

School Resources, Family Characteristics and Student Performance: Evidence from Secondary School Entrance Exam in Turkey

Eğitim Kurumu Kaynakları, Aile Özellikleri ve Öğrenci Başarısı: Türkiye’den Ortaöğretim Kurumları Öğrenci Seçme Sınavı Örneği

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Abstract

The paper examines the determinants of student achievement on the secondary school entrance exam (SSEE). The data for this project were collected through a survey of 810 primary-school graduates. The empirical work is carried out by forming a model on student achievement and three categories of school, student, and family characteristics from primary-school graduates who were successful in SSEE.

Keywords: Student achievement, school characteristics, individual characteristics, family characteristics

Öz

Bu çalışmanın amacı, Ortaöğretim Kurumları Öğrenci Seçme Sınavı’na (OKS) katılan öğrencilerin başarısının hangi faktörlerden kaynaklandığını araştırmaktır. Veriler 810 ilköğretim mezunuyla yapılan anket çalışması sonucu elde edilmiştir. Bu bilgilerden yararlanarak OKS’de yüksek puan alan ilköğretim kurumu mezunlarının başarısı ile eğitim kurumu, öğrencinin ve ailenin nitelikleri arasındaki ilişki ortaya konulmaya çalışılmıştır

Anahtar Sözcükler: Öğrenci başarısı, okul özellikleri, bireysel özellikler, aile özellikleri

Introduction

Over the past four decades, a large body of literature has focused on the determinants of student achievement. Reflecting policy implications, a significant amount of that research has centered on the role of school resources. The impetus for the research in the U.S. has been the conclusion by the “Coleman Report” (Coleman et al., 1966) suggesting that schools did not play a powerful role on student achievement. Hanushek (1981, 1986, 1989a, 1989b, 1997, and 2003) has provided extensive reviews of the massive literature. Does a school make a great difference in this achievement or are other factors more effective? As Collins (2002) suggests, the strong educational policy and improved physical facilities of a school are no doubt influential. Yet, all graduates of an “effective school” are not totally successful and less qualified schools’ graduates may have high achievement.

The standard framework for these studies has been the specification and estimation of a production function with student performance serving as output and school resources and other characteristics serving as primary inputs. As Hanushek (2003) points out, “This focus flows from the

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underlying perspective of production functions, from its obvious relevance for policy, and from the prevalence of relevant resource data in the administrative records that are frequently used.”

According to Hanushek (2003), available studies on school performance fall into two broad categories based on the level of aggregation and measures of school resources. The first category uses real school resources of the classroom including teacher-pupil ratio and levels of teacher education and experience. This category has received a great deal of attention for three reasons: (1) it provides a good summary of variations in instructional resources across classrooms; (2) measures of these variables are readily available; and (3) their changes have been very noticeable in the U.S. over the past three decades. The second category has relied on aggregated measures such as per pupil expenditure and other school resources (administrative inputs and facilities) at the district or the entire state level in U.S. education system, and relies on relatively poor measures of family background. As Hanushek et al. (1996) points out, disaggregated analysis is generally superior, although some have argued that aggregation of the relationships may actually have beneficial effects by reducing measurement error or the bias due to endogeneity of school and residential location choice¹.

Empirical evidence on the relationship between school resources and student achievement using U.S. data has been mixed. Studies based on real school resources generally support Coleman’s assertions. In comprehensive reviews of the literature, Hanushek (1981, 1986, 1989a, 1989b, 1997, 2003, and 2006) and Hanushek et al (1996) does not find a consistent or systematic relationship between student achievement and measures of school resources². A study regarding the home environments of 15 higher achieving and 11 lower achieving Puerto Rican students residing in southeastern urban Pennsylvania (Diaz, 1989) shows that “the homes of higher achievers were characterized by the following: (1) supervision; (2) organization; (3) parent involvement and communication; (4) bilingualism. The homes of low achievers were characterized by the following: (1) lack of supervision; (2) no parent involvement or communication; and (3) one language”. There is however, some evidence from meta-analysis (Hedges et al, 1994) suggesting that weighted averages of individual estimates for school resources have a meaningful and significant effect on student achievement³.

