THE IMPACT OF SCHOOL SIZE ON EDUCATIONAL OUTCOME: THE CASE OF MOLDOVA

by

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Abstract

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This thesis investigates the relationship between school size and educational outcomes in the Republic of Moldova. Using the information for almost entire population of schools in Moldova administrated by the Ministry of Economy found a positive statistically significant impact of school size on school performance, as measured by the mean test score for secondary school graduates. The positive effect was revealed before and after adding controls relevant for the case of Moldova. Based on the results of the best specification, we conclude that there is an optimal school size for Moldova, it is about 777 students. The results of the current work can be used as guidance during network optimization agenda in the country.

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GLOSSARY

PIRLS.Progress in International Reading Literacy Study

TIMMS.Trends in International Mathematics and Science Study

UNICEF.United Nations International Children's Emergency Fund

MOE.Ministry of Economy of Moldova

MOF.Ministry of Finance of Moldova

NBSM.National Bureau of Statistics of Moldova

Chapter 1

INTRODUCTION

Over the past two decades, there has been a pronounced demographic decline in the Republic of Moldova. The low birth rate led to a significant decrease in the number of pupils enrolled in schools, mainly in the rural areas. The number of students enrolled in primary education has decreased by more than 40 percent since the early 1990s. At the same time, the numberof school has remained virtually unchanged. As a consequence big Soviet era schools[1] are still maintained, but used only at half of their capacity (see Figure 1).

At the same time, spending on education in Moldova reached its peak in 2010 and constituted approximately 10 percent of the GDP (5.4 percent of GDP in 2001), while the share of education expenditures in GDP in Europe amountedto 5.6%[2]. Thus, the expansion of Moldova's budget on education moves in the opposite direction of the demographic trend (see Figure 2). Moreover, students' performance still requires much improvement. According to the international tests in mathematics and science (TIMMS 2003) and reading literacy (PIRLS 2003), Moldova scored significantly below the international and regional means (UNICEF 2008). The results have slightly improved overtime based on PISA plus 2009 with regards to science, but there has not been a positive change in mathematics and reading: among all participants in PISA 2009 and PISA plus 2009 projects, Moldova scored poorly in reading being on 64th place and in mathematics being on 59th place relative to 74 participants.

[1] Authors' estimates based on 1105 public schools in Moldova show that almost half of schools (530) require capital reparation.

[2] The indicator was sourced from Eurostat report for EU-27 countries.

Hence, Moldovan 15 years old students performed significantly worse than their peers from the region and other OECD countries.

It is hardly to find any rational justification of this still bad educational performance and almost doubled expenditures on education. What looks even more dramatic in this case is that while expenditures on personnel representing the lion share (63% in 2010) in total education budget (see Figure 3) have expanded with the rest of the budget, teachers' wages still lag behind constituting 62% of economy average in 2009 (Popa et al., p.16, 2011).

This poor educational performance and the decreasing student-teacher ratio (e.g. the index has declined from 29 in 1981 to 16 in 2009 in the case of primary education[3]), combined with costly maintenance of large, half-empty buildings and payment system with low incentives for teaching personnel suggest that there is a need for school network optimization in Moldova.

The process of school network optimization involves the creation of a network that maximally guarantees the quality of education provision for all children irrespective of their geographical location, social, cultural or ethnical backgrounds, while at the same time taking into consideration the economic rationalization and the country's resources (Bogojević et al., 2002).

The school network optimization process in Moldova has caused many debates between local authorities and the Moldavian government. Muntian (2011) reported that out of the 30 schools that should be consolidated at the initial stage of the reform, only 19 schools agreed, while 11 schools were not willing to be merged. In most cases, the school network optimization process meets strong resistance from communities, teachers and parents. On the one hand,

[3] Author's estimates based on sample of ordinary schools in Moldova revealed that student-teacher ratio in secondary education constituted approximately 10 students per teacher in comparison with 15 students per teacher in 1986.

economic efficiency (it is cheaper to maintain one school than two schools, if it is possible) should be taken into account. On the other hand, social factors such as the right for and access to education matters too.

School closures and mergersrepresenboth a riskand a challenge for Moldova. The risk is associated with children's transportation to different schools. Students, who already have low attendance rates, may go to school even less often or even worse, they may dropout. Especially for socio-economicallyvulnerable groups of children, mostly kids whose parents left them at home usually with grandparents, while working abroad, or kids from bigger families who may experience the lack of parents' supervision, the need for transportation to school may result in lower attendance and poor performance. Recent studies show that approximately 31 percent of Moldovan children under 15 years old do not live with both parents, 7 percent live with neither parents. The median age of children left by their parents is 11 years and majority of these children (80 percent) live in rural areas (Salah, 2008).

Statistical official data in Moldova shows that there is a difference between enrollment rates for primary school children from urban and rural areas with lower rates for the latter. Also, the form of "hidden enrollment" (when children are formally enrolled in school, but they don't attend the classes) is wide spread in rural areas. Asimilar pattern is observed in case of secondary education too, where the difference in enrollment rates between urban areas (89.7%) has widened substantially in comparison with rural areas (73.1%) for the last decade. According to the findings of Institute of Education Sciences of Moldova (2007) based on the survey of school managers and teachers, the main reasons for non-enrollment in secondary education in rural areas are

- Parents are present and they are poorlyengaged in children' education, 28%[4]

[4] Hereafter, it is the percentage rate of responders from 128 rural settlements who agreed with the following statement.

- Parents work abroad and do not monitor children, 35%
- Parents can't afford clothes for kids and school suppliers, 25%
- Children work together with parents to support families, 11%

Parents view poverty factor as a key element that constrains education process. Indeed, if we look at two last reasons mentioned above by the managers and school teachers, we find that financial need is a major negative factor.

Finally, the dropout rate is 4 times greater in rural areas. One possible reason is a low motivation among students to study further (Popa et al., pp. 20-26, 2011). Taking into considerations the above discussion, we view school network optimization process in Moldova as a possible opportunity for children from rural areas to improve the access and quality of education provided. While the reform may not directly improve the financial state of people from rural areas, it may allow for additional release of the resources what could be reallocated to the target groups.

According to the minister of education of Moldova, Mr. Shleahtischi, the process of school consolidationwill involve approximately 370 schools across the country (25% of all schools in Moldova). The average class size will increase up to 30-35 students for large schools and 25-30 for the rest. The decision on school closure will depend initially on local authorities and the school size will be the key determinant which will influence the decision (Shleahtischi, 2011).

In this paper we would like to investigate what factors influence the efficiency of school performance in the Republic of Moldova, focusing on school size as a key factor given its central role in the proposed policies. Since the final goal of the reform is a better provision of educational services and, as a result, better student's performance, we want to link school size effect and students' outcomes. Hence, the main question that we are going to explore is: does school size affect performance across schools in Moldova?

In order to explore this question we will estimate educational production function (Glewwe, 2002; Coupé et al., 2011). The "average test score" for students from asecondary school is our output variable and input variables are represented by school characteristics such as information about teaching staff and non-teaching staff, language of instruction, total number of students enrolled in school and in classes, total number of students who need to travel (up to 5 km and more than 5 km), expenditures per school, etc.

The data is based on three official sources: i) the Ministry of Educationof Moldova, ii) the Ministry of Finance of Moldova and iii)theNational Bureau of Statistics of Moldova. The data collected from the Ministry of Education of Moldova contains the information about schools and test scores for 2009/2010 years. The data concerning school expenditures on different inputs was obtained from the Ministry of Finance of Moldova for the same years.

