Do Greater School Autonomy and Accountability Make a Difference? Evidence from the Random Assignment of Students into Private and Public High Schools in Seoul

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Abstract

We show that private high school students outperform public high school students in Seoul, South Korea, where secondary school students are randomly assigned into schools within school districts. Both private and public schools in Seoul must admit students randomly assigned to them, charge the same fees, and use the same curricula under the so-called 'equalization policy', but private schools enjoy greater autonomy in hiring and other staffing decisions and their principals and teachers face stronger incentives to deliver good students' performance. Our findings suggest that providing schools greater autonomy in their personnel and resource allocation decisions while keeping school principals accountable can be effective in improving students' outcomes.

Keywords: Private schools; Charter schools; Public schools; Academic performance; Randomization; Korea.

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I. Introduction

A large body of literature in economics, education, and sociology has shown that students attending private schools outperform students attending traditional public schools in a wide range of outcomes. Since a common feature of private schools is their autonomy from school district offices, these findings strengthen initiatives to improve outcomes of public schools students through the establishment of charter public schools in the United States, free schools in the United Kingdom, independent public schools in Australia, and community-managed schools in many developing countries. However, it is often unclear whether private and independent public schools causally improve student outcomes and even if they do, which characteristics drive such improvements.

Studies attempting to identify the effects of private or charter schooling and to disentangle the various causal mechanisms face two major challenges. First, it is difficult to identify the causal effects of independent public or private schooling on students' outcomes on the basis of most observational data available because unobserved selection bias is pervasive and challenging to address (Altonji et al. 2005a). Although recent experimental evidence based on the random assignment of private school vouchers or oversubscribed charter school slots to low-income applicants shows significant positive effects of these schools on student outcomes, it is still difficult to learn precisely which aspects of these schools explain the differences in outcomes.[1] When these studies compare the outcomes between the randomly selected receivers (treatment group) and non-receivers (control group) of private school vouchers or charter school slots, the estimated effects of private or charter schooling capture the overall differences in peer quality and other dimensions of school and teacher quality between the highly sought-after schools and the default traditional public schools. In some cases, the newly-introduced randomization programs would also put competitive pressures on existing public schools in which the control groups enroll, and hence would change the outcome trajectories of the control groups and bias the estimates. As

[1] For examples of experimental evidence, see Peterson et al. (2003), Angrist et al. (2002), Angrist et al. (2006) and Hoxby and Murarka (2009). Earlier observational studies, such as Coleman et al. (1982), Alexander and Pallas (1985), and Coleman and Hoffer (1987) found that private schooling in the U.S. is more effective in raising student achievement (test score) than public schooling, even after controlling for the factors that jointly influence private school choice and achievement. More recent observational studies by Figlio and Stone (1999), Vandenberghe and Robin (2004), Altonji et al. (2005a, 2005b), however, show mixed results regarding the effect of private schooling on achievement. On the other hand, observational studies focusing on the effects of private or Catholic schooling on high school completion and college attendance, such as Evans and Schwab (1995), Neal (1997), Altonji et al. (2005a), Le and Miller (2003), and Vella (1999) consistently show positive effects of private schooling.

applicants may differ from the general student population, it is also unclear whether the effects will be similar if these programs are scaled up.

The objectives of this study are two folds. First, using a unique randomized natural experiment in Seoul, South Korea (hereafter Korea), we show that private high schools are more effective than public high schools in generating positive educational outcomes. Since the 1970s and until recently, the Korean government had implemented the so-called 'equalization policy' in several major metropolitan areas, where students were randomly assigned to different high schools within school districts of their residence. The random assignment in Seoul indicates that, although motivated parents may choose to live in a neighborhood with high-quality schools, they do not have controls over which schools—private, public, single-sex or coeducational schools—their children attend *within* the school district. This randomization process allows us to identify the causal effects of attending private high schools by removing unobserved selection bias that may be present otherwise. We use administrative school-level and individual-level data to examine the effects of private schooling on the likelihood of dropping out, the likelihood of college attendance, test scores, and violent behavior. These outcomes are not only important predictors of individual earnings and productivity, but also measures of school quality to which parents and policy makers pay attention.[2]

Second, we examine the mechanisms through which private schooling may benefit students. As in many other countries, private schools in Seoul are privately owned and have significant autonomy from the local school district. However, Korean private schools are subject to many of the same government regulations as public schools, such as adopting a similar curriculum, tuition, and base salaries for teachers. As the randomization process removes differences in entering students' quality across schools, as well as the incentives for schools to compete for students and funding, private and public schools in Seoul are similar in many dimensions. This feature of the Korean school system provides a useful setting to help pinpoint whether decentralizing decision making from school district offices and providing greater discretion to individual schools – a key component shared across the charter public, independent, and community managed school movements in many countries – lead to better outcomes.

[2] For example, as a part of the annual evaluation of schools, New York City school surveys ask parents about their perception and satisfaction on how the schools handle disciplinary problems and absenteeism of their children.

We find that private school students are no more likely than public school students to drop out of and graduate from high school, but they are more likely to attend colleges and less likely to be involved in violent incidents. In particular, the increase in college attendance rates is primarily driven by the increase in four-year college attendance rates, rather than two-year junior college attendance rates. The test score distribution of the College Scholastic Aptitude Test (CSAT), a standardized test for most college admissions in South Korea, indicates that private schools are more effective in improving test scores of students in the lower end of the distribution and hence placing a greater proportion of high school seniors into colleges. We also find that private school students perform better in the National Assessment of Educational Achievement (NAEA) test, a national standardized examination administered to students in their second year of high school (i.e., equivalent to the eleventh graders in other countries). Private school students are more likely to be present on the day of the NAEA test, suggesting lower student absenteeism in private schools. Because of the potential non-random selection into test taking, we use Lee's (2009) sharp-bound estimators to estimate the causal effects of private schooling on test scores. Findings indicate that private school students outperform public school students in all NAEA subjects, namely Korean, Mathematics, and English by at least 0.06 to 0.08 standard deviations.

The equalization policy removes channels that are commonly associated with the relatively superior performance of private schools in other countries, such as the differences in resources, curricula, peer quality, and incentives to compete for students. We further rule out single-sex schooling, religious affiliation of private schools, ability-tracking, private tutoring, and school infrastructures as explanations for the private school effects.

We argue that the relative effectiveness of private schooling is mainly driven by (1) the autonomy that private school principals have over their personnel and resource allocation decisions, and (2) the more stringent accountability measures and incentives that private school principals face. In particular, the board of directors of a private school hires the school principal, and the principal in turn decides school policies, makes other personnel decisions, and allocates the budget. In contrast, public school principals and teachers in Seoul rotate from school to school every several years and the Seoul Metropolitan Office of Education has the ultimate control over personnel decisions of all public schools, like the school districts and ministries of education in many other countries (Kim et al. 2007). Survey data that we independently collected indicate that private school principals face less job security and place a higher emphasis on students' academic performance than public school principals. The greater autonomy in hiring teachers and setting school policies means that private school

principals can better select teachers and design the school environment to deliver their desired outcomes. Despite having similar level of resources per student, the data show that private school principals tend to encourage innovative teaching and allocate their limited resources differently from public schools, especially in personnel decisions. Our results suggest that giving schools greater autonomy while keeping principals accountable for their performance can lead to better student outcomes, even when there are no differences in student quality, additional resources, or curricula and in the absence of competition between schools.

