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TRANSITION TO HIGHER EDUCATION EXAMINATION OUTCOMES: DOES HIGH SCHOOL MATTER?

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Transition to Higher Education Examination Outcomes: Does High School Matter?

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Abstract

This paper estimates the impact of school quality on the transition to higher education examination (abbreviated as YGS in Turkey) outcomes by controlling for the student quality. Either the class size or the teacher-pupil ratio in main branches is used as a proxy for the quality of schools. Due to data limitations we concentrate on the Anatolian High Schools (AHS) in Istanbul. This choice gives us the opportunity to control for the student quality by making use of the minimum OKS score required for admission to each AHS. Using YGS scores for 2010&2011 and OKS scores for 2006&2007 corresponding to the same cohort, we find that student quality explains the transition to higher education examination outcomes to a large extent. Holding constant student quality however, we find no evidence that class size or the teacher-pupil ratio affects average YGS score of AHS. This can be explained by the relatively standardized school resources devoted to AHS. The results are robust to different scorings of YGS and to the inclusion of clustering.

Keywords : Education, High schools, Entrance exams, Cluster

JEL Classification : I20, I21, C38

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Transition to Higher Education Examination Outcomes: Does High School Matter?

1. Introduction

Education plays a key role in economic development as a major determinant of a country's human capital stock. Increasing quality of education and individuals' level of education on average help foster economic development and provide individuals with equal opportunity in both social and economic spheres. To our knowledge, there has been little quantitative research related to the quality of education in Turkey, probably due to the data limitations.

In this paper, we attempt to question the quality of high schools in Turkey. Nevertheless, the quality is a concept, which is difficult to measure and is often represented by achievement in test scores. As the high school graduates in Turkey has been much higher than the available student quotas in Turkish universities, a country-wide standardized test scores, under different names are used for placement since 1970s. Lately, it is divided into two such that the scores obtained from the first are used for selection and those from the second for placement. The first step, called the Transition to Higher Education Examination (YGS) is designed to measure high level cognitive skills under reading, math, as well as natural and social sciences. Since it has to be taken by all high school graduates who wish to continue higher education in Turkey, the scores obtained can be considered as the major proxy for the quality of education offered by schools. The student achievement in the YGS may be affected by a host of factors. These include individual and household characteristics such as student ability, motivation, childhood training and experience, gender differences in attitudes, parental and teacher expectations and behaviors besides the quality of the secondary education obtained. Since certain aspects of school quality, unlike most of the other factors, are amenable to policy intervention, this study tries to reveal whether high school matters in outcomes of the YGS.

Turkish case provides a unique opportunity to reveal high school value added since two nationwide examinations are conducted at the beginning and at the end of high schools. Specifically, Anatolian High Schools (AHS), which admit students depending on the scores they obtain in OKS (High School Selection and Placement Examination) conducted at the end of the elementary education by the Ministry of Education, present an opportunity to test the effects of school resources on outcomes in an education production function framework. Furthermore, the use of minimum OKS score required for admission to each AHS as an

independent variable helps to overcome omitted variables bias stemming not only from the student characteristics, but also from student background including family characteristics.

In fact, it would be erroneous to include academic achievement of students from different high schools since high schools have different standards in Turkey as revealed by the previous research and in the first stage of our regression analysis. Therefore, in order to overcome variance that may result from the differences in school standards, only Anatolian High Schools, which select high ranked students in OKS outcomes, are considered. In the second stage, we apply Ordinary Least Square (OLS) regression analysis using two data sets. The first comprises the YGS scores of the years 2010 and 2011. The second is the minimum OKS score required for admission to each Anatolian High School (AHS). This minimum score is used in order to control for the quality of students enrolled. Note that, we use outcomes of OKS 2006 and 2007 since the same cohort graduated from high school and took YGS in 2010 and 2011, respectively. Due to data limitations, we only consider AHS in Istanbul.

In line with the findings of empirical studies on other countries, school characteristics such as class size and higher expenditure per pupil proxied by the number of teachers in each branch considered in different types of scoring of YGS seem to have no significant effect on student achievement. We find that the quality of students enrolled to AHS has a positive and significant effect on the transition to higher education outcomes: as student quality of an AHS increases, average achievement in YGS increases. In other words, the level of achievement at the beginning of high school explains a great deal of student achievement in YGS.

This paper consists of five sections. Section 1 is the introduction. Following Section 2, which is dedicated to the theoretical framework and empirical background, Section 3 presents the data and the methodology. The empirical findings are given in Section 4 while the last section is reserved for the discussion of these findings and the conclusion.

2. ***Theoretical and Empirical Background***

Quantitative research on whether schools matter in student achievement has long been conducted, especially for the United States. The recognition of the importance of human capital formation to both individuals' and society's welfare triggered this interest, since theoretical and empirical analyses showed the positive relationship between schooling and income, productivity, and economic growth. Empirical studies based on the models of endogenous growth developed theoretically during 1990s show that growth rates are affected

by ideas and invention, which in turn are related to the stock of human capital either through research and development (R&D) activities or through adoption behavior. These formulations indicate not only why the level of output is higher when a country has more human capital but also why the growth rate is higher (Hanushek, and Kimko, 2000). Investigations on growth have concentrated on various measures of formal schooling activities as proxies for relevant human capital. The most frequently employed measure is primary- or secondary-school enrollment rate, used, for instance, in Romer (1989), Barro (1991), and N. Gregory Mankiw et al. (1992). These aggregate cross country studies show that initial level of schooling or expansion of schooling of the labor force is an important determinant of economic growth.