The data set is rich in information provided about the schools and it is based on disaggregated data about the entire population of schools in Moldova (approximately 1500 observation). We consider this fact as an advantage since in previous studies with the best specifications examined by Glewwe and Kremer, the small sample size and unrepresentative sample were mentioned as a major drawback: the research work on Brazil with a sample size of 250 schools, Ghana (163 schools), India (902 schools) and Jamaica (355 schools) (Boissier, 2004).

The richness of the data set may allow us to explore the problem from different angles. However, the interpretation of the expected results should be done with caution due to the problems associated with the estimation of educational production function. These are omitted variable bias as student's ability, endogeneity resulted from parents' choice of small schools or from the fact that better schools may attract good students and sample selection problems. We

will discuss these problemsand to what extent they are relevant in case of Moldova inMethodology section.

In Chapter 2, we review the literature of school size effect on student's performance and major findings for developed, developing and transition countries. In Chapter 3, we discussmethodology for estimation education production function and in Chapter 4 we providedescriptive statistics of data used for its estimation. Chapter 5 summarizes our major findings and we conclude with Chapter 6, our major policy recommendations regarding school network optimization process in Moldova.

Chapter 2

LITERATURE REVIEW

Westarttheliteraturereview sectionwith the focus on human capital theory and the importance of investment in education in Moldova. Next we discuss school enlargement from the point of view of opponents and supporters of school consolidation. Finally,wewillfocus on major findings in the framework of developed, developing and transition countries.

The history of human capital theory dates back to 1776, initially introduced by Adam Smith in his famous "The Wealth of Nations". Later two Nobel laureates, Shultz (1960, 1961) and Becker (1975) have broadened the concept of human capital and stressed its role in economic development. According to the authors, experience, training and education are the three key factors that favor human capital accumulation with education being the most important one. In its turn, accumulated human capital, viewed as input in the research and development activity (Romer, 1990) or as a factor of production (Lucas, 1988),facilitates economic growth. That is why the ultimate goal of many government policies is to secure effective provisions for education as a key driver of country development.

A recent empirical study of returns on investment in education in Moldova conducted by Bozu et al. (2007)using the Mincer regression approach revealed that income would increase by 9.5%, all else being equal, withan additional year of schooling (based on Household Budget Survey data from 2006) and by 13.4% with an additional year of schooling (based on the Labor Force Survey data from 2006). The estimates have increased in comparison with the year 2003 and are higher than in neighboring countries (Popa et al., 2011). This tendency may signal

the fact that the lack of human capital starts to become a binding constraint for growth in Moldova.

One may argue that Moldova doesn't invest enough into education. However, the opposite is true, i.e. Moldova invests a lot relative to its budget, but educational outcomes are still low. Though, for Moldova, not a resource rich country, proper investment in education may unlock its innate ability and facilitate future growth.

The existing literature suggests that this poor performance can be at least partly driven by non-optimal organization structure of educational process: school size, class size, student-teacher ratio, etc. These indicators were affected most of all by demographic shifts and country transition from planned to market economy. Moldova together with other former Soviet union countries experienced so many changes that it is reasonable to argue whether current school structure guarantees high quality of education provision. That's why, our research work on optimal school structure and particularly school size is so important for Moldova.

Given the central role of education in economic growth and the need for its effective provision, we will continue our discussion with the debates that favor and oppose school enlargement.

2.1 School consolidation: pros and cons

The opponents of schools consolidation ground their reasons on less cases of social behavior problems (fighting, vandalism, alcohol and drug abuse, disorder) higher student attendance rates and fewer dropouts, better teachers' attitudes, etc. in case of small schools in comparison with larger schools (Cotton, 1996).

Summarizing major findings of Cotton (1996) on the review of 103 research papers which connect school size and education performance we find the following factors that favor small schools:

- minorities and low-income students benefit more from small schools;

- small schools have less incidence of vandalism, theft, drug abuse, etc;
- students' attitude toward schools and particular subjects is better in small schools;
- small schools perform at least as well as larger schools with respect to student achievement (school grades, test scores, evaluation of higher-order thinking skills);
- students attendance in small schools is much better than in larger schools;
- the dropout rates are lower in the case of small schools.

In addition, small schools can create a better environment for the educational process in the sense of belonginess to school. Stiefel et al. (2000, p. 29) claims that students from smaller schools may perform better due to close relationships between teachers and students. Experiencing closer support, students may tend to perform better. Similar results were found by Bryk et al. (1993, pp. 75-78) who argued that close relationships between students and teachers create the sense of community and this, in its turn, facilitates the learning process.

Finally, parents may be better involved in student's process in small schools. The increased parental engagement in children's educational process can be predetermined by the same sense of community that is inherent in small schools. This can lead to better control over children's performance and improved academic achievement all in all (Stiefeletal., 2000, p. 29).

While the supporters of small schools ground their arguments mainly on the behavioral economics, the advocates of larger schools claim that bigger schools are better in terms of economic efficiency and curricular offerings.

The advocates of school consolidation claimed that bigger schools can achieve better outcomes in terms of curricular offerings (Fox, 1981; Walberg, 1992). That

is why small schools are unfair for children who attend them due to limited curricular and extracurricular activities. In addition, Smith andDeYoung (1988) revealed that students from larger schools may perform better due to having different teachers every academic year[5]. Also, the authors consider that bigger schools with a variety of socio-cultural groups could be better for minorities, who could find their own group there.

Referring to economic efficiency, the proponents of big schools claim that larger school can be more effective than small schools due to economy of scale. However, it is not always the case. In labor-intensive service organizations the effect of size and efficiency can be negative (Gooding and Wagner, 1985).
After considering basic arguments of proponents and opponents of school consolidation, we next consider studies on the effect of school size in the framework of developed, developing and transition countries.

2.2 Evidence from developed and developing countries

One of the recent works for developed countries is presented by Leithwood and Jantzi (2009) for schools in the US and Canada. Using data from 57 empirical studies, the authors found that students with weak socio-economic backgrounds benefit most from attending small schools. The authors suggest that the elementary schools with large proportion of such children should be no larger than 300 students, while for other students the school size can be increased up to 500 people. Following the same approach for secondary schools, the authors claim that schools size for disadvantaged students should be limited up to 600 students and 1000 students in case of relatively advantaged students.

[5] Authors consider this fact as a beneficial for students since they won't get used to single method of teaching and will experience different methods.

Earlier, Garrett et al. (2004) performed a large review of education reports mainly for American and British schools. About 4000 reports were considered and only 31 studies were left for further analysis. Two-thirds of 31 studies were for the USA schools and one-fifth for British schools.We can summarize authors' findings in the following way:

1. **Studies that don't control for prior attainment**. 15 works were determined: half of them found positive effect of school size on educational performance and half of them revealed negative effect of school size on educational outcomes.
2. **Studies that control for prior attainment.** 4 studies found optimal school size that varied within and across these studies from 600 to 2155 students per school.
3. **Studies that consider behavior and attitude issues.** In all studies a negative relationship between school size and the "feelings of engagement, connectedness and participation" was determined. At the same time, the results concerning violence proved to be controversial: "some types of violent behavior increased as school size increased, whereas other types of violent behavior decreased as school size increased[6]" (Garrett et al., 2004, p.3). Dropout rates seem to increase together with school size. Finally, authors conclude that teachers from smaller schools tend to have more positive attitude towards educational environment.

[6] Ma (2001) using data of 1996 New Brunswick School Climate Study for 6,883 sixth grade students and 6,868 eighth grade students found negative statistically significant effect of school size on bullying for both grades.

