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The Effect of School Type on Academic Achievement: Evidence from Indonesia

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Using data from Indonesia, this paper evaluates the impact of school type on academic achievement of junior secondary school students. Students that graduate from public junior secondary schools, controlling for a variety of other characteristics, score four to eight percentage points higher on the national exit exam than their privately-schooled peers. This finding is robust to OLS, fixed-effects, and instrumental variable estimation strategies. The higher return on exam scores associated with public school attendance is equal between public secular schools and public Madrassahs. Students attending Muslim private schools, including Madrassahs, fare no worse on average than students attending secular private schools. Existing research shows that public junior secondary schools employ higher quality inputs and attract better students than private schools. Our results therefore provide indirect evidence that higher quality inputs promote higher test scores.

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INTRODUCTION

Evidence how characteristics of schools in developing economies, including whether they are publicly or privately administered, affect students' acquisition of cognitive skills is surprisingly mixed. The effect of educational policies in general on learning in developing countries is poorly understood, as a recent survey on the topic conceded that "most of what has been learned has been methodological" rather than substantive (Glewwe, 2002). Better understanding of the effect of school characteristics on learning is important because public policy can influence the characteristics of public schools, as well as the cost of private schools through vouchers and scholarships. As the first step towards understanding the determinants of student achievement in Indonesia, this paper focuses on how type of school attended by junior secondary school students influences their academic achievement.

This study presents evidence that Indonesian public junior secondary schools are more effective than their private counterparts at imparting cognitive skills, as measured by students' scores on the national test administered upon completion of junior secondary school. We present a model in which households select a school type based on their wealth and preference for academic achievement, which raises the prospect of selection bias in empirical estimates of the effect of school type on test scores. Our empirical results, however, suggest that after controlling for a large number of household characteristics, selection bias due to parental preference for achievement is small. OLS, fixed effects, and instrumental variables estimation methods indicate that public school students score between four and eight percentage points higher than their privately schooled peers. We find no evidence that private schools are more effective than public schools at raising test scores.

We also examine the relative performance of Madrassah, Muslim non-Madrassah, secular, and other religious schools, and find two tiers of performance. Students attending public and the small number of students attending non-Muslim religious privates perform equally well, while students in secular and Muslim private schools each fare approximately eight percentage points worse. Generally, data show that public junior secondary schools appear to employ higher quality inputs. Our results therefore provide indirect evidence that the higher quality of public school inputs promote higher test

scores. Future research will hopefully lead to a better understanding of why public schools outperform their private counterparts, by identifying the specific characteristics of schools that explain this disparity.

BACKGROUND

Notwithstanding the Asian crisis in 1997-1998, schooling in Indonesia has been characterized by rapid development since independence in 1945. Elementary school enrollment increased steadily since the early 1970s, when it was around 76 percent, to being nearly universal by 1995 (Ahuja and Filmer, 1996). This was fueled by a major expansion of the availability of elementary schools in the early 1970s. While also increasing in this period, enrollment rates at the junior secondary (grades 7-9) and senior secondary (grades 10-12) levels remain well below universal. More recently, despite the Asian financial crisis that hit Indonesia in late 1997 and early 1998, enrollment rates at all levels were unchanged between 1997 and 2000.[1]

In Indonesia, focusing on junior secondary schools is appropriate for several reasons. The universal enrollment achieved at the elementary level makes the junior secondary level a focal point for efforts to increase school attainment in Indonesia and achieve compulsory junior secondary education. The recent USAID grant of $157 million dollars is targeted to upgrade an education system that is generally considered to lag behind its Southeast Asian neighbors. At the same time, there are on-going efforts aimed at decentralizing decision-making in the education system, devolving authority from the centralized system to the district (*kabupaten*) level. Policy-makers at the district level, in the presence of grant money, can benefit from studies that shed light on which school types are effective. In addition, better understanding the determinants of junior high school quality can also inform efforts to raise senior secondary enrollment levels, since these exit scores presumably influence continuation to and eventual graduation from senior secondary schools.

[1] See results in Pradhan (2001) and Strauss *et al*. (2004) drawn from two different sets of household surveys.