II. Background: Secondary Schools in Korea

Concerned about the adverse effects of competitive high school entrance exams, private tutoring, corruption, and large differences in peer quality across schools, the Korean government first implemented the 'equalization policy' among high schools in Seoul and Pusan in 1974. The equalization policy removed the competitive high school entrance examination and introduced random assignment of students across schools within school districts.

With the introduction of the equalization policy in 1970s, all private schools were added into the existing system of centralized public school finance in Korea. Uniform and centralized policies over fees and tuition, curriculum, and teachers' qualification were introduced.[3] As private schools are not allowed to charge higher tuition, they are heavily subsidized by the government. Teachers must instruct students in accordance with the unified national curriculum, based on designated or certified textbooks (Kim et al. 2007). Both private and public school teachers are guaranteed with equivalent salary schedules based on their experiences and qualifications. High school teachers must be graduates from teacher's college or fulfil specific course requirements for teachers, but public teachers must also pass the national teachers' employment examination as they are considered as government employees.

Although both public and private high schools are heavily regulated, some differences exist between the two. All school principals in Seoul are selected among those with a certificate for principal eligibility. Principals of public schools in Seoul are appointed by Seoul Metropolitan Office of Education while those of private schools are appointed by the

[3]According to the legislation on school tuition fee and admission fee, the annual tuition in 2009 for both public and private high schools was set at about 1300 USD (1.45 million KRW). Admission fee was 14,100 KRW, which is less than 15 USD (Source: http://www.law.go.kr).

individual school's board of directors. The board of directors determines the appointment and promotion of principals.[4] Private school principals decide whom they hire as teachers and the length of the teachers' contracts (i.e. short-term teachers or regular teachers). Public school principals and teachers are government employees and they must rotate to different schools every four years. Also, public school principals can work as regular teachers after their term as a principal ends (i.e., guaranteed employment although at a lower level), but private school principals are not guaranteed a position after their term ends. Thus, private school principals and teachers generally face less job security comparing to public school principals and teachers.

Principals at both public and private schools have control over their daily operations and how they allocate their overall budget and resources, though public school principals have little control over how they spend on personnel and staffing. For example, principals can decide how they provide financial assistance to students and how they organize their classrooms and teachers. The difference in outcomes between public and private may appear along these dimensions especially if private schools make a more efficient use of educational inputs.

III. Data

A. Description

The data used in this paper are drawn from several sources. First, we use publicly disclosed school-level information pertaining to enrollment, dropouts, transfers, graduates' destinations, number of teachers, number of classrooms, incidents of violence, and student achievements.[5] Second, we obtain data on individual eleventh graders' performance in the National Assessment of Educational Achievement (NAEA), surveys of principals and test takers participating in NAEA, as well as individual twelfth graders' test scores in the College Scholastic Aptitude Test (CSAT) from the Korea Institute for Curriculum and Evaluation (KICE). In 2010, Korean eleventh graders were given the NAEA test. Unlike the CSAT, which is a national standardized test used for college admission, the NAEA is a relatively low-stakes test designed by the KICE to identify factors affecting student achievements.[6] The NAEA data also provide some student and school information which is useful for our

[4] Private School Law, Korea Ministry of Government Legislation (Source: http://www.law.go.kr).
[5] The data are available at www.schoolinfo.go.kr, the Ministry of Education, Technology and Science's website. We also verify the data with those collected by the Korea Education and Research Information Service (http://edudata.keris.or.kr).
[6] Source: http://www.kice.re.kr.

analysis. Third, we surveyed 173 high school principals in Seoul in 2013 to obtain information about differences in the management and governance styles, as well as the perceptions regarding differences between public and private schools.[7] Except for our own survey data, all data used in this paper are administrative data, so we have information for the universe of schools (school-level data) and test-takers (student-level data) in Seoul.

In 2008, middle school graduates (aged 16) in Seoul were randomly assigned into roughly 200 high schools within its 11 school districts illustrated in Figure 1.[8] These high schools can be public or private, as well as single-sex or coeducational. The private schools are either religiously affiliated or secular. Religiously affiliated private schools are predominantly Christian. Students who entered high schools in Seoul prior to 2010 were randomly assigned into schools unconditional on any potential school preferences they have within school districts. We focus on outcomes of students entering into high schools in 20Among the universe of high schools in Seoul, we focus on 195 schools which have data available for all of the key outcome variables between 2008 and 2010.[9] Table 1 provides summary statistics of the variables used. The first four binary variables concern school types. Nearly two-thirds of the high schools are privately owned and about 30 percent of the private schools are religiously affiliated. Coeducational, all-boys, and all-girls schools are roughly one-third each.

The second set of variables in Table 1 includes predetermined school-level information. We briefly summarize some of the key variables of interest here. Transferring and dropping out are fairly uncommon in Seoul; less than two percent on average. Violent incidents are rare; one incident per 1000 students annually. The schools on average have approximately two-thirds of all seniors entering into colleges. Among those attending colleges, about two-thirds are in four-year colleges. The average class size in Seoul is about 39 students and the average student-teacher ratio is 18. Approximately 40 percent of teachers have a masters' degree. On average, four percent of high school students came from families

[7] Out of the 194 high schools sampled in this paper, we excluded schools which changed their school type from general academic to autonomous school between 2010 and 2013.

[8] In Korea, primary schooling spans six grade levels, and secondary schooling composes of three years of middle schools and three years of high schools. Most students start their primary schooling at age 6.

[9] There are roughly 20 highly selective high schools in Seoul, often specialized in arts, science and foreign languages, exempted from the randomization process and have priority over all other schools in their student selection process. These students and schools are not part of our sample. We also exclude the schools that changed their gender or academic types between 2008 and 2010. In addition, one school district made up by Jongno-gu, Jung-gu, and Yongsan-gu administrative districts practices conditional randomization as they are located in the central area of Seoul and there are few residents within the district. The results reported in this paper are not sensitive to dropping this school district and the results are available upon request.

on governmental welfare support. 12 percent of students receive free lunch support from the government. Ethnic minority students are rare; 0.1 percent of the student population.

Finally, Table 1 summarizes student-level data of the NAEA test takers in 2010. Out of the 88,406 students expected to take the NAEA tests in 2010, about three percent missed some of the tests. We normalize the NAEA test scores, which range between 100 and 300, to have mean zero and standard deviation 1.

B. Verification of Random Assignment

If randomization is strictly enforced in the high schools in Seoul, then the final school assignments should not be correlated with any predetermined characteristics of students and parents. We verify random assignment by examining whether private and public schools have similar student characteristics within school districts in the following regression equation:

$$x_{jkt} = \alpha \cdot Private_{jk} + \delta_{kt} + \epsilon_{jkt}, \quad (1)$$

where x_{jkt} represents the average characteristics of students in school j of school district k in year t. $Private_{jk}$ is an indicator for whether a school is privately owned or not. The term δ_{kt} represents 11 school district fixed effects or 33 school-district-year fixed effects depending on whether one year or three years of data are used. School district fixed effects are included because randomization is implemented within districts. There are only a small set of predetermined student characteristics available. These variables include the percentage of students living in families participating in public welfare program, the percentage of students from ethnic minority groups, and the percentage of students on lunch support (a proxy for poverty). Although transferring is uncommon (less than two percent) and the students who transfer to another school district are subject to random assignment again, we also examine whether the percentage of students transferring to another school is different between private and public schools.[10] If randomization is strictly enforced, the coefficient α should not be statistically different from zero, indicating that private and public schools tend to have similar student characteristics and transfer rate.