Another recent work for developed and developing countries is represented by Gabriela Schütz (2006). Based on TIMMS data for students at the 8th grade from 51 countries (approximately 237,833 student observations in full sample), she found a linear statistically significant relationship between schools size and performance in case of 9 countries and both linear and quadratic relationship for 15 countries. For the rest of 27 countries neither linear, nor quadratic effect was found.Next the author controls for family background, teachers' and schools' effects: in 8 cases of 15 countries the coefficients remained statistically significant for both linear and the quadratic estimates of school size. These are Bahrain (623)[7], Belgium (1188), Chile (3822), Indonesia (3535), Lebanon (3005), Serbia (1107), Singapore (862) and South Africa (1519). Only in the case of Singapore a u-shaped relationship between school size and performance was revealed. In general, the author concludes that bigger schools perform better.

In addition, Schützfound no clear evidence of difference in the effect of school size among students with different socio-cultural and economic backgrounds. The exception in this case is Belgium and Hong Kong, where the difference is significant and children with disadvantage backgrounds benefit more from attending larger schools.

We need to mention here that Schütz used in her estimated sample data for Moldova, and she didn't find any relationship between school size and performance based on 115schools. It is approximately 10% of our estimated sample, which exhausts almost entire population of schools in Moldova. The author agrees with the fact that for some countries"…the school sample is rather small and not representative for the population of schools" (Schütz, p. 4, 2006). Finally, due to TIMMS data limitation, it is not clear how the author avoids the

[7] Hereafter, the number in brackets indicates the optimal school size found by the author. The exception is Singapore, where non-optimal school size was revealed.

problem of non-random selection of students into the test. That's why, as for now, we should treat her results for Moldova with caution.

2.3 Evidence from transition countries

The literature on the effect of school size on education performance is not so rich for transition countries in comparison with the number of research works done for developed and developing countries. Most of the works on schools in transition countries started appearing together with the demand for school network optimization and better policy recommendations.

The most recent work in this area is represented by Coupé et al. (2011), in the case of Ukraine. Based on the information for 11683 Ukrainian schools and test scores of school graduates in Ukraine's External Independent Test (EIT), the authors found that school size typically has a positive effect on the school's mean exam score in all specifications. And this effect is bigger for urban schools. In addition, the authors revealed that bigger schools have a higher participation ratio (the share of students taking the exams relative to the number of students enrolled in graduate class).

Similar results were obtained by Bukowska and Siwinska-Gorzela (2010) who estimated the effect of school size on the quality of education in Poland and earlier by Kallai et al. (2004) in Romania. Positive and statistically significant effect of school size was found both for urban and rural schools in the case of Poland and mainly for girls in the case of Romania. The effect was stronger for urban schools.

A negative effect of school mergers and reorganization on performance in mathematics was found byGyongyosi (2011) in Hungary. Merging reduced performance by 3.5 points and reorganization resulted in 2.5 points less or in

3.5% and 2.5% of the standard deviation, respectively. However, after inclusion of control variables the impact of merging is statistically significant only in one specification, while the effect of reorganization turned to be insignificant.

Finally, we looked at the World Bank (2010) review of schools autonomy reforms in Bulgaria. Here school enlargement resulted in decline of net enrollment[8] and no clear evidence of improvement in educational outcomes. The authors concluded that "linguistic minorities" performed better in small schools than in larger schools. At the same time, reform allowed generating considerable financial savings[9].

Summarizing the literature review section, one can notice that the effect of school size differs across and within countries: in case of residence type (rural or urban schools), genders (males or females) and other aspects (ethnicity backgrounds, socio-economic status). It proves the fact that country specific study is needed. As it was mentioned by Boissiere (2004) "each country needs to analyzeits own experiences with a wide spectrum of research techniques" (p.30).

[8] The net enrollment declined from 100% in 2006 to 93% 2009.

[9] The reform increased the wage in educational sector by 140% from 2001 up to 2008.

Chapter 3

METHODOLOGY

This section starts with the motivation of inputs for the estimation of educational production function. Next we focus on the educational production function model, appropriate specifications and possible problems associated with its estimation.

The basic model what we are going to estimate is educational production function:

$$T_i = \beta_0 + \beta_1 CInd_i + \beta_2 Z_i + \beta_3 SS_i + \beta_4 SS_i^2 + \varepsilon_i$$

where **T** is an average measure of school performance for students who graduated secondary school **i.**

Z is a vector of school resources, such as teaching staff and non-teaching staff, school budget.

CInd is a vector of control indicators, such as the language in which the test was taken (usually it is the same as the language of instruction in schools), ethnicity of students, type of residence, community characteristics, etc.

SS is a school size represented by the total number of students enrolled in school i.

$SS^2$is a school size squared. We introduce this variable in order to explore if there is an optimal school size for Moldova.

Given the central role of secondary education in educational system, being terminal (for those who don't wish to continue studies further) and being preparatory at the same time (for those who is going to continue studies in middle school or to enter lyceum and vocational schools), we use the mean test

score for graduates of secondary education as agood measure of school performance in Moldova. There are also papers that use students' dropouts, attendance rates and student attitudes as a measure of educational outcomes (Hanushek, 1979, p.335). Due to the lack of information for these indicators we don't use them.

Next we discuss the choice and motivation for the educational inputs in the production function. We ground our reasons on economic theory and the experience of other researches in this field.

School resources: Poor school facilities (absence of heating, medical office, lack of computers, library, swimming pool, gym, etc) may result in low student outcomes. Access to modern computers and libraries may enlarge a student's knowledge and improve performance (Osin, 1998). In addition, empirical findings by Lorton and Walley (1979), Hallack (1990), Adeogun and Osifila (1995) suggest that unattractive old school buildings, crowded or, in contrast, empty classes, lack of adequate surrounding infrastructure may contribute to poor students and substandard overall school performance.

Teaching staff: This is one of the most important educational inputs, used in almost every education research paper, since it is the primary source through which the learning process occurs. Hanushek (1992) claimed that the effect of having good teachers may increase the student performance by more than one-grade level. The teacher's quality may have an even stronger effect on pupils and, as a result, school outcomes than leaner background characteristics (Darling-Hammond, 2000). In order to measure the degree of attention that student get we will use students-teacher and students-non teaching staff ratios.

Institutional characteristics and location: Given the difference in rural and urban areas of Moldova highlighted in the introduction, we believe that students

from rural and urban schools may have different performance outcomes. Private and public schools may allocate the resources differently (Pritchettet al., 1999). However, the empirical findings show that after controlling for unobserved school characteristics there is not too much difference between private and public schools (Vandenbergheand Robin, 2000). The exception from this case can be Belgium, where there is a significant difference between public and private schools. In order to control for additional institutional characteristics (economic and demographic situation), we will use the unemployment rate for the community at the end of 2009, the share of families with single parent, the share of families which benefit from government support, the share of families with many kids for every community where the school is located.

Students: There is a wide array of literature that claims that student background characteristics greatly affect educational outcomes. We will include a set of demographic indicators that contain the information about the ethnicity of children, language of instruction, etc. Since the school network optimization process in Moldova may lead to the need for transportation to school for some pupils, we also explore this effect on overall school performance. We have the information for some schools in Moldova that have students who need to commute to school. Using this data we can explore how the need to commute may affect educational outcomes.

Before to move to the discussion of our results, we need to mention potential problems associated with the estimation of educational production function.

Potential problems with the estimation of educational production function

Omitted variable bias

The omitted variable bias may result due to the exclusion of an important variable that may affect student's achievement and, as a result, school performance. It can

be parental background, children's ability, etc. In case if not included variables are correlated with the explanatory variables the produced estimates will be biased and inconsistent. One way to control for school composition is to use the lagged value of achievement measured as a test score (Goldhaber and Brewer, 1997; Hedges et al, 1994).For the purpose of our analysis we will use lagged value of mean test score for 2009 as a control for school unobserved ability. Since we are working with school level data, to control for "parental background" we will use the information regarding vulnerable groups in community where the school is located: share of families with 3 and more kids up to 18 years, share of families with one parent, share of families which benefit from government support.

