. The next section will be devoted to the overview of existing theoretical and empirical literature related to the topic. In Chapter 3 we will develop methodology for the construction of the Educational Corruption Index. Chapter 4 of the paper will concentrate on data. Chapter 5 demonstrates empirical results. Finally, the last chapter is devoted to the discussion of results and conclusions.

Chapter 2

LITERATURE REVIEW

To a sufficient extent of consensus corruption has been regarded as a global phenomenon that hinders economic growth and induces overall distortion of societal attitudes. Relationship between corruption and economic development has been broadly investigated both under theoretical and empirical framework. Economic analysis is largely supported by works of Shleifer and Vishny (1993), Mauro (1995), Sachs and Warner (1997), Lui (1996), Tanzi and Davoodi (2000), Svensson (2005), Mo (2001), Méndez and Sepúlveda (2006), Shao et al. (2008). A common finding of adverse effects of corruption on economic growth can be attributed to the abovementioned papers.

Mauro (1995) uses per capita GDP as a dependent variable responsible for economic growth to study its responsiveness to different levels of corruption in a cross-section of 68 countries. He shows that corruption has negative effect on investment and as a result undermines economic development. Mo (2001) provides empirical evidence that "1% increase in the corruption level reduces the growth rate by about 0.72%" (Mo, 2001). Moreover, he argues that this growth decrease occurs primarily due to political instability that allows corruption to reduce human capital accumulation and share of private investment. Making use of corruption indices derived from four different sources and conducting a series of cross-country regression, Rock and Bonnett (2004) find that "corruption slows growth and reduces investment in most developing countries, particularly small developing countries, but increases growth in the large East Asian newly industrializing economies" (Rock and Bonnett, 2004). Mo (2001) concludes that corruption has negative implications for growth due to weak law enforcement and inefficient work of central administration. Through the implication of

dynamic general equilibrium model, Méndez and Sepúlveda (2006) argue that "free" countries are subject to observable positive impact of corruption. Their evaluation of country's freedom is based on the values of the Freedom House democracy index, which measures civil liberties and political rights. "After splitting countries into groups classified as "free" or "not-free," they find no relationship between corruption and growth in "not-free" countries but a small, positive, growth-maximizing level of corruption in "free" countries" (Heckelman and Powell, 2008).

Up to this point, summary of existing studies on impact of corruption on economic indicators has given us reasonable right to make a conclusion about their adverse relation in a framework of cross-section of countries. Since our primary interest in this thesis focuses on transition economies, it would be appropriate to investigate level of research achievement regarding this issue in transition environment.

With the breakup of the Soviet Union and the general decline of communism, transition process has started with building new political and economic institutions, mainly, through deep and comprehensive structural reforms. Privatization was one of the most important components of the transition from centrally-planned to a market economy. However, despite its mandatory structure, it has become one of the most fruitful sources for political corruption in the former Soviet Union and the former communist countries of Central and Eastern Europe (Kaufman and Siegelbaum, 1996). Administrative corruption has also created a considerable impediment in the overall process of economic development across transition economies. World Bank (2002) reports that administrative corruption constitutes approximately 17 percent of profits across the transition economies, with 22 percent of average reported profit for CIS

countries, and 13 percent for the countries of Central and Eastern Europe (CEE).

In this environment, Nowak (1993) distinguishes corruption as one of the main transition-specific threats that represents danger to the overall development process during transformation period.

The most evident feature of the existing literature in regards educational corruption in transition countries is lack of empirical studies that investigate this issue to sufficient extent. Wide range of theoretical framework has far outstripped practical side of the question; however, it would be appropriate to emphasize on great importance of theoretical background in shaping the way empirical research can be accomplished.

It's not earlier than in year 2004 when the notion of educational corruption started to gain attention of educational researchers. Heyneman (2004) undertakes the first attempts in this direction making use of general understanding of corruption that is defined as: "the abuse of authority for personal as well as material gain." Material gain attributable to corruption is quite obvious motivation for bribes and embezzling of government resources allocated to educational sector, but in developed society personal gain plays even more important role. Educational system is an effective selection mechanism for distinguishing leaders and for "refreshing" nation's resources for future development. "Although it is possible for leaders to emerge through experience or just good fortune, nevertheless, getting ahead in schooling itself is seen as essential" (Heyneman, 2004). Existence of corruption in educational system provides students with opportunity to easily overcome this complicated natural selection mechanism. As a consequence, they attain social status that is not based on their merit and abilities.

Therefore, the overall quality of labor force and its productivity are undermined. As a result, some part of economic growth is sacrificed.

Further contribution to theoretical investigation of educational corruption phenomenon is made by Rumyantseva (2005). In her paper she introduces the notion of "taxonomy of corruption in higher education". The author also disaggregates educational corruption into direct and indirect types depending on the source of occurrence. The former one explicitly involves students and distorts evaluation of their initial abilities, potential and achievements. The latter type deals with wastefulness of government funds that are allocated to support educational institutions. This misallocation of government expenditures by university authorities negatively, but indirectly, affects students' performance and their possible outcomes, and consequently, economic benefits from education. This assumption may be more convincing if we base it on the previous empirical findings that investigate relationship between educational expenditures and economic growth.

Government expenditures on education usually refer to quantity measures of human capital in its relation to economic performance. According to the literature, it's relatively hard to establish distinct conclusion in regards towards education spending as one of the quantity measures. While Baladacci et al. (2008) finds positive impact of government expenditures on education on economic growth, other studies observe absolutely different results, varying from insignificant negative effect of public expenditures on growth (Devarajan et al., 1996) to absence of any connection between these variables (Landau, 1986). A more recent work of Cooray (2009) suggests the way of clarifying this issue. In her empirical framework the author incorporates total government spending on education and government spending per student with quality variables through interaction terms imposed into regression. Her

main finding is that "the effect of total government expenditure on economic growth is not direct but contingent on its interaction with the quality variables" (Cooray, 2009). The author of the paper relates this problem to significant inefficiencies of provision of education in a number of developing countries. One is related to embezzling funds from an educational institution. The statistically reported amount of expenditures that is allocated in educational institutions, on one hand, may not reflect realistic amount that is in fact obtained by the latter, and on the other, may not be used in improving the educational conditions, mainly due to lack of regulation over these resources (Rumyantseva, 2005). Authorities of schools and universities may deplete the funds available as government expenditures on education, and thus distort expected outcomes of proper education.

Therefore, it's intuitively logical to assume that educational corruption depletes both qualitative and quantitative dimensions of labor force that leads to country's worse perspectives in economic performance.

Le Van and Maurel (2006) introduce an empirical model of relationship between education, corruption and economic growth in a cross-section of developing countries. They implement too complicated mathematical technique that starts to generate diverse result from some threshold level of per capita GDP. However their analytical model provides evidence that corruption decreases returns to education in developing countries.

Shaw (2007a) represents an interesting case of educational corruption in Ukraine. The author collected a unique dataset on the survey confidentially conducted among 1558 students of Ukrainian higher educational establishments. The survey aimed at obtaining answers for the following set of questions: whether the student gave a bribe on the exams and term papers,

whether the student gave a bribe to obtain credits and whether the student gave a bribe to enter institutions. The survey showed that "approximately 56% of Ukrainian students bribed to enter their educational institution" (Shaw, 2007a). Among these were 16% of students who paid for their high school diploma as well. Moreover, the survey revealed that women tend to be 6% more likely to accept a bribe than men.

Similar survey was represented by Heyneman, et al. (2006). They covered larger sample consisting of students from six countries: Bulgaria, Croatia, Kyrgyzstan, Kazakhstan, Moldova and Serbia. The results reported are even more depressing: 69% of students bribed for their entrance exams to universities, among which 10% regularly bribed to obtain better grades during their studies. In addition to conclusion about high level of corruption observed in academic institutions of these countries, the authors also report that "corruption varies by market demand of academic major, with greater frequencies in high demand fields such as law, economics and finance" (Heyneman et al., 2006). Researchers also find higher level of corruption in universities with local accreditation in these six countries in comparison with corruption level in universities of North America and Western Europe. Using the data on Corruption Perception Index (CPI) for 68 countries, the authors demonstrate that inordinate corruption tends to undermine the returns to education in more developed countries. And additional interesting fact: according to MacWilliams (2002), in Georgia there even was a striking case when a professor distributed a list with prices for different "educational" services to her students.

Even though conducted surveys reveal some tendencies in corruption perception attributable to particular countries, they don't provide a framework in which these perceptions can be empirically evaluated. Interesting

investigation of relationship between educational corruption and economic growth is provided by Shaw (2007b). The author bases her research on a theoretical framework with overlapping generations model. Educational corruption is generated "by allowing agents to increase their entrance probabilities through bribing" (Shaw, 2007b). Agents in the model are constrained in borrowing. The author supports this framework through empirical verification by using publicly available indicators of corruption (Transparency Internationals Corruption Perceptions Index), Penn World Table data on GDP, Barro-Lee data on educational attainment and data on the return to education from Psacharopoulos (1993) for a cross-section of countries over a period of 30 years. The author shows that educational corruption is negatively related to economic growth and the level of educational attainment. Moreover, the study demonstrates positive impact of educational corruption on educational wage premium. The researcher also states that "even in highly corrupt countries; the probability of entry is not solely based on bribes, but rather some combination of bribes and an agent's ability" (Shaw, 2007b).

Reviewing the above mentioned economic literature dealing with issue of educational corruption, it would be reasonable to emphasize on a considerable gap between theoretical and empirical framework. Most of the analytical papers are either unpublished and, thus, unreliable, or provide doubtful and contradicting results. So far no clearly stated empirical research has been conducted to measure educational corruption in transition countries. Therefore, this research will try to make a contribution to the existing body of literature regarding this issue.

Chapter 3

METHODOLOGY

The central purpose of this work is to verify to what extent corruption exists in educational sector in a sample of transition countries. To measure corruption in education, we apply a procedure that consists of two stages.

The goal of the first stage is to calculate a percentage of new entrants to higher educational establishments from the overall number of secondary school graduates. Two indicators are used at this stage:

1) **Secondary school graduates.** We concentrate primarily on students who completed upper secondary education according to International Standard Classification of Education (ISCED 3 or ISCED 4). The successful completion of this level provides a direct access to the first stage of tertiary education (ISCED 5, ISCED 5A, ISCED 5B).

2) **New entrants to tertiary education.** This component reflects the number of students officially admitted to the first stage of tertiary programs (ISCED 5, ISCED 5A, ISCED 5B).

In this paper we assume that the main source of corruption incentives occurs at the time of admission process to tertiary programs. Therefore, in corrupt environment the number of students officially enrolled in the first year of higher education may not be representative in a sense of students' eligibility. Following this logic, we choose the benchmark country for which certain requirements must hold:

1) **Corruption level.** The benchmark country must have sufficiently low rates of corruption serving as an indicator of fair and competitive admission process to tertiary education. The least corrupt country is identified through the measure of Corruption Perceptions Index (CPI). CPI appears to be a well-structured and reliable measure of corruption. Transparency International publishes an annual data on CPI measures since 1995. Data on corruption can be easily obtained for 183 countries that are collected by 10 independent institutions around the world. The level of frequency and/or size of bribes are put into ranking scale from 0 to 10 points: from the highest to the lowest level of corruption.

2) **Merit-based admission policy in higher education institutions.** This prerequisite is essentially important since we assume that students are admitted according to their merit rather than financial or social status. Therefore, we identify a country that provides an opportunity to acquire higher education without tuition fees providing that a student possesses sufficient knowledge and skills to be admitted on a competitive, but tuition-free basis.

3) **Participation in TIMSS.** The benchmark country has to be among TIMSS participants to enable calculation of the benchmark TIMSS score cut-off point. Moreover, to make our results more reasonable and comparable we also choose a set of reference countries among TIMSS 2007 participants (including a benchmark country) that can be regarded as developed ones with sufficiently low levels of corruption according to the CPI ranking. Applying calculated percentage of new entrants to higher education in each country to the distribution of TIMSS test scores, we obtain the lowest possible passing grades. The cut-off TIMSS test score in this case is determined as an average value of all the passing grades.

To control for the family financial background, we apply the suggested methodology to the residual TIMSS mathematics test scores from the following regression:

$$T_{ics} = \beta_0 + R_{cs}\beta_1 + \varepsilon_{ics} + v_s \ , \qquad (1)$$

where

$\boldsymbol{T}$ is a TIMSS measure of student ***i****'s* performance at math test in class $\boldsymbol{c}$ at school ***s;***

$\boldsymbol{R}$ is a vector of resource measures – controlling for four indicator variables – two reflecting whether the student comes from disadvantaged background and two for students coming from economically affluent background. Table 1 summarizes these variables.

$\boldsymbol{\varepsilon}$ and $\boldsymbol{v}$ stand for error terms at the student and school levels respectively.

The Third International Math and Science Study (TIMSS) provides results of the 4th and 8th grade students' achievements in mathematics and sciences through comprehensive international assessment conducted by the International Association for the Evaluation of Educational Achievement (IEA) every four years. TIMSS database provides systematic and in-depth analysis of results of assessment in each country where the test is conducted. It also comprises other important determinants of students' performance: student and family characteristics, resources and teacher characteristics and institutional setting.

In this paper our primary interest lies in mathematics scores obtained by 8th grade cohort of the secondary school students. The choice of this specific dimension is motivated by the fact that math results are the most reliable in explaining

students' cognitive abilities. Moreover, high performance in mathematics can explain a great deal of subsequent wage inequality including black/white gap (Grogger, 1996).

It should be mentioned that unbiased estimates of students' scores in TIMSS database are obtained using plausible values methodology. Instead of aggregating individual proficiency estimates, this approach generates multiple imputed scores, called plausible values, by exploiting all available data (students' responses to the items together with all background variables) to create population parameters (Foy et al., 2008). TIMSS 2007 database contains five plausible values of mathematics test scores for each student.

OLS regression is used to control for the family financial background characteristics. Since we have five distinct plausible values of mathematics test scores, we regress each of them on a set of control variables. The average value of residuals obtained after each estimation is subsequently computed. Special attention is paid to the residual test scores since they are supposed to reflect students' cognitive abilities independent of other influential factors that may affect their performance at the test and during further admission to tertiary education.

Having the distribution of residual test scores we are able to determine the cut-off residual score both for a specified benchmark country and for a set of reference countries. The latter is used as a robustness check. Thus, as for now we already have two algorithms to implement:

Algorithm 1.

1) Run regression (1) controlling for the family financial background for the benchmark country and for each of the transition countries.

2) Obtain residuals from the previous step and plot their distribution.

3) Calculate the percentage of newly enrolled students among the recent secondary school graduates.

4) Determine the residual cut-off test score corresponding to the afore-mentioned percentage, assuming that only the ablest students get admitted to universities.

5) Apply the cut-off residual score obtained in the previous step for the benchmark country to distributions of residual test scores in each of the transition countries to determine hypothetical percentage of students who would be eligible for the admission to universities in the benchmark country based on their abilities only.

6) Calculate the difference between statistically recorded and hypothetical percentage of new entrants among secondary school graduates.

7) Interpret this difference as Educational Corruption Index (ECI) and rank transition country according to this index.

Algorithm 2.