This paper provides some evidence from Turkey on the determinants of student achievement. More specifically, it reexamines the relevance of a broad class of school, individual and family characteristics as the source of variation in student achievement using a fairly rich cross sectional data set on students in Istanbul, Turkey. In particular, it will address a number of basic questions that have repeatedly appeared in previous literature, and play a central role in most policy debates. First, are there systematic differences between schools in their ability to raise student achievement? In particular, does the level of student achievement differ across public and private schools, and if so, what private school characteristics may contribute to such differences? Second, what are the roles of students’ out-of-school curricular activities and prior educational background, such as kindergarten, in their educational achievement? Third, does student gender play a major role in educational achievement? Fourth, what role does family characteristics, such as income, education, and parents’ professional activities play in students’ educational achievement?

¹ As Hanushek et al (1996) show, problems of omitted variables bias tend to increase along with the level of aggregation, resulting in an over-estimation of the effect of school-expenditure characteristics on student attainment. Furthermore, aggregate state-level analyses generally suffer from specification problems by omitting potentially important variables. In contrast, studies which contain more information about community characteristics and which use less aggregated data are likely to produce more reliable estimates of the true impact of school expenditure on attainment.

² These measures have included pupil-teacher ratios, teacher salaries, years of schooling, years of teacher experience or per-student expenditure.

³ A number of other studies have examined the effect of school resources on future earnings. In particular, Card and Krueger (1992a, 1992b) find that smaller classes and higher teacher salaries contribute to a wage premium associated with an additional year of schooling.

We examine these issues using a fairly rich cross sectional data set on 535 primary school graduates in Istanbul, Turkey. We measure student achievement by individual scores on the secondary school entrance exam (SSEE) for primary-school graduates in the Fall of 2006. Two unique aspects of these students deserve attention: First, these students are high achievers, with SSEE scores in the top one percent of 2006 student population; and second, these students were admitted into the top twelve (private and public) high schools in Istanbul, based on their SSEE scores. Our explanatory variables fall into three groups: (1) primary-school characteristics; (2) student characteristics; and (3) family characteristics.

The remainder of the paper is organized as follow: Section 2 develops the empirical model. Here we model student achievement in relation to three classes of explanatory variables representing primary school characteristics, student's out-of-school curricular activities, and individual and family specific characteristics. Section 3 describes the data set, the variables, and the process of conducting the survey. Section 4 discusses the empirical results. Section 5 summarizes the main findings and concludes.

Method

The standard approach for studying student achievement and its determinants is by specification and estimation of a production function. Following Hanushek (1979, Aithkin and Longford (1986), Hanushek and Taylor (1990), Hanushek, Rivkin and Taylor (1996), and Hanushek and Raymond (2003), we model the relationship between student achievement and school, student, and family characteristics as,

$$y_i = \alpha + B'S_i + \Gamma'X_i + \Theta'F_i + e_i \quad (1)$$

Where y_i is the achievement for student i ; S_i is a vector of student's primary-school characteristics; X_i is a vector of student's individual characteristics; F_i is a vector of student's family characteristics; B , Γ and Θ are corresponding parameter vectors, and e_i is a random error with zero mean and constant variance.

As explained in the next section, data for this study are drawn from a subset of primary- school graduates who scored in the top one percent of the student population on the national secondary school entrance exam. Thus our sample is not a random drawing from the underlying student population. As Green (1993, p. 689) has shown, ordinary least squares regression of equation (1) is subject to a non-linear omitted variable problem, and its parameter estimates are biased toward zero. The proper approach is to estimate the model with the truncated regression model.