In general, evidence from school surveys is consistent with the longstanding perception of the superiority of public schools in Indonesia over private schools. In terms of schooling inputs, Strauss *et al*. (2004) and Serrato and Melnick (1995) generally point to higher quality in public schools, although not necessarily for every indicator of quality. Textbooks appear to be more available from public junior secondary schools than from private ones, including textbooks that are borrowed or given for free. The average faculty education at the junior secondary level is higher at public schools than private. At private schools, teachers are significantly more likely to have a second job. On the other hand, data from 1997 and 2000 show that student-to-teacher ratios in public schools are equal to or higher than ratios in private schools for all three schooling levels. In 1993, junior secondary entrance fees paid for public schools were actually higher than the fees paid at private schools. School entrance fees at public schools were abolished starting in the 1998/99 academic year. However, totaling school fees and other schooling costs, expenditures were higher for private schools. Overall, past research on school inputs concludes that along most dimensions, public schools use higher quality inputs.

Two existing studies on public and private schooling in Indonesia suggest that reform efforts and financial investments in the educational system should promote private school attendance and management. James *et al.* (1996) find that, after controlling for exiting test scores, private elementary schools in Indonesia incur lower costs per pupil. They conclude that private management is more efficient at achieving academic quality. A more recent study goes further, and claims that students schooled at private secular secondary schools enjoy a wage premium of 75 percent over their publicly schooled peers (Bedi and Garg, 2000). However, neither study uses a plausibly exogenous source of variation to identify the private school effect. James *et al.* (1996) identify the effect of school type using the religious and demographic makeup of its sub-district (*kecamatan*), which is assumed to not directly affect the per pupil spending of the school.[2] Bedi and Garg's finding that private schools promote greater adult earnings is based on the

[2] Furthermore, James *et al.* (1996) cannot control for the ability of students who select private elementary schools (only five percent of all schools) and are therefore not measuring the per pupil cost of promoting test scores.

identifying assumption that an adult's province of birth is uncorrelated with the unexplained portion of their earnings.[3]

The implication of this last study, namely that private secular senior secondary schools provide a more valuable education than public senior secondary schools, is puzzling for two reasons. First, as noted above, public schools in Indonesia look stronger on observable measures and are widely perceived to be superior to secular and Muslim private schools. Past studies, such as Bedi and Garg (2000), confirm that at the secondary level, public schools and private Christian schools attract observably stronger students. This appears to be inconsistent with the finding of a large private-school earnings premium.

Second, some public schools in urban areas screen applicants based on the score of their national test following elementary school. Therefore, many public school students benefit from a higher-scoring peer group. The positive effect of a private administration would have to be larger to outweigh these peer effects, especially given their apparent importance in other contexts (See Hoxby, 2000, and Somers *et al.*, 2003).

MODEL

Because public secondary schools appear to be superior to private secondary schools in Indonesia, past work has focused on the potential for positive selection of the best students into public secondary schools (Bedi and Garg, 2000). This section presents a very simple model in which two countervailing sources of selection bias may occur. One source of bias derives from the perceived superiority of public schools; the other derives from the selection of wealthier households into private schools.

Consider a two period model in which a parent selects a school in period 1. The parent's utility function is assumed to be concave and increasing in each period's consumption, and an increasing function of the student's academic performance at the end of period 1. The parent's utility is also assumed to be an increasing function of non-academic features of the school (such as its safety or proximity). The child returns a portion of their income to the parent in period 2, which is consumed. We assume the

[3] This study's finding that selection bias is small with respect to the effect of school type on junior high school exam scores does not imply that selection bias was not present in these two studies, which used

parent's utility from the child's attending school j takes the following simple functional form:[4]

$$(1) \qquad U_j = \ln(Y_1 - P_j) + \delta \ln(Y_2 + \kappa A_j) + \sigma A_j + \gamma O_j .$$

Y_t represents the household income in period t, which is exogenous with respect to their choice of school type. P_j is the tuition of school j, and δ is the parent's discount rate. A_j represents the student's academic achievement at the end of period 1, after attending school j, which enters the parent's utility function directly if σ is non-zero. Meanwhile, κA_j represents the transfer from the child to the parent in period two, which is assumed to be proportional to the academic ability of the student. Finally, O_j represents other, non-academic characteristics of the school, such as safety, convenience, and discipline, that are valued by parents for more than their contribution to academic achievement.