1) Repeat steps 1-4 in the previous **Algorithm** for each of the set of reference countries to determine the set of the cut-off residual test scores. Then obtain the average of these cut-off points. Using this average, continue with steps 5-7 described in the **Algorithm 1**.

According to this methodology we control for student's family income to avoid any dependence of test scores on financial status of new applicants to tertiary education. This may happen because more affluent families can afford

additional preparation for the tests, better schools and more conducive education environment.

Our further interest is concerned with comparative issues. Namely, we apply the same logic to determine Educational Corruption Indexes throughout transition countries but without controlling for financial indicators. More precisely, instead of using the distribution of residual test scores we will deal with the distribution of demeaned TIMSS scores. These leads to two more algorithms to consider:

Algorithm 3.

Corresponds to **Algorithm 1**. The only difference that here we are considering the distribution of demeaned TIMSS test scores without any controls.

Algorithm 4.

Corresponds to **Algorithm 2**. The only difference that here we are considering the distribution of demeaned TIMSS scores without any controls.

The described four algorithms will result in four measures of the ECI depending on the presence of controls in the distribution of test scores and on whether a single benchmark country is used or a composite reference country.

Chapter 4

DATA DESCRIPTION

The empirical analysis of this paper attempts to construct a justified measure of educational corruption, namely, Educational Corruption Index (ECI).

Relying on data availability for 8th grade students who participated in TIMSS 2007 mathematics assessment, this paper focuses on a sample of 13 transition countries. As it was mentioned in the previous section, the process of constructing the measure of educational corruption index (ECI) involves two stages. Moreover, 4 proposed algorithms are subsequently considered relying on different conditions applied to its evaluation.

The first stage is based on the information about secondary school graduates and new entrants to tertiary education in year 2011 for a sample of transition countries, for a predetermined benchmark country and for a set of reference countries. Year 2011 is chosen for comparison under the assumption that those students who participated in TIMSS 2007 are also the ones who graduated from secondary school and subsequently applied for admission to higher educational establishments in year 2011. The underlying assumption is supported by the fact that the average age of 8th grade students who passed TIMSS 2007 is 14 years and the average age of completion of secondary education at the level that allows seeking for higher education is 18 years.

This data is taken predominantly from EuroStat database. Missing countries are treated individually, namely, by extracting educational statistics from the National Statistical Offices websites. Sweden is chosen as a benchmark country since its characteristics meet the requirements introduced before:

1) Participation in TIMSS

Sweden is one of the 57 countries that participated in TIMSS 2007 assessment in mathematics for 8th grade students.

2) Corruption level

According to CPI ranking provided by Transparency International in year 2011, Sweden had rank 4 among 183 countries and obtained sufficiently high score (9.3, CI: 9.2-9.4) which characterizes it as the least corrupt among international assessment participants.

3) Policy of higher education institutions

Public universities in Sweden do not require any tuition fees both for Swedish and international citizens providing that a student is admitted by higher educational establishment (universities, university colleges, academies of professional higher education and university level institutions) based on a point scale, with the highest ranking students offered a place. Points are awarded according to average grades from upper secondary school on a competitive basis.

Regarding reference countries, Australia, England, Japan, Scotland, Sweden and the United States were chosen among TIMSS 2007 participants. The choice of these specific countries was motivated by sufficiently high level of their development and low corruption rates according to the CPI ranking.

Table 2 provides summary statistics of educational indicators for 13 transition countries, Sweden and a set of reference countries. All the participants are ranked by their CPI values (from the most to the least corrupt). According to these values Ukraine, Russian Federation and Armenia have the lowest CPI ranks: 152nd, 143rd and 129th respectively, which characterize them as the most corrupt transition countries in our sample. Hungary, Lithuania and Slovenia tend to be the least corrupt within transitional environment, with 54th, 50th and 35th CPI ranks respectively.

Estimation of model (1) is the next step of our research. The data on main explanatory variables used in the regression is taken from TIMSS 2007 database and includes information on more than 84,800 students from over 3,000 schools. Table 3 presents descriptive statistics for overall participation in TIMSS 2007 mathematics assessment of 8th grade students. As it follows from the Table 3 number of 8th grade students that participated in TIMSS 2007 international mathematics assessment ranges around 4000 per transition country. As for the reference countries, the greatest number of students assessed is recorded for the United States and Sweden where 7377 and 5215 students respectively were examined during TIMSS 2007 assessment.

Table 4 comprises information about students' mathematics test scores at TIMSS 2007 assessment. According to TIMSS 2007 International Mathematics Report (Mulis et al., 2008) the average test score among all the participants equals 500. Therefore, in our sample of transition countries we have participants that over performed, with the highest score reached in Hungary (517). The lowest average test score was obtained by Georgia (410). Among reference countries we can observe the apparent leader that is Japan with the average score of 570. Moreover, Japan is ranked fifth among the overall number of TIMSS 2007 participants (Mulis et al., 2008).

Table 5 provides descriptive statistics of important control variables that indicate financial status of student's family. From Table 5 it follows that across transition countries Russia has more than a half (53,2%) of schools where the share of students coming from economically affluent homes is the largest (more than 50%). Interestingly enough that Russian indicator of financial status is sufficiently close to a Swedish case where 57,2% of schools comprise mostly of rich students. Moreover, according to the same variable, Slovenia has more students coming from economically affluent homes (42,4%) than Japan (42,2%).

Chapter 5

EMPIRICAL RESULTS

As it was previously mentioned in Chapter 3, empirical investigation of corruption in education in transitional surrounding includes four algorithms. Algorithm 1 and Algorithm 2 are based on estimation of educational production function, controlling for the family financial background, and subsequent determination of residual scores distribution, while Algorithm 3 and Algorithm 4 are dealing with demeaned TIMSS scores without any controls.

We further consider each of these algorithms with greater extent of precision.

Algorithm 1.

Proceeding through steps for Algorithm 1 described in Chapter 3, we obtain the following results:

1) We regress 8^{th} grade students' math scores on a set of control variables that reflect the family financial background in a benchmark country and in each of the transition countries. Sweden was predetermined as a benchmark country, since it possesses all the necessary attributes for this status (see Appendix B for OLS estimation results).

2) Distribution of residuals is further obtained for each country and plotted (see Appendix A for corresponding distributions of residual scores).

3) Table 2 is necessary at this point since it contains calculated percentage of new university entrants from the number of recent secondary school graduates.

4) According to the percentage value of students admitted to higher educational establishment in Sweden (24%), we obtain cut-off residual score which equals 53 and can be interpreted as an indicator of students' performance that allows entering the university.

5) We further apply this test score to the distribution of residual scores in the transition countries to evaluate the hypothetical percentage of new entrants to higher educational establishments in the countries of primary interest.

6) Difference between reported percentage of newly enrolled students in year 2011 and hypothetical one will be characterized as Educational Corruption Index (ECI). Table 6 contains both estimated and recorded percentage of new entrants.

7) Furthermore, Table 6 summarizes ECI values and corresponding ranks attributable to each country.

From Table 6 we can conclude that Romania obtained the highest value of ECI (64,7%) which characterizes it as the most educationally corrupt country in a sample of transition countries. Reported number of new university entrants substantially exceeds estimated one which allows us to assume that admission process in Romanian higher educational establishments is highly non-transparent and uncompetitive. Czech Republic and Ukraine also gained considerably high rates of educational corruption, 57,1% and 56,7% respectively. The least educationally corrupt country is Bosnia and Herzegovina in our case, where statistically reported number of new entrants and estimated one almost coincide with negligible difference in 0,3%.

Algorithm 2.

We now apply estimation procedure of **Algorithm 1** to each of predetermined reference countries. We assume that reported number of newly enrolled students is fair and transparent, which allows us to apply it to a distribution of residual scores obtained after educational production function estimation. The cut-off residual scores extracted from each country are then averaged to apply it to transition case. Table 7 contains results at this preliminary stage. Average cut-off residual score is equal to 17,3 for a composite reference country.

Table 8 presents results of applying the determined cut-off residual score to the distribution of residuals in transition countries. Namely, it contains hypothetical percentage of new entrants and calculated difference with statistically recorded one, which is interpreted as Educational Corruption Index (ECI). Country ranking according to ECI value in this case is also provided.

As in case of Algorithm 1 implementation, the highest value of ECI was attained by Romania (49,8%). Bosnia and Herzegovina saved its status as the least educationally corrupt country with even lower value of ECI than under the previous algorithm (-17,4%).

We now turn to cases where instead of using distribution of residual scores for ECI evaluation we will consider countries' distribution of demeaned TIMSS scores in math. As in the previous algorithms, we will distinguish our estimation procedure between Sweden as a benchmark country and a composite reference country.

Algorithm 3.

Applying reported percentage of new entrants in Sweden (24%) to its distribution of demeaned scores, we obtained a cut-off demeaned score of 42. Table 9 presents results of ECI values in appliance with this score and corresponding ranking in transition countries.

According to the ECI values presented in Table 9 Romania can still be characterized as the most corrupt transition country in regard to educational sector with ECI value of 68,1%. Ukrainian value of ECI is also substantially high: more than 58% of students are admitted to universities on non-transparent basis. Bosnia and Herzegovina managed to save its leading position remaining the least educationally corrupt transition country.

Algorithm 4.

The same estimation strategy as in previous algorithm is now applied to the reference countries. Cut-off demeaned score is determined as an average of the lowest demeaned scores needed for admission according to the statistically recorded number of newly enrolled students. Table 10 contains results of cut-off demeaned score evaluation. Average cut-off demeaned score is equal to 9,4 for a composite reference country.

Our next traditional step is to apply the determined cut-off demeaned score to the distribution of the same scores in a sample of transition countries to obtain hypothetical percentage of new entrants and subsequently proceed to ECI calculation (see Appendix A for corresponding distributions of demeaned scores). Table 11 presents results produced by each step.

At this stage of our estimation strategy we can definitely assert that results provided in Table 11 are no longer surprising. Romania and Bosnia and Herzegovina still remain the most and the least educationally corrupt countries respectively.

Table 12 makes our results of ECI estimation more visually perceptible and comparable within the observed cases.

Summarizing the results presented in Table 12 it's quite straightforward to conclude that according to ECI ranking certain countries remain on the same level depending on the presence of controls in the distribution of test scores and on whether a single benchmark country is used or a composite reference country. In order to measure how strong the relationship between ECI ranks under each of the four algorithms is we can exploit Table 12 to calculate correlation coefficients.

Table 13 concludes our investigation with a matrix of correlation coefficients.

Therefore, from Table 13 it's sufficiently reasonable to assert that each of the algorithms exploited for ECI calculation can be used interchangeably to assess country's educational corruption level. Both distribution of residual scores and demeaned scores are capable to provide a solid ground for analysis of educational corruption that was proposed in this research work.

In order to perform our further analysis of educational corruption to a sufficient extent, we also provide information on corruption perceptions in transitional environment collected from other sources. Among them are the following:

1) Values of Corruption Perceptions Index (CPI) in year 2011 on a scale of 0 (highly corrupt) to 10 (very clean) and corresponding country ranking among 183 participants.

2) Values of Global Competitiveness Index (GCI, 2012-2013) according to the indicator that reflects irregular payments and bribes throughout country's public institutions. Scores are distributed on the scale of 0-10 (best) and presented along with the corresponding ranking among 144 assessed countries.

3) The EBRD Life in Transition survey (LiT) indicators related to corruption and trust. The survey was conducted in year 2010 to assess respondents' attitudes to corruption in public institutions. The survey incorporates responses of almost 39,000 households in 34 countries to the following statements and questions:

- *LiT Survey (1):* Percentage of respondents who disagree or agree that there is less corruption now than around 4 years ago.

- *LiT Survey (2):* Percentage of respondents who believe that it's absolutely normal to buy a university degree that one has not earned.

- *LiT Survey (3):* Percentage of respondents who think that it's important to use the support of influential authorities during the university admissions.

- *LiT Survey (4):* Percentage of respondents who at least sometimes have to make unofficial payments or gifts when receiving primary and secondary education.

- *LiT Survey (5):* Percentage of respondents who at least sometimes have to make unofficial payments or gifts when receiving professional education.

Table 14 summarizes values of the abovementioned indicators which are ordered according to ECI values previously estimated.

According to ECI value Romania has attained the highest score that characterizes its educational sector as highly corrupt. Moreover, Romanian sufficiently low values in CPI and GCI rankings support this statement, since these surveys assess country's corrupt perceptions throughout all public institutions. Furthermore, according to LiT survey, more than 72% of Romanian respondents believe that persistent corruption still exists in public institutions. Regarding Romanian higher education establishments, more than 45% of respondents think that it's necessary to enlist the support of influential authorities during admissions to universities, and about 24% at least sometimes make unofficial payments during their tertiary education.

As for Ukrainian case, its educational system can be also considered as highly corrupt according to ECI ranking. Moreover, it would be appropriate to lay some emphasis also on Ukrainian low CPI and GCI ranks (152 and 133 respectively) and the fact that more than 80% of LiT respondents in Ukraine are admitted to universities using the support of influential authorities. These results provide a reasonable justification for our resolute statement about considerable corrupt perceptions in Ukrainian education.

To make this statement even more reasonable, we've conducted a case study that evaluates educational capacity of Ukrainian higher educational establishments and gives possible explanations for reasons of their corrupt perceptions.

Case Study. Ukrainian Higher Education

Table 15 presents top-10 high-performing Ukrainian universities and corresponding average number of enrolled students. The ranking was prepared by "КорреспондентT.net" Weekly based on the opinion of the most successful employers of the country, among which are Ukrainian branches of multinational corporations and powerful Ukrainian companies.

The publication surveyed HR-managers of 29 companies that responded to the question about university graduates who are mostly preferred for employment. Therefore, supply of study places at the abovementioned universities is driven, at least to some reasonable extent, by the demand of labor market for their highly qualified graduates, rather than by corrupt incentives.

Moreover, as it is posited by some experts in higher education, Taras Shevchenko National University of Kyiv, and especially National University of "Kyiv-Mohyla Academy" and National Technical University of Ukraine "Kyiv Polytechnic Institute", that obtained the highest ranks according to Ukrainian employers' ranking, have no relationship with bribery problem at all.

Table 16 incorporates Ukrainian private universities that are ranked according to the number of students enrolled in each of them.

Most of these universities have the fourth level of accreditation; thus, provide students with the same range of degree programs and types of diploma as state-owned higher educational establishments. However, since these universities cannot be considered as high-performing ones by any well-structured ranking, the supply of their study places is weakly justified by labor market demand for their graduates. Therefore, it's quite surprising that the number of enrolled students at

Open International University of Human Development "Ukraine" and European University is greater than in the leading Ukrainian institutions.

It's reasonable to assume that high supply of study places available for applicants at private universities is attained through easiness of entering and subsequent acquiring a state-type diploma comparing with an effort level needful for the same purpose at leading state universities. At this point under "easiness" we imply the acceptability of corrupt activities in a variety of forms.

Table 17 and Table 18 provide some results of the national survey conducted by Ukrainian Democratic Initiatives Foundation in year 2011 among 1,008 students. According to Table 17, acquiring higher education in Ukrainian universities is indeed widely associated with corrupt incentives, since more than 74% of assessed students are paying for exams and about 23% are unable to defend their thesis without turning to corrupt activities. Interestingly, that following the opinion of 45,7% of survey respondents, behind such considerable level of corrupt perceptions among Ukrainian students stands their simple laziness and unwillingness to study.