Endogeneity

Endogeneity is present when the explanatory variables and the error term are correlated. Hence, the OLS is no longer unbiased, nor consistent. In the case of school size effect, the problem of endogeneity may result from the fact that parents may choose the school for children and more wealthy parents may afford better schools. While the parents from rural areas may not choose the school, the exogeneity of school characteristics is still doubtful (Glewwe et al., 2005). It results from the fact that parents can still affect children outcomes by lobbing them to better classes, so called within-school selection (Asadullah, et al., 2006).In addition, more experienced teachers may choose schools with greater resources and better performing students (Klein et al., 2007).

To what extent is the problem of endogeneity relevant for the case of Moldova?

In our estimated sample we have 946 rural schools and 263 urban schools. Almost all rural communities have only one school, usually with one class. Hence, the assumptions that parents can allocate their kids to better schools or place kids to better classes can be relaxed in case of schools from rural areas. The allocation

of students to better schools could be possible in case of urban schools, especially in Chisinau and Balti, and it is more common for privately operating schools which can attract more resources and, as a result, better teachers and facilities. Since we are focused only on ordinary public schools, the problem of school selection in urban areas can be minimized. However, it is still present and can't be ignored as in the case of schools from rural areas.

Another issue is the selection of students into the test. Since the exam is mandatory and students can't graduate secondary school not taking the test, weneglect the problem of students' selection into the test. However, while students can't choose to pass or not to pass the test, schools can disqualify weaker students from taking the exam and allow stronger students to pass it. In order to identify these schools we will use students-participation ratio[10].We ground our motivation on the following reasons: first, the data regarding officially registered students in schools was dated by the 1st of January 2010. All students who were studying at school X were already registered. Those who wanted to change the school in graduated year could do that in the beginning of the year (before the data was collected) and to pass additional tests. Second, it is not allowed to change school during graduated year in Moldova. In our case, it is more realistic to assume that higher than 1 student participation ratio was due to students who had to re-take the examination because of falling grade in 2009 year or simply because some students were disqualified from taking the test in 2009 year due to poor performance during graduate year. Unfortunately, we don't have information about the number of students who came to re-take the test from the previous year and whether these students influenced the participation ratio

[10] We obtained student participation ratio dividing total number of test takers by the number of graduates in 9th class.

greatly[11].Though, following the above discussion we restrict participation ratio to one if it is greater than 1.

Next, in order to control for community size, we use officially registered population in a village or town at the end of 2009[12] year.In such a way we control for the fact that bigger communities could have bigger schools and for the possibility that parents or better teachers moved to bigger communities what could result in better schools (Coupé et al., 2011, p.16).

Finally, we add a variable that stands for language of instructions at school. Historically in Moldova we have two officially recognized languages of instructions at schools: Russian and Romanian. In our sample we have 67 schools that practice two languages of instruction, the rest of school have the single language of instructions. It means that if we have 2 schools in community, which have different languages of instruction (for instance, Romanian and Russian), Russian speaking families will allocate children to Russian schools, even though school with Romanian language of instruction could be better to some extent. Hence, the ease of kid's allocation to "better" schools by the parents could be restricted by their native languages spoken at home.

[11] For instance, if 5 students were disqualified from taking the test in 2010 year, and 5 students came to re-take the test from the previous years, the participation ration would be 1. However, true participation ratio should be less than 1.

[12] It is not exact the same number that was 9 years ago when current graduates entered the school. Though, this indicator measures officially registered number of people in the community and it differs from the permanent population (what is more exposed to changes since 2000 year). That is why it could be a good approximation of the population in 2000 year.

Chapter 4

DATA DESCRIPTION

For our analysis we use the disaggregated cross-sectional data for the whole population of schools in Moldova (approximately 1500 observations), which is administrated by the Ministry of Economy of Moldova. Information about expenditures per schools was extracted from BOOST database publically available at the Ministry of Finance web-site. The data about socio-economic characteristics of communities where the schools are located was obtained from the National Bureau of Statistics of Moldova. Every school has its own identification number in every database, what allowed connecting the information available.

The key variables in our analysis areschool mean test score and school size. The set of possible input variables is summarized in **Table1**.

The initial data set obtained from Ministry of Economy accounted 1489 observations. After restricting the sample size to the number of schools, which had secondary education graduates[13], and merging this database with information regarding schools' performance we came to 1210 observations. Next, following the recommendation of people familiar with MoE database we restricted our sample to 1158 observations. Namely, we excluded schools for which we didn't have the complete information regarding school size, class size, teaching staff and non-teaching staff.Also, we dropped schools which had unrealistically high students-teacher ratio and class size. For the purpose of our analysis we restricted further our sample to the total number of controls used. Our final sample amounts 836 observations. We still consider the restricted sample to be

[13]Mostly we dropped primary schools.

representative for the population of schools in Moldova, it contains almost the whole set of rural schools and urban schools located in the towns (rayon centers)[14].

To control for unobserved factors that could influence schools' performance we add community characteristics and socio-economic vulnerable groups, namely:

officially registered population in community at the end of 2009
unemployment rate in community at the end of 2009
share of families with 3 and more kids up to 18 years at the end of 2009
share of single families in communityat the end of 2009
share of families who benefit from government support at the end of 2009

Following our discussion from the Introductory section, we expect to find a negative relationship between presence of vulnerable groups in community and overall school performance in Moldova.

Tables 2 and **Table 3** provide basic descriptive statistics of variables used in our analysis. In **Table 2** we divided the country in 3 officially recognized parts and in **Table 3** we presented the break-down of schools' mean test scores and inputs by urban and rural areas. In such a manner we want to explore whether there is any difference in schools' performance and absorption of educational inputs across country and residence type. In addition, in **Tables 4** and **Table 5** we provided descriptive statistics for controls used for educational production function estimation.

Based on the information from the **Tables 2** and **Table 3**, we can conclude that performance and school resources differ across country regions as well as between rural and urban areas. Namely:

[14] Mostly we dropped schools from Chisinau and Balti (urban areas) for which we didn't have the whole set of control variables.

1. Schools from North region seem to perform better based on average school test score in 2010. These schools scored 7.074 points, on average. It was slightly higher than schools' mean from Central and South regions, 6.68points and 6.86 points respectively. At the same time, there is limited variance across schools' performance within the regions. Standard deviation equals 0.59 points for schools from North and Central regions and 0.53 point for schools from the South region. In addition, we notice that urban schools perform better than rural schools. Schools from towns score 7.16 points, while schools from villages score 6.80 points, on average. Regarding participation ratio, on average, it is almost the same for all regions, rural and urban schools. It scores 95.63%,on average, with standard deviation 7.1%.

2. School size is not distributed evenly across regions and residence type. The smallest schools are found in the Northern region. The average school size there is 252 students with mean capacity 500 students in comparison with schools from the Central region, 295 students with average capacity 527 students, and from the South region, 319 students with capacity 585 students, on average. The same it is true for schools from rural and urban areas. Schools from rural areas have, on average, 258 pupils with mean capacity of498 people, while schools from urban areas have, on average, 442 students with mean capacity of 723 people. Also, we notice a high variation in school size and capacity across the regions and residence type, 196 and 313 people respectively.

3. Class size amounts to 20 students, on average, for schools from the Central and the South regions, and 18 students for schools from the North region. We notice a higher difference in mean class size in case of urban and rural areas, 21 and 19 pupils.

4. Mean students-teacher ratio is the lowest in case of North region schools, approximately 10 pupils per teacher in comparison with approximately 11 students per teacher in our regions. At the same time, mean expenditures per student (7,563 MDL) are slightly higher in the North region in comparison with other parts of the country.There is a little difference in distribution of teaching staff if we disaggregate our sample into rural and urban schools. On average, students-teacher ratio is 11 with standard deviation 3.4students per teacher. However, financial resources are not distributed evenly across rural and urban schools. Schools from urban areas consume 8,112 MDL per student on average, while schools from rural areas benefit from 7,324 MDL per pupil.