The data for this project were collected through a survey of 810 primary-school graduates who (a) completed the secondary school entrance exam (SSEE), (b) performed in the top one percent of the population, and (c) based on their rankings, they were admitted to one of the top twelve (three private and nine public) high schools in Istanbul-Turkey in the fall of 2006.⁴ 285 of the survey responds contained missing values and were subsequently omitted. The empirical work that follows is based on the remaining 535 respondents. Table 1 provides the information on the twelve high schools and their admission criteria. Private schools admitted students with SSEE scores in the top range of 0.01 to 0.03 percent while public schools admitted students with SSEE scores in the top range of 0.6% to 1.08%.⁵

⁴ In 2006, a total of 797,286 primary school graduates in Turkey participated in the secondary school entrance exam (SSEE). A total of 7,972 of these students scored in the top one percent category. This survey covers 810 (or approximately 10 percent) of the students in the top one percent category. These students were admitted into the top 9 public high schools and three top private high schools in Istanbul. Out of the 810 observations, 285 suffered from missing values. Thus the empirical work was carried out using the remaining 535 observations.

⁵ The survey was conducted by the Cozum Consulting Firm in collaboration with Faculty of Economics, Department of Public Finance at Istanbul University. The interviews were carried out during the registration procedure in each respective high school. To increase its reliability, the questioner clearly stated that the purpose of the survey was purely academic, and had no links to governmental agencies. Finally, necessary permissions for the actual conduct of the survey were obtained from the Ministry of National Education.

Table 1.

Private and Public High Schools in the Survey, Their SSEE Admission Criteria, and Number of Students Admitted

| High School Name | Admission Criteria | Number of students Admitted |
|--|--------------------|-----------------------------|
| American Robert Academy in Istanbul (Private) | 0.01% | 90 |
| Deutsche Schule Istanbul (Private) | 0.03% | 135 |
| Galatasaray Lisesi (Public)a | 0.06% | 100 |
| Istanbul Ataturk High School of Science (Public)a | 0.09% | 96 |
| Istanbul High School (Public)a | 0.13% | 180 |
| Notre Dame de Sion Istanbul (Private) | 0.21% | 126 |
| Beşiktaş Kabataş Public)a | 0.23% | 180 |
| Adnan Menderes Anadolu High School (Public)a,b | 0.65% | 150 |
| Hüseyin Avni Sözen Anadolu High School (Public)a,b | 0.65% | 150 |
| Besiktaş Sakıp Sabancı Anadolu High School (Public)a,b | 0.79% | 120 |
| Atatürk Anadolu High School (Public)a,b | 1.05% | 150 |
| Cağaloğlu Anadolu High School (Public)a,b | 1.08% | 180 |

Notes

a Public High Schools which admit students based on SSEE scores in the top 0.06%-1.08% range taken at public schools in 2006.

b High schools with English as a medium of instruction.

For each student, we have collected data on four categories of variables:

- a. SSEE score as a measure of student performance;
- b. Student's primary school characteristics;
- c. Student's individual characteristics;
- d. Student's family characteristics.

Table 2 lists the variables along with a brief explanation while Table 3 summarizes their basic statistics organized by school type. The SSEE scores are in the narrow range of 438 – 498 for public schools and 437 - 500 for private schools, with means of 466.41 and 470.26, respectively. Thus, the mean score for sample of students from private schools is approximately higher by four points relative to the score for public school students. As shown in the last column of Table 3, this difference is also statistically significant at the one percent level.

Table 2.

Variables

Dependent Variable: Score on secondary school entrance exam (SSEE)

Explanatory Variables:

A. Primary-School variables:

1. Type: Type of primary school (dummy: private=1, public=0);
2. Tuition: Tuition for primary school (Turkish Lira);
3. Size: Number of students in a class;
4. Labs: Number of labs in a primary school;
5. Sports: Availability of sports facilities in a primary school (dummy: yes=1; no=0);

B. Student characteristics:

6. Course: After-school course (dummy: yes =1, no =0);
7. Tutor: Private tutor (dummy: yes = 1, no = 0);
8. Length: Length of preparations (in months);
9. kinder: Attended kindergarten (dummy: yes=1, no=0);
10. Gender: (dummy: female=1, male =0);