Thus, it's more preferable for an average student to pay for admission, exams, diploma and other types of study obligations than to acquire some real knowledge. Since for 35,7% of surveyed students holding a formal confirmation of their higher education degree is more important than knowledge that should stand behind it, the high demand for easy-obtained diploma is justifiable.

This conclusion, in turn, gives a reasonable support for attractiveness of such huge number of "over-populated" private universities that are ready to supply students with highly desirable diploma for a minimum effort level and for "moderate fee".

Chapter 6

CONCLUSION

This study evaluates an extent to which corruption is present in educational system across 13 transition countries. More precisely, in this research work we aim to construct a specific measure of educational corruption, namely, Educational Corruption Index (ECI). We investigated that corrupt incentives in educational system can be tracked during admission process to tertiary education. Following the reasonable assumption that only the ablest and the smartest students are supposed to be admitted to universities, we estimated their share using the distribution of TIMSS 2007 mathematics test scores.

Relying on a benchmark case we determine a cut-off test score that allows to be admitted to higher educational establishments. Applying this cut-off test score to the distribution of scores in transition countries, we estimate the hypothetical number of new entrants. The difference between reported and hypothetical number of newly enrolled students is interpreted as the measure of educational corruption, namely, Educational Corruption Index (ECI).

Resulting ECI values allow us to construct a specific ranking of transition countries. According to this ranking Romania, Ukraine and Czech Republic are among the three most corrupt countries in the tertiary education sector. Resulting ECI value of Ukraine characterizes its educational system as highly corrupt with ECI value of 56,7% and 11th place in the corresponding ranking. At the same time Bosina and Herzegovina, Georgia and Turkey are among the least corrupt in the tertiary education sector.

The sample of transition countries for our analysis was not accidently chosen. Some of the countries have successfully managed to overcome transformation period, while some of them haven't. This paper focuses on one of the dimensions, in which the source of the development divergence can be investigated, namely, corruption in educational system.

Therefore, the measure of educational corruption introduced in this work is aimed to attract attention of policymakers to existing problems in education and provide additional information in educational policy development.

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Table 1. Variables included into educational production function

Variable	Definition	Type
st_affluent	percentage of students from economically affluent homes,% 3 = 26 to 50 4 = more than 50	dummies
st_disadv	percentage of students from economically disadvantaged homes,% 3 = 26 to 50 4 = more than 50	dummies

Table 2. Summary statistics of educational indicators

TIMSS 2007 Participants	Secondary Graduates	New entrants to tertiary education	New entrants as % of secondary graduates	CPI, Value/Rank
		Transition countries		
UKR	364,000	314,500	86,4	2,3/152
RUS	703,000	510,500	72,6	2,4/143
ARM	35,800	26,443	73,8	2,6/129
BIH	35,349	9,126	25,8	3,2/91
BGR	66,997	52,752	78,7	3,3/86
SCG	56,524	25,800	45,6	3,3/86
ROM	294,668	285,339	96,8	3,6/75
GEO	50,072	22,839	45,6	4,1/64
TUR	396,219	169,661	42,8	4,2/61
CZE	104,294	84,353	80,9	4,4/56
HUN	85,925	66,810	77,8	4,6/54
LTU	45,224	22,451	50	4,8/50
SVN	22,883	17,463	76,3	5,9/35
		Benchmark country		
SWE	99,993	23,998	24	9,3/4
		Reference countries		
USA	3,103,540	2,327,093	74,9	7,1/24
ENG	327,130	223,285	68,2	7,8/16
SCO	54,073	19,358	35,8	7,8/16
JPN	2,892,866	512,617	17,7	8/14
AUS	229,400	93,500	40,7	8,8/8
SWE	99,993	23,998	24	9,3/4

Table 3. Participation of students, classes and schools in TIMSS 2007

Country	Students	Classes	Schools
	Transition countries		
ARM	4,689	250	148
BIH	4,220	181	150
BGR	4,019	247	163
CZE	4,845	212	147
GEO	4,178	184	135
HUN	4,111	246	144
LTU	3,991	258	142
ROM	4,198	266	149
RUS	4,472	271	210
SCG	4,045	227	147
SVN	4,043	260	148
TUR	4,498	146	146
UKR	4,424	184	146
	Benchmark country		
SWE	5,215	307	159
	Reference countries		
AUS	4,069	238	228
ENG	4,025	238	137
JPN	4,312	169	146
SCO	4,070	244	129
SWE	5,215	307	159
USA	7,377	510	239

Table 4. Summary statistics of TIMSS math scores

Country	mean	st.dev	min	max	50%	75%	95%
Transition countries							
HUN	517	82,1	212	775	519	574	648
RUS	512	80,2	215	774	515	567	641
LTU	506	77,1	250	723	505	560	633
CZE	504	71	262	741	504	549	624
SVN	501	68,7	270	750	500	548	616
ARM	498	81	248	821	501	552	626
SCG	486	86,4	130	768	490	547	620
BGR	464	97,8	187	794	471	534	613
UKR	462	86	86	745	465	520	597
ROM	461	96,2	117	759	465	530	612
BIH	456	74	226	673	459	507	574
TUR	432	105	170	812	421	501	623
GEO	410	91,3	142	680	411	475	558
Benchmark country							
SWE	491	67	267	683	493	537	601
Reference countries							
JPN	570	82,4	284	834	573	627	698
ENG	513	81,4	252	712	517	574	638
USA	508	74	265	721	509	561	628
AUS	496	76,7	232	756	497	546	629
SCO	491	77,1	239	711	488	542	613
SWE	491	67	267	683	493	537	601

Table 5. Descriptive statistics of control variables

Country	st_affluent4,%	st_affluent3,%	st_disadv_4,%	st_disadv3,%
Transition countries				
RUS	53,2	29,3	9,2	21,5
SVN	42,4	34,5	9,6	23,3
UKR	39,4	25,9	4,8	4,4
ARM	25	29,3	26,3	25
SCG	15	19,5	41,8	31,2
TUR	14,8	16	63,2	17,8
ROM	11,3	7,5	39,2	23,9
GEO	10	23,3	35,8	26,2
BGR	7,9	16	24,1	17,2
BIH	7,6	24	44,1	27,9
HUN	7,1	14,1	19,8	29,9
CZE	3,1	5,8	7,9	22,9
LTU	-	2,9	2,3	17,8
Benchmark country				
SWE	57,2	28,2	2,3	10,1
Reference countries				
SWE	57,2	28,2	2,3	10,1
JPN	42,2	15,4	1,2	7,9
SCO	20,4	16,4	6,9	13,2
AUS	18,6	11,6	11,3	23,7
ENG	16,4	23,1	6,6	20,9
USA	8,9	15,5	32,4	35,5

Table 6. ECI estimation (Sweden as a benchmark, residual score)

Country	Number of obs.	Average TIMSS score	Statistically recorded percentage of new entrants, %	Hypothetical percentage of new entrants, %	Educational corruption index (ECI), %	ECI rank
ROM	4,198	461	96,8	32,1	64,7	13
CZE	4,845	504	80,9	23,8	57,1	12
UKR	4,424	462	86,4	29,7	56,7	11
SVN	4,043	501	76,3	23,7	52,6	10
HUN	4,111	517	77,8	27,7	50,1	9
ARM	4,689	499	73,8	25,2	48,6	8
BGR	4,019	464	78,7	31,1	47,6	7
RUS	4,472	512	72,6	29	43,6	6
LTU	3,991	506	50	27	23	5
SCG	4,045	486	45,6	29,6	16	4
GEO	4,178	410	45,6	31,2	14,4	3
TUR	4,498	432	42,8	30,5	12,3	2
BIH	4,220	456	25,8	25,5	0,3	1

Table 7. Cut-off residual score estimation (Reference countries)

Country	Number of obs.	Average TIMSS 2007 score	Statistically recorded percentage of new entrants, %	Estimated residual score
AUS	4,069	496	40,7	18,5
ENG	4,025	513	68,2	-35,1
JPN	4,312	570	17,7	82,5
SCO	4,070	487	35,8	34,9
SWE	5,215	491	24	53
USA	7,377	508	74,9	-50,3
Composite reference country:				17,3

Table 8. ECI estimation (composite reference country, residual score)

Country	Number of obs.	Average TIMSS score	Statistically recorded percentage of new entrants, %	Hypothetical percentage of new entrants, %	Educational corruption index (ECI), %	ECI rank
ROM	4,198	461	96,8	47	49,8	12
UKR	4,424	462	86,4	45,9	40,5	11
CZE	4,845	504	80,9	41,4	39,5	10
SVN	4,043	501	76,3	41,7	34,6	9
BGR	4,019	464	78,7	45,4	33,3	8
HUN	4,111	517	77,8	44,5	33,3	8
ARM	4,689	499	73,8	42,6	31,2	7
RUS	4,472	512	72,6	46,6	26	6
LTU	3,991	506	50	43,4	6,6	5
TUR	4,498	432	42,8	43,1	-0,3	4
SCG	4,045	486	45,6	46,1	-0,5	3
GEO	4,178	410	45,6	46,3	-0,7	2
BIH	4,220	456	25,8	43,2	-17,4	1

Table 9. ECI estimation (Sweden as a benchmark, demeaned score)

Country	Number of obs.	Average TIMSS score	Statistically recorded percentage of new entrants, %	Hypothetical percentage of new entrants, %	Educational corruption index (ECI), %	ECI rank
ROM	4,198	461	96,8	28,7	68,1	13
UKR	4,424	462	86,4	28,2	58,2	12
CZE	4,845	504	80,9	26,8	54,1	11
SVN	4,044	501	76,3	25,7	50,6	10
HUN	4,168	517	77,8	28,2	49,6	9
ARM	4,736	499	73,8	27,3	46,5	8
BGR	4,019	464	78,7	32,4	46,3	7
RUS	4,506	512	72,6	26,8	45,8	6
LTU	3,991	506	50	27,1	22,9	5
SCG	4,045	486	45,6	29,1	16,5	4
GEO	4,179	410	45,6	30,9	14,7	3
TUR	4,498	432	42,8	36,6	6,2	2
BIH	4,220	456	25,8	27,8	-2	1

Table 10. Cut-off demeaned score estimation (Reference countries)

Country	Number of obs.	Average TIMSS 2007 score	Statistically recorded percentage of new entrants, %	Estimated demeaned score
AUS	4,069	496	40,7	17,5
ENG	4,025	513	68,2	-47
JPN	4,312	570	17,7	73
SCO	4,070	487	35,8	23
SWE	5,215	491	24	42
USA	7,377	508	74,9	-52
Composite reference country:				9,4

Table 11. ECI estimation (composite reference country, demeaned score)

Country	Number of obs.	Average TIMSS score	Statistically recorded percentage of new entrants, %	Hypothetical percentage of new entrants, %	Educational corruption index (ECI), %	ECI rank
ROM	4,198	461	96,8	40,1	56,7	13
UKR	4,424	462	86,4	41,7	44,7	12
CZE	4,845	504	80,9	43,9	37	11
HUN	4,111	517	77,8	42,3	35,5	10
BGR	4,019	464	78,7	43,5	35,2	9
SVN	4,043	501	76,3	43,3	33	8
RUS	4,472	512	72,6	40,9	31,7	7
ARM	4,689	499	73,8	43,6	30,2	6
LTU	3,991	506	50	42,5	7,5	5
SCG	4,045	486	45,6	41,3	4,3	4
GEO	4,178	410	45,6	43,1	2,5	3
TUR	4,498	432	42,8	48,7	-5,9	2
BIH	4,220	456	25,8	42,8	-17	1

Table 12. Summary statistics of ECI values

Country	ECI, value/rank							
	Residual scores				Demeaned scores			
	Algorithm 1		Algorithm 2		Algorithm 3		Algorithm 4	
	Sweden		Composite reference country		Sweden		Composite reference country	
	Value	Rank	Value	Rank	Value	Rank	Value	Rank
ROM	64,7	13	49,8	12	68,1	13	56,7	13
CZE	57,1	12	39,5	10	54,1	11	37	11
UKR	56,7	11	40,5	11	58,2	12	44,7	12
SVN	52,6	10	34,6	9	50,6	10	33	8
HUN	50,1	9	33,3	8	49,6	9	35,5	10
ARM	48,6	8	31,2	7	46,5	8	30,2	6
BGR	47,6	7	33,3	8	46,3	7	35,2	9
RUS	43,6	6	26	6	45,8	6	31,7	7
LTU	23	5	6,6	5	22,9	5	7,5	5
SCG	16	4	-0,5	3	16,5	4	4,3	4
GEO	14,4	3	-0,7	2	14,7	3	2,5	3
TUR	12,3	2	-0,3	4	6,2	2	-5,9	2
BIH	0,3	1	-17,4	1	-2	1	-17	1

Table 13. ECI ranking correlation matrix

ECI ranking cases		Residual scores		Demeaned scores	
		Sweden	Composite reference country	Sweden	Composite reference country
Residual scores	Sweden	1	-	-	-
	Composite reference country	0.9662*	1	-	-
Demeaned scores	Sweden	0.9945*	0.9723*	1	
	Composite reference country	0.9560*	0.9600*	0.9615*	1

* $p<0.05$

Table 14. Proposed indicators of corruption perceptions

Country	ECI, Value/Rank	CPI, Value/Rank	GCI, Value/Rank	LiT Survey, %				
				observe decreased corruption (Y/N)	buy university degree	use support of authorities to enter university	unofficial payments: primary/ secondary school	unofficial payments: Higher education
Reference countries								
USA		7,1/24	4,9/42					
ENG*		7,8/16	5,9/20	n/a	0,4	39,7	3,7	3,5
SCO*		7,8/16	5,9/20					
JPN		8/14	6,3/9					
AUS		8,8/8	5,8/23					
SWE*		9,3/4	6,6/4	49,4/6	0,7	13,5	0,3	0,4
Transition countries								
ROM	64,7/13	3,6/75	3,7/79	72,2/9,1	1,1	45,2	19,8	24,1
CZE	57,1/12	4,4/56	3,8/74	68,4/11	0,9	62,9	19,1	28,6
UKR	56,7/11	2,3/152	2,7/133	62,3/9,2	3,3	80,6	32,5	40,9
SVN	52,6/10	5,9/35	4,9/39	70,6/10,2	2,1	46,9	10,3	12,2
HUN	50,1/9	4,6/54	4,3/55	56,3/13,1	4,7	54,7	13	16,6
ARM	48,6/8	2,6/129	3,7/82	47,8/14,3	2,1	80,4	36,1	41,3
BGR	47,6/7	3,3/86	3,8/76	44,9/19,3	0,9	73,9	11,8	17
RUS	43,6/6	2,4/143	3,1/120	60,2/8,4	5,9	66,9	20,3	23,8
LTU	23/5	4,8/50	4,5/48	72,6/6,2	1,4	56,1	5,5	7
SCG	16/4	3,3/86	3,6/86	62,2/9,3	1,2	70,1	11,4	17,8
GEO	14,4/3	4,1/64	5,6/26	7,9/68,6	0,6	29,9	11,2	9,6
TUR	12,3/2	4,2/61	4,3/59	35/39,1	2,4	66	35,2	25,2
BIH	0,3/1	3,2/91	4,1/63	63,7/8,7	1	90,9	17,8	23,5