The widespread acceptance that human capital is important not only for individuals, but also for the society as a whole as shown by aggregate cross-country regressions on growth, motivated studies that try to measure outcome of investment in education and other inputs for human capital. These are, in general, micro level studies on whether schools matter, which typically make use of output proxies such as achievement test scores in econometric analyses. As it is well known that families and peers have considerable influence on a student's achievement, input proxies include family and peer characteristics as well as school resources, such as teacher-pupil ratio; class size; expenditure per pupil; administrative inputs; facilities; and education, experience, and salary of teachers. In sum, the common framework used in these analyses is to estimate the relationship between educational inputs (family influences, peers, and schools) and outputs (academic achievement tests) at a point in time. This relationship is called ''education production function'' following an analogy to production function approach used in growth estimates.[4]

The literature on the role of school level resources such as classroom size and teachers' experience on student achievement generally finds ambiguous, conflicting, and weak results. One of the earliest studies on the subject - the 'Coleman Report' - widely interpreted as saying that schools did not matter (Hanushek, 2003). Instead, the Report conducted in the mid-1960s by the US government concludes that the most important factor in achievement is the family, followed by peers in school. Unlike the Coleman Report, for which the data is collected specifically for the study, the subsequent analyses on US use the Biennial Survey of

[4] This approach is criticized by Hoxby (2000) since it suggests that inputs translate systemically into achievement, as they do in the production functions of profit-maximizing firms. According to Hoxby (2000), the analogy is a false one, because firms' production functions are not just a result of their ability to turn inputs into outputs. A firm's production function is the result of maximizing an objective (profits), given a production possibilities set. It is not obvious that schools have stringent achievement maximization objectives imposed on them.

Education. This survey is a rich source of information on the average characteristics of public schools in different states at different points in time, gathered from the results of questionnaires sent to the state offices of education inquiring about statewide enrollment, revenues, number of teaching positions, the length of school term, average teacher salaries, and other variables. From the available data, e.g. Card and Krueger (1992) assemble information on three main characteristics: the ratio of enrolled students to instructional staff in the state, the average length of the school term, and average annual teacher salaries. Using earnings data from the 1980 census, they find that among men born between 1920 and 1949, the ones who are educated in states with higher-quality schools, have a higher return to additional years of schooling. Rates of return are also higher for individuals from states with better-educated teachers and with a higher fraction of female teachers. Holding constant school quality measures, however, they find no evidence that parental income or education affects average state-level rates of return.

Hanushek (1996) provides a review of the US evidence of educational inputs such as teacher-pupil ratio and expenditure per pupil. Among the studies on the US, estimates that use cross-state variation in school resources typically find positive effects of school resources, whereas studies that use within-state data are more likely to find insignificant or wrong-signed estimates. For the teacher-pupil ratio, of the 157 estimates surveyed in single state samples, 70% is statistically insignificant and 18% is significant but has a wrong sign. On the other hand, among the 120 estimates related to multiple state samples, only 8% has wrong sign while 74% is statistically insignificant. Hanushek (1996) attributes this difference to omitted state-level variables related to the overall policy environment of each state that bias the multiple state studies. However, according to Krueger (1999) endogenous resource decisions within states (e.g., assignment of weaker students to smaller classes as required by compensatory education) bias the within-state micro-data estimates, and that the interstate estimates are unbiased. In any case, omitted state-level variables bias is not an issue for a study on Turkey, since the same legislation is valid for the whole country. Specifically, Anatolian High Schools in Turkey face the same policy environment.

The fact that empirical analyses on the US data that cover earlier periods of the twentieth century such as that of Card and Krueger (1992), find a positive relationship between school inputs and output measured by earnings, while the studies that use recent data cannot, suggests at least two explanations. First, if added resources have diminishing effects on student achievement, the latter school operations in the US may be largely ‘on the flat’ part of

the production function. In other words, it is possible that for the US, the enormous changes in educational resources did have an effect on outcomes in the first half of the twentieth century, but more recent studies are also correct in finding 'no effect' of changes in school inputs on outputs. Second explanation is related to the proxy used for the outcome. Card and Krueger (1992) analysis employ labor market earnings as the output while most analyses use standardized test scores. It is possible that schools do not affect test performance of students but do affect earnings. However, since earnings data is not available, it is not possible to conduct such an analysis for Turkey. On the other hand, the relationship between school inputs and outputs can be tested in Turkey, where resources may have stronger effects due to possibly not being on the flat, but upward sloping part of the education production function.

Besides the pupil-teacher ratio, average term length, and relative teacher pay, the class size is used as well in the literature to measure school quality. Similar to the literature reviews on increased spending in general, those on smaller class size in particular, also conclude that it does not systematically lead to improved student achievement. The most important challenge to this dominant view has arisen after the STAR (Student/Teacher Achievement Ratio Study) experiment conducted by the state of Tennessee, which is considered as the largest and best designed experiment in the class size literature. Attempting to determine whether achievement would increase with smaller class sizes, the state legislature authorized schools to volunteer to participate in an experiment whereby they would receive additional funds for lowering class sizes from kindergarten to third grade, provided that students and teachers were randomly assigned to regular (large) or small classes (Rothstein, 2000). Studies based on the STAR experiment find that class size has a significant effect on test scores: reducing class size from 22 to 15 in the early primary grades seems to increase both math and reading test scores by about 0.2 standard deviations (Krueger, 2000).

The economic theory of class size is laid out by Lazear (2001), which argues that students who attend a smaller class learn more because they experience fewer student disruptions during class time, on average. A student who is disruptive or who takes up teacher time in ways that are not useful to other students affects not only his own learning, but that of others in the class. For this reason, class size may have important effects on educational output. Lazear's model implies that better students are optimally placed in larger classes, and thus educational output may be higher in the large classes, despite the reduced teacher-student ratio. This can be the reason behind the weak or nonexistent class size effects found in empirical studies on US public schools. Indeed, Hanushek's literature reviews reveal that

studies are almost equally likely to find negative effects of small class sizes on achievement as they are to find positive effects, and that majority of the estimates in the literature are statistically insignificant. Furthermore, according to the empirical evidence, to the extent that class size matters, it is more likely to matter at lower grade levels than at upper grade levels. This is in line with the Lazear's model, which implies that class-size reductions provide better results for disadvantaged and special needs children, taking into account the fact that students in lower grades need special attention in the process of getting used to school. Therefore, it is possible that students who spend time in small classes in lower grade levels learn to behave better with closer supervision, leading to a reduced propensity to disrupt subsequent classes. Lazear's model probably captures an important feature of class size, and yields a specific functional form for the education production function.