For simplicity, academic performance is assumed to be a positive and linear function of three factors: the quality of the school (Q_j), the parent's income in period 1 (Y_1), and the degree to which parents directly value academic performance (σ).

$$(2) \qquad A_j = Q_j + aY_1 + b\sigma ,$$

We assume that parents who are wealthier and value education more will provide a household environment more conducive to learning, meaning that the parameters *a* and *b* are positive. In addition, we assume for simplicity that σ, which measures a parent's taste for education, is positive and that household income Y_t is greater than tuition P_j, for all schools j.

Because public schools are generally considered to be superior on average to private schools in Indonesia, we assume that $Q_{pub} > Q_{pri}$. However, the set of schools which a child can attend is typically constrained by the location of the household, and in some cases, by the child's score on the national test for elementary school graduates (the

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different dependent variables and a smaller set of control variables.

[4] The exact form of the utility function does not affect the results derived below, as long as utility is concave in consumption.

Ebtanas test score). These constraints, along with other non-academic characteristics of the school O_j, may lead parents to choose a private school even if higher quality public schools exist. The child attends public school if the maximum utility of the set of public schools they can attend, U^*_{pub} , exceeds the maximum utility of the set of private schools they can attend U^*_{pri}.

The difference in utilities between the best available public school and the best available private option is:

$$(3) \qquad \Delta U^* = \ln\left(Y_1 - P_{pub}\right) - \ln\left(Y_1 - P_{pri}\right) + \delta \ln\left(Y_2 + \kappa A_{pub}\right) - \delta \ln\left(Y_2 + \kappa A_{pri}\right) + \sigma\left(A_{pub} - A_{pri}\right) + \gamma\left(O_{pub} - O_{pri}\right).$$

Appendix A shows that, under the assumption that $P_{pri} > P_{pub}$:

$$(4) \quad \frac{\delta \Delta U^*}{\delta \sigma} > 0 \text{, and}$$

$$(5) \quad \frac{\delta \Delta U^*}{\delta Y_1} < 0.$$

This model confirms the intuition a parent that places a higher values on education is more likely to send their child to public schools, which are assumed to be of higher average quality, while the likelihood of attending private school increases as the household's wealth increases. In the U.S., where private schools are generally considered to be higher quality, wealthier and more motivated students will select into private school. In Indonesia, however, where in general public schools are considered to be of higher quality, the two sources of selection bias are of opposite sign. Thus, the direction and magnitude of bias in the OLS models is unknown, and depends on the relative strength of unmeasured wealth and unmeasured motivation, as well as the importance of these factors in determining students' test score.

DATA

The primary data source for this study is the three full rounds of the Indonesia Family Life Survey (IFLS1, IFLS2, and IFLS3) (see Frankenberg and Karoly, 1995; Frankenberg and Thomas, 2000; Strauss *et al.*, 2004). The first round of the survey sampled 7,200 households in 1993; subsequent surveys attempted to re-interview these households and households to which previous household members had relocated since the original interview ("split-off" households). The 1993 sample was drawn from 321 randomly selected villages, spread among 13 Indonesian provinces containing 83 percent of the country's two hundred million people. The 321 villages were selected from the sample frame of the 1993 SUSENAS, the national economic survey, and are located in 149 districts. The sample captures an impressive amount of Indonesia's remarkable ethnic and geographic diversity.

We analyze the national *Ebtanas* test scores of former junior secondary school students. Data on test scores was collected in 1997 and 2000 from all household members between the ages of 14 and 25 at the time of the interview. The survey asked respondents to state their score on the test, if they took the exam, for the elementary, junior, and senior secondary school levels. The survey also ascertained the type of school attended at each level.