*benchmark countries in LiT Survey

Table 15. Top 10 Ukrainian Universities, 2012

Rank	Higher Educational Establishment	Number of students
7	The National Aviation University	50,000
4	Kyiv National Economic University named after Vadym Hetman	38,000
3	National Technical University of Ukraine "Kyiv Polytechnic Institute"	35,800
6	Lviv Polytechnic National University	31,500
1	Taras Shevchenko National University of Kyiv	26,000
5	National University «Yaroslav the Wise Law Academy of Ukraine»	23,000
9	The National Technical University «Kharkiv Polytechnic Institute»	22,000
10	National Pedagogical Dragomanov University	19,000
8	Ivan Franko Lviv National University	11,600
2	National University of "Kyiv-Mohyla Academy"	3,500

Source: "КорреспонденТ.net"

Table 16. Selected private Ukrainian universities

Number	Higher Educational Establishment	Number of Students
1	Open International University of Human Development "Ukraine"	35,000
2	European University	30,000
3	The Interregional Academy of Personnel Management	26,500
4	Kyiv Slavonic University	8,796
5	Alfred Nobel University of Dnipropetrovsk	8,000
6	Kyiv International University	6,780
7	National Academy of Managers in Culture and Arts	6,200
8	"KROK" University	5,000
9	Kyiv University of Tourism, Economics and Law	5,000
10	Kyiv Economic Institute of Management	4,000
11	Kharkov Institute of Business and Management	4,000
12	Kharkov Institute of Economics and Management of market relations	4,000
13	Donetsk Institute of Social Education	3,270
14	Donetsk University of Economics and Law	3,028

Table 17. The most widespread occasions of bribery in Ukrainian universities

Occasions	Percentage of respondents, %
Admission to university (Master program)	8,2
Exams	74,6
Thesis defense	23,3
Exclusion avoidance	22,9
In resolving questions about exams rescheduling, retaking the course	11,5

Source: Democratic Initiatives Foundation

Table 18. Basic reasons of bribery in Ukrainian higher education

Reasons	Percentage of respondents, %
Total depreciation of moral norms	29,9
Depreciation of the overall higher education (students care for diploma only)	35,7
Inadequate wage compensation of professors	28,5
Laziness of students, unwillingness to study	45,7
Lack of time for working students	22,8
Lack of effective ways to fight against this phenomenon in the learning process	20,9