As the survey so far reveals, research on school quality is conducted overwhelmingly for the US. Indeed, international research in this area is less plentiful. Although aggregate cross country studies showed that initial level of schooling or expansion of schooling of the labor force is an important part of economic growth, quality of schooling is not taken into account in general. Furthermore, continued growth arising from human capital requires continued growth in human capital as well, but one cannot expect that years of schooling will expand in an unbounded manner. To address this problem and the idea that a year of schooling is not equivalent in each country, Hanushek and Kimko (2000) include a new measure of quality based on student cognitive performance on international tests of academic achievement in mathematics and science. They prove that labor-force quality differences measured in this way have a consistent, stable, and strong relationship with economic growth. Besides the scarcity of between country evidence on quality of schooling based on test scores, the within country evidence on school quality is even less plentiful excluding the ones on the US. This is because most other countries have not tracked student performance over any length of time, making analyses comparable to the US discussion impossible (Hanushek, 2003).

One of the within country evidence on school quality is provided by Angrist and Lavy (1999) for Israel, where Maimonides' rule of 40 is used to construct instrumental variables estimates of effects of class size on test scores[5]. The data used in their study comes from a short-lived national testing program in Israeli elementary schools. In June of 1991, all fourth and fifth graders were given achievement tests designed to measure mathematics and reading skills

[5] The twelfth century rabbinic scholar Maimonides proposed a maximum class size of 40. This same maximum induces a nonlinear and nonmonotonic relationship between grade enrolment and class size in Israeli public schools today (Angrist and Lavy, 1999).

while similar tests were given to third graders in June 1992. Their estimates show that reducing class size induces a significant and substantial increase in test scores for fourth and fifth graders, although not for third graders. This result contradicts the theory of class size outlined above, which plausibly implies that class size matters more at lower grade levels than at upper grade levels. The importance of Angrist and Lavy (1999) for our study derives from the fact that Israel has a lower standard of living and spends less on education per pupil than the United States and that Israel has larger class sizes than the United States, thus has more common characteristics with Turkey. So the results presented may be showing evidence of a marginal return for reductions in class size over a range of sizes that are not characteristic of most American schools, considering that the lack of an association between education inputs and test scores in general using US data is interpreted as evidence that school resources have no causal effect on learning. Unfortunately, the research on Israel cannot be repeated since the national testing program was abandoned after 1992 due to considerable public controversy because of lower scores than anticipated, especially in 1991, and because of large regional difference in outcomes (Angrist and Lavy, 1999).

Another example of within country evidence on school quality is conducted for Chile. Motivated by the systematic superior performance in national standardized tests of students attending a network of 17 private voucher schools called SIP[6], Henríquez et al. (2009), try to shed light on the factors that contribute to the better education of these students. It is evident that the lessons of this analysis can help improve the performance in schools with poor achievement since SIP schools show that it is possible to create an environment in which low income students can achieve high academic achievement. First, they find that SIP students perform better than those attending other private voucher and municipal schools, even better than the children of the elite families attending in general private non voucher schools. Second, they conducted a series of interviews with principles of SIP schools and those of the other schools that are close in terms of the average socioeconomic background of students within the same municipality. The main result of the paper is that despite students' disadvantaged backgrounds, there are schools in Chile that serve low income students and that obtain superior academic outcomes. Furthermore, they present qualitative evidence that the success of these schools does not hinge on a better access to resources or selection, but on a number of systematically applied strategies, such as method of selection of directors and teachers; tasks and autonomy assigned to directors (e.g. for hiring and firing teachers); clear

[6] Sociedad de Instrucción Primaria (SIP) is a non-for profit organization serving low income students in Chile.

and shared methodology; team work and collaboration between teachers and directors; sharing of the best practices; presence of an under director; systematic evaluation of teachers and students; actions taken based on the information gathered; incentive pay and the recognition of the best evaluated teachers; continuous training of teachers; strategies and resources devoted to leveling children that lag behind; and possibility of exploiting economies of scale, in particular through the Pedagogical Department. But probably the most important feature in the success of these schools is setting the students' learning as their primary and permanent goal.

The last example of within country evidence on school quality presents quasi-experimental evidence on the impact of school resourcing and management using the outcomes of the largest government-funded direct intervention in Australian education. The Smarter Schools National Partnership (SSNP) program provided approximately $2.5 billion in funding to Australian schools with the aim of addressing disadvantaged schools, supporting teachers and school leaders, and improving literacy and numeracy. Crucially, the program is grounded in flexibility, with states deciding how to implement specific reforms (Helal, 2012). Therefore, it provides a rare opportunity to evaluate the impact of additional school resources, granted under very broad conditions within a devolved policy environment. Student achievement before and after the implementation of SSNP is measured by the scores obtained in the standardized assessment test, which has been implemented biennially since 2008 in grades 3, 5, 7 and 9 across Australia. The test is intended to measure essential skills under five domains: numeracy, reading, grammar, spelling and writing and the scores are considered as the major proxy of the quality of education offered by schools. Helal (2012) finds substantial effects of the program on growth in student achievement though varied in effectiveness by year level and domain. Secondary school students appeared to have gained more than their primary school counterparts while numeracy was more positively affected than reading.

There has been little quantitative research on school quality in Turkey. In one of these, Berberoglu and Kalender (2005) use Student Selection Examination results to assess student achievement across years, school types, and geographical regions. They also analyze differences with respect to regions and school types using Programme for International Student Assessment (PISA) 2003 results for Turkey. The findings of both analyses indicate that student achievement is very low, and there is no improvement across time. They also find that between school differences are larger compared to regional differences using Multivariate Analysis of Variance (MANOVA). This is of no surprise considering that the most successful

schools such as Science and Anatolian High Schools select high ranked students with a nationwide examination (OKS) performed at the end of the elementary school. Therefore any research on the school quality in Turkey should take into account the school type. One such study is performed for the Anatolian High Schools in Ankara. Atan, Karpat, and Goksel (2002) evaluate the performance of 22 Anatolian High Schools by employing Data Envelopment Analysis with 6 input and 4 output variables. Input variables are number of students, number of teachers, class number in each grade, total number of classes, number of laboratories, and number of computers. The output variables are chosen as number of graduates, number of students placed in a university, ratio of success in each grade and ratio of success in university placement exam. The results show that even the performance of the Anatolian High Schools varies considerably and that only 8 of 22 schools are efficient.