C. Family characteristics:

11. Income: Family's net income (Turkish Lira);
 12. M. ed: Mother's education in years;
 13. F. ed: Father's education in years;
 14. M. home: Mother being a homemaker (dummy: yes=1, no=0);
 15. M. ed×M. home: education of homemaking mothers in years;
 16. M. retired: Mother retired (dummy: yes = 1, no =0);
 17. F. retired: Father retired (dummy; yes =1, no=0);
 18. Sibling: Number of siblings;
 19. Own: Home ownership (dummy: yes=1, no=0);
 20. Distance: distance from school (Kilometers)
 21. Books: Number of books in the home library;
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Results

We measure primary school characteristics by five variables: school type, log of tuition, log of class size, number of lab facilities, and availability of sports facilities. As documented in Table (3), (a) 60% of graduates attended public schools and the remaining 40% came from private schools; (b) tuition was in the range of 1 to 5 thousand Turkish Lira for public schools and 1 to 30 thousand Turkish Lira for private schools. Also the mean tuition of 1.66 for public schools was significantly lower than 9.29 for private schools. (c) Class size was in the range of 20-60 students for public schools and 13-30 for private schools. The mean class size of 37 for public schools was significantly larger than the mean of 20.70 for private schools. (d) The average number of lab facilities in public schools was almost half the number of those in private schools. (e) Availability of sports facilities varied significantly between private and public schools, with 69% of students from public schools and 98% of students from private schools reporting access to such facilities. Finally, as reported in the last column, individual school-specific factors differ significantly between private and public schools. Private schools are endowed with higher tuition, smaller classes, more labs and more access to sports facilities.

We consider five measures of student characteristics: course, tutor, length, kinder, and gender. Course and tutor are designed to capture the extent of student's out-of-school preparatory activities. Course takes a value of one if the student attended an after-school course while tutor took a value of one if the student had a private tutor. Else, the variables take zero values. As table 3 shows, (a) 55% of public school students and 54% of private school students participated in an after-school preparatory course; (b) 24% of public school students and 17% of private school

students had a private tutor; (c) average preparation length was 20 months for public school students and 19 months for private school students; (d) 29% of public school students and 43% of private school students had attended kindergarten; and (e) 45% of students from public schools and 44% of those from private schools were females. Also, with the exception of gender and length, all student characteristics differ significantly between public and private school graduates.

We capture family characteristics by ten variables: log of income, mother homemaker, mother and father's education and labor force involvements, number of siblings, home ownership, distance from school and family book inventory. As table 3 shows, (a) average family incomes were 3.15 and 5.81 thousand Turkish Lira for students attending public and private schools, respectively; (b) 46% of mothers for students in public schools and 29% of students from private schools were homemakers; (c) average years of mothers' (fathers') education were 11.14 (12.85) for public school students and 13.32 (14.20) for private school students, respectively; (d) average education of fathers also varied from 12.91 to 14.20 between the two school types, respectively. (e) Average number of siblings varied from 1.23 for public school students and 1.07 for private school students; (f) distance from school was 28.9 kilometers for public school students and 31.50 for private school students; (g) home ownership was 81% for public school students and 83% for private school students; and (h) the average number of books in the family varied between 83.3 and 100 for public and private school students, respectively. Two additional points deserve attention: First, as reported in the last column of Table 3, with the exception of home ownership and mother's job market activity, family characteristics differ significantly between public and private school students. Second, as a general rule, private school students are associated with higher income families, more educated parents, fewer siblings, and access to more reading materials.⁶