Source: Democratic Initiatives Foundation

APPENDIX A. Distributions of residual and demeaned TIMSS scores

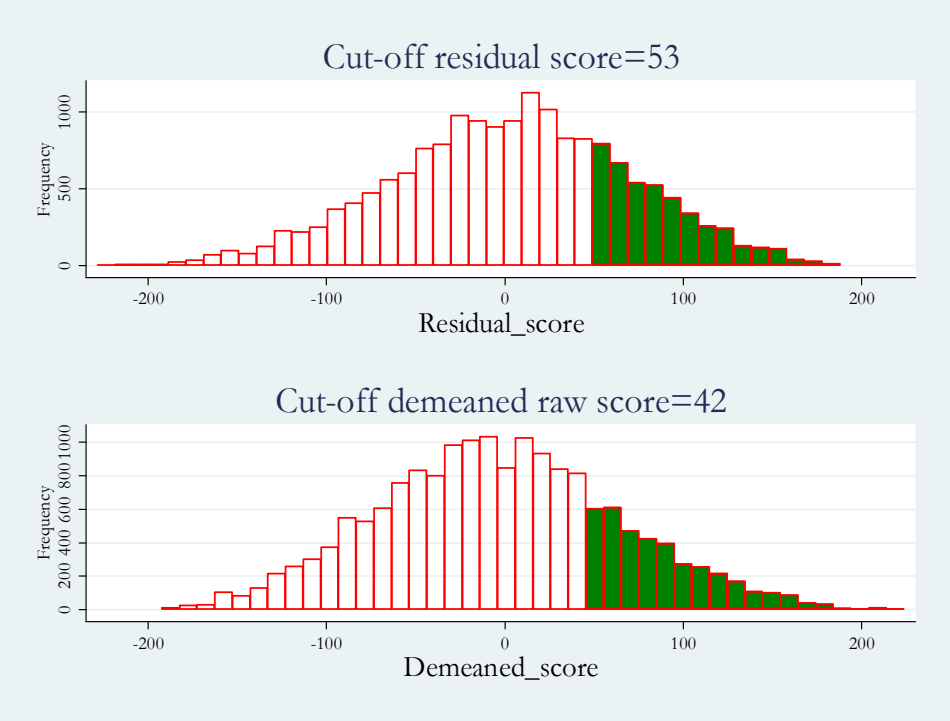

Figure A1. Distribution of residual and demeaned scores. SWE

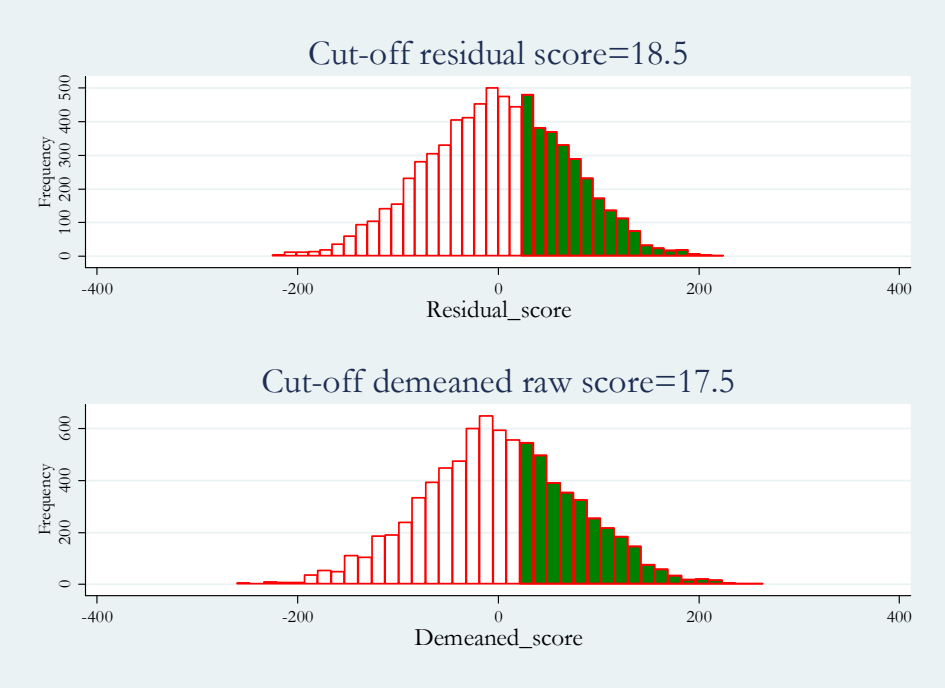

Figure A2. Distribution of residual and demeaned scores. AUS

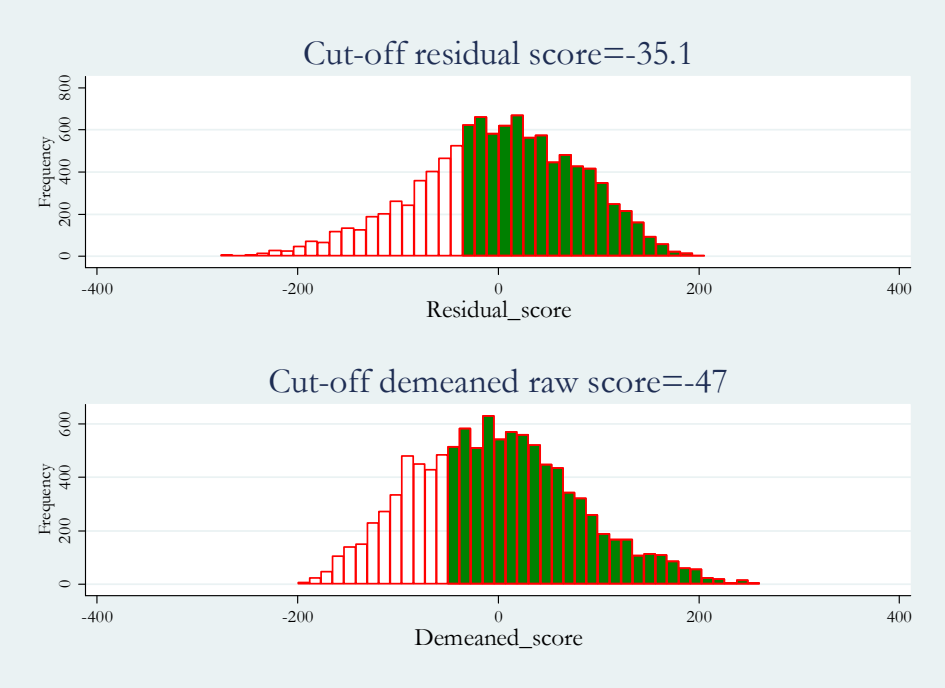

Figure A3. Distribution of residual and demeaned scores. ENG

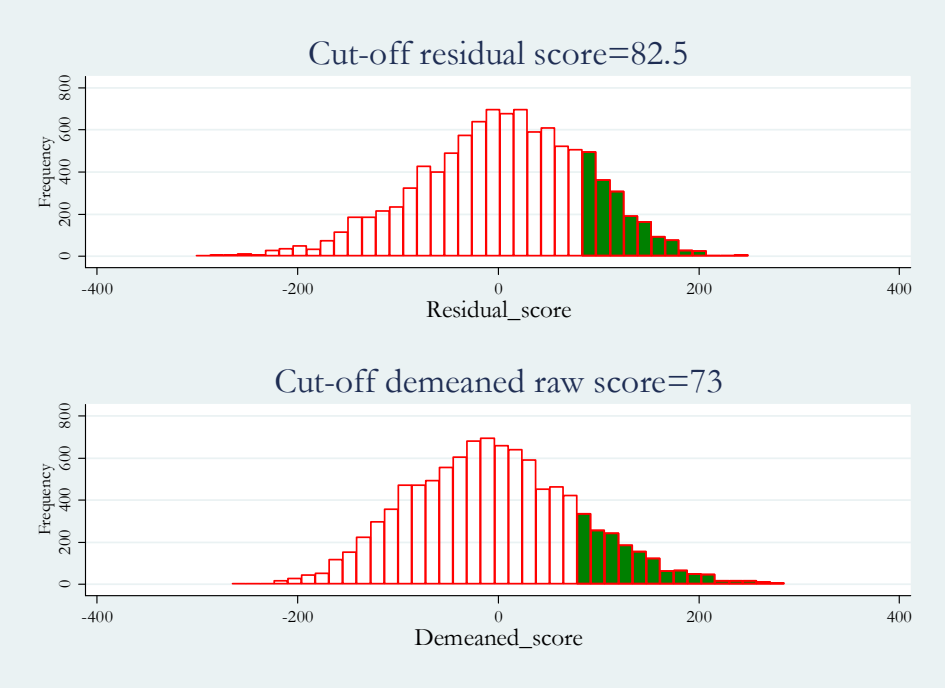

Figure A4. Distribution of residual and demeaned scores. JPN

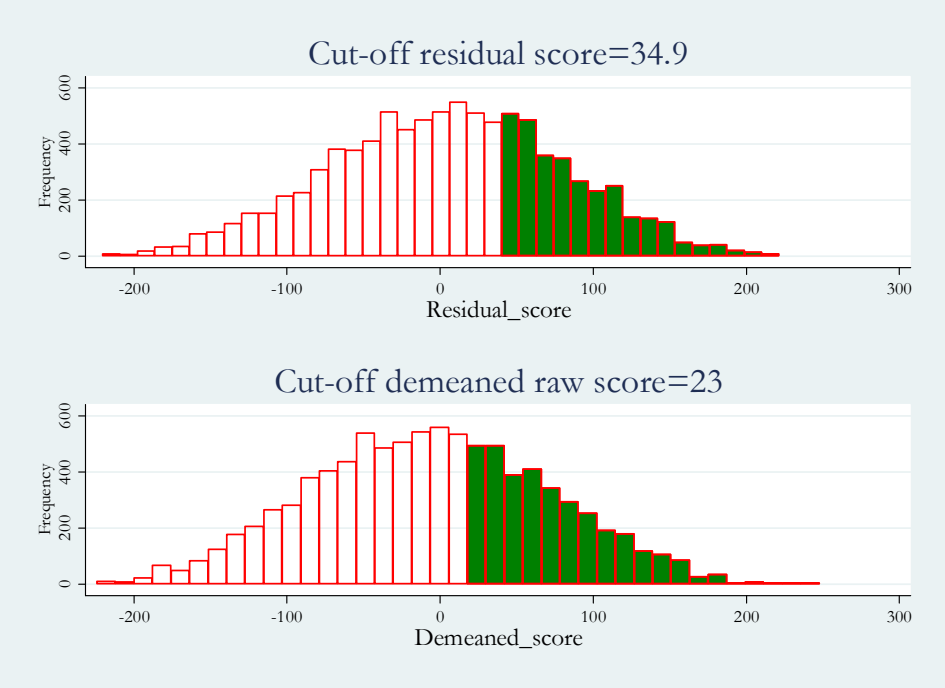

Figure A5. Distribution of residual and demeaned scores. SCO

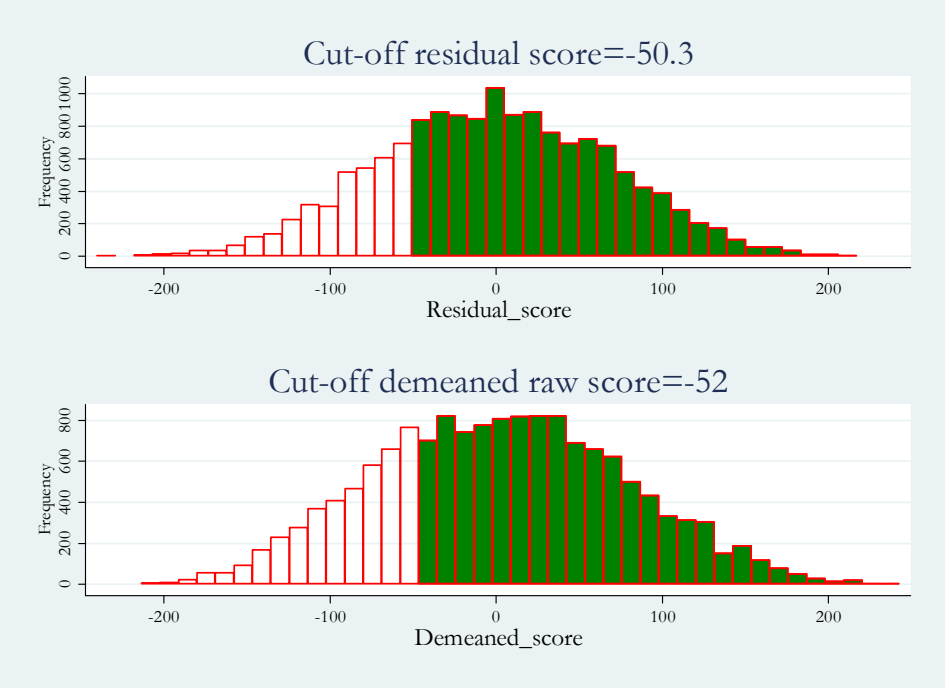

Figure A6. Distribution of residual and demeaned scores. USA

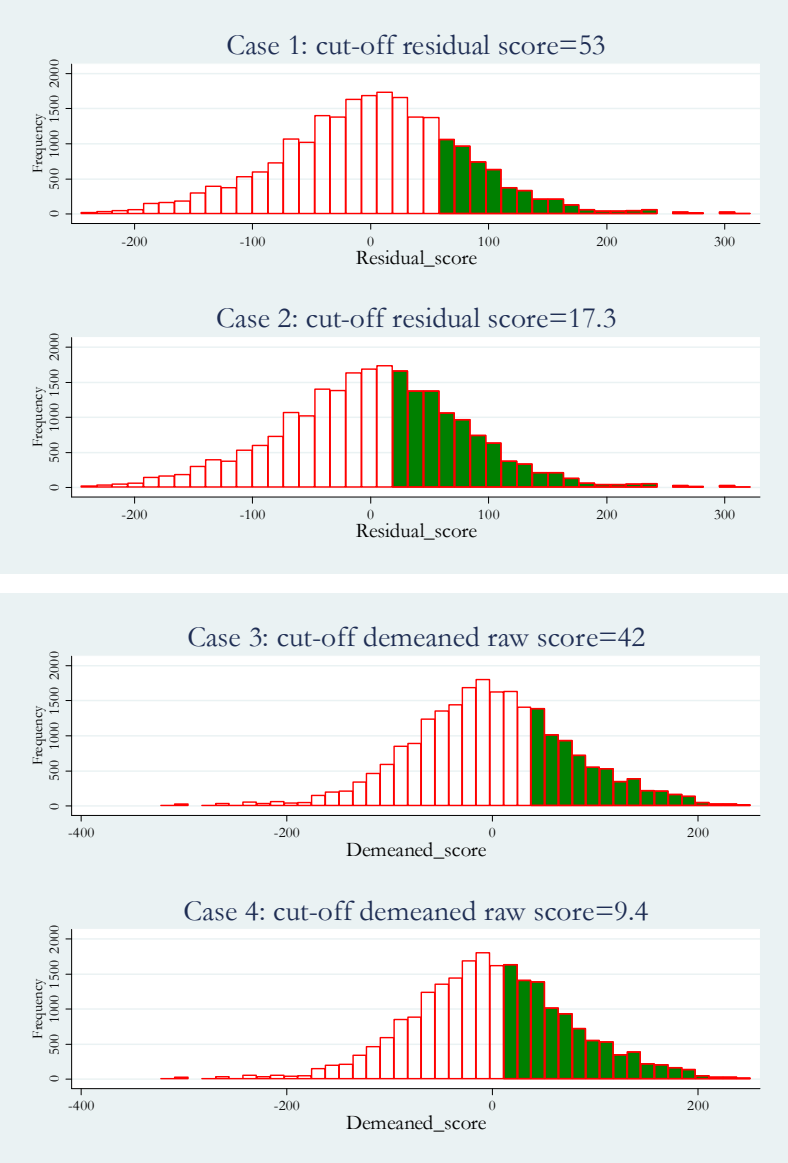

Figure A7. Distribution of residual and demeaned scores. ARM

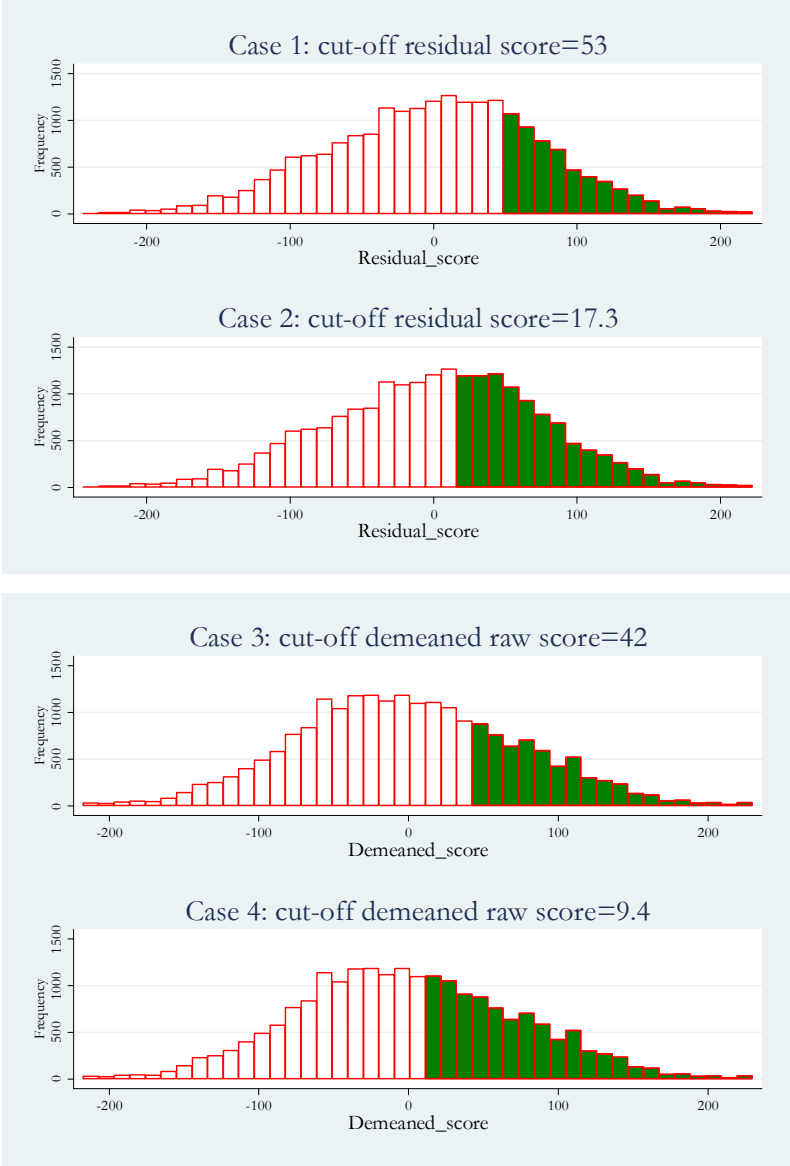

Figure A8. Distribution of residual and demeaned scores. BIH

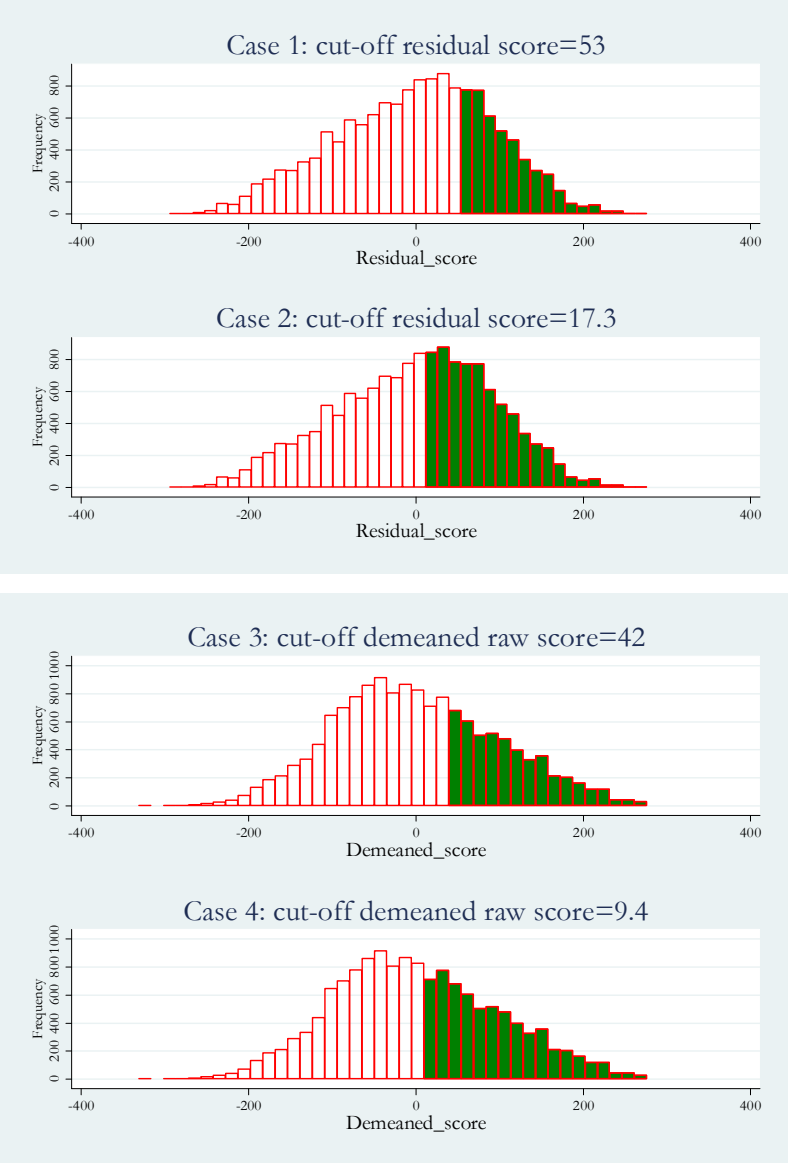

Figure A9. Distribution of residual and demeaned scores. BGR

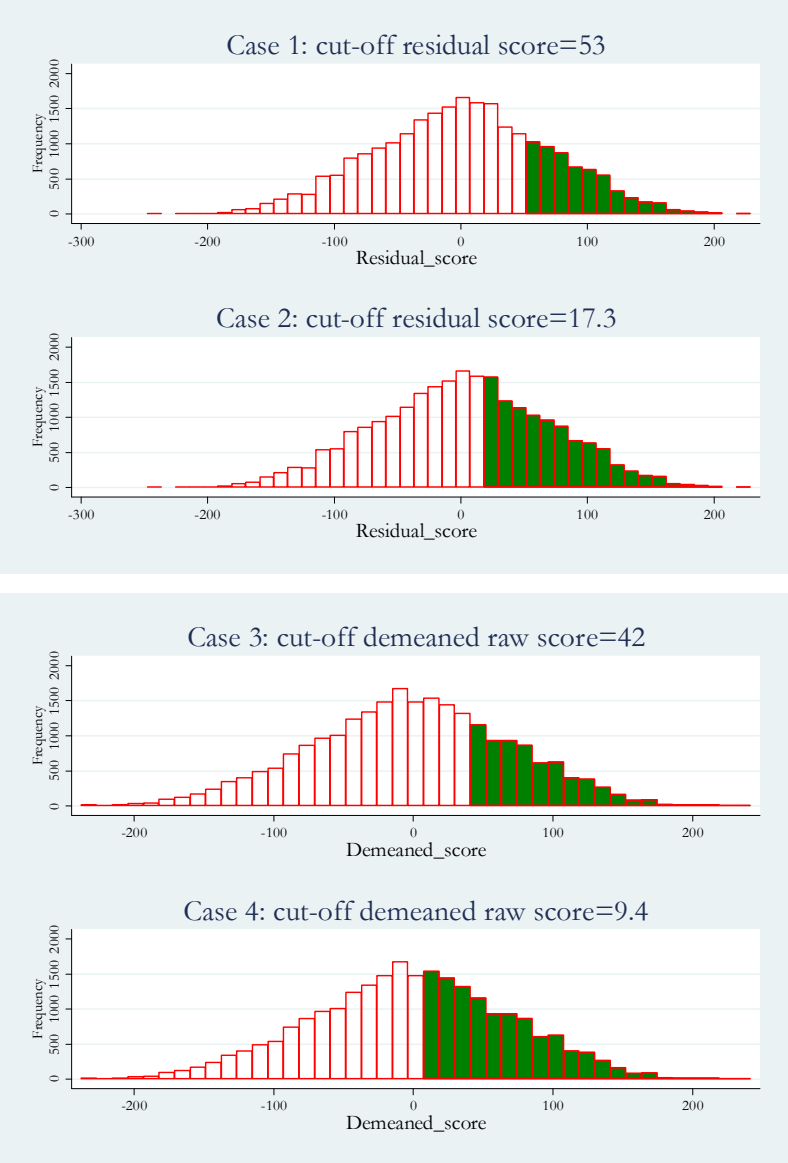

Figure A10. Distribution of residual and demeaned scores. CZE

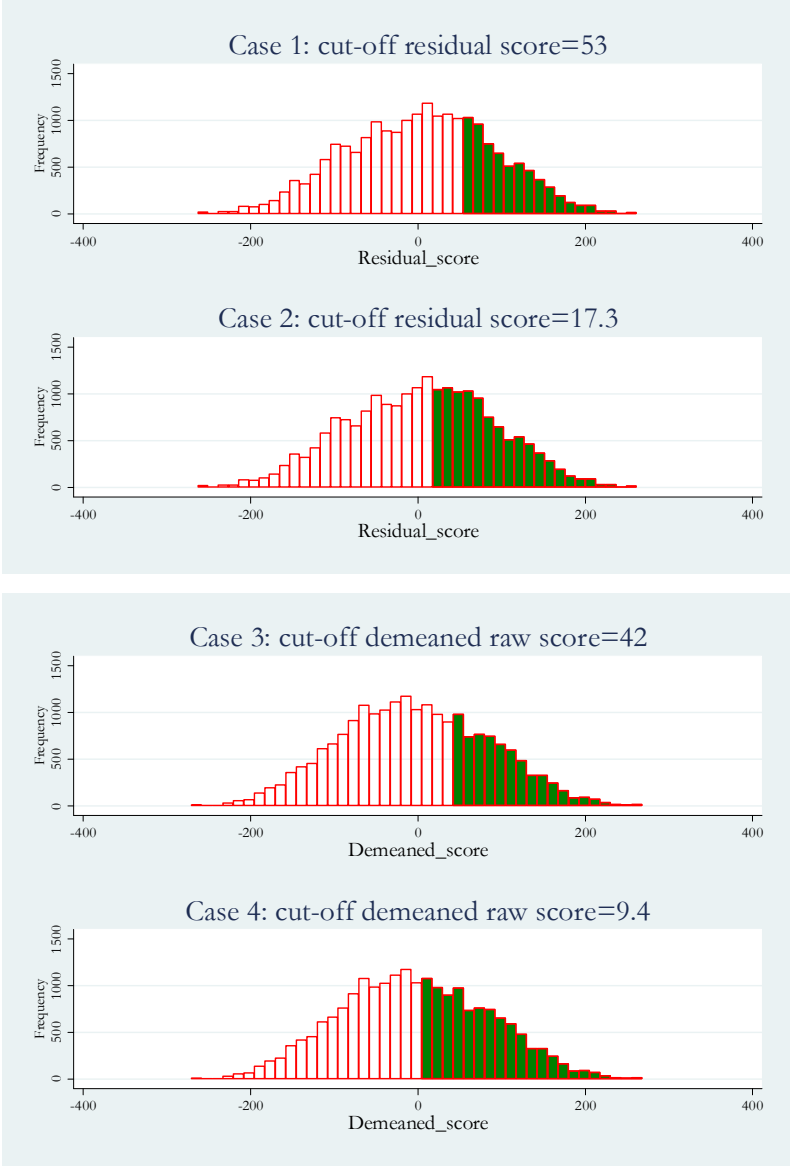

Figure A11. Distribution of residual and demeaned scores. GEO

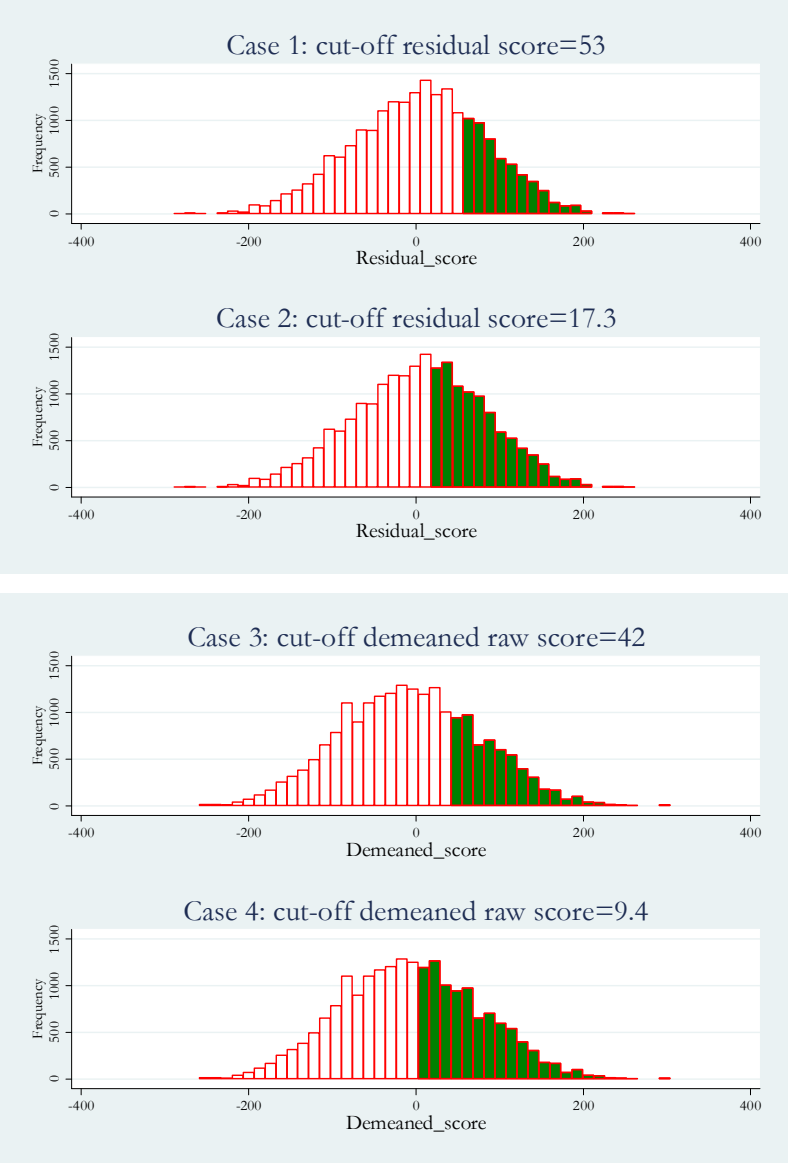

Figure A12. Distribution of residual and demeaned scores. HUN

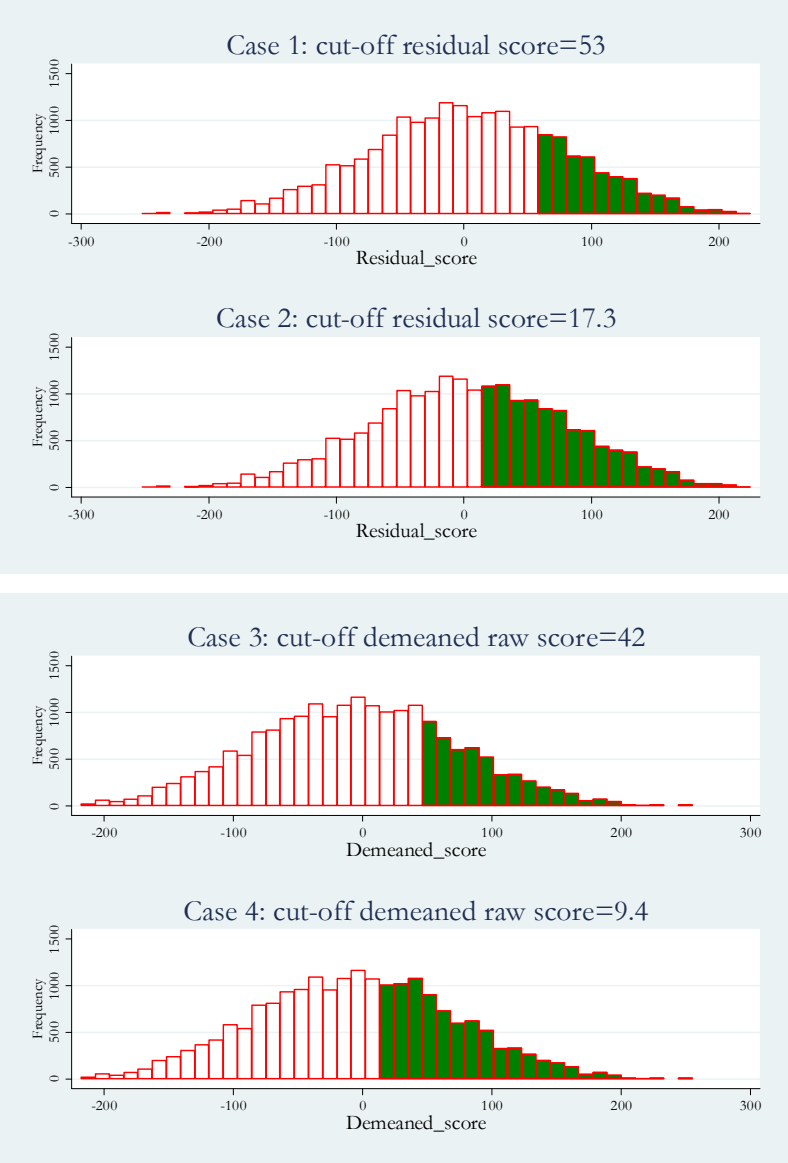

Figure A13. Distribution of residual and demeaned scores. LTU

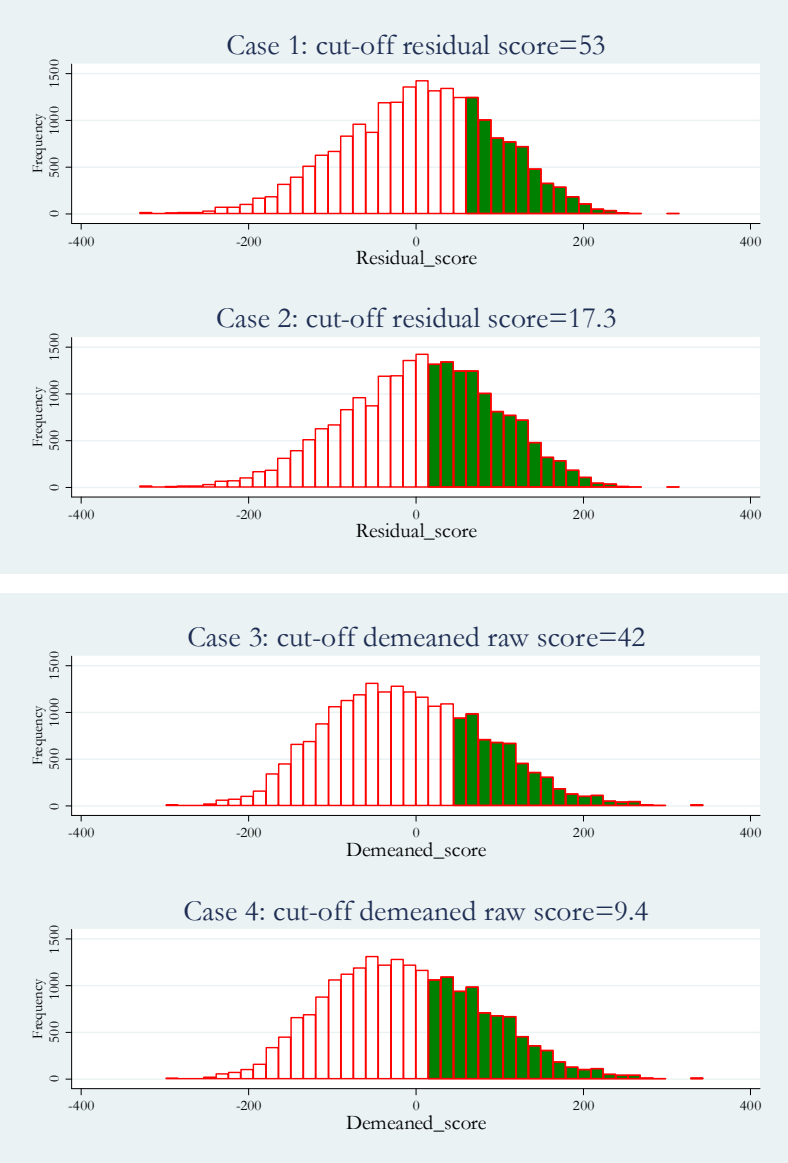

Figure A14. Distribution of residual and demeaned scores. ROM

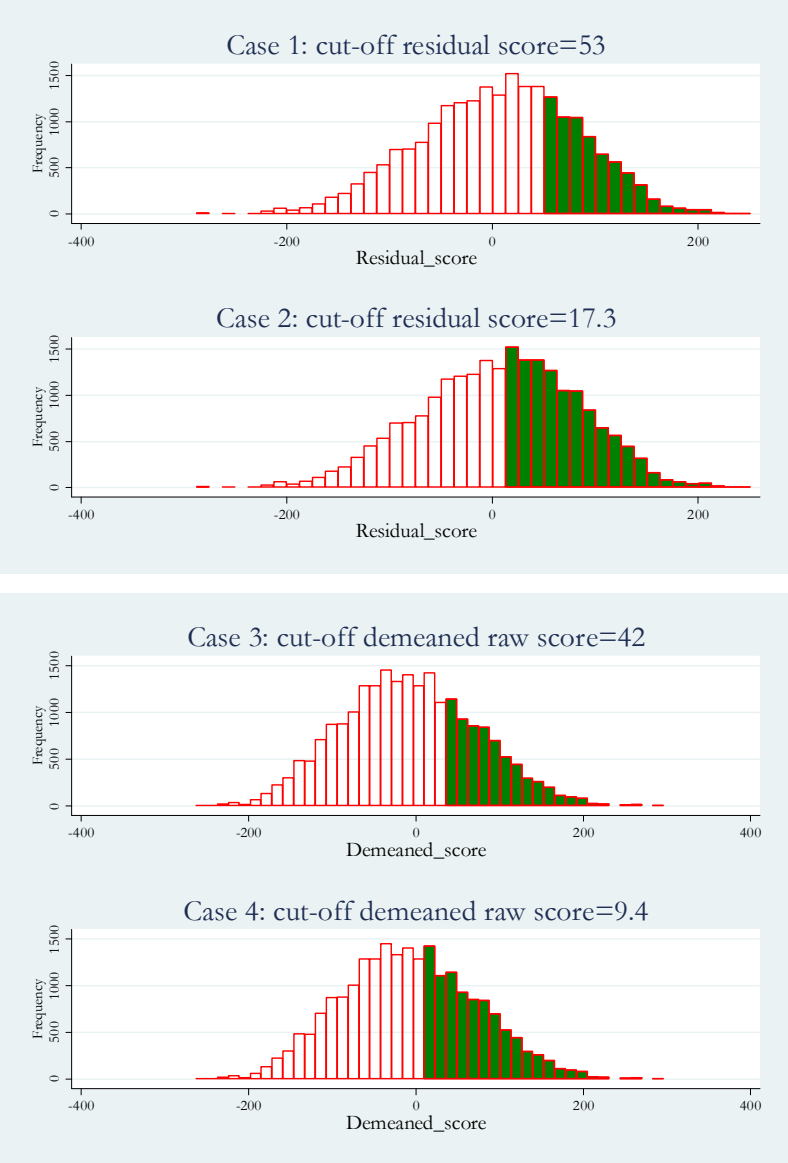

Figure A15. Distribution of residual and demeaned scores. RUS

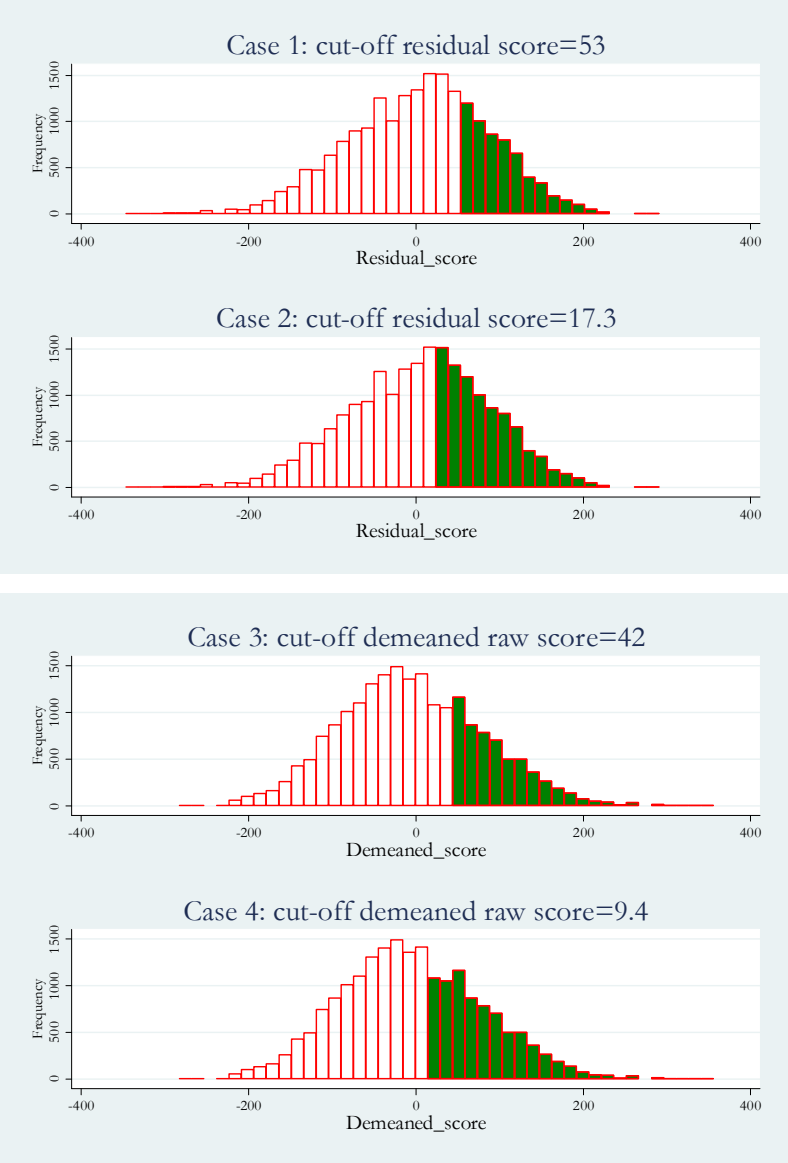

Figure A16. Distribution of residual and demeaned scores. SCG

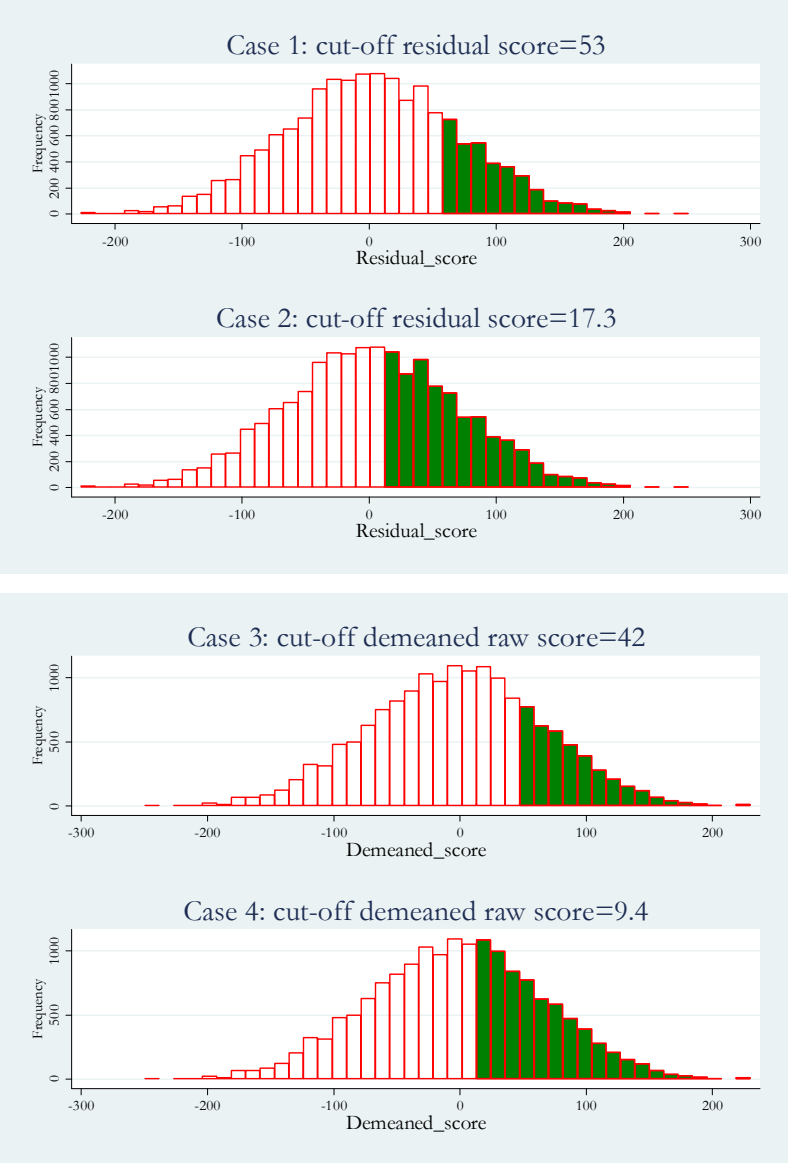

Figure A17. Distribution of residual and demeaned scores. SVN