These two exceptions notwithstanding, quantitative research on whether schools matter in student achievement for Turkey is missing to our knowledge. On the other hand, quantitative research, especially on the US has tended to find that the effects of student background on student achievement and other outcomes far overshadow school effects. Some of the research has found no school effects at all, while other research has found effects that are, at best, modest (Wenglinsky, 2002). Indeed, research concentrated on the US has found that most characteristics of schools, such as class size and the pupil-teacher ratio, do not matter, and the few that do are not as important as student background.

According to Krueger (1999), much of the uncertainty in the literature derives from the fact that the appropriate specification – including the functional form, level of aggregation, relevant control variables, and identification – of the 'education production function' is uncertain. Furthermore, we know that certain schools are highly conducive to student achievement in Turkey. If this is the case, then schools may explain a significant portion of the variance in student achievement. Turkish case provides a unique opportunity to reveal high school value added since two nationwide examinations are conducted at the beginning and at the end of high schools. Specifically, Anatolian High Schools, which admit students depending on the scores they obtain in OKS conducted at the end of elementary education by the Ministry of Education, present an opportunity to test the effects of school resources on outcomes in an education production function framework. Here, the outcome is the scores obtained in the Transition to Higher Education Examination (YGS). Besides, the use of minimum OKS scores required for admission as an independent variable helps us overcome omitted variables bias stemming not only from the student characteristics, but also from

student background including family characteristics. Indeed, the results of a TUBITAK (The Scientific and Technological Research Council of Turkey) project on the value added by high schools show that family and background characteristics such as income, education level of parents, gender, and region have indirect effects on Higher Education Examination Outcomes such that they lose significance once the High School Entrance Examination (OKS) scores are included in the regression (Alkan et al., 2008).

3. ***Data and Methodology***

A brief summary of the main and supplementary data sources will be given in this section. Afterwards, we focus on the methodology. There is a widespread acceptance that high schools have different standards in Turkey. In order to confirm this empirically, we need to test whether average YGS scores of different types of high schools are significantly different from each other using five high school dummies since high schools can be divided into five main groups, namely: Science High Schools, Anatolian High Schools, Private High Schools, General High Schools, and Vocational High Schools. Due to data limitations, we consider only the high schools in Istanbul, for which detailed YGS scores of the years 2010 and 2011 are available to public. Among these detailed YGS scores such as minimum, maximum and average scores obtained by the graduates of each AHS, we choose the average YGS scores. The reason for not using the minimum or maximum scores is that we don't know whether the student with minimum OKS (High School Selection and Placement Examination) score is the same as that in the YGS, since student specific data is not available to public. In sum, we use two different data sets. The first comprises the YGS scores of the years 2010 and 2011 and is published at the 'YÖNVER' website for all high schools in Istanbul[7]. The second is the minimum OKS score required for admission to each Anatolian High School (AHS), which is available at the website of the Ministry of Education[8]. Note that, we use outcomes of OKS 2006 and 2007 since the same cohort graduated from high school and took YGS in 2010 and 2011, respectively. The results of the first step of our empirical analysis show that average YGS scores of different high school types are indeed significantly different from each other. Therefore, in order to overcome heterogeneity problem that originates from the differences in school standards, we consider only the Anatolian High Schools (AHS) which select high ranked students with a nationwide examination. This gives us the opportunity to exploit the

[7] Conducted by Istanbul Kültür University.
[8] This nationwide examination was called OKS in 2006 and 2007, the years, for which the scores are used since the same cohort takes YGS in 2010 and 2011, respectively.

outcomes of the other nationwide examination called OKS, conducted at the end of the elementary education by the Ministry of Education. Specifically, since the AHS admit students depending on the scores they obtain in OKS, the minimum score required for admission in each AHS can be used to control for the quality of students enrolled. In fact, the use of minimum scores of OKS as an independent variable helps us to overcome omitted variables bias stemming not only from the student characteristics, but also from student background including family characteristics as mentioned before.

We use two specifications during our empirical analysis. Our first specification focuses on the class size. We use the natural logarithm of class size in the empirical analysis following the literature. The rationale behind this is to take account the fact that a one-student reduction is proportionately larger from a base of 17 students, say, than from a base of 35 students (Hoxby, 2000). The class size in AHS is determined as 30 (MEB, 2013) at the start of high school, specifically at grade ninth, or language preparatory class for a couple of AHS[9]. However, class size in each AHS changes over time due to transitions between schools. Here, we compute the class size through dividing the number of graduates by the number of classes in each AHS. For the second specification, we focus on the teacher-pupil ratio in the main branches, namely reading, math, as well as natural and social sciences, because YGS intends to measure high level cognitive skills under these areas. The number of teachers in these branches is obtained directly from the websites of each AHS. We utilize the number of teachers in main branches per graduate student as a proxy for the school quality.

First of all, we pool the YGS data corresponding to years 2010 and 2011. Our data set is a short panel since the data is on many individual units (in our case high school units) and only a two-year time dimension (t=2010 and 2011)[10]. Therefore, the sample size is I*T, where 'I' equals to the number of AHS in Istanbul (64) and T equals to 2 (year 2010 and 2011), ending up with 128 observations. We use the normalized average YGS scores as the dependent variable. The main reason for normalization of YGS scores is to increase the number of observations by combining the scores of 2010 and 2011 and to be able to control for the variation in the difficulty of YGS between the two years. There are six different types YGS scores, calculated by assigning different weights to each of the four main branches of the test.