[10]The information of student transfers and percent of students on lunch support came from the school-level data for 2008-2010 available at www.schoolinfo.go.kr, while other information of the average student characteristics of each school is sourced from the principal survey accompanying the 2010 National Assessment of Educational Achievement.

Columns 1 to 3 in Table 2 show that there are no statistically significant differences between the average characteristics of students that private and public schools admitted. Column 4 also indicates that students do not selectively transfer out to other schools. The coefficient estimates of *Private* in all cases are close to zero, consistent with what the randomized allocations would imply.

[Insert Table 2]

IV. Impacts of Private Schooling on Student Outcomes

A. Drop Out, Graduation, Violence, and College Attendance

We exploit the random assignment of students into schools within school districts to identify the causal effects of private schooling on student outcomes using the following regression specification:

$$y_{jkt} = \beta \cdot Private_{jk} + \delta_{kt} + \epsilon_{jkt}, \quad (2)$$

where y_{jkt} denotes an outcome of students in school *j* of school district *k* in year *t*. The school-level outcome variables include (1) the percentage of students dropping out of high school, (2) the percentage of high school seniors graduating, (3) the number of violent incidents reported per student, (4) the percentage of high school seniors attending any college, (5) the percentage of high school seniors attending two-year colleges, and (6) the percentage of high school seniors attending four-year colleges. $Private_{jk}$ is an indicator for whether school *j* is privately owned or not. δ_{kt} represents a set of school district-year fixed effects. When we have only one year of data, δ_{kt} includes 11 school district fixed effects; when we have three years of data, δ_{kt} includes 33 school district-year fixed effects. As students are randomly assigned into schools within a district, the inclusion of δ_{kt} ensures that the selection into school districts is controlled for and that the coefficient of interest β captures the causal effect of attending a private school on student outcomes. The term ϵ_{jkt} denotes all other unobserved influences of the outcomes.

We report the estimated effects of private schooling on school-level student outcomes in Table 3. The first two columns in Table 3 indicate that private school students and public school students are equally likely to drop out of and graduate from high school. As high

school dropout rate is very low at 1.6 percent and graduation rate is close to 100 percent in Seoul,[11] there is not much room for improvement in these outcomes.

Column 3 in Table 3 shows that private school students are less likely to be involved in violent incidents. In particular, private schooling reduces average violent incidents per student by approximately one per 1000 students.[12] Comparing to the average violent incidents per student in public schools, which is 1.5 incidents per 1000 students, private schooling reduces violent incidents per student by almost 60 percent. This estimate is comparable to the finding by Cullen et al. (2006), which shows that self-reported arrest rates are reduced by nearly 60 percent among the students who win lotteries to attend high-achieving schools compared to those who do not. Violence is an extreme form of behavioral problems and is fairly rare in Korean high schools. Having more violent incidents will likely mean that other forms of behavioral problems are also pervasive. The fact that private schools have fewer violent incidents per student than public schools suggests that students in private schools tend to have lower level of other behavioral issues and enjoy safer school environment.

Column 4 reports that private schooling significantly increases high school seniors' college attendance rates. The effect is estimated to be 4.3 percentage points or 7 percent higher than public schools, where roughly 60 percent of public high school seniors enter colleges. Columns 5 and 6 indicate that private schooling significantly raises the likelihood of four-year college attendance and reduces the likelihood of two-year college attendance. In sum, our findings show that private high school students are less likely to be involved in violent incidents, and more likely to pursue higher education. In particular, private schooling increases college attendance rates of high school seniors by moving them into four-year universities and away from two-year junior colleges and other options.

[Insert Table 3]

Since the school-level data of four-year and two-year college attendance of high school seniors are also available by gender, we report the estimated effects on college attendance rates by gender in Table 4. Overall, the evidence suggests that private schooling significantly increases the probability to attend any college considerably more for boys than for girls (columns 1 and 2). Interestingly, the constants are higher for female students than

[11] In 2010, the dropout rate of high school students in the United States is 7.4 percent (Source: http://nces.ed.gov/fastfacts/display.asp?id=16, accessed August 2013).

[12] Schools may underreport the number of violent incidents, but the measurement errors are likely orthogonal to the school ownership type.

male students, meaning that girls in public school tend to do better than boys. Also, the size of the coefficients means that private schools help boys close the gap somewhat, but not enough to catch the educational performance of girls. Columns 3 and 4 show that private schooling increases the likelihood of high school seniors to attend four-year colleges by 8.1 percentage points for males and by 5.3 percentage points for females, respectively. Columns 5 and 6 show that private schooling reduces the likelihood of high school seniors to attend two-year colleges by 2.8 percentage points for males and by 2.3 percentage points for females, respectively. Thus, higher overall college attendance rate among boys in private schools are mostly driven by increased likelihood of attending 4-year colleges.

[Insert Table 4]

Because a student's performance in the College Scholastic Aptitude Test (CSAT) predominantly determines whether the admission requirements of a desired college and major are met, differences in the distributions of CSAT scores (conditional on school district fixed effects) across school types should correspond to the differences in college attendance rates and four-year college attendance rates across school types.[13] Figure 2 shows that private schooling shifts the entire CSAT score distribution to the right with the exception of high-achieving students and reduces the share of students falling in the bottom tail of the test score distribution.

[Insert Figure 2]

B. Impacts on Test Taking and Test Scores

We use individual eleventh graders' test scores in the National Assessment of Educational Achievement (NAEA) to assess the effects of private schooling on high school students' achievement. Because the NAEA is relatively low-stakes and students cannot strategically select subjects the way they would do for the CSAT, the NAEA test scores can more appropriately reveal whether private schooling improves students' learning. We estimate the effects of private schooling on individual students' test scores using the following regression equation:

[13] Students must take 7 subjects in CSAT. Korean and English tests are the same for all students, but other tests depend on students' track and their choice of mathematics and electives.

$$y_{ijk} = \beta \cdot Private_{jk} + \delta_k + \epsilon_{ijk}, \quad (3)$$

where y_{ijk} measures the test score of student i in the subject of Korean, mathematics, or English in 2010. As before, the coefficient of interest is β and δ_k represents a set of school district fixed effects. Before estimating the effects of private schooling on test scores, we also check whether private school students and public school students are equally likely to take each test to ensure that the estimates do not suffer from any selection bias. For example, if private schools are more effective in making academically-inclined students take the test, then the estimated effects of private schooling on test score will be biased upward.

The test score distribution for each test by type of school (conditional on school district fixed effects) is shown in Figure 3. The top panel shows the test score distributions for Korean; the middle panel shows the test score distributions for math; and the bottom panel shows the test score distributions for English. Figure 3 illustrates that the distributions of private school students' test scores are to the right of the distributions of public school students' test scores. More importantly, the figure shows that private schooling not only increases the mean test scores, but also reduces the fraction of students falling into the bottom tails of the distributions.