The sample consists of all students who reported, in either 1997 or 2000, taking the junior secondary school test between 1990 and 2000. Of the 5,608 respondents that reported taking the national junior secondary school exam between 1990 and 2000, 4,617 reported scores from both elementary and junior secondary schools. An additional 165 respondents were not included in the sample because they did not report the type or district of the junior secondary school they attended. Finally, 10 outlier observations were dropped, leaving a final sample consisting of 4,442 respondents.[5]

This study also uses data on the presence of private schools, at both the district and the village level, to identify the effect of school type on student's test score. District-level data on the presence of schools comes from the 1998 round of annual census of

[5] The 10 observations were dropped because the reported test score was further than three standard deviations from that year's mean score.

schools conducted by the Indonesian Ministry of Education.[6] Eighty percent of the 42,000 secondary schools in Indonesia responded to this survey. Unfortunately, because of a budgetary shortfall during the 1998 financial crisis, the education census did not record detailed data on the characteristics of private schools. The only information recorded for private schools were its private status and location. This information is used to construct both the total number of junior secondary schools and the percentage of district junior secondary schools that are public in the district.

We obtain village-level data on the percentage of schools that are private using the 2000 IFLS, which like earlier IFLS rounds contains a complete roster of neighborhood schools. This roster contains the schools that household members report attending, as well as schools identified by community leaders but which are not attended by the sample of survey households in the community. These community leaders were not asked to provide information regarding the school type, however. Therefore, we inferred the public or private status of schools listed on the roster, using the school name.[7]

In order to investigate how a student's test score is affected by the type of junior secondary school, we focus on a particular dependent variable: the normalized test score using the scores of other students that took the test in the same year.[8] The results, then, are expressing the impact of school type as the fraction of a standard deviation on test results. Analyzing these test scores requires making a trade-off between the size of the sample and the availability of certain variables. Because test scores are provided retrospectively, the largest sample includes respondents who first appeared in an IFLS household several years after their graduation from junior secondary. For these respondents, time-varying household characteristics such as household consumption are not observed at the time they took the test. However, excluding these time-varying

[6] The district rather than sub-district was chosen because respondents were far less likely to report the sub-district in which they went to junior secondary school, whereas 95% of respondents successfully reported the district in which they attended school.

[7] Public junior secondary schools in Indonesia are typically assigned a registration number. Therefore, any school name containing the Indonesian acronym for junior secondary school followed by a number is designated as public. In addition, a school was also considered to be public if its name identified it as a public *madrassah* (MTSN) or public technical school (SLTPN), or if its name contained the word "public" (*negara*).

[8] Scores are normalized using the mean and variance of all scores reported from the same year.

household characteristics may confound estimates of the effect of junior secondary school type on test score. Therefore, we also present results for two sub-samples. The junior secondary school sample consists of 2,767 respondents who were interviewed within a year of their junior secondary school graduation.[9] When this sample is used, the time-varying characteristics which are measured within a year of taking the exam are included as control variables. The elementary school sample consists of 1,978 students who are in the junior secondary school sample and were also interviewed in a previous round of the survey. For these respondents, time-varying characteristics such as household consumption are available both before and after the student's entry into junior secondary school. We present results for these three samples throughout. Means and standard errors of the set of covariates are presented in Appendix B.

Regressions using the full sample include, as control variables, a set of time-invariant characteristics of the respondent:

- *Academic Achievement in Elementary School*: The (normalized) student's reported elementary school test score and its square, and whether the student repeated a grade in elementary school.
- *District Characteristics*: For the district in which the student attended junior secondary school, the average elementary school test score of all other students and the number of total schools.[10]
- *Parental Characteristics and Language:* Indicators for the education level of the mother and father, the family's religion, and the primary language spoken at home.[11]

[9] The junior secondary sample consists of students who took the test in 1999 or 2000 and were interviewed in 2000, students who took the test between 1996 and 1998 and were interviewed in 1997, and students who took the test between 1992 and 1994 and were interviewed in 1993. The elementary school sample consists of students in the junior secondary sample that were also interviewed in a previous survey round.
[10] The average elementary school test score for a particular district is constructed by averaging the elementary test score of all other respondents that attended junior secondary school in the same district. If only one respondent attended junior secondary school in that district, her score was used as the average.
[11] Each parent's education level is coded as either a dummy indicating whether their highest level was elementary school, junior secondary school, high school, or university. Religion is coded as Muslim, Christian, Catholic, Hindu, or other. Languages spoken at home include Indonesian, Javanese, Chinese, or one of 18 regional dialects.