[9] Galatasaray L., İstanbul L., Kadıköy A. L.; from 2006-2007 and onwards: Kabatas L., Vefa A. L. , Cağaloğlu A. L.; from 2007-2008 and onwards: Huseyin Avni Sözen A. L.

[10] To allow for variance in different time periods, there is no need to use year dummies since we normalized the scores.

The weights are given in Appendix A. In order to calculate the mean of the average YGS scores for 2010 and 2011, we use the formulas below:

$$\overline{YGSave}_{j,2010} = \frac{\sum_i^n YGSave_{ji,2010}}{N} \quad \text{i=1,…N and j=1,…J} \tag{1}$$

$$\overline{YGSave}_{j,2011} = \frac{\sum_i^n YGSave_{ji,2011}}{N} \quad \text{i=1,…N and j=1,…J} \tag{2}$$

where 'i' represents the Anatolian High Schools in Istanbul and 'j' represents the type of YGS score, such that J is equal to 6. Afterwards, to normalize the average YGS scores, we calculate the standard deviation of the average scores:

$$\sigma_{YGSavej2010} = \frac{\sum_i^n (YGSave_{ji,2010} - \overline{YGSave}_{j,2010})^2}{N} \tag{3}$$

$$\sigma_{YGSavej2011} = \frac{\sum_i^n (YGSave_{i,2011} - \overline{YGSave}_{2011})^2}{N} \tag{4}$$

Then, we normalize the average YGS scores using the following formulas:

$$Z(YGSave)_{ji,2010} = \frac{YGSave_{ji,2010} - \overline{YGSave}_{j,2010}}{\sigma_{YGSavej2010}} \quad \text{i=1,…N j=1,…J} \tag{5}$$

$$Z(YGSave)_{ji,2011} = \frac{YGSave_{j,i,2011} - \overline{YGSave}_{j,2011}}{\sigma_{YGSavej2011}} \quad \text{i=1,…N j=1,…J} \tag{6}$$

The independent variables are the normalized minimum OKS score required for admission to each AHS; and either the logarithm of the class size or the weighted sum of teacher-pupil ratios in each AHS, depending on our specification We normalize the minimum OKS scores by using the mean of and the standard deviation of the minimum OKS scores, as usual.

$$\overline{OKSmin}_{2006} = \frac{\sum_i^n OKSmin_{i,2006}}{n} \quad \text{i=1…N} \tag{7}$$

$$\overline{OKSmin}_{2007} = \frac{\sum_i^n OKSmin_{i,2007}}{n} \quad \text{i=1…N} \tag{8}$$

where 'i' represents the Anatolian High Schools in Istanbul.

$$\sigma_{OKSmin,2006} = \frac{\sum_i^n (OKSmin_{i,2006} - \overline{OKSmin}_{2006})^2}{N} \tag{9}$$

$$\sigma_{OKSmin,2007} = \frac{(\sum_i^n (OKSmin_{i,2007} - \overline{OKSmin}_{2007})^2}{N} \tag{10}$$

We normalize the minimum OKS scores using the following formulas:

$$Z(OKSmin)_{i,2006} = \frac{OKSmin_{i,2006} - \overline{OKSmin}_{2006}}{\sigma_{OKSmin,2006}} \quad \text{i=1…N} \tag{11}$$

$$Z(OKSmin)_{i,2007} = \frac{OKSM_{i,2007} - \overline{OKSmin}_{2007}}{\sigma_{OKSmin,2007}} \quad \text{i=1…N} \tag{12}$$

For the first specification, we need the average class size of each AHS. These are calculated by dividing the number of graduates of each AHS by the number of classes at each grade, which is found in turn by dividing the quota of each AHS by 30. As mentioned before, this is the standard class size for AHS as determined by the Ministry of Education (MEB, 2013). We then take the logarithm of the class size:

$$Size_{i,2010} = \frac{Q_{i,2010}}{\#\ of\ classes} \tag{13}$$

$$ln(Size_{i,2010}) = \ln\left(\frac{Q_{i,2010}}{\#\ of\ classes}\right) \tag{14}$$

where $Q_{i,2010}$ is the number of graduates in each Anatolian High Schools and i represents the AHS in Istanbul. The same procedure is repeated for the graduates of year 2011 as well.

For the second specification, we utilize the number of teachers in main branches per graduate student as a proxy for the school quality[11].

$$R_{lit,i} = \frac{\#\ of\ literature\ teachers_i}{\#\ of\ graduates} \tag{15}$$

$$R_{math,i} = \frac{\#\ of\ math\ teachers_i}{\#\ of\ graduates} \tag{16}$$

$$R_{soc,i} = \frac{\#\ of\ social\ sciences\ teachers_i}{\#\ of\ graduates} \tag{17}$$

$$R_{science,i} = \frac{\#\ of\ science\ teachers_i}{\#\ of\ graduates}$$

where 'i' represents the Anatolian High Schools in Istanbul. By using these ratios, we calculate the weighted number of teachers in main branches per graduate student according to weights of the test given in each of the main four branches (literature, math, social sciences and science) related to six different types of YGS scores using the formula given below:[12]

$$w_{ji} = a_{lit,ji}R_{lit,i} + a_{math,i}R_{math,i} + a_{soc,i}R_{soc,i} + a_{sicence,i}R_{science,i} \tag{18}$$

where 'i' represents the Anatolian High Schools and 'j' represents the type of YGS score. For example for YGS-1, we calculate $w_{1i,}$ which represents the weighted sum of the number of teachers in main branches per graduate student as:

[11] The number of teachers in main branches is gathered from the website of each AHS. Though these websites are accessed in 2013, we use them for our regressions related to years 2010 and 2011 assuming that the teacher quotas of the AHS do not change over time.