[Insert Figure 3]

The OLS estimates support the patterns shown in Figure 3. Specifically, columns 1 to 3 in Table 5 indicate that private school students significantly outperform public school students in Korean, mathematics, and English. The estimated effect of private schooling on test score is 0.12 standard deviations for Korean and 0.11 standard deviations for Math and English. However, columns 4 to 6 show that private school students are less likely to miss the NAEA tests by 2 percentage points, indicating higher absenteeism on the test date among the students in public schools. If there are non-random differences in the selection into test taking between private and public school students, the estimated effects of private schooling based on equation (3) will suffer from non-random selection bias. To address this concern, we use Lee's (2009) sharp-bound estimators to bind the effects of private schooling on test scores. The sharp-bound estimators trim the private school sample on the basis of the selection rate (i.e., the probability of missing the test) of the public school sample relative to that of the private school sample, so that the private school sample is comparable to the public school

sample. When the upper tail of private school test scores is trimmed, the remaining sample of test takers in private schools is comparable to the sample of test takers in public schools, assuming high performers of the public schools miss the test. The lower-bound estimate of the private school effect is then the difference between the average test score of public school test takers and the average test score of the trimmed sample of private school test takers. Similarly, the upper-bound estimate of the private school effect is obtained from trimming the lower tail of the private school test score distribution and then taking the difference between the average test scores of public test takers and trimmed private school test takers.

[Insert Table 5]

The bottom panel in Table 5 reports the lower-bound and upper-bound estimates of the effects of private schooling on Korean, Math, and English test scores. The lower sharp bound estimates are greater than zero, indicating that even in the worst case scenario, where the brightest public school students are selected out of test taking, the estimated effect of private schooling on test performance is positive. If the worst-performing public school students miss the NAEA tests, then the estimated effect of private schooling on test score is as large as 0.15 standard deviations for Korean and 0.13 for Math and English. This is a sizable effect, considering that one standard-deviation increase in teacher quality (i.e., measured by teacher fixed effects) is found to increase student test score by 0.1 standard deviations (Rockoff 2004). This effect size is also roughly three-quarters of what Angrist et al. (2002) found for the random assignment of private school vouchers in Colombia. It is not surprising that the estimates are smaller than those reported in Angrist et al. (2002). Unlike the situation in Colombia, private and public high schools in Seoul must admit similar students, use the same curricula, and charge similar fees, so there are fewer factors to influence outcomes. Nevertheless, the private school effects are sizable. The findings call for further investigation into the factors that explain the private school effects in the next section.

V. What Factors Explain the Private School Effects?

The randomization of students into schools and the equalization policy imply that many factors typically attributed to the effects of private schooling are absent in Seoul. The randomization of students into schools removes peer quality differences among newly admitted students, as well as the incentives for schools to compete for students and revenues. The implementation of the equalization policy also means that fees charged and curricula

used are similar in private and public schools. This unique setting allows us to eliminate some of the frequently discussed channels through which private and charter schooling may improve student outcomes.

Our own investigation of the channels indicates that: (1) greater autonomy given to private schools, together with (2) the more stringent accountability system placed on private schools are likely the main drivers of the better outcomes for private high school students in Seoul. This section is devoted to present how we come to this conclusion. We first show how various other factors are ruled out as likely channels due to insufficient evidence on the differences between public and private schools. We then corroborate the two likely channels using principal survey data that we conducted in 2013.

A. Factors that Do Not Explain the Private School Effects

We examine the common inputs in the education production function that might be correlated with private schooling and have independent effects on student outcomes. These inputs include effective school practices, inputs of students and parents, and school-level resources. We discuss the channels relevant to the differences between private and public schools in the order of: (1) tracking practice; (2) single-sex schooling; (3) religious affiliation; (4) private tutoring; and (5) resources.

First, the private school effects may be attributable to the greater use of ability-tracking, as a recent experimental study by Duflo et al. (2011) shows that tracking students by ability leads to improved achievement of all students. If the likelihood of tracking students into different classrooms on the basis of ability differs between private and public schools, then it is possible that the private school effects are attributable to the greater use of tracking. Table 6 shows no significant differences in the likelihood of ability-tracking students by subject between private and public schools.

[Insert Table 6]

Second, private schools in Seoul are more likely to be single-sex. It is possible that the estimated private school effects also capture the effects of single-sex schooling. We estimate equations (2) and (3) separately for students attending single-sex schools and coeducational schools to disentangle the effects of private schooling from the effects of single-sex schooling. If the private school effects are present within each gender type of schools, then it is unlikely that the effects are driven by single-sex schooling. The analysis is

pertinent given recent findings by Park et al. (2012) and Hahn and Wang (2012) showing that students in single-sex high schools outperform those in coeducational high schools in some outcomes, depending on the gender of students and the ownership type of the schools.

Table 7 reports the estimated effects of private schooling by gender of student and gender type of school. For simplicity, we only report the OLS estimates but not Lee's (2009) sharp-bound estimates for the NAEA test scores. Similar to the results reported earlier, private schooling reduces the likelihood of in violent incidents and increases the probability of attending college across all gender types of schools. However, the estimated effects of private schooling on test scores are much noisier when we split the sample by the gender type of school. Overall, students attending private schools still show higher test scores than students attending public schools, but the effects are not precisely estimated. In particular, the effects are insignificant for female students attending coeducational schools, even though the magnitudes are generally modest and positive. Thus, the effects of private schooling on college outcomes and violent incidents are unlikely driven by single-sex schooling, but private schools' tendency to be single-sex may partially contribute to their higher average test scores.

[Insert Table 7]

Next, we examine whether the religious affiliation of schools drives the private school effects. Only private schools can be religiously affiliated, and about 30 percent of private schools in Seoul are religious schools, with the majority of them being Christian private schools. Past studies in other countries, such as the U.S. and Australia, have shown significant benefits associated with Catholic private schooling on individuals (e.g., Evans and Schwab 1995; Neal 1997; Vella 1999; Altonji et al. 2005a, 2005b; Le and Miller 2003). It is possible that religious affiliation of private schools, rather than the ownership type per se, explains the outcome differences across school types in Seoul. When we run regressions for each outcome variable against a religious affiliation dummy for the sample of private schools, the estimates show no differences between religiously affiliated private schools and secular private schools (Table 8). Thus, the religious affiliation of schools does not explain the outcome differences.

[Insert Table 8]

The channels examined thus far have focused on the possible differences in school practices between private and public schools. However, students' and their parents' inputs may also respond differently according to their school type, even if the school practices are similar across school type. One such input is the level of private tutoring, given that South Korea has one of the largest and most active private tutoring markets in the world (Bray 2009). On the one hand, it is possible that private schooling is complementary to private tutoring, thus it may increase the likelihood of students taking up private tutoring outside school hours. The positive effects of private schooling on outcomes then would reflect the differential likelihood in private tutoring across school types. On the other hand, students in public schools may not be satisfied with their school quality and in response increase private tutoring. In either case, the effect of private schooling might not be precisely captured.

To test whether private schooling leads to differential responses in private tutoring, we use student survey information available in the NAEA dataset where students report their frequency of private tutoring. Table 9 shows the results from the OLS regressions where the dependent variables include various degrees of private tutoring. There is no significant difference in the likelihood and extent to which students take private tutoring lessons across school types.[14] If anything, private schooling tends to decrease the likelihood of having intensive private tutoring, but the estimate is still insignificant.