- *Location Characteristics*: The province in which the student attended junior secondary school and whether the town in which the respondent lived at age 12 was a village, a small town, or a big city.
- *Type of Elementary School*: Indicators for the type of elementary school attended (public secular, public Madrassah, private secular, private Madrassah, private Muslim non-Madrassah, or private other)
- *Student Characteristics*: Whether the respondent is female. Whether the respondent worked while attending junior secondary school.
- *Type of Junior Secondary School*: Whether the junior secondary school attended was a vocational school. Indicators for the type of junior secondary school attended (public secular, public Madrassah, private secular, private Madrassah, private Muslim non-Madrassah, or private other)

Regressions that use the junior secondary school sample include the following three time-varying characteristics of the household:

- *Household Wealth*: The natural logarithm of the household's per capita expenditure. The type of floor in the dwelling.
- The respondent's description of their general health (healthy, somewhat healthy, or unhealthy).[12]

The elementary school sub-sample adds the same time-varying characteristics as the junior secondary school sub-sample, measured two to four years before the completion of junior secondary school.[13]

As a first check, we regressed the student's test score percentile on the variables listed above, using the junior secondary school sub-sample and variables. The results are presented in Appendix C. The model explains nearly half of the total variation in test scores, and the signs and magnitudes of the coefficients are reasonable. Academic performance in elementary school and higher levels of parental education are associated with higher test scores in junior secondary school.[14]

[12] This question was not asked in 1993 and is therefore only available for half of the sample. Missing observations are grouped as a separate category.
[13] For elementary school students, general health status is reported by the mother or primary caregiver.
[14] The coefficients on the province dummies are as high as twenty and thirty percentiles. These substantial differences, which we do not attempt explain, may be the topic of future research.

DETERMINANTS OF SCHOOL TYPE

Before turning to the question of how school type affects academic performance, we first examine the relationship between a student's characteristics and the type of school she chooses. While the determinants of school type are of some interest in their own right, they may also provide some guidance to the extent and nature of selection bias due to unobserved student characteristics. Public schools, which are generally considered to be superior to private schools in Indonesia, may attract more motivated students. However, the children of wealthier parents may be more likely to attend private schools. To examine the effect of household wealth and student academic ability on the type of school attended, we use the junior secondary school sample to estimate a multinomial logit regression of school type attendance. The dependent variable is an indicator of whether the student attended public school, private secular school, private Muslim school, or a private non-Muslim religious school. About eight percent of public schools are Madrassahs. Just under half of the private schools have an Islamic affiliation. Among this school type, about 45 percent of students are attending Madrassahs. There are few students attending private non-Muslim religious schools; these schools include Christian and Catholic private schools that are considered to be of comparable quality to public schools.[15] Therefore, we focus on the determinants of attendance at private secular and Muslim schools. The entire set of household and student characteristics listed in the data section are included as control variables, but we report only the results from indicators of household wealth, the student's prior academic achievement and parental education.

[15] Three percent of the full sample and ten percent of the private school attendees attend non-Muslim religious schools. Of these schools, about 60 percent of this category are Catholic schools, while the remaining 40 percent are Christian, Buddhist, or other religious affiliation. Christian schools are not restricted to Christian students. Private Catholic and Protestant secondary schools often enroll Muslim students. In the data used, very few students switched schools at all, let alone switched between public and private schools, during their attendance at the junior secondary level.

Table 1 reports the marginal effects of each variable on the probability of attending a particular type of school, and whether the variable was statistically significant in the multinomial logit model.[16]

The regression contains two measures of wealth: household log per capita consumption and the floor type of the house. After controlling for a wide variety of other household characteristics, household wealth is a relatively weak determinant of the type of junior secondary school attended. In joint significance F tests, log per capita consumption is statistically significant but the floor type of the house is not. Generally, these variables have a small effect on the probability of attending private school. Because the marginal effect of log household per capita consumption is 0.027, a ten percent increase in household per capita income lowers the probability of private secular or Muslim school attendance by less than three tenths of a percentage point. Meanwhile, despite the theoretical prediction of a positive relationship between wealth and private school attendance, we find no consistent pattern between the quality of the floor and the probability of attending private secular or Muslim school.