[12] See Appendix A for the weights of the four main branches of the test used for the calculation of the six different score types of the YGS.

$$w_{1i} = 0.20 * R_{lit,i} + 0.40 * R_{soc,i} + 0.10 * R_{soc,i} + 0.30 * R_{science,i} \quad (19)$$

In the second step of our empirical analysis, we employ Ordinary Least Square estimation, which is the simplest method for pooled estimation with panel data:

$$\boldsymbol{Z} = \boldsymbol{X'\beta} + \boldsymbol{\varepsilon} \quad (20)$$

where $\mathbf{Z}_{Tx1}$ is for the dependent variable and $\mathbf{X}_{(k+1)xT}$ refers to the vector of independent variables. The vector $\boldsymbol{\beta}_{(K+1)x1}$ shows the constant term and parameters of the independent variables. Finally, $\boldsymbol{\varepsilon}_{Tx1}$ represents error terms. For the first specification, normalized average YGS is the dependent variable while normalized minimum OKS score required for admission to each AHS and the natural logarithm of class size are independent variables. For the second specification, weighted sum of the number of teachers in main branches per graduate student according to the YGS score type is utilized as one of the independent variables.

Normally, using OLS estimation without fixed effects makes the estimation vulnerable to omitted variables bias (Kukla-Acevedo, 2009). However, using minimum OKS scores as an explanatory variable helps us to take into account the bias stemming from both student and family characteristics. Indeed, our analysis of the relation between OKS scores and the return to education in high schools proxied by YGS scores has the advantage of controlling for unobserved differences across students and background factors such as family characteristics. In this manner we are able to see the effects of school characteristics, such as the class size and teacher-pupil ratio. Furthermore, the bias on class size due to the other factors such as parents' choice as mentioned in Hoxby (2000) is not valid in Anatolian High Schools, because all have the same class size at the first grade.

Finally, since standard OLS assumes homoskedasticity and no correlation between unit i's observations in different periods (or between different units in the same period), we cluster the standard errors that are robust to correlation between error terms of the same unit and heteroskedasticity over time. Clustering the standard errors allows for intragroup correlation, that is, the observations are independent across groups (clusters). Therefore, in the specifications that use clustering, data can be viewed as clustered on the high school unit.

4. Empirical Findings

The primary concern of this paper is to investigate the relationship between the school quality and transition to higher education examination outcomes. We also examine the effect of the quality of students enrolled to AHS on the transition to higher education outcomes.

We start by regressing normalized average YGS scores on type of high school dummies to be able to see the variation among high school outcomes in YGS using five high school dummies corresponding to five different high school types in Turkey: Science High Schools, Anatolian High Schools, Private High Schools, General High Schools, and Vocational High Schools.

Table 1: Parameter Estimates from OLS Model, Normalized Average YGSs

VARIABLES **Dependent variable: Normalized average YGS-1**	**Parameter Estimates**
Science High Schools	3.023***
	(0.101)
Anatolian High Schools	2.289***
	(0.068)
Private High Schools	0.405***
	(0.051)
Vocational High Schools	-0.532***
	(0.044)
Constant	-0.036
	(0.036)
Observations	***1,756***
R-squared	***0.641***
F-stat	***782.61***
Prob > F	***0.00***

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Base is General High Schools

Table 1 includes the parameter estimates from OLS regression[13]. The results show that the type of high school has significant effect on normalized average YGS-1 scores. Once we use the average YGS-1 scores of General High Schools as the base variable, we see that only Vocational High Schools perform significantly worse and Science High Schools perform best. This result is not surprising due to the combined effects of the quality of students enrolled and the science and math oriented curriculum applied in Science High Schools. In addition, we test whether impacts of different high school types are different from each other. We reject all the related null hypotheses (H_0: $\beta_2=\beta_3$, H_0: $\beta_2=\beta_4$, H_0: $\beta_2=\beta_5$, H_0: $\beta_3=\beta_4$, H_0: $\beta_3=\beta_5$, etc…). Therefore, we confirm that impacts of different types of high schools are different.

In Table 2, results of the specification, where normalized minimum OKS scores and natural logarithm of class-size are utilized as independent variables, are shown. The results of the second specification where normalized minimum OKS and weighted number of teachers in main branches per graduate student are used as independent variables, are given in Table 3. At the bottom of the tables, number of observations and R-squared and F-tests, which are used to test whether all independent variables are jointly statistically significant, are given. The first

[13] We give regression results only for the normalized average for YGS-1.

two columns show the parameter estimates of the model whose dependent variable is normalized average YGS-1 while the following columns show the models for normalized average YGS-2 to YGS-6. First, we run models without correcting the standard errors by clustering at the high school level afterwards; we run the same OLS models with correction of the standard errors.

The results in Table 2 indicate that normalized minimum OKS score has a positive significant impact on the normalized average YGS scores. For example, 1 unit increase in normalized minimum OKS score leads to 0.95 unit increase in normalized average YGS-1. This effect is almost the same for all types of YGS scores. Note that, normalized minimum OKS scores preserve its significance after correcting for the standard errors by clustering at the high school level. Surprisingly, the ln (class size) variable has a positive impact on normalized average YGS-1, YGS-2, and YGS-6 scores at 10% significance level. For example, a 1% increase in the natural logarithm of class-size leads to a 0.01 point increase in normalized average score of YGS-1. This effect is robust to the inclusion of clustering. However, it does not have any significant effect on the other three types of YGS score.

In Table 3, instead of natural logarithm of class-size, weighted sum of number of teachers in main branches per graduate student are utilized as independent variable besides the normalized minimum OKS scores. Normalized minimum OKS has a positive significant impact on the normalized average YGSs as for the first specification, while none of the weighted sum of number of teachers in main branches per graduate student according to type of YGS scores are significant.