[Insert Table 9]

Lastly, we examine whether resources available differ across school types. Although under the equalization policy, each school receives similar funding per student from the government, private schools may find other sources of funding. Column 1 in Table 10 confirms that resources per student available to private and public schools are comparable, as teacher salary expenses per student are similar across school types. As some studies indicate that school infrastructures may make a difference to student outcomes (Branham 2004, Uline and Tschannen-Moran 2008, and Glewwe et al. 2011), we also investigate whether private schools have better infrastructure using information about school land size and ground size. These measures capture only the quantitative aspects of infrastructure but they should provide some indications regarding the influence of school infrastructures on student outcomes.

[14] We also estimate an ordered logit model and the estimated effects of private schooling are not statistically significant at the 10% level.

Columns 2 to 4 in Table 10 show that there are no differences between private and public schools in terms of infrastructure available per student.

[Insert Table 10]

B. Autonomy and Accountability

We have ruled out ability-tracking, single-sex schooling, religious affiliation, private tutoring, and school resources as the likely factors explaining the private school effects in Seoul. What are the underlying mechanisms, then, that make private schools more conducive to better student outcomes? We argue that the underlying forces behind the success of private schools are: (1) the greater autonomy in personnel decisions, together with (2) the more stringent accountability measure associated with less job security for private school principals and teachers.

Private school boards are fully responsible for hiring their school principals among eligible candidates, so private school principals are not public servants and their continued employment depends on their performance. In contrast, public school principals in Seoul are appointed by the Seoul Metropolitan Office of Education. They rotate to different schools every few years, are less likely to lose their jobs, and may continue to be public school teachers after finishing their terms as principals. Our survey data show that principals' perception about the relative job security by school type is consistent with this fact (question1 in Table 11): 62.7% of school principals answered that public schools provide principals with higher job security than private schools do. The survey data also show that there is a stronger incentive to produce good academic performance in private schools than in public schools (questions 3, 4 and 7 in Table 11). In line with job insecurity and incentives, private school principals generally place a greater emphasis on students' success in entering into colleges and academic achievement (Table 12) than public school principals.[15] The greater emphasis on college admission rate among private school principals is observed with diminished efforts on encouraging students' creativity.[16] Thus, private school principals focus on delivering good academic outcomes as well as facing stronger incentives to do so.

[15] While there is significant difference in picking the entrance rate into prestigious university as the most important measure of student achievement, there is no significant difference in the good performance between private and public school principals. The reason can be that the survey question asked principals to pick one of two most important measures, and private principals did not pick the latter as a second choice in the case of their choosing the former first since the two choices seem to be similar.

[16] The survey results do not imply that creativity is considered not important in private schools. Instead, private principals place more emphasis on entrance into prestigious university than on developing creativity of students.

[Insert Table 11]

[Insert Table 12]

Private school principals have a lot of controls over whom they recruit as teachers and can set teachers incentives to be more aligned with their objectives (questions 6 and 7 in Table 11), while public school principals have almost no control over recruitment. For example, private school principals may screen their teachers on the basis of characteristics less observables to researchers, which past studies have shown to be more reflective of teacher quality. In order to test whether private schools tend to hire better quality teachers, ideally, we would need matched student-teacher level data that allow us to estimate teacher fixed effects, which are a common measure of teacher quality (Hanushek and Rivkin 2006). Although we lack data that directly measure teacher quality, if private and public schools differ in observable school-level teacher characteristics, it is likely that their teachers also differ in other unobservable dimensions that lead to outcome differences.

We find that private schools and public schools have different compositions of teacher types and compensate their teachers differently. First, column 1 in Table 13 shows that private schools employ a larger fraction of their teachers on short-term contracts. Teachers on short-term contracts face less job security so they have incentives to perform better, but short-term teachers in private schools face even greater incentives as they have an opportunity for continued employment. In public schools, short-term teachers have to leave when their contracts are over, whereas in private schools, short-term teachers can be promoted to be regular teachers depending on their performance.[17] As a result, short-term teachers in private schools have stronger incentives to deliver better student outcomes, and regular teachers in private schools are more likely a selected group of teachers who have proven themselves. Second, column 2 in Table 13 shows that private schools tend to pay their teachers much higher financial compensation package on average. Since private and public schools are required to follow a pay-scale schedule and pay the same base salary to teachers with the same years of teaching and credentials, the higher average financial compensation package

[17] Short term teachers in public schools can be promoted to permanent teachers after passing the teacher's exam.

means that private school teachers also receive other forms of compensations in addition to the base salary. The additional compensation can incentivize teachers to work harder.

[Insert Table 13]

Since private schools and public schools receive similar resources per student, private school principals must have allocated their limited resources differently to pay for the higher average financial compensation to their teachers. Hiring a larger fraction of short-term teachers is one of the ways. Other ways include hiring less experienced teachers who do not possess an advanced teaching certificate (column 3 in Table 13), hiring less educated teachers who do not hold a graduate degree (column 4 in Table 13), hiring fewer teachers per student (column 5 in Table 13), and running larger class size (column 6 in Table 13). Without teacher incentives, these cost-saving ways adopted by private schools, such as hiring seemingly less qualified teachers and running larger class size, would have probably worsened student outcomes as some studies indicate.[18] Thus, unobservable teacher characteristics probably play a larger role in explaining the results.

Although we cannot identify all the observable and unobservable factors that are directly responsible for the superior performance of private school students, we show evidence that private school principals allocate the limited resources differently from public school principals, and that private school principals and teachers face less job security. Combining the incentives private school principals face and the staffing autonomy they enjoy, it appears that private school principals are able to deliver the outcomes they care about.

VI. Conclusions

This paper answers some of the key questions on the relative effectiveness of private or charter to public schooling that past papers were unable to satisfactorily answer. We exploit the random assignment of students into private and public high schools within school districts in Seoul to show that private schooling causally improves student outcomes. Private schooling leads to a greater likelihood of four-year college attendance, lower likelihood of two-year college attendance, and fewer violent incidents per student. However, private schooling has no significant effect on dropout rates and high school seniors' graduation rates.

[18] The findings about class size and teacher credentials are mixed (see Hanushek (2006) for a review of the evidence). More recently, Dobbie and Fryer (2013) show that conventional input measures—class size, per pupil expenditure, the fraction of teachers with no teaching certification, and the fraction of teachers with an advanced degree—are not positively correlated with school effectiveness using data on charter schools in New York City.

We also show that private school students are more likely to be present on the day of national standardized tests, suggesting that private schools have lower students' absenteeism. Our estimates indicate that private school students outperform public school students in Korean, English, and mathematics standardized tests even after taking into consideration the potential non-random selection into test taking.

Because of the equalization policy and the randomization of students into schools, many factors commonly attributed to the effects of private schooling, such as peer quality, resources, incentives for schools to compete for students and revenues, and curricula differences, are absent in Seoul. We also present evidence that the benefits of private schooling on student outcomes in Seoul are not driven by the use of tracking, single-sex schooling, religious affiliation of private schools, and greater use of private tutoring. We argue that the explanations for the differential outcomes are likely due to the way private schools are organized. In particular, because private school principals must be directly accountable to the school boards and have greater autonomy over their staffing decisions, whereas public school principals and teachers rotate to different public schools every four years without much threat of losing their jobs, principals and teachers in private schools face stronger incentives to deliver good student outcomes.