5. Mean students-nonteaching staff ratio is more volatile withincountry regions, rural and urban areas. At the same time, it doesn't deviate a lot across country regions, it amounts to approximately 17 students per non-teaching personnel. We notice higher volatility if we disaggregate the sample into rural and urban areas. On average, rural schools have 16 students per non-teaching staff in comparison with 22 pupils per non-teaching personnel[15].

Based on the **Table 4** and **Table 5** we conclude that schools from the North region performed better in comparison with other regionsin 2009. They scored, on average, 7.08 points in comparison with 6.73 points for schools from the Central region and with 6.89 points for schools from the South regions. Rural schools performed worse relative to urban schools in 2009 as well as in 2010. As for the number of students who need to commute, it is the highest, on average, in case of the Central region. It is almost twice higher (151 students) than the mean

[15] For some schools we have very high students-nonteaching staff ration, 80 students per person or even more. It may look unrealistic, but it is indeed a case for Moldova. For instance, a teacher can be a librarian (nonteaching staff) and an instructor of craft (teaching staff) at the same time. Thus, very high students-nonteaching staff ratio may be a sign of such combined activities when only maintenance is left as nonteaching personnel.

number of students who need to commute in order to get to school in the North and South regions, approximately 75 students there. As for the unemployment rate, south region seems to be more deprived in comparison with over parts of the country, 12.21% on average. Also here the highest share of families with many kids was registered, 4.72%, in comparison with 2.36% in the North region and with 3.97% in the Central region.

Chapter 5

EMPIRICAL RESULTS

This section provides empirical results regarding estimation of educational production function.

First, we run OLS regression using school resources without any demographic or performance controls (Table 6,specification 1).

We find

1. A positive statistically significant school size effect. Namely, increasing school size by **100 students**we increase school performance by **0.141 points**or it is equivalent to**25%** of thestandard deviation in school performance. With 10% significance level we can conclude that there is an optimal school size for Moldova, **1195 students**. But this size is outside of our sample range.This illustrates the fact that schools in Moldova are currently smaller than optimal.
2. Negative statistically significant effect of students-teacher ratio and positive statistically significant effect of students-nonteaching staff ratio. Findings show that increasing the number of students per one teacher by **1 student**, the performance reduces by **0.0827points**, and raising the number of students per one nonteaching staff by **1 pupil**we increase the performance by **0.00738 points**. One possible explanation here that students in Moldova benefit from more attention from teaching personnel. As for non-teaching personnel, we can assume that, for instance, librarians are more productive or more motivated to work with more students attending libraries (read books), the same could be true for personnel involved in extra-curricular activities like sport sections.

3. No class size effect. One may argue that it is due to correlation with students-teacher ratio. For this purpose we estimated the same specification (1) dropping students-teacher and students-teacher squared ratio. Even then we didn't find any significant effect of class size[16].

Next we run OLS regression using the set of controls for unobserved factors (Table 6, specification 2). We added lagged value of school performance (mean school test score in 2009), we also include dummy for residence type (urban or rural), language of instruction[17], share of Moldovan students enrolled in school, population and unemployment rate in community where the school is located. Also, we add a set of variables that stand for vulnerable groups in community where the school is located, particularly, share of families with 3 and more kids up to 18 years, share of families with single parent, share of families who benefit from government support.

We find

1. Positive statistically significant effect of school size on educational performance. Though, the effect is smaller after controlling for school composition. Increasing school size by **100 students**, we raise performance by **0.095 points** or by **16.8%** of thestandard deviation in school performance. With 5% significance level we can conclude that there is an optimal school size, approximately **777 students**.It is for 519 students more than average school size in rural areas and for 335 students higher than mean size of urban schools. It is closes to average capacity of urban schools (723 students).
2. Positive statistical significant correlation between last year school performance

[16] The output could be presented upon request.

[17] Language of instruction is the same as the language in which the test was taken.

and current outcomes. Additional **1 grade** scored last year contributed to **0.375 points** increase in current performance.

3. No class size effect.

4. Positive effect of students-nonteaching staff ratioand negative effect of students-teaching staff ratio. In the case of students-teaching staff ratio, the effect slightly decreased after adding controls: increasing the number of students per one teacher by **1 pupil**, we decrease performance by **0.0612points** or by **11%** of standard deviationin comparison with 15% of standard deviation reduction in specification 1.

In addition, we find that

1. Increasing share of Moldovan students by **1%** in overall number of students enrolled, the performance increases by **0.00121 points**. Also, we tried to use dummy variable for ethnicity denoting by 1 if share of Moldovan students exceeds 50% of the total number of students enrolled in school and 0 otherwise. Using the same specification we found that schools with majority of Moldovan students are **11%** more likely to perform better than other ethnicities[18].

2. Schools with single language of instructions, Romanian or Russian, are more likely to perform better, **12.2%** and **16.7%** respectively, than schools that practice both languages of instructions.

3. From all vulnerable groups available only families with many kids seem to affect negatively performance. Namely, increasing the share of large families by **1**

[18] The results are not presented and are available upon request.

percentwe decrease school performance by **0.0176 points**. Recalling our discussion in introduction, it is indeed the case for Moldova, especially in rural areas, where kids from big families may experience lack of parents' supervision or they are simply working with parents supporting families.

The input variables explain **27.3 percent** of variation in mean school test score.

Since we have less observation for per pupil expenditures, we run OLS with this additional input separately (Table6, specification 3).

We don't find any effect of expenditures on overall school performance.

Again, we find positive statistically significant effect of school size and students-nonteaching staff ratio and negative statistically significant effect of students-teacher ratio. Findings reveal optimal school size, which equals **686 students**. In addition to optimal school size, with 5% confidence level we can conclude that there is non-optimal students-teaching staff ratio for Moldova. It equals **27students** per one teacher. Non-optimal students-teaching staff ratio is much higher than country average indicator, 10.5 students per teacher, and it is possible that it is driven by some outliers.

Finally, we have around 170 observations for schools with children who need to commute to get to school. Matching this information with specification (2) we find that increasing number of students who need to commute to school by **100 kids**we reduce school performance by **0.0659 points**orby **12% of standard deviation** (Table 6, specification 4).Another interesting finding in this specification is the negative effect of families with single parent on educational performance, namely, increasing the share of families with one parent by 1% we decrease performance by 0.0223 points.We don't possess additional information about these schools in order to answer whether the need to commute resulted in worse performance of kids from families with single parents or maybe these kids performed already poorly due to some other reasons. Though, these results seem

to coincide with our prior assumption about the need to commute and its negative effect on education outcomes especially for children who are left at home by the parents while working abroad. However, due to fewer observations in this specification, this result should be treated with caution.

In order to perform one more robustness check we disaggregate our sample into rural and urban schools. As it was mentioned in Methodology sections, rural data is less affected by the endogeneity problem. Hence, disaggregating the sample we may obtain cleaner estimates. Based on output from **Table 7**, we notice that positive statistically significant school size effect is present in all specifications after adding controls and in specification (2) for rural schools. The effects of other estimates (sign and almost the same magnitude) for rural schools areconsistent with the estimates from **Table 6.**

Noteworthy is thatthe results differ with respect to students-teaching and students-nonteaching staff ratios for rural and urban schools respectively. The effect of students-teaching staff ratio has negative statistically significant effect on the educational performance of rural schools and no effect on overall performance of schools from towns. At the same time, students-nonteaching staff ratio has positive statistically significant effect on schools' performance from urban areas and no effect on educational outcomes of rural schools.