Table 2: Parameter Estimates from OLS Model, Normalized Average YGSs (by using Ln(Class-size) as an Explanatory Variable)

	Normalized YGS1 average		**Normalized YGS2 average**		**Normalized YGS3 average**		**Normalized YGS4 average**		**Normalized YGS5 average**		**Normalized YGS6 average**	
VARIABLES	**w/o cluster**	**with cluster**	**w/o cluster**	**with cluster**	**w/o cluster**	**with cluster**	**w/o cluster**	**with cluster**	**w/o cluster**	**with cluster**	**w/o cluster**	**with cluster**
Normalized OKS_min	0.950***	0.950***	0.950***	0.950***	0.958***	0.958***	0.955***	0.955***	0.958***	0.958***	0.955***	0.955***
	(0.031)	(0.077)	(0.031)	(0.078)	(0.028)	(0.053)	(0.029)	(0.051)	(0.028)	(0.061)	(0.030)	(0.072)
Ln(class size)	0.907*	0.907*	0.935*	0.935*	0.547	0.547	0.480	0.480	0.681	0.681	0.849*	0.849*
	(0.525)	(0.474)	(0.530)	(0.489)	(0.474)	(0.441)	(0.488)	(0.471)	(0.480)	(0.425)	(0.503)	(0.446)
Constant	-1.303*	-1.303*	-1.343*	-1.343*	-0.785	-0.785	-0.690	-0.690	-0.978	-0.978	-1.219*	-1.219*
	(0.755)	(0.694)	(0.762)	(0.716)	(0.681)	(0.636)	(0.701)	(0.678)	(0.690)	(0.616)	(0.723)	(0.652)
Observations	***128***	***128***	***128***	***128***	***128***	***128***	***128***	***128***	***128***	***128***	***128***	***128***
R-squared	***0.885***	***0.885***	***0.883***	***0.883***	***0.906***	***0.906***	***0.901***	***0.901***	***0.904***	***0.904***	***0.894***	***0.894***
F-stat	***480.26***	***114.31***	***470.65***	***108.41***	***604.92***	***183.25***	***566.3***	***185.12***	***588.34***	***160.03***	***529.77***	***131.31***
Prob > F	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 3: Parameter Estimates from OLS Model, Normalized Average YGSs (by using weighted sum of the number of teachers in main branches per graduate student as an Explanatory Variable)

	Normalized YGS1 average		**Normalized YGS2 average**		**Normalized YGS3 average**		**Normalized YGS4 average**		**Normalized YGS5 average**		**Normalized YGS6 average**	
VARIABLES	**w/o cluster**	**with cluster**	**w/o cluster**	**with cluster**	**w/o cluster**	**with cluster**	**w/o cluster**	**with cluster**	**w/o cluster**	**with cluster**	**w/o cluster**	**with cluster**
Normalized OKS_min	0.941***	0.941***	0.939***	0.939***	0.959***	0.959***	0.957***	0.957***	0.957***	0.957***	0.949***	0.949***
	(0.032)	(0.084)	(0.032)	(0.086)	(0.028)	(0.055)	(0.029)	(0.053)	(0.028)	(0.064)	(0.030)	(0.077)
Weightygs1	-0.437	-0.437										
	(2.102)	(2.204)										
Weightygs2			-0.223	-0.223								
			(2.138)	(2.485)								
Weightygs3					-3.105	-3.105*						
					(2.043)	(1.755)						
Weightygs4							-3.039	-3.039				
							(2.184)	(1.930)				
Weightygs5									-2.483	-2.483		
									(1.985)	(1.601)		
Weightygs6											-1.449	-1.449
											(2.019)	(1.748)
Constant	0.022	0.022	0.011	0.011	0.142	0.142	0.137	0.137	0.118	0.118	0.071	0.071
	(0.110)	(0.121)	(0.112)	(0.135)	(0.097)	(0.088)	(0.102)	(0.095)	(0.098)	(0.084)	(0.104)	(0.095)
Observations	***128***	***128***	***128***	***128***	***128***	***128***	***128***	***128***	***128***	***128***	***128***	***128***
R-squared	***0.882***	***0.882***	***0.880***	***0.880***	***0.907***	***0.907***	***0.901***	***0.901***	***0.904***	***0.904***	***0.893***	***0.893***
F-stat	***467.79***	***73.61***	***457.74***	***75.95***	***610.08***	***156.98***	***571.13***	***165.71***	***586.04***	***113.4***	***518.94***	***77***
Prob > F	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

In order to check whether the complex calculation of weights affects the regression results, we also run the second specification with normalized average net correct answers of each high school in each of the main four tests (mathematics, science, social sciences and literature) as dependent variables (Table 4). In these models, normalized minimum OKS scores and number of teachers in main branches per graduate student are used as independent variables. We obtain the same results for the impact of the normalized minimum OKS scores, i.e. they have a positive significant impact on normalized average net correct answers in mathematics, science, social sciences and literature test. Similarly, correcting standard errors by clustering does not change the results. The only difference in results is related to the effect of the number of teachers in literature per graduate student on the normalized average net correct answers in literature test, such that as the number of teachers in literature per graduate student increases by 1 unit, normalized average net correct answers in literature test decreases unexpectedly by 4.2 units.

Table 4: Parameter Estimates from OLS Model, Normalized Average Net Correct Answers

	Normalized Math Net		**Normalized Science Net**		**Normalized Literature Net**		**Normalized Social Sciences Net**	
VARIABLES	**w/o cluster**	**with cluster**	**w/o cluster**	**with cluster**	**w/o cluster**	**with cluster**	**w/o cluster**	**with cluster**
Normalized OKS_min	0.904***	0.904***	0.902***	0.902***	0.944***	0.944***	0.908***	0.908***
	(0.039)	(0.097)	(0.039)	(0.107)	(0.030)	(0.043)	(0.040)	(0.048)
Math Teacher/Graduates	0.444	0.444						
	(2.219)	(1.800)						
Science Teacher/Graduates			2.037	2.037				
			(2.183)	(3.783)				
Literature Teacher/Graduates					-4.210**	-4.210*		
					(1.910)	(2.478)		
Social Teacher/Graduates							-1.924	-1.924
							(3.336)	(3.626)
Constant	-0.023	-0.023	-0.111	-0.111	0.192**	0.192*	0.075	0.075
	(0.122)	(0.115)	(0.125)	(0.216)	(0.092)	(0.113)	(0.135)	(0.148)
Observations	***128***	***128***	***128***	***128***	***128***	***128***	***128***	***128***
R-squared	***0.821***	***0.821***	***0.839***	***0.839***	***0.889***	***0.889***	***0.815***	***0.815***
F-stat	***286.45***	***49.9***	***326.45***	***84.97***	***500.9***	***246.65***	***274.54***	***190.29***
Prob > F	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