⁶ Other articles also state the similar results: For example, Gelbal (2008) states that the success in Turkish language courses gets as high as the more educated the mother is and as the less sisters and brothers are owned. Hortaçsu (1995) suggests that educated parents serve as tutors and advisors. Yenilmez and Duman (2008) indicates that the more educated the mother is, the more the student is interested in mathematics. Yet, it is rather interesting that these factors are not so much effective when the child becomes an undergraduate student (Şeker, Çınar and Özkaya (2004). Preparatory courses, physical characteristics of school play more important role in Higher Education Entrance Exam (Altun and Çakan, 2008)

Table 3.
Basic Statistics for Public and Private Schools

| Variable | Public Schools (319 observations) | | | | Private Schools (216 observations) | | | | H0: $\mu_1 = \mu_2$ |
|-----------|-----------------------------------|---------------------------|------|------|------------------------------------|---------------------------|------|------|----------------------------|
| | Mean (μ_1) | Std Dev (σ_1) | Min. | Max. | Mean (μ_2) | Std Dev (σ_2) | Min. | Max. | |
| SSEE | 456.05 | 14.91 | 438 | 498 | 470.71 | 15.05 | 437 | 500 | 3.53 (0.00) ^{a,d} |
| Tuition | 1.66 | 0.55 | 1 | 5 | 9.29 | 5.97 | 1 | 30 | 22.70 (0.00) ^a |
| Size | 37.11 | 7.61 | 20 | 60 | 20.70 | 3.64 | 13 | 30 | -29.48 (0.00) ^a |
| Labs | 1.80 | 0.94 | 0 | 7 | 3.22 | 2.31 | 0 | 15 | 9.84 (0.00) ^a |
| Sports | 0.69 | 0.46 | 0 | 1 | 0.98 | 0.14 | 0 | 1 | 9.00 (0.00) ^a |
| Course | 0.65 | 0.48 | 0 | 1 | 0.54 | 0.50 | 0 | 1 | -2.53 (0.01) ^a |
| Tutor | 0.24 | 0.43 | 0 | 1 | 0.17 | 0.38 | 0 | 1 | -2.16 (0.03) ^a |
| Length | 19.91 | 9.68 | 1 | 60 | 18.81 | 8.27 | 6 | 48 | -1.36 (0.17) |
| Kinder | 0.29 | 0.46 | 0 | 1 | 0.43 | 0.50 | 0 | 1 | 3.23 (0.00) ^a |
| Gender | 0.45 | 0.50 | 0 | 1 | 0.44 | 0.50 | 0 | 1 | -0.03 (0.76) |
| Income | 3.15 | 2.60 | 0.75 | 15 | 5.81 | 4.36 | 0.30 | 30 | 8.80 (0.00) ^a |
| M.home | 0.46 | 0.50 | 0 | 1 | 0.29 | 0.46 | 0 | 1 | -3.91 (0.00) ^a |
| M.ed | 11.14 | 3.82 | 2 | 15 | 13.32 | 2.72 | 2 | 15 | 2.20 (0.30) ^a |
| M.retired | 0.07 | 0.25 | 0 | 1 | 0.05 | 0.21 | 0 | 1 | -0.95 (0.34) |
| F.ed | 12.85 | 3.37 | 2 | 15 | 14.23 | 2.16 | 5 | 15 | 5.26 (0.00) ^a |
| F.retired | 0.15 | 0.35 | 0 | 1 | 0.05 | 0.21 | 0 | 1 | -0.85 (0.65) |
| Sibling | 1.23 | 0.87 | 0 | 7 | 1.07 | 0.83 | 0 | 4 | -2.02 (0.04) ^a |
| Own | 0.81 | 0.39 | 0 | 1 | 0.83 | 0.37 | 0 | 1 | 0.72 (0.47) |
| Distance | 28.89 | 23.17 | 5 | 240 | 31.47 | 19.73 | 5 | 120 | 0.35 (0.25) |
| Books | 83.26 | 66.12 | 5 | 300 | 97.94 | 94.63 | 18 | 477 | 2.11 (0.04) ^a |

Note:

Values in parentheses are standard errors of coefficients. Significance at 1, 5, and 10 percent are represented by a, b, and c respectively. d Student t-statistics with their p-values in parentheses.