In addition, we again find negative effect of large families in rural communities on educational performance, mixed rural schools with 2 languages of instructions seem to perform worse than schools with single language of instruction, namely Russian, and increasing share of Moldovan students in rural schools the performance tends to improve.

Finally, in order to check whether the estimates produced by OLS are unbiased and consistent, we perform formal check for endogeneity using theHausmantest (1978). For this purpose we use capacity as an instrument for schools size and capacity squared as an instrument for school size squared. We ground our motivation on the fact that capacity is exogenous to the current performance since it was determined long ago and, hence, it represents history. Following all the steps in the Hausmantest, we found that school size and school size squared are exogenous[19]. Thus, there is no need to use an instrumental variable approach since the estimates obtained by OLS are consistent.

[19] The results are not presented in this work and are available upon request.

Chapter 6

CONCLUSIONS

In this thesis we tried to analysis the effect of school size on school performance in the Republic of Moldova. Our findings support the claim that enlargement, indeed, favors the improvement of educational performance across schools, especially for rural areas where we have more reliable estimates.The obtained optimal school size, 777 students, is slightly higher than mean capacity of urban schools (723 students) and could be used as a starting point in the network optimization agenda.

In order to estimate educational production function we used OLS method with a set of succeeding robustness checks. We broke down our estimation process in 2 stages: first we estimated educational production function without controls and second with controls for school composition and community characteristics that could affect overall school performance.

Besides revealing positive school size effect, our findings suggest different issues that could be potentially taken into account by the policymakers during school network optimization process in Moldova. For instance, schools with single language of instruction, Russian or Romanian, tend to perform better in comparison with the mixed schools, as well as schools with the majority of Moldovan students. At the same time, students in Moldova benefit from higher degree attention from teaching staff expressed in terms of students-teacher ratio and the increase in the number of students per teacher may harm the performance. While increasing the number of students per non-teaching staff, the performance tends to improve. This is true especially for schools from rural areas.

Another important finding is that need to commute, indeed, negatively affects the performance. With respect to this issue, this work seems to be progressive since many papers stress potential negative effect of commuting on educational outcomes not testing empirically the affect.

While we tried to estimate the effect of school size on educational outcomes from different angles, there is still room for further research. For instance, in our work we just focused on secondary education graduates, not looking at the performance of kids from primary schools. It could be relevant to explore how the school size and the need to travel to new school may affect these groups of students since they may be more sensitive to the following agenda.

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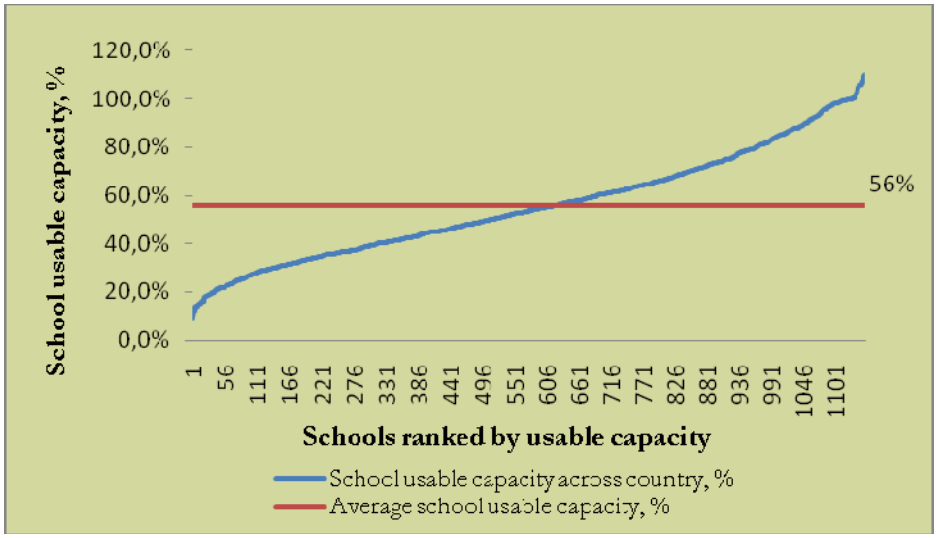

Figure 1. Usable capacity[20] across schools in Moldova in 2010.

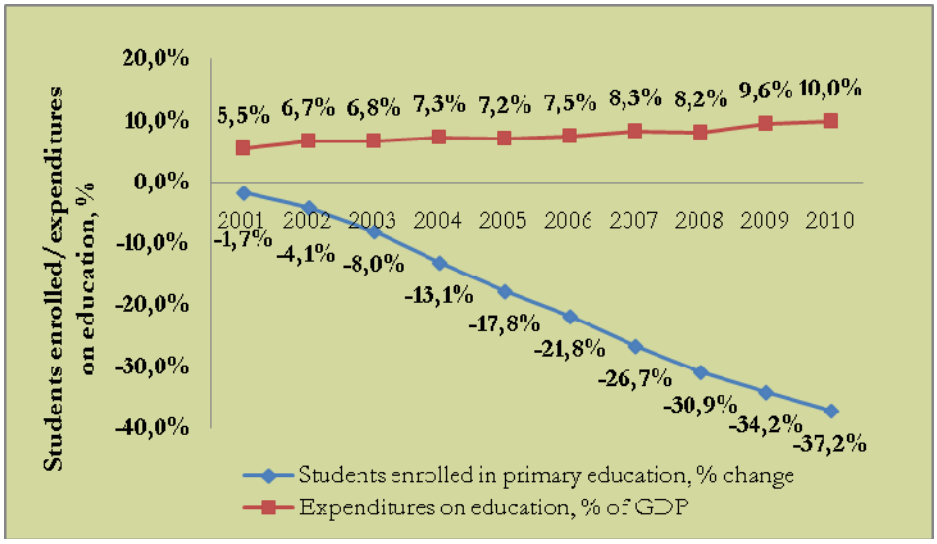

Figure 2. Dynamics of students enrolled in primary education and expenditures on education as share of GDP in Moldova, 2001-2010[21].