Since one of the key arguments for why private and charter schooling can improve outcomes lies in their potential to increase competition, it is important to note that our findings do not imply that other countries should also adopt a policy that randomizes students across schools and eliminates the incentives for schools to compete for students. The randomized natural experiment in Seoul mainly provides a unique opportunity for us to learn the benefits of giving greater autonomy to individual schools, while keeping school principals accountable, on student outcomes. An important caveat worth pointing out is that the findings in Korea may not readily extend to other economies, as Hanushek et al. (2013) use panel observational data to show that greater school autonomy leads to improved student achievement in developed countries, but not in developing countries where accountability measures are lacking. More evidence from field or natural experiments is needed to improve our understanding of whether greater school autonomy or corporatization leads to better student outcomes.

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Table 1: Summary Statistics of Variables

Variable	Obs.	Mean	Std. Dev.	Min	Max
School level data					
Private	582	0.644	0.479	0.000	1.000
Coeducational	582	0.359	0.479	0.000	1.000
All boys	582	0.333	0.472	0.000	1.000
All girls	582	0.308	0.462	0.000	1.000
Religious	582	0.180	0.385	0.000	1.000
% Welfare	194	4.064	3.882	0.447	33.87
% Minorities	194	0.087	0.141	0.000	0.978
% Lunch support	582	10.39	12.83	0.000	100
% Transfer out	582	1.821	0.807	0.240	6.563
% Dropout	582	1.583	1.328	0.000	18.806
% Graduation	582	99.87	0.333	96.457	100
Violence incidents per student	582	0.001	0.001	0.000	0.013
% College	582	63.14	8.054	41.404	86.61
% 4-year college	582	42.51	8.333	13.992	73.13
% 2-year college	582	20.63	8.786	1.183	53.68
Teacher salary per student	194	3,214	460.8	0.000	5,002
Students per ground area	531	0.133	0.340	0.000	7.857
Students per school area	579	0.075	0.048	0.001	0.430
Students per total area	579	0.080	0.051	0.007	0.531
Average teacher compensation	582	48,724	6,328	0.000	61,919
% Teachers with advanced certificates	582	77.88	10.15	44.26	97.92
% Teachers on short- term contracts	582	8.516	5.836	0.000	27.40
% Teachers with M.A.	194	38.25	14.36	2.041	77.66
Students per teacher	582	18.17	1.398	13.48	24.23
Tracking – Korean	194	0.149	0.357	0.000	1.000
Tracking – Math	194	0.974	0.159	0.000	1.000
Tracking – English	194	0.964	0.187	0.000	1.000
Tracking – Science	194	0.026	0.159	0.000	1.000
Tracking – Social science	194	0.021	0.142	0.000	1.000
Student level data					
Missed NAEA Korean	88406	0.027	0.163	0.000	1.000
Missed NAEA Math	88406	0.027	0.161	0.000	1.000
Missed NAEA English	88406	0.026	0.161	0.000	1.000
NAEA Korean (standardized)	86002	0.000	1.000	-2.972	3.041
NAEA Math (standardized)	86058	0.000	1.000	-2.624	2.704
NAEA English (standardized)	86066	0.000	1.000	-2.651	2.049

Notes: School level data are mostly for years 2008, 2009, 2010, with some exceptions; for example, variables for percentage of teachers with masters degrees, percentage of students from families on public welfare, percentage of students of ethnic minorities, and percentage of students on free lunch are available for 2010 only. Student level data are NAEA test score data for eleventh graders in 2010.

Table 2: Verification of Random Assignment

	% Welfare	% Minorities	% Free lunch	% Transfer out
Private	-0.111	0.008	1.273	-0.017
	(0.490)	(0.022)	(1.204)	(0.112)
Constant	4.136	0.082	9.569	1.832
	(0.315)***	(0.015)***	(0.864)***	(0.091)***
District-year F.Es	Yes	Yes	Yes	Yes
Number of obs.	194	194	582	582
R-squared	0.110	0.095	0.162	0.198

Notes: % Welfare is percentage of students in families under governmental welfare assistance; % minorities is the percentage of students from ethnic minority groups; % free lunch is the percentage of students receiving free lunch. The first two columns are based on 2010 principal survey data, while the last two columns are based on school data for 2008-2010. Robust standard errors clustered by school reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 3: The effects of private schooling on school-level students' outcomes

	% Dropout	% Grads	Violence per capita	% College	% 4-year	% 2-year
Private	-0.052	0.025	-0.0009	4.283	6.641	-2.358
	(0.112)	(0.032)	(0.0002)***	(0.724)***	(0.857)***	(0.995)**
Constant	1.617	99.849	0.0015	60.384	38.234	22.150
	(0.079)***	(0.023)***	(0.0002)***	(0.564)***	(0.661)***	(0.803)***
District-year F.Es	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	582	582	582	582	582	582
R-squared	0.055	0.128	0.144	0.381	0.354	0.389

Notes: % dropout is the number of dropout over total number of year-start enrollment; violence per capita is the number of reported violent incidents per student. Sample includes 11 school districts for the year 2008, 2009, and 2010. Robust standard errors clustered by school reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 4: The effects of private schooling on college attendance outcomes by gender

	% College Male	% College Female	% 4-year Male	% 4-year Female	% 2-year Male	% 2-year Female
Private	5.283	3.041	8.086	5.328	-2.804	-2.287
	(0.822)***	(0.913)***	(1.070)***	(1.112)***	(1.004)***	(1.289)*
Constant	56.739	64.778	36.625	39.486	20.113	25.292
	(0.633)***	(0.730)***	(0.717)***	(0.807)***	(0.793)***	(0.945)***
District-year F.Es	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	402	388	402	388	402	388
R-squared	0.365	0.347	0.364	0.333	0.418	0.381

Notes: % Graduation is the share of seniors graduating from high school; %College is the number of graduates entering into any foreign or domestic university or college over total number of seniors. Sample includes 11 school districts for the year 2008, 2009, and 2010. Robust standard errors clustered by school reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Differences in test scores and taking rates between private and public school students

	Korean Score	Math Score	English Score	Korean Missing	Math Missing	English Missing
Private	0.127	0.112	0.115	-0.017	-0.017	-0.017
	(0.041)***	(0.032)***	(0.042)***	(0.003)***	(0.003)***	(0.003)***
Constant	-0.083	-0.073	-0.075	0.038	0.038	0.037
	(0.030)***	(0.026)***	(0.034)**	(0.003)***	(0.003)***	(0.003)***
District F.Es	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.023	0.041	0.064	0.003	0.004	0.003
Number of obs.	86002	86058	86066	88406	88406	88406
Sharp Bounds:						
Lower bound	0.076	0.060	0.079			
	(0.045)*	(0.027)**	(0.040)**			
Upper bound	0.151	0.130	0.129			
	(0.051)***	(0.027)***	(0.044)***			
Trim. proportion	0.016	0.015	0.015			