Discussion

A potential problem in estimating the model is the possibility of multicollinearity among the right-hand-side variables. In fact, our preliminary investigation reveals high correlation between several variables including: (1) school type, tuition and class size; (2) M_home, M_ed and M_home*M_ed; and (3) F_ret with M_ret. We address this problem by estimating five alternative specifications which exclude some of these variables from the model. Table 4 provides the estimation results along with a number of descriptive statistics on each model. Numbers in parentheses are White's heteroskedasticity-consistent standard errors. Significance at 1, 5, and 10 percents are represented by a, b, and c, respectively. Diagnostic tests reported in the bottom panel of the table shows improvements in performance as additional variables are included into the model. The significant values of F-statistics suggest that all right-hand-side variables are jointly significant. The successive rises in the log likelihood function, AIC and SBC suggests that additional variables contribute to the model's performance. The high values of Jarque-Bera statistic, however, rejects the null hypothesis of normal distribution.

Model 1 examines if student performance varies significantly between public and private schools without controlling for other variables. The positive and significant coefficient of 'type' reveals that private schools students outperform public school students by a margin of one percent. Model 2 examines to what extent school-specific characteristics (tuition, class size, lab facilities and access to sport facilities contribute to differences in test performance. The effect of tuition on student performance is weak and statistically insignificant as are the effects of class size and school labs. The only exception is the sports facilities, which has a positive and significant effect.

Model 3 examines to what extent the effect of tuition and class size on student performance varies between private and public schools. The findings suggest that: (1) the effect of tuition varies significantly between public and private school students, with a negative effect on public school students but a positive effect on private school students. Perhaps private schools with sufficiently high tuition are capable of attracting better quality teachers and contribute to student achievement. (2) The effect of class size while negative is significantly different between public and private schools. (3) Additional lab facilities do not contribute significantly to student performance; and (4) availability of sports facilities contributes positively and significantly to student performance in both public and private schools.

Table 4.
Determinants of Student Performance on the Secondary School Entrance Exam

| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 |
|-------------------|----------------|----------------|-----------------|-----------------|---------------------|
| Intercept | 6.144 (0.002)a | 6.151 (0.019)a | 6.155 (0.023)a | 6.160 (0.022)a | 6.147 (0.025)a |
| Type | 0.010 (0.003)a | | | | |
| Log(Tuition) | | 0.002 (0.002) | -0.016 (0.005)a | -0.013 (0.005)a | -0.018 (0.005)a |
| Type×log(Tuition) | | | 0.022 (0.006)a | 0.020 (0.006)a | 0.023 (0.006)a |
| Log(Size) | | -0.005 (0.005) | -0.004 (0.006) | -0.005 (0.006) | -0.001 (0.006) |
| Type×log(Size) | | | -0.006 (0.003)b | -0.005 (0.003)b | -0.005 (0.003)b |
| Labs | | 0.001 (0.001) | 0.001 (0.001) | 0.001 (0.001) | 0.001 (0.001) |
| Sports | | 0.012 (0.004)a | 0.012 (0.003)a | 0.011 (0.003)a | 0.010 (0.004)a |
| Course | | | | -0.005 (0.004) | -0.005 (0.004) |
| Tutor | | | | 0.012 (0.004) | 0.012 (0.004) |
| Length | | | | 0.0001 (0.001) | 0.0001 (0.001) |
| Kinder | | | | -0.008 (0.003)a | -0.008 (0.003)a |
| Log(Income) | | | | | 0.00002 (0.002) |
| M_Home | | | | | -0.023 (0.013)c |
| M_ed | | | | | -0.0002 (0.001)b |
| M_Home×M_Ed | | | | | 0.002 (0.001)b |
| F_Ed | | | | | -.00002 (0.0006) |
| F_Retired | | | | | -0.001 (0.004) |
| Sibling | | | | | 0.0003 (0.001) |
| Own | | | | | -0.005 (0.003) |
| Distance | | | | | 0.0002 (0.00006) |
| Books | | | | | 0.00004 (0.00002) b |
| \bar{R}^2 | 0.087 | 0.042 | 0.061 | 0.100 | 0.115 |
| F-Statistic | 7.390a | 6.835a | 6.784a | 6.872a | 4.462a |
| Log likelihood | 1084 | 1093 | 1099 | 1111 | 1120 |
| AIC | 1082 | 1087 | 1097 | 1109 | 1108 |
| SBC | 1078 | 1076 | 1078 | 1077 | 1055 |
| Normality | 24.974a | 20.723a | 18.789a | 10.950b | 9.660 b |