[20]Usable capacity was obtained dividing schools size by school capacity

[21]2000 year was used as a base year for enrolment rate calculation

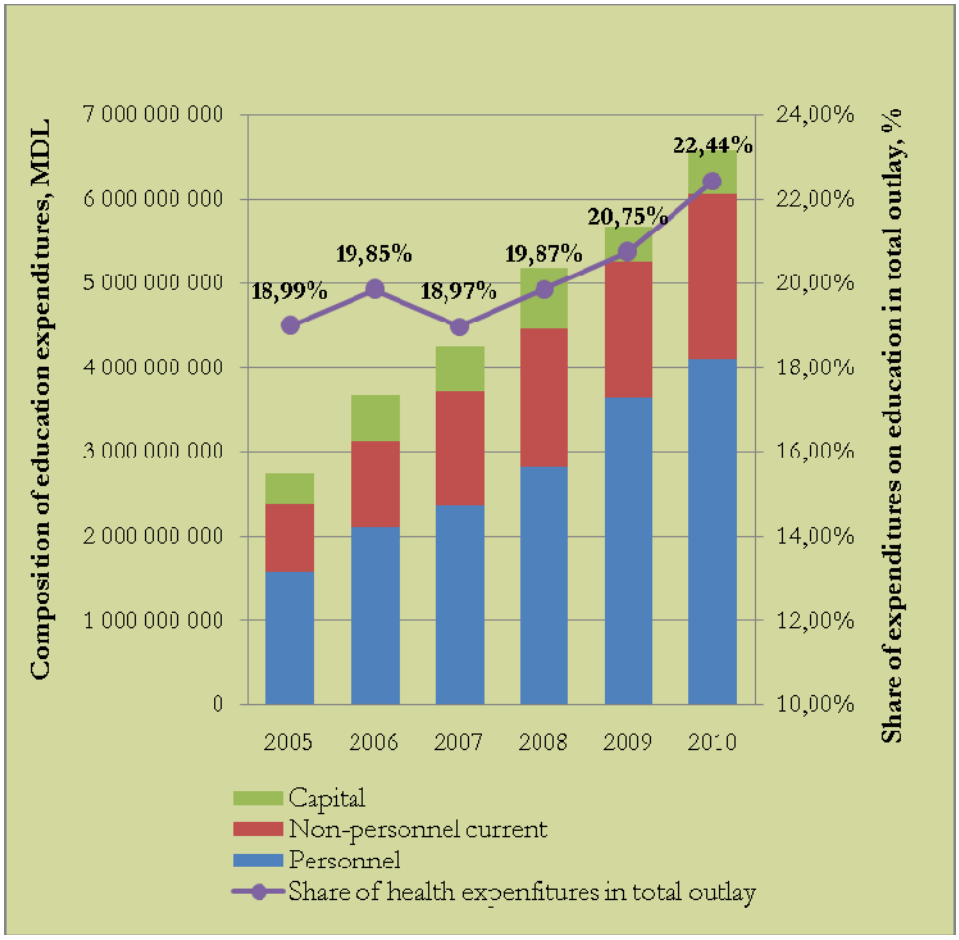

Figure 3. Composition and evolution of expenditures on education relative to total government spending in Moldova, 2005-2010.

Table 1. Variables used for educational production function estimation

Indicator	Measurement	Data
School specific demographic and performance indicators		
Language of instruction	Dummy variable: Russian or Romanian, both Romanian and Russian languages of instruction	MoE
Residence type	Dummy variable: urban or rural	Author's calculations
Ethnicity	Numeric: share of Moldovan students relative to the total number of students enrolled	MoE
School mean test score 2009	Numeric: average test score per school for secondary education graduates in 2009	MoE
School mean test score 2010	Numeric: average test score per school for secondary education graduates in 2010	MoE
Participation ratio	Numeric: share of students who took the test relative to the total number of students in graduate class	MoE
School resources		
School size	Numeric: number of students enrolled in school	MoE
Students-teacher ratio	Numeric: total number of students divided by total number of teachers	MoE
Students-non-teaching staff ratio	Numeric: total number of students divided by total number of non-teaching staff	MoE
Class size	Numeric: number of students in graduate class (9^{th}) divided by total number of classes (9^{th})	MoE
Per student spending	Numeric: amount of spending per school divided by number of students enrolled	MoF
Students to commute	Numeric: number of students who need to commute in order to get to school	MoE
Capacity	Numeric: maximum potential number of students that could be enrolled in school	MoE
Community specific indicators		
Unemployment rate	Numeric: relative number of unemployed people in community at the end of 2009	NBS

Table 1. Variables used for educational production function estimation – Continued

Indicator	Measurement	Data
Population	Numeric: total number of people registered in community at the end of 2009	NBS
Share of large families in community at the end of 2009	Numeric: number of families with 3 and more kids up to 18 years in community relative to total number of families	NBS
Share of single families in community at the end of 2009	Numeric: number of families with 1parent in community relative to total number of families	NBS
Share of families who benefit from government support	Numeric: number of families who benefit from government support relative to total number of families in community	NBS

Table 2. Basic descriptive statistics for schools from country regions: school resources and performance

		Schoolsize	Classsize	Students_ teachingstaffratio	Students_non-teaching staffratio	Capacity	Perpupils pending	Meantestscore_2010	Participationratio
North region	**mean**	**252**	**18.32**	**9.668**	**16.58**	**499.7**	**7,563**	**7.074**	**95.67**
	min	48	4	3.6	1.6	80	520	5.5	40
	max	1,221	39	22.93	62.8	1,360	21,000	8.667	100
	st.dev.	179	5.945	2.881	7.646	286.9	2,390	0.5923	7.647
	N	274	274	274	274	274	220	274	274
Centralregion	**mean**	**295**	**20.16**	**11.55**	**17.84**	**527.7**	**7,308**	**6.682**	**95.21**
	min	58	5	2.979	2.509	70	401	5.304	47.06
	max	1,156	35	40.33	89.6	2,070	47,000	8.182	100
	st.dev.	202	5.181	3.502	8.714	317.6	3,302	0.5009	7.53
	N	347	347	347	347	347	275	347	347
South region	**mean**	**319**	**19.99**	**11.25**	**17.38**	**585.2**	**7,441**	**6.872**	**96.24**
	min	50	7	4.174	4.09	95	669	5.067	65
	max	1,003	36	28.7	83.5	1,694	25,000	8.582	100
	st.dev.	199	5.148	3.598	9.394	331.6	2,814	0.533	5.542
	N	215	215	215	215	215	174	215	215
Country	**mean**	**287**	**19.51**	**10.86**	**17.31**	**533.3**	**7,426**	**6.859**	**95.63**
	min	48	4	2.979	1.6	70	401	5.067	40
	max	1,221	39	40.33	89.6	2,070	47,000	8.667	100
	st.dev.	196	5.493	3.437	8.573	313	2,900	0.5655	7.117
	N	836	836	836	836	836	669	836	836

Table 3. Basic descriptive statistics for schools from rural and urban areas: school resources and performance

		School size	Class size	Students_ teachingstaffratio	Students_non-teaching staffratio	Capacity	Perpupil spending	Mean testscore_2010	Participationratio
Rural	**mean**	**258**	**19.16**	**10.84**	**16.42**	**498**	**7,324**	**6.803**	**95.5**
	min	50	4	2.979	2.509	70	401	5.067	47.06
	max	996	39	40.33	89.6	2,070	25,000	8.667	100
	st.dev.	162	5.472	3.416	7.591	291	2,315	0.5511	6.889
	N	704	704	704	704	704	582	704	704
Urban	**mean**	**442**	**21.41**	**10.94**	**22.05**	**723**	**8,112**	**7.159**	**96.3**
	min	48	7	3.6	1.6	140	3,388	5.5	40
	max	1,221	36	20.7	83.5	1,568	47,000	8.582	100
	st.dev.	273	5.232	3.56	11.5	359	5,344	0.5485	8.223
	N	132	132	132	132	132	87	132	132
Country	**mean**	**287**	**19.51**	**10.86**	**17.31**	**533**	**7,426**	**6.859**	**95.63**
	min	48	4	2.979	1.6	70	401	5.067	40
	max	1,221	39	40.33	89.6	2,070	47,000	8.667	100

	st.dev.	196	5.493	3.437	8.573	313	2,900	0.5655	7.117
	N	836	836	836	836	836	669	836	836

Table4. Basic descriptive statistics for schools from different country regions: community characteristics and performance controls

Indicators	Northregion			Centralregion			Southregion			Country		
	mean	st.dev.	N	**mean**	st.dev.	N	**mean**	st.dev.	N	**mean**	st.dev.	N
Meantestscorein 2009	**7.08**	0.63	274	**6.73**	0.59	347	**6.89**	0.56	215	**6.88**	0.61	836
Numberofstudentswhoneedtocommute	**75**	76	50	**151**	146	65	**72**	73	54	**103**	113	169
ShareofMoldovanstudents	**81.18**	31.57	274	**92.78**	20.86	347	**67.84**	39.65	215	**82.56**	31.76	836
Unemploymentincommunity, 2009	**9.02**	9.32	274	**9.37**	9.46	347	**12.21**	10.69	215	**9.99**	9.83	836
Permanent populationincommunity, 2009	**4,655**	6,351	274	**4,583**	5806	347	**5,780**	7,145	215	**4,915**	6,364	836
Share of large families in community, 2009	**2.36**	1.74	274	**3.97**	2.78	347	**4.72**	3.39	215	**3.64**	2.83	836
Shareoffamilies who benefit from governmentsupport in community, 2009	**0.40**	0.33	274	**0.53**	0.45	347	**0.72**	0.81	215	**0.53**	0.55	836
Shareofsingle families in community, 2009	**3.46**	3.39	274	**4.30**	4.14	347	**4.09**	2.93	215	**3.97**	3.63	836