Notes: The first three dependent variables are the NAEA test scores normalized to have mean zero and variance one. Each of the last three dependent variables measures whether the student is absent on the day of the particular test. Sample includes 11 school districts for the year 2010. Lower and upper bound effects are estimated using Lee's (2009) sharp-bound estimators. Robust standard errors clustered by school reported in parentheses in the upper panel. Bootstrapped standard errors (5000 repetitions) clustered by school reported in parentheses for sharp-bound estimates in the bottom panel. *** p<0.01, ** p<0.05, * p<0.1

Table 6: Differences in the use of ability-tracking across school types

	Tracking - Korean	Tracking - Math	Tracking - English	Tracking - Science	Tracking - Social Sci.
Private	0.073	-0.021	0.027	0.008	-0.038
	(0.059)	(0.018)	(0.026)	(0.021)	(0.031)
Constant	0.102	0.988	0.947	0.020	0.045
	(0.040)**	(0.011)***	(0.024)***	(0.017)	(0.027)*
District F.Es	Yes	Yes	Yes	Yes	Yes
Observations	194	194	194	194	194
R-squared	0.110	0.029	0.138	0.032	0.087

Notes: Data drawn from NAEA principal survey in 2010. The sample includes 11 school districts. Robust standard errors clustered by school reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 7: The effects of private schooling on student outcomes by gender type of school

	Violence per capita	Male %College	-------- NAEA-Korean	Male NAEA-Math	-------- NAEA-English	Female %College	-------- NAEA-Korean	Female NAEA-Math	-------- NAEA-English
Single-Sex									
Private	-0.0008	4.932	0.122	0.123	0.071	5.999	0.164	0.098	0.109
	(0.0004)*	(1.477)***	(0.075)	(0.064)*	(0.084)	(2.125)***	(0.060)***	(0.055)*	(0.085)
Constant	0.0013	56.566	-0.272	-0.011	-0.136	61.049	0.140	-0.108	0.075
	(0.0004)***	(1.409)***	(0.072)***	(0.061)	(0.082)	(1.992)***	(0.057)**	(0.051)**	(0.081)
District-year F.Es	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	375	195	30088	30054	30040	181	26225	26211	26198
R-squared	0.132	0.428	0.033	0.057	0.079	0.409	0.021	0.034	0.060
Coeducational									
Private	-0.0008	5.805	0.068	0.041	0.131	3.760	-0.001	0.041	0.032
	(0.0004)**	(1.484)***	(0.060)	(0.066)	(0.075)*	(1.533)**	(0.051)	(0.070)	(0.084)
Constant	0.0016	57.017	-0.341	-0.083	-0.279	65.676	0.219	-0.082	0.118
	(0.0002)***	(0.752)***	(0.023)***	(0.030)***	(0.036)***	(0.797)***	(0.027)***	(0.035)**	(0.045)**
District-year F.Es	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	207	207	15701	15693	15680	207	13431	13428	13421
R-squared	0.182	0.370	0.022	0.040	0.059	0.446	0.021	0.032	0.064

Notes: Robust standard errors clustered by school reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 8: The effects of religious private schooling on student outcomes

	Violence per capita	% College	NAEA-Korean	NAEA-Math	NAEA-English
Religious	-0.0002	0.914	0.020	0.004	0.009
	(0.0002)	(1.330)	(0.062)	(0.043)	(0.053)
Constant	0.0007	64.054	0.047	0.047	0.049
	(0.0001)***	(0.579)***	(0.029)	(0.022)**	(0.028)*
District-year F.Es	Yes	Yes	Yes	Yes	Yes
Number of obs.	375	375	56230	56258	56256
R-squared	0.094	0.374	0.017	0.034	0.057

Notes: Sample restricted to private schools only. Robust standard errors clustered by school reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 9: The effect of private schooling on the extent of private tutoring

	Light	Mild	Heavy
Private	0.002	-0.005	-0.014
	(0.013)	(0.013)	(0.012)
Constant	0.662	0.622	0.457
	(0.010)***	(0.011)***	(0.010)***
District-year F.Es	Yes	Yes	Yes
Number of obs.	88100	88100	88100
R-squared	0.027	0.027	0. 032

Notes: Sample includes 11 school districts for the year 2010. Robust standard errors clustered by school reported in parentheses for OLS estimates. Lee's (2009) bound estimates based on clustered bootstrapped standard errors are similar. *** p<0.01, ** p<0.05, * p<0.1

Table 10: Differences in resources and infrastructure across school types

	Salary expense per student	School land size	School ground size	Total size
Private	69.32	-0.033	-0.005	-0.003
	(66.55)	(0.042)	(0.006)	(0.006)
Constant	3169.41	0.154	0.079	0.081
	(42.55)***	(0.041)***	(0.004)***	(0.004)***
District-year F.Es	Yes	Yes	Yes	Yes
Number of obs.	194	531	579	579
R-squared	0.156	0.057	0.117	0.091

Notes: Data of teacher salary expense are only available in 2010. Robust standard errors clustered by school reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 11: Principal's perception on differences between private and public schools

1. Principal job security	%
Public schools are more secure than private school	62.71
Private schools are more secure than public school	5.08
Equal job security	32.2
2. Teacher job security	
Public schools are more secure than private school	39.83
Private schools are more secure than public school	5.08
Equal job security	55.08
3. Principals' incentive to deliver good outcomes	
Public schools have greater incentive than private schools	7.63
Private schools have greater incentive than public schools	76.27
Equal incentive	16.1
4. Teachers' incentive to deliver good outcomes	
Public schools have greater incentive than private schools	8.55
Private schools have greater incentive than public schools	76.92
Equal incentive	14.53
5. The punishment on teachers for poor performance	
Public schools have greater punishment	15.38
Private schools have greater punishment	47.01
Equal punishment	37.61
6. More flexible and autonomous school policies	
Public schools are more flexible	5.98
Private schools are more flexible	70.09
Equally flexible	23.93
7. Whether teachers are encouraged to implement innovative classroom practices and solutions	
Public schools are more encouraged	14.66
Private schools are more encouraged	63.79
Equal encouragement	21.55

Notes: The results are based on the high school principal survey we conducted in 2013. Out of the 173 principals that we surveyed, 118 responded. There is no differential response rate between private and public school principals.

Table 12: Most important measures of student achievement

	The coefficient of *Private*
Dependent variable	
Good performance in college entrance exam or national educational assessment	-0.049
	(0.090)
Enter into prestigious university	0.302***
	(0.090)
Show good disciplines and behaviors	-0.043
	(0.061)
Develop creativity	-0.219***
	(0.075)
Excel in extracurricular activities	-0.020
	(0.020)

Notes: The results are based on the high school principal survey we conducted in 2013. Out of the 173 principals that we surveyed, 118 responded. There is no differential response rate between private and public school principals. Each principal in the survey is asked to pick two most important outcomes. The dependent variable is an indicator of whether the principal picked the particular outcome. Each coefficient is the estimate of whether private school principals are more or less likely to pick the outcome than public school principals. Robust standard errors clustered by school reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 13: Differences in teacher characteristics and class size