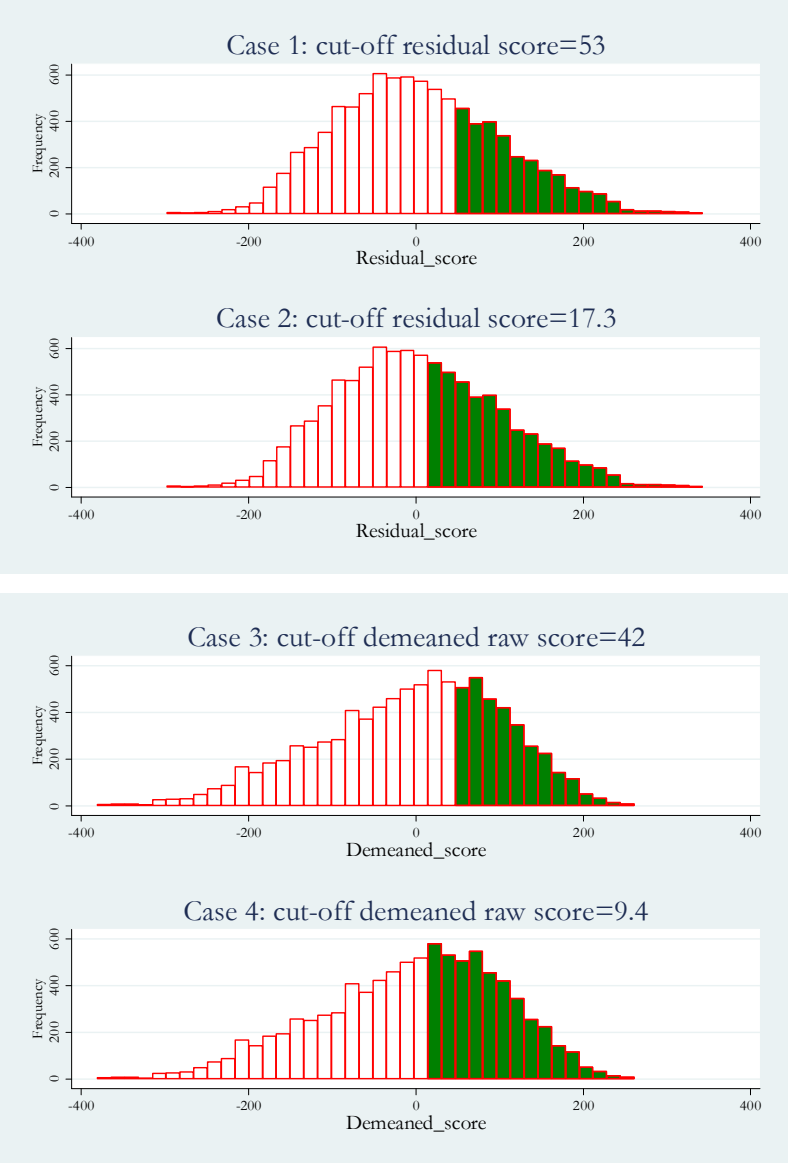

Figure A18. Distribution of residual and demeaned scores. TUR

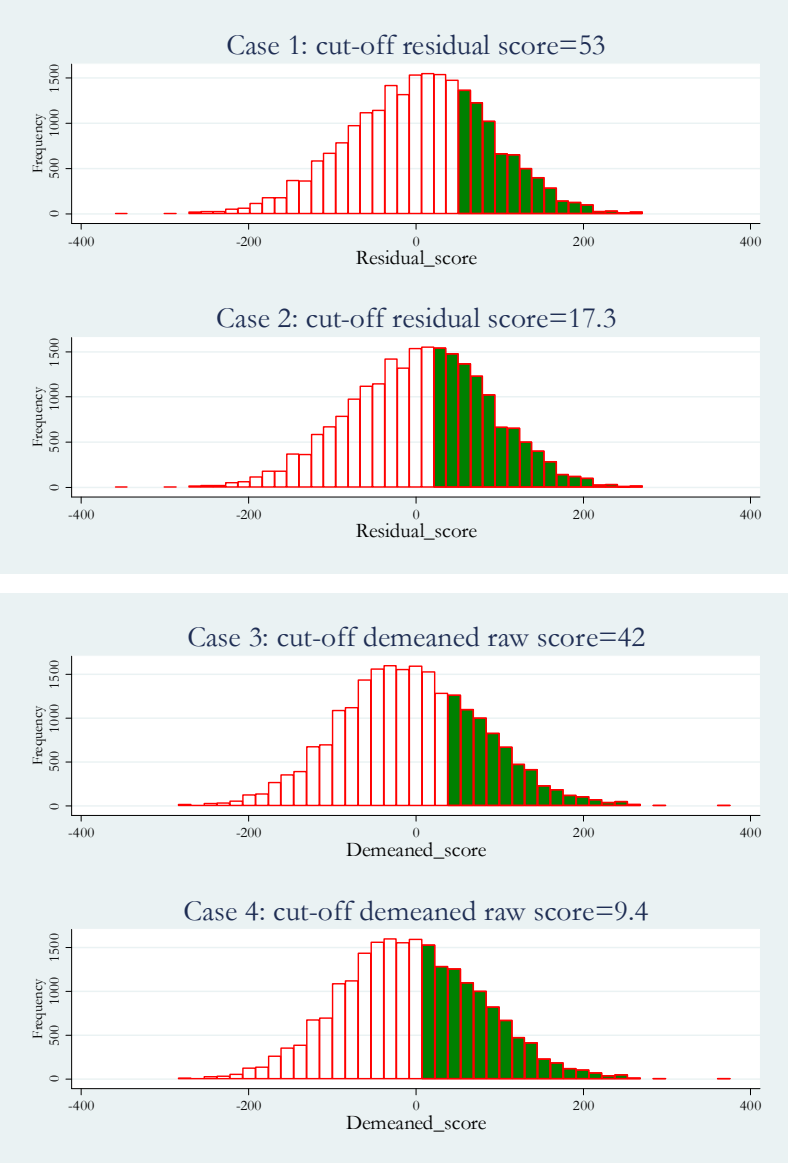

Figure A19. Distribution of residual and demeaned scores. UKR

APPENDIX B: OLS estimation of educational production functions

Table B1. OLS estimates. SWE

	(1)	(2)	(3)	(4)	(5)
VARIABLES	MAT01	MAT02	MAT03	MAT04	MAT05
dst_disadv3	-1.36	-2.98	-3.31	-3.04	-1.06
	(3.26)	(3.32)	(3.32)	(3.35)	(3.28)
dst_disadv4	-15.03***	-15.29***	-12.47**	-17.34***	-15.64***
	(4.93)	(5.02)	(5.03)	(5.07)	(4.97)
dst_affluent3	3.06	2.24	0.48	2.83	2.76
	(2.82)	(2.88)	(2.88)	(2.90)	(2.85)
dst_affluent4	9.81***	7.36***	7.68***	8.51***	9.11***
	(2.61)	(2.66)	(2.66)	(2.68)	(2.63)
Constant	485.62***	487.01***	488.12***	486.29***	487.61***
	(2.31)	(2.36)	(2.36)	(2.38)	(2.33)
Observations	5,722	5,722	5,722	5,722	5,722
R-squared	0.0062	0.0046	0.0051	0.0057	0.0057

Standard errors in parentheses

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

Table B2. OLS estimates. AUS

	(1)	(2)	(3)	(4)	(5)
VARIABLES	MAT01	MAT02	MAT03	MAT04	MAT05
dst_disadv3	-17.71***	-19.14***	-20.40***	-17.27***	-16.38***
	(3.01)	(2.99)	(3.02)	(2.99)	(2.99)
dst_disadv4	-62.49***	-65.84***	-67.26***	-62.25***	-60.11***
	(4.07)	(4.04)	(4.09)	(4.04)	(4.04)
dst_affluent3	-5.00	-2.96	-4.32	-4.26	-3.22
	(4.12)	(4.09)	(4.14)	(4.09)	(4.09)
dst_affluent4	51.61***	51.42***	50.04***	51.54***	52.84***
	(3.35)	(3.33)	(3.37)	(3.33)	(3.33)
constant	497.92***	498.68***	499.48***	499.47***	497.81***
	(1.92)	(1.90)	(1.93)	(1.90)	(1.91)
Observations	3,591	3,591	3,591	3,591	3,591
R-squared	0.1565	0.1654	0.1622	0.1575	0.1558

Standard errors in parentheses

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

Table B3. OLS estimates. ENG

	(1)	(2)	(3)	(4)	(5)
VARIABLES	MAT01	MAT02	MAT03	MAT04	MAT05
dst_disadv3	-5.37*	-5.89*	-7.00**	-5.16	-7.52**
	(3.25)	(3.29)	(3.33)	(3.26)	(3.26)
dst_disadv4	-27.52***	-25.39***	-26.48***	-25.53***	-25.78***