Table 5. Basic descriptive statistics for schools from rural and urban areas: community characteristics and performance controls

Indicators	Ruralarea			Urbanarea			Country		
	mean	st.dev.	N	**mean**	st.dev.	N	**mean**	st.dev.	N
Meantestscorein 2009	**6.83**	0.5941	704	**7.169**	0.647	132	**6.883**	0.6149	836
Numberofstudentswhoneedtocommute	**104**	117	139	**98**	94.051	30	**103**	113	169
ShareofMoldovanstudents	**85.09**	30.263	704	**69.09**	36.04	132	**82.56**	31.763	836
Unemploymentincommunity, 2009	**10.1377**	10.023	704	**9.1929**	8.689	132	**9.989**	9.826	836
Permamentpopulationincommunity, 2009	**2844.67**	2348.92	704	**15954.4**	9094.52	132	**4914.63**	6364.01	836
Share of large families in community, 2009	**3.90242**	2.85179	704	**2.2182**	2.24	132	**3.637**	2.831	836
Shareoffamilies who benefit from governmentsupport	**0.5079**	0.518	704	**0.6758**	0.672	132	**0.534**	0.548	836
Shareofsingle families in community, 2009	**3.684**	2.5045	704	**5.5026**	6.906	132	**3.971**	3.634	836

Table 6. Educational production function estimation

Specifications	(1)	(2)	(3)	(4)
VARIABLES	Mean test score2010	Mean test score2010	Mean test score2010	Mean test score2010
Mean test score2009		0.375***	0.383***	0.350***
		(0.0308)	(0.0347)	(0.0649)
School size	0.00141***	0.000944***	0.00105***	0.00303***
	(0.000373)	(0.000323)	(0.000365)	(0.000786)
(School size)²	-5.90e-07*	-6.05e-07**	-7.65e-07***	-2.43e-06***
	(3.36e-07)	(2.67e-07)	(2.94e-07)	(7.77e-07)
Class size	0.00424	-0.0126	-0.0139	-0.0281
	(0.0252)	(0.0252)	(0.0293)	(0.0343)
(Class size)²	-1.46e-05	0.000424	0.000444	0.000584
	(0.000582)	(0.000574)	(0.000670)	(0.000827)
Students/teaching staff	-0.0827***	-0.0612***	-0.0763***	-0.0530
	(0.0242)	(0.0227)	(0.0248)	(0.0330)
(Students/teaching staff)²	0.00114	0.00100	0.00141**	0.00123*
	(0.000801)	(0.000734)	(0.000719)	(0.000647)
Students/nonteaching staff	0.00738***	0.00703***	0.00755**	0.00106
	(0.00269)	(0.00248)	(0.00300)	(0.00472)
Share Moldovan students´		0.00124*	0.00165**	0.00227*
		(0.000629)	(0.000753)	(0.00123)
Share families with many kids´		-0.0176***	-0.0229***	-0.0183
		(0.00570)	(0.00635)	(0.0126)
Share families gov. support´		0.0112	0.0225	0.0717
		(0.0338)	(0.0356)	(0.0528)
Share of single families´		-0.00450	0.00199	-0.0223***
		(0.00523)	(0.00556)	(0.00761)
Romanian language		0.122*	0.129*	-0.0938
		(0.0635)	(0.0667)	(0.115)
Russian language		0.167**	0.174**	0.118
		(0.0736)	(0.0788)	(0.144)

Table 6. Educational production function estimation – Continued

Specifications	(1)	(2)	(3)	(4)
VARIABLES	Mean test score2010	Mean test score2010	Mean test score2010	Mean test score2010
Unemployment rate		-0.000636	-0.00172	-0.00886**
		(0.00181)	(0.00207)	(0.00433)
Urban		0.0549	0.00376	0.0333
		(0.0640)	(0.0762)	(0.121)
Population		4.59e-06	5.38e-06	1.13e-05*
		(3.78e-06)	(4.25e-06)	(6.79e-06)
Participation ratio		-0.000244	-0.00155	-0.00124
		(0.00262)	(0.00300)	(0.00552)
Expenditures per student			6.55e-06	
			(6.77e-06)	
Students commute				-0.000659**
				(0.000311)
Constant	7.070***	4.418***	4.509***	4.804***
	(0.229)	(0.424)	(0.515)	(0.679)
Observations	836	836	669	169
R-squared	0.090	0.274	0.277	0.395

Robust standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1
Note: Share of families with many kids is equivalents to families with 3 and more kids up to 18 years. ´Community level indicators

Table 7. Educational production function estimation: disaggregation into rural and urban schools

Specifications	(1)	(2)	(3)	(4)
Residence type	Urban	Rural	Urban	Rural
	Mean test	Mean test	Mean test	Mean test
VARIABLES	score2010	score2010	score2010	score2010
Mean test score2009			0.427***	0.366***
			(0.0612)	(0.0353)
School size	0.000980	0.00165***	0.00169**	0.000855*
	(0.000937)	(0.000463)	(0.000821)	(0.000442)
(School size)^2	-5.59e-07	-1.07e-06**	-1.29e-06**	-5.11e-07
	(6.83e-07)	(4.61e-07)	(5.90e-07)	(4.04e-07)
Class size	-0.00673	0.00609	-0.0114	-0.0128
	(0.0616)	(0.0275)	(0.0518)	(0.0284)
(Class size)^2	0.000198	-7.01e-05	0.000323	0.000449
	(0.00132)	(0.000637)	(0.00112)	(0.000656)
Students/teaching staff	-0.00987	-0.0888***	-0.0537	-0.0663***
	(0.0830)	(0.0258)	(0.0709)	(0.0242)
(Students/teaching staff)^2	-0.000410	0.00149*	0.000705	0.00125*
	(0.00338)	(0.000773)	(0.00301)	(0.000708)
Students/nonteaching staff	0.0108**	0.00332	0.0125***	0.00477
	(0.00438)	(0.00323)	(0.00354)	(0.00312)
Share Moldovan students´			-0.000818	0.00158**
			(0.00141)	(0.000731)
Share families with many kids´			0.0122	-0.0190***
			(0.0178)	(0.00627)
Share families gov. support´			-0.00670	0.00777
			(0.0762)	(0.0395)
Share of single families´			-0.000280	-0.0108
			(0.00703)	(0.00760)

Table 7. Educational production function estimation: disaggregation into rural and urban schools – Continued

Specifications	(1)	(2)	(3)	(4)
Residence type	Urban	Rural	Urban	Rural
	Mean test	Mean test	Mean test	Mean test
VARIABLES	score2010	score2010	score2010	score2010
Romanian language			0.244	0.0953
			(0.209)	(0.0655)
Russian language			0.309	0.136*
			(0.248)	(0.0761)
Unemployment rate´			-0.00617	-0.000348
			(0.00501)	(0.00199)
Population´			5.67e-06	2.00e-06
			(4.37e-06)	(1.03e-05)
Participation ratio			0.000670	-0.00146
			(0.00446)	(0.00319)
Constant	6.850***	7.102***	3.709***	4.689***
	(0.673)	(0.242)	(0.758)	(0.491)
Observations	132	704	132	704
R-squared	0.099	0.054	0.351	0.224

Robust standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1
Note: Share of families with many kids is equivalents to families with 3 and more kids up to 18 years. ´Community level indicators