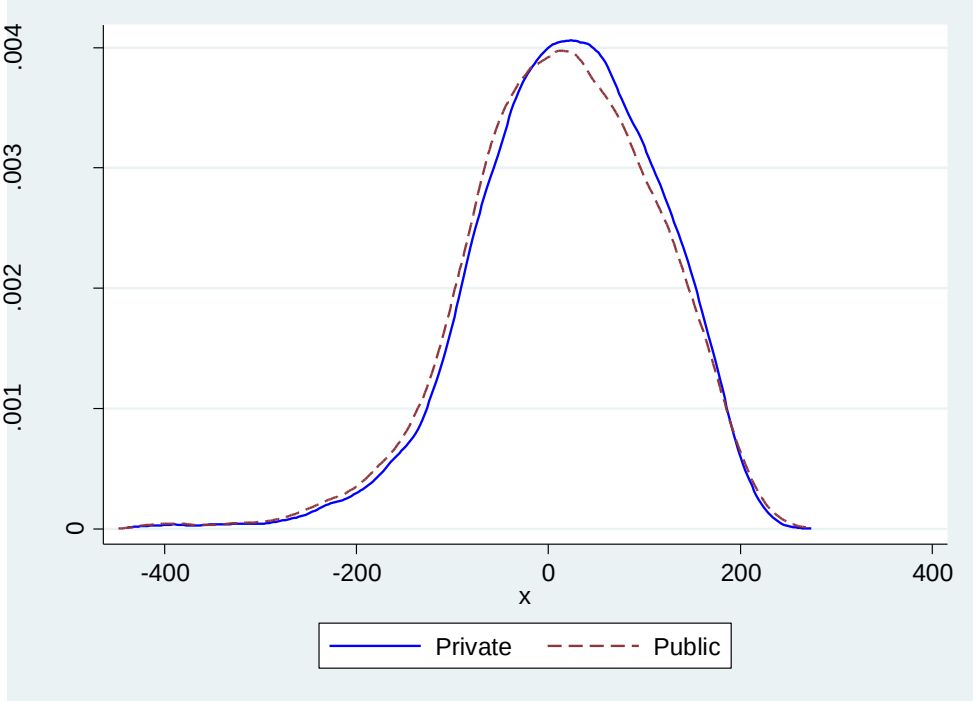
	% Short-term teachers	Average salary	% Teachers on adv. certificate	% Teachers with M.A.	Average class size	Pupil-teacher ratio
Private	5.958	4617.9	-9.685	-14.8	0.539	0.426
	(0.606)***	(881.2)***	(1.119)***	(1.8)***	(0.284)*	(0.150)***
Constant	4.677	45749	84.119	47.8	35.803	17.899
	(0.338)***	(451.4)***	(0.661)***	(1.3)***	(0.229)***	(0.113)***
District-year F.Es	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	582	194	582	194	578	582
R-squared	0.294	0.169	0.314	0.321	0.291	0.339

Notes: Total salary includes all salaries and wages paid to teaching, administrative, and general staff. Data on teacher and staff expenditure are available for public schools in 2010 only. Robust standard errors clustered by school reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Figure 1: School districts and administrative districts in Seoul

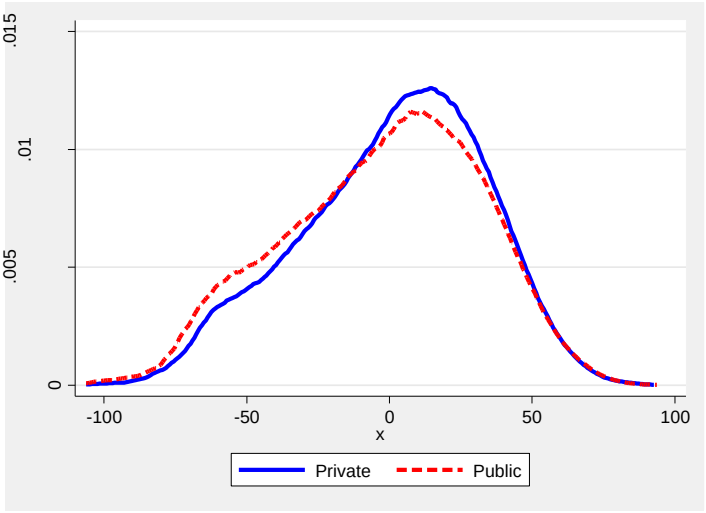
Notes: Seoul has 25 administrative districts. The map shows the 11 official school districts (in colors). Source: http://commons.wikimedia.org/wiki/File:Map_Seoul_districts_de.png

Figure 2: Distributions of Conditional Aggregate CSAT Scores

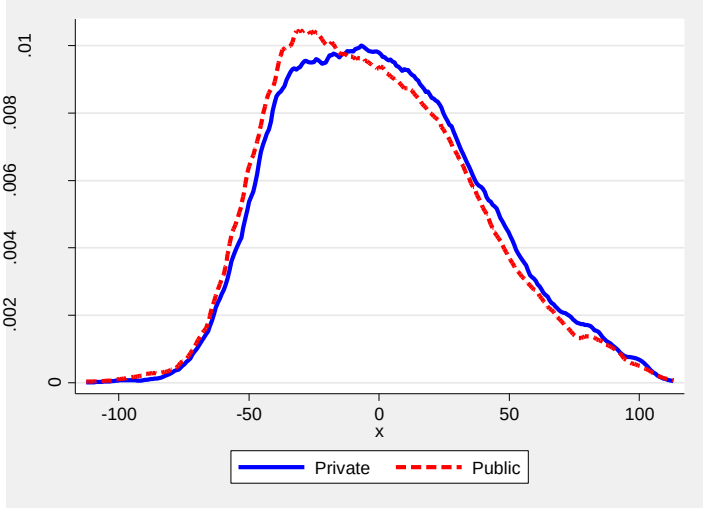


Notes: Conditional aggregate CSAT scores were residuals of the regression of aggregate CSAT scores against a set of school district year fixed effects. There is no differential selection into CSAT participation across school types. Kolmogorov-Smirnov test for equality of distribution functions rejects the null hypothesis that the two distributions are the same at the 1% level of significance.

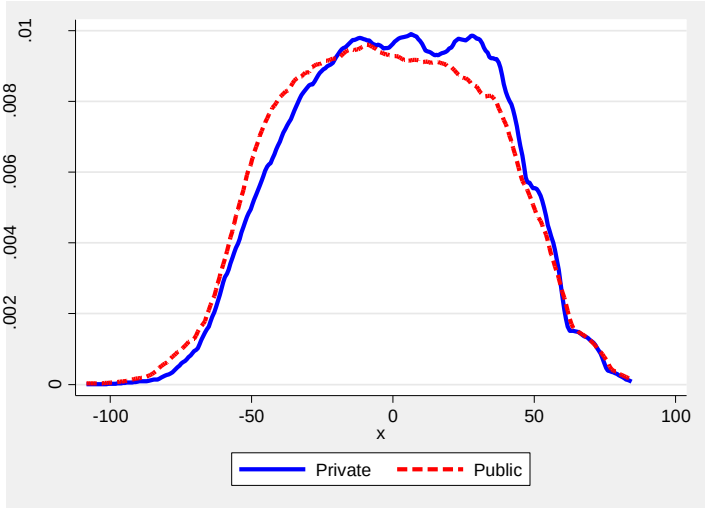
Figure 3: Distributions of NAEA Test Scores



Note: Kernel density of NAEA Korean test scores conditional on school district fixed effects.



Note: Kernel density of NAEA Math test scores conditional on school district fixed effects.



Note: Kernel density of NAEA English test scores conditional on school district fixed effects.