The student's past academic performance has a slightly larger effect on the probability of attending private school. A ten percentile increase in the elementary school exam score lowers the probability of attending secular school by three percentage points; the probability of attending private Muslim school falls by two percentage points. On balance, prior academic achievement leads to a moderate reduction in the probability of attending private secular or Muslim school. Grade repetition in elementary school is associated with a two percentage point reduction in probability of attending a secular private school, although this effect is not statistically significant. Grade repetition is not associated with the probability of attending private schools. Likewise, parental education is not associated with the propensity to attend private junior secondary school. Parental education is presumably correlated with student motivation and, in results presented later, is shown to be a strong predictor of junior secondary school test score.

[16] For dummy variables, the marginal effect is the sample average of the difference in the predicted probabilities when the dummy variable is set to one or zero. For the test score and consumption variables, which appear with their squares, we report the average of the sample average of marginal effects calculated for each observation. For these variables, the significance of the two terms is tested jointly.

To sum up, household wealth has no discernable effect on the household's choice of school type. Students with higher elementary school test scores are somewhat less likely to attend secular and Muslim private school. This confirms the widespread impression that public schools in Indonesia tend to benefit from positive selection. If selection on unobservable characteristics is similar to selection on observables, the effect of selection of better students into public schools likely outweighs the selection of wealthier students into private schools, which are more costly. If so, the estimated effects of public school attendance on test scores will be biased upward. The next section turns to examining estimates of the effect of public schooling on test scores as well as the approximate magnitude of bias due to selection on unobservable characteristics.

THE EFFECT OF PUBLIC SCHOOLING ON TEST SCORES

Are public or private schools, on average, more effective at raising the test scores of Indonesian junior secondary school students? To address this question, we regressed the percentile of the respondent's junior secondary test score on the control variables described above, with school type represented by dummy variable for public school attendance. Because of space considerations, only the coefficient on school type is shown. Column 1 of Table 2 indicates that public school students, in the presence of controls, scored an average of nearly seven percentage points higher than private school students. In the second specification, time-varying control variables measured after junior secondary school, which are only available for the junior secondary schools sub-sample, are included. The public school premium is now approximately eight percentage points. The premium remains about eight percentage points when time-varying variables measured at around graduation from elementary school are added (Column 5). Finally, the last specification (Column 6) displays estimates in the presence of family-level fixed effects, which are identified using siblings that attended different types of schools. This methodology also results in an estimated public school premium of seven percentage points.[17] After controlling for a wide variety of student and parent characteristics,

[17] Results of the fixed effects estimation strategy are not reported for the junior secondary school and elementary sub-samples, because there is little variation within family in the time-varying variables that are included in these sub-samples.

regression estimates indicate that, on average, public school students have test scores which are seven to eight percentage points higher than private schools students.

Of course, least squares estimates of the public school effect will be biased if public school attendance is correlated with unobserved factors that determine test scores. In the Indonesian context, the direction of this endogeneity bias is unclear in theory, as described above. However, the correlation between observable characteristics and school choice suggests that public schools benefit from positive selection. If so, selection bias will lead to an upwardly biased effect of public school on Moreover, because parents choose the school separately for each child within the household, partly on the basis of unobservable child characteristics, the inclusion of family-level fixed effects does not eliminate this bias.

To address concerns regarding bias due to non-random sorting of students into different types of schools, we estimate two-stage-least-squares models of test scores, employing measures of the local availability of private schools as an instrument for public school attendance. Data on the presence of private schools are available at both the district and the village level. The first model is identified by excluding, from the test score equation, the percentage of schools that are public in the district that the student attended junior secondary school. The second model includes that district-level percentage as a control variable and instead is identified using the percentage of schools within 25 miles of the village center that are public. Because village-level school data are only available for the 321 original IFLS communities, this specification does not include students interviewed in a different sub-district from where they attended junior secondary school.[18]

The resulting estimates of the effect of public schooling on test scores are consistent if the local presence of private schools is uncorrelated with the unexplained portion of test scores. However, profit-maximizing private schools may be more likely to locate in areas with a higher demand for education, in wealthier areas, and in larger cities.