Notes. Significant at 1, 5, and 10 percent are represented by a, b and c respectively, \bar{R}^2 is the corrected R-Squared; F-statistic tests the joint significance of all right-hand-side variables; AIC and SBC are Akiake and Schwarz information criteria; and Normality is the Jarque-Bera test of normality.

Model four incorporates four additional student-specific characteristics – course, tutor, length and kinder – to the model.⁷ The main findings are: (1) The conclusions regarding the impact of school-specific characteristics (type, tuition, size, labs, and sports facilities) remain robust to the inclusion of these additional variables. Perhaps the only exception is in regard to the effect of class size, which is now insignificant for public schools but negative and significant for private schools. (2) There is no evidence that merely taking after-school courses, or their duration, affect school performance in a meaningful and significant way. This is reflected in the small and insignificant parameter estimates for both course and length variables. However, (3) having private tutors contributes positively and significantly to student performance. Students

⁷ In our original specification, we included two additional student characteristics, Prep and Both. However, given their extremely high correlation with the intercept and other variables, they were omitted from the model.

with private tutors scored more than 1.2 percent higher than those without tutors. (4) Prior educational experience such as kindergarten does not appear to have its intended outcome. In fact, students with kindergarten experience scored slightly less than one percent.

Model five incorporates seven additional variables reflecting family-specific characteristics -- income, mother homemaker, mother's and father's years of education, number of siblings, home ownership and family book inventory. It also allows the effect of homemaking mothers to depend on their level of education. This is done by adding the product of 'mother homemaker' and 'mother education'. Three findings stand out: (1) The coefficients of school- and student-specific characteristics in models 3 and 4 remain robust to these additions. (2) Home-maker mothers contribute negatively to student performance but educated home-maker mothers contribute positively. (3) The number of family book holdings has a positive and significant effect on student performance, suggesting that parents' intellectual orientation may have a positive effect on student performance. (3) Also, distance from school appears to have a positive effect on student performance, perhaps reflecting the opportunity cost of time for these students and their families. No other family characteristic contributes significantly to student performance. Thus, in general, family characteristics appear to play a minimal role in student achievement after accounting for school and student-specific characteristics.

Conclusion

The determinants of student achievement and their policy implications have received a great deal of attention over the past four decades. This paper contributes to this literature by examining the relevance of a broad class of school, individual and family characteristics as the source of variation in student achievement. The empirical work is carried out using a cross sectional data on student achievement and three categories of school, student, and family characteristics from primary-school graduates in Istanbul, Turkey.

A number of important findings emerge. First, other things the same, school type contributes significantly to student performance. Second, the effect of school specific factors varies between public and private schools. In general, tuition is associated with a decline in student performance in public schools but an improvement in private schools. The effect of class size is negative and more pronounced for private schools. The availability of lab and sports facilities contribute positively to student achievement. Third, after-school activities such as additional courses and their duration as well as prior kindergarten experience do not have a meaningful effect on student performance. However, having private tutors does. Fourth, family characteristics such as income, parents' education, parents' professional activities, number of siblings and home ownership generally do not play an important role in student achievement. However, the effects of family book inventory and distance from school are positive and significant. The former may reflect the potential importance of parents' intellectual orientation in development of children's educational attainment while the later may reflect the opportunity cost of time.

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