	(4.12)	(4.17)	(4.21)	(4.13)	(4.13)
dst_affluent3	33.00***	31.71***	32.54***	32.36***	31.89***
	(3.31)	(3.36)	(3.39)	(3.32)	(3.32)
dst_affluent4	44.02***	48.08***	45.20***	45.60***	44.06***
	(3.73)	(3.78)	(3.82)	(3.74)	(3.74)
Constant	504.53***	504.15***	504.74***	503.59***	505.74***
	(1.95)	(1.97)	(1.99)	(1.95)	(1.95)
Observations	4,048	4,048	4,048	4,048	4,048
R-squared	0.0680	0.0695	0.0664	0.0674	0.0664

Standard errors in parentheses

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

Table B4. OLS estimates. JPN

	(1)	(2)	(3)	(4)	(5)
VARIABLES	MAT01	MAT02	MAT03	MAT04	MAT05
dst_disadv3	-32.73***	-34.91***	-35.69***	-32.73***	-34.50***
	(4.48)	(4.56)	(4.53)	(4.54)	(4.54)
dst_disadv4	-57.71***	-53.98***	-57.46***	-51.74***	-49.81***
	(7.84)	(7.98)	(7.93)	(7.94)	(7.94)
dst_affluent3	1.88	2.40	1.17	0.83	1.09
	(3.46)	(3.52)	(3.50)	(3.50)	(3.50)
dst_affluent4	20.42***	22.08***	20.39**	22.70***	20.94***
	(2.51)	(2.56)	(2.54)	(2.54)	(2.54)
Constant	563.22***	564.96***	565.93***	564.00***	563.46***
	(1.85)	(1.89)	(1.87)	(1.88)	(1.88)
Observations	5,524	5,524	5,524	5,524	5,524
R-squared	0.0399	0.0415	0.0411	0.0410	0.0385

Standard errors in parentheses

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

Table B5. OLS estimates. SCO

	(1)	(2)	(3)	(4)	(5)
VARIABLES	MAT01	MAT02	MAT03	MAT04	MAT05
dst_disadv3	-22.00***	-18.62***	-22.95***	-21.90***	-19.62***
	(3.40)	(3.48)	(3.46)	(3.45)	(3.44)
dst_disadv4	-36.17***	-33.82***	-38.39***	-34.45***	-39.54***
	(4.54)	(4.65)	(4.62)	(4.61)	(4.60)
dst_affluent3	13.67***	12.19***	12.52***	13.80***	11.03***
	(3.44)	(3.52)	(3.50)	(3.49)	(3.49)
dst_affluent4	34.82***	35.98***	36.83***	36.38***	37.87***
	(3.17)	(3.24)	(3.23)	(3.22)	(3.21)
Constant	484.82***	484.37***	484.50***	484.61***	486.19***
	(1.58)	(1.62)	(1.61)	(1.61)	(1.61)
Observations	4,205	4,205	4,205	4,205	4,205
R-squared	0.0570	0.0520	0.0608	0.0566	0.0616