5. ***Discussion and Conclusion***

In this paper, we try to reveal whether high school matters in outcomes of the Transition to Higher Education Examination, abbreviated as YGS, by investigating the impact of school quality on the average score obtained in this test. YGS is a country-wide standardized test taken by high school graduates as a first step to continue higher education since high school graduates in Turkey is much higher than the available student quotas in Turkish universities. The student achievement in YGS may be affected by a host of factors. These include the quality of the secondary education obtained as well as various individual and household characteristics, which we control by using the scores of another nationwide examination called OKS, conducted at the end of elementary education by the Ministry of Education.

The score obtained in OKS is used by Science High Schools, Anatolian High Schools, and some Private High Schools for admission. Therefore, we can use the minimum OKS score required for admission by these schools to control for the quality of graduates. However, as we verify in the first step of our empirical analysis, where we use only high schools in Istanbul due to data limitations, high schools have different standards in Turkey. So in the rest of our empirical analysis, we include only Anatolian High Schools in Istanbul.

We use the class size or the number of teachers in main branches per graduate student as a proxy for the quality of schools in specification 1 and 2, respectively, besides the minimum OKS score required for admission to each AHS. The results of the first specification point that class size reduction does not increase the achievement, in line with the theoretical and evidence-based results of the literature. With respect to the former, Lazear's (2001) model implies that class-size reductions provide better results for disadvantaged and special needs children. Evidence based studies also conclude that class size reductions are beneficial in specific circumstances — for specific groups of students, subject matters, and teachers (Hanushek, 2000); and that the effect sizes found in the STAR experiment and much of the literature are greater for minority and disadvantaged students than for other students (Krueger, 2000). It's clear that students of Anatolian High Schools cannot be considered as such. Since students of AHS are admitted according to their ranking in OKS and the ones with lower than a certain score in OKS enrolled to general high schools, students of AHS represent a selected group.

Furthermore, among the results of the first specification, three of them, specifically the ones related to YGS-1, YGS-2, and YGS-6 scores, show that as class size increases the

achievement increases as well. This unexpected result can be explained by the transfer of students between Anatolian High Schools. Since such transfers are permitted only if the student has at least the minimum OKS score required for admission to that AHS for the corresponding grade, there is a bias towards AHS with higher minimum OKS score requirement. Consequently, the class size of these AHS gets higher through time than the ones, which has lower minimum OKS score requirement. And since the quality of students are getting even higher in AHS with higher minimum OKS score requirement, their average YGS scores are higher though they have larger class size at the last grade.

Results of our second specification, where we test various measures of teacher-pupil ratio find no significant effect on achievement. Both specifications find that only the quality of students enrolled to AHS has a positive effect on the transition to higher education outcomes: as student quality increases, outcome in YGS increases. In other words, the level of achievement at the beginning of the high school, explains a great deal of student achievement in YGS. Holding students' quality constant, however, we find no evidence that school resources, such as pupil-teacher ratio and the class size have significant effects on Transition to Higher Education Examination score. Furthermore, the results are robust to different scorings of YGS and to the inclusion of clustering, and more importantly explain around 90% of the outcomes in YGS as depicted by the R-squared values of our regression analysis. The rest can be explained by the motivation and teacher quality in each school among others. Regarding the latter, it should be kept in mind that teacher matters, i.e., differences among teachers are unquestionably large and significant, indicating their potential for decisively altering student achievement. For example, in US, within one inner-city school system serving an entirely black population, a good teacher was found to surpass a bad teacher by more than a full grade level of student achievement over a single academic year, even after holding constant the family characteristics of students and the level of achievement at which they started the class (Hanushek, 1992).

To sum up, we find no evidence that school resources, such as pupil-teacher ratio and the class size have effects on the transition to higher education exam scores, at least for AHS in Istanbul. This finding is in line with the claim that, input policies such as reduced class sizes and higher expenditure per pupil, vigorously pursued over a long period of time in the US, does not seem to improve student performance. According to Hanushek (2003), there are two arguments for this evidence in case of the US. First, the characteristics of students may have changed such that they are more difficult (and expensive) to educate now than in the past.

This argument can be supported by the fact that formerly, when the enrollment ratios are lower, relatively talented population, which was easier (and cheaper) to educate, were able to attend schools. Indeed, the percentage of children not speaking English at home rose from 9% in 1980 to 17% in 2000. Second, other expansions of the requirements on schools have driven up costs but would not be expected to influence observed student performance.

We can conclude that, input policies such as reduced class sizes and higher expenditure per pupil in Anatolian High Schools will not be helpful to improve student outcomes with respect to YGS scores. However, transforming general high schools such that they have the same class size and teacher quality as AHS will be helpful in increasing the overall achievement of high school graduates in Turkey. Furthermore, since student quality at the beginning of the high school is obtained during primary education, policies focusing on primary schools, where class size seems to matter more would be much more efficient.

This paper can be developed in two ways. First, a wider data set, which covers all AHS in Turkey, can be used. Secondly, the Civil Servant Selection Examination (KPSS) scores required from the teachers by each AHS can be included in the regression models as a proxy for the quality of teachers in each AHS. These are exactly what we plan as further research.

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APPENDIX A:

Table A: Weights of YGS Tests by the Type of the Score, Turkey

Type of the Score	Weights of Tests			
	Literature	Math	Social Sciences	Science
YGS-1	20	40	10	30
YGS-2	20	30	10	40
YGS-3	40	20	30	10
YGS-4	30	20	40	10
YGS-5	37	33	20	10
YGS-6	33	37	10	20

Source: *The Council of Higher Education, 2012*