Standard errors in parentheses

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

Table B6. OLS estimates. USA

	(1)	(2)	(3)	(4)	(5)
VARIABLES	MAT01	MAT02	MAT03	MAT04	MAT05
dst_disadv3	-27.71***	-26.37***	-27.83***	-27.97***	-26.32***
	(2.09)	(2.12)	(2.14)	(2.13)	(2.11)
dst_disadv4	-64.27***	-64.0635***	-64.64***	-64.87***	-62.59***
	(2.18)	(2.21)	(2.23)	(2.22)	(2.20)
dst_affluent3	3.78	6.00**	3.72	3.26	4.91**
	(2.30)	(2.34)	(2.35)	(2.35)	(2.32)
dst_affluent4	18.46***	20.80***	20.30***	20.69***	19.65***
	(2.99)	(3.03)	(3.06)	(3.05)	(3.02)
Constant	535.38***	534.43***	535.32***	534.98***	534.95***
	(1.73)	(1.76)	(1.77)	(1.77)	(1.75)
Observations	7,593	7,593	7,593	7,593	7,593
R-squared	0.1391	0.1386	0.1369	0.1385	0.1329

Standard errors in parentheses

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

Table B7. OLS estimates. ARM

VARIABLES	(1) MAT01	(2) MAT02	(3) MAT03	(4) MAT04	(5) MAT05
dst_disadv3	12.54***	12.84***	15.12***	15.21***	13.24***
	(3.10)	(3.16)	(3.14)	(3.13)	(3.10)
dst_disadv4	1.98	3.29	5.35	6.84*	2.52
	(3.50)	(3.56)	(3.54)	(3.53)	(3.50)
dst_affluent3	-4.82	-2.60	-2.69	-3.93	-1.23
	(3.14)	(3.20)	(3.18)	(3.17)	(3.14)
dst_affluent4	-4.09	-4.94	-0.79	-2.65	-1.17
	(3.63)	(3.69)	(3.67)	(3.66)	(3.63)
Constant	496.65***	496.45***	494.43***	494.47***	496.23***
	(2.84)	(2.89)	(2.87)	(2.86)	(2.84)
Observations	4,736	4,736	4,736	4,736	4,736
R-squared	0.0048	0.0048	0.0056	0.0064	0.0044

Standard errors in parentheses

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

Table B8. OLS estimates. BIH

	(1)	(2)	(3)	(4)	(5)
VARIABLES	MAT01	MAT02	MAT03	MAT04	MAT05
dst_disadv3	6.50**	7.72**	8.33**	3.53	6.96**
	(3.25)	(3.27)	(3.31)	(3.28)	(3.27)
dst_disadv4	0.95	3.62	1.80	0.09	3.44
	(3.21)	(3.23)	(3.26)	(3.24)	(3.23)
dst_affluent3	16.05***	16.09***	13.54***	13.67***	14.42***
	(3.08)	(3.10)	(3.14)	(3.11)	(3.10)
dst_affluent4	8.19*	11.02*	12.02**	9.54**	8.61*
	(4.81)	(4.83)	(4.89)	(4.86)	(4.84)
Constant	449.42***	447.67***	449.08***	450.82***	448.06***
	(2.83)	(2.85)	(2.88)	(2.86)	(2.85)
Observations	4,220	4,220	4,220	4,220	4,220
R-squared	0.0090	0.0085	0.0078	0.0063	0.0066

Standard errors in parentheses

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

Table B9. OLS estimates. BGR

	(1)	(2)	(3)	(4)	(5)
VARIABLES	MAT01	MAT02	MAT03	MAT04	MAT05
dst_disadv3	-52.90***	-52.69***	-50.61***	-54.23***	-52.34***
	(4.10)	(4.13)	(4.19)	(4.15)	(4.15)
dst_disadv4	-50.14***	-49.08***	-51.82***	-55.10***	-53.40***
	(3.73)	(3.76)	(3.81)	(3.77)	(3.77)
dst_affluent3	27.22***	25.85***	25.37***	25.09***	25.68***
	(4.23)	(4.27)	(4.33)	(4.28)	(4.28)
dst_affluent4	38.10***	38.72***	40.38***	39.43***	40.18***
	(5.44)	(5.49)	(5.57)	(5.51)	(5.51)
Constant	478.41***	479.49***	478.26***	479.69***	480.80***
	(2.42)	(2.44)	(2.47)	(2.45)	(2.45)
Observations	4,019	4,019	4,019	4,019	4,019
R-squared	0.1008	0.0966	0.0975	0.1073	0.1036

Standard errors in parentheses

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

Table B10. OLS estimates. CZE

	(1)	(2)	(3)	(4)	(5)
VARIABLES	MAT01	MAT02	MAT03	MAT04	MAT05
dst_disadv3	-52.90***	-52.69***	-50.61***	-54.23***	-52.34***
	(4.10)	(4.13)	(4.19)	(4.15)	(4.15)
dst_disadv4	-50.14***	-49.08***	-51.82***	-55.10***	-53.40***
	(3.73)	(3.76)	(3.81)	(3.77)	(3.77)
dst_affluent3	27.22***	25.8518***	25.37***	25.09***	25.68***
	(4.23)	(4.27)	(4.33)	(4.28)	(4.28)
dst_affluent4	38.10***	38.72***	40.38***	39.43***	40.18***
	(5.44)	(5.49)	(5.57)	(5.51)	(5.51)
Constant	478.41***	479.49***	478.26***	479.69***	480.80***
	(2.42)	(2.44)	(2.47)	(2.45)	(2.45)
Observations	4,019	4,019	4,019	4,019	4,019
R-squared	0.1008	0.0966	0.0975	0.1073	0.1036

Standard errors in parentheses

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

Table B11. OLS estimates. GEO

	(1)	(2)	(3)	(4)	(5)
VARIABLES	MAT01	MAT02	MAT03	MAT04	MAT05
dst_disadv3	-21.72***	-18.50***	-17.49***	-21.30***	-21.53***
	(3.89)	(3.92)	(3.93)	(4.01)	(3.99)
dst_disadv4	-2.94	-5.77	-8.30**	-5.13	-5.15
	(3.63)	(3.66)	(3.67)	(3.74)	(3.72)
dst_affluent3	9.27**	10.52***	7.21*	9.99***	5.22
	(3.71)	(3.75)	(3.75)	(3.83)	(3.81)
dst_affluent4	22.02***	17.15***	17.51***	16.60***	19.11***
	(5.45)	(5.50)	(5.50)	(5.62)	(5.59)
Constant	413.36***	412.90***	415.23***	412.69***	415.25***
	(3.01)	(3.04)	(3.04)	(3.10)	(3.09)
Observations	4,179	4,179	4,179	4,179	4,179
R-squared	0.0140	0.0108	0.0089	0.0120	0.0107

Standard errors in parentheses

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

Table B12. OLS estimates. HUN

	(1)	(2)	(3)	(4)	(5)
VARIABLES	MAT01	MAT02	MAT03	MAT04	MAT05
dst_disadv3	-19.16***	-20.00***	-20.02***	-20.14***	-19.26***
	(3.09)	(3.09)	(3.08)	(3.13)	(3.07)
dst_disadv4	-35.59***	-39.92***	-37.32***	-38.30***	-39.93***
	(3.20)	(3.21)	(3.19)	(3.25)	(3.18)
dst_affluent3	34.00***	33.54***	35.37***	32.42***	35.10***
	(3.98)	(3.99)	(3.97)	(4.04)	(3.96)
dst_affluent4	27.96***	23.25***	28.94***	24.23***	26.95***
	(4.92)	(4.93)	(4.90)	(5.00)	(4.90)
Constant	524.36***	527.12***	526.21***	526.20***	526.55***
	(2.10)	(2.10)	(2.09)	(2.13)	(2.09)
Observations	4,168	4,168	4,168	4,168	4,168
R-squared	0.0670	0.0715	0.0731	0.0664	0.0761

Standard errors in parentheses

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

Table B13. OLS estimates. LTU

	(1)	(2)	(3)	(4)	(5)
VARIABLES	MAT01	MAT02	MAT03	MAT04	MAT05
dst_disadv3	-25.74***	-24.73***	-24.58***	-25.98***	-25.45***
	(3.00)	(3.08)	(3.07)	(3.10)	(3.03)
dst_disadv4	-28.95***	-30.14***	-28.76***	-26.00***	-34.18***
	(5.83)	(5.99)	(5.97)	(6.02)	(5.90)
dst_affluent3	17.33**	17.80**	19.66***	16.36**	19.48***
	(7.36)	(7.56)	(7.53)	(7.60)	(7.45)
Constant	511.74***	512.55***	511.49***	511.84***	513.28***
	(1.45)	(1.49)	(1.49)	(1.50)	(1.47)
Observations	3,991	3,991	3,991	3,991	3,991
R-squared	0.0245	0.0225	0.0225	0.0223	0.0260

Standard errors in parentheses

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

Table B14. OLS estimates. ROM

	(1)	(2)	(3)	(4)	(5)
VARIABLES	MAT01	MAT02	MAT03	MAT04	MAT05
dst_disadv3	-23.85***	-23.28***	-24.22***	-22.30***	-23.55***
	(4.09)	(4.23)	(4.25)	(4.24)	(4.13)
dst_disadv4	-44.81***	-46.18***	-47.16***	-45.74***	-43.06***
	(3.64)	(3.76)	(3.78)	(3.77)	(3.68)
dst_affluent3	21.88***	21.81***	20.02***	18.17**	21.78***
	(7.00)	(7.23)	(7.27)	(7.26)	(7.07)
dst_affluent4	30.95***	33.07***	31.32***	32.59***	35.40***
	(5.80)	(5.99)	(6.03)	(6.01)	(5.86)
Constant	485.77***	484.61***	485.69***	484.57***	483.94***
	(2.99)	(3.09)	(3.11)	(3.10)	(3.02)
Observations	4,198	4,198	4,198	4,198	4,198
R-squared	0.0597	0.0602	0.0596	0.0579	0.0583

Standard errors in parentheses

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

Table B15. OLS estimates. RUS

	(1)	(2)	(3)	(4)	(5)
VARIABLES	MAT01	MAT02	MAT03	MAT04	MAT05
dst_disadv3	-8.18***	-6.67**	-10.30***	-10.07***	-7.31**
	(3.16)	(3.19)	(3.22)	(3.18)	(3.16)
dst_disadv4	-16.37***	-17.78***	-22.33***	-23.76***	-15.74***
	(4.15)	(4.18)	(4.22)	(4.17)	(4.15)
dst_affluent3	-36.77***	-31.61***	-34.03***	-33.97***	-35.70***
	(3.47)	(3.50)	(3.53)	(3.48)	(3.47)
dst_affluent4	10.98***	13.63***	11.99***	9.96***	11.90***
	(3.48)	(3.50)	(3.54)	(3.49)	(3.48)
Constant	520.23***	518.07***	521.48***	522.74***	520.31***
	(3.16)	(3.18)	(3.21)	(3.17)	(3.16)
Observations	4,506	4,506	4,506	4,506	4,506
R-squared	0.0830	0.0750	0.0828	0.0806	0.0812

Standard errors in parentheses

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

Table B16. OLS estimates. SCG

	(1)	(2)	(3)	(4)	(5)
VARIABLES	MAT01	MAT02	MAT03	MAT04	MAT05
dst_disadv3	-18.57***	-17.31***	-19.05***	-21.06***	-18.85***
	(3.83)	(3.89)	(3.89)	(3.89)	(3.84)
dst_disadv4	-22.73***	-24.75***	-22.87***	-22.57***	-22.01***
	(3.88)	(3.94)	(3.95)	(3.94)	(3.89)
dst_affluent3	-3.50	-3.46	-2.50	-3.22	-2.88
	(3.44)	(3.49)	(3.49)	(3.49)	(3.44)
dst_affluent4	20.21***	19.66***	17.29***	18.63***	19.13***
	(4.52)	(4.58)	(4.59)	(4.59)	(4.53)
Constant	499.19***	500.36***	499.43***	498.77***	500.75***
	(3.41)	(3.46)	(3.47)	(3.46)	(3.42)
Observations	4,045	4,045	4,045	4,045	4,045
R-squared	0.0253	0.0260	0.0218	0.0236	0.0233

Standard errors in parentheses

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

Table B17. OLS estimates. SVN

	(1)	(2)	(3)	(4)	(5)
VARIABLES	MAT01	MAT02	MAT03	MAT04	MAT05
dst_disadv3	-4.44	-0.79	-4.55	-2.26	-3.46
	(2.85)	(2.86)	(2.87)	(2.88)	(2.85)
dst_disadv4	-8.27**	-8.50**	-9.97**	-7.47*	-10.58***
	(3.99)	(4.01)	(4.01)	(4.03)	(3.99)
dst_affluent3	-0.45	-0.97	-1.34	0.09	-1.45
	(3.08)	(3.09)	(3.10)	(3.11)	(3.08)
dst_affluent4	8.07***	6.42**	5.77*	7.86**	5.47*
	(3.10)	(3.12)	(3.12)	(3.13)	(3.10)
Constant	499.13***	500.13***	501.82***	498.59***	502.02***
	(2.76)	(2.7)	(2.78)	(2.80)	(2.76)
Observations	4,044	4,044	4,044	4,044	4,044
R-squared	0.0068	0.0046	0.0057	0.0052	0.0055

Standard errors in parentheses

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

Table B18. OLS estimates. TUR

	(1)	(2)	(3)	(4)	(5)
VARIABLES	MAT01	MAT02	MAT03	MAT04	MAT05
dst_disadv3	-52.68***	-53.38***	-53.40***	-51.72***	-54.60***
	(5.31)	(5.33)	(5.33)	(5.40)	(5.37)
dst_disadv4	-95.91***	-101.84***	-97.52***	-96.34***	-100.33***
	(5.47)	(5.50)	(5.49)	(5.56)	(5.53)
dst_affluent3	-6.93	-8.63*	-6.98	-5.32	-7.50
	(4.63)	(4.65)	(4.65)	(4.71)	(4.69)
dst_affluent4	19.13***	14.01**	20.18***	20.31***	15.87***
	(6.07)	(6.09)	(6.09)	(6.17)	(6.14)
Constant	503.10***	507.14***	503.99***	502.15***	507.92***
	(5.32)	(5.35)	(5.34)	(5.41)	(5.38)
Observations	4,498	4,498	4,498	4,498	4,498
R-squared	0.1332	0.1391	0.1373	0.1331	0.1359

Standard errors in parentheses

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

Table B19. OLS estimates. UKR

	(1)	(2)	(3)	(4)	(5)
VARIABLES	MAT01	MAT02	MAT03	MAT04	MAT05
dst_disadv3	-36.09***	-33.15***	-32.66***	-32.98***	-34.51***
	(5.49)	(5.45)	(5.54)	(5.48)	(5.51)
dst_disadv4	-7.24	-10.43*	-6.15	-9.63*	-7.38
	(5.84)	(5.81)	(5.90)	(5.83)	(5.86)
dst_affluent3	-31.56***	-29.06***	-28.87***	-28.44***	-29.44***
	(3.55)	(3.53)	(3.58)	(3.55)	(3.56)
dst_affluent4	-7.30**	-6.58**	-4.70	-5.54*	-5.75*
	(3.24)	(3.22)	(3.27)	(3.24)	(3.26)
Constant	475.92***	475.16***	474.45***	474.15***	475.24***
	(2.56)	(2.54)	(2.58)	(2.55)	(2.57)
Observations	4,424	4,424	4,424	4,424	4,424
R-squared	0.0266	0.0234	0.0230	0.0230	0.0241

Standard errors in parentheses

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