[18] In principle, considering only students that remained in the same sub-district that that they attended junior secondary school could cause selection bias. To probe this, we utilized the fact that student's test scores are ranked based on their deviations from annual means, and estimated a Heckman two step model excluding the year the test was taken from the test score equation. The estimated public school premium remained essentially the same in the presence of the selection correction term, even though the years since the test was taken was strongly and positively correlated with whether the student had subsequently moved.

Urban environments, which offer both a higher return to education and a higher opportunity cost of studying, may or may not promote academic achievement. However, we expect *a priori* that profit-maximizing private schools locate in regions with higher demand for education, in which case instrumental variables methods produce estimates of the public school premium which may be biased downward. Likewise, governments may locate public schools based on unobserved characteristics of education demand or students ability (Pitt *et al.*, 1993).

To gain some insight into the direction of bias due to the location decisions of private schools, we regressed the percentage of schools that are public, at both the district and the village level, on the full set of observed household characteristics listed above. Table 3 presents selected coefficients from these regressions. Observable measures of the student's academic ability are positively correlated with the percentage of public schools in the district, although the relationship is not statistically significant. Surprisingly, private schools appear to locate in areas with observably weaker students on average when assessed at the village level. If the negative correlation between the presence of private schools and observable determinants of test scores extends to unobserved determinants, the two-stage-least-squares estimates of the public school premium will be biased upwards when village-level instruments are used. The results in Table 2 suggest no systematic relationship between observable measures of elementary academic achievement and the percent of public schools in the district or the village.

Table 4 presents the instrumental variables results. When the percentage of schools in the district that are public are used as an instrument, the public school premium is eight percentage points for the full sample and junior secondary school sub-sample, and about four percentage points in the elementary school sub-sample. The first stage F statistic on these instruments ranges from 40 to 75, meaning that finite sample bias due to weak instruments is not an important concern.[19] When the village-level presence of private schools is used, the results are only estimated for the sub-sample of students that were interviewed in the sub-district in which they went to junior secondary school. The estimated public school premium is twelve to fourteen percentage points for

[19] The estimates may still be biased, of course, if the access instruments are not orthogonal to the control variables.

all three samples. The first stage F statistics for the village level instrument are all above 35 in these regressions. We discount the results using village-level instruments somewhat, because of the relatively strong correlation between these instruments and observed indicators of academic ability, as well as the fact that inter-sub-district movers were dropped from the sample.

Taken as a whole, the results from regressions estimating the average effect of public schools on test scores are remarkably consistent. Least squares estimates suggest a public school premium of seven to eight percentage points. Fixed effects estimation results in an estimated premium of eight percentage points. Using district-level access instruments result in an estimated effect of four to eight percentage points, while village-level access instruments yield a fourteen percentage point premium. The positive correlation between observable indicators of academic performance and the village-level instruments leads us to view these last results with caution. Nonetheless, the similarity of the OLS and the district-level instrumental variable estimates suggest that in total, the endogeneity bias resulting from parent's choice of school type does not invalidate the qualitative conclusions drawn from the OLS and fixed-effect estimates. Furthermore, the consistent finding of a positive public school premium across all estimation strategies is strong evidence that public junior secondary schools, on average, provide superior preparation for the national exam.

DIFFERENT TYPES OF PRIVATE SCHOOLS

We now turn to comparing the average effect of attending different types of private junior secondary schools on test scores. We regressed students' percentile score for the junior secondary school test on an indicator of school type that distinguishes between public Madrassah, private secular, private Madrassah, private other Muslim, and non-Muslim religious schools, controlling for the student characteristics listed above. Because type of private school cannot be identified using the village data from the IFLS or school census data from the Ministry of Education, instruments for this regression were unavailable and only OLS and fixed effects results are presented. Table 5 presents these results. In the full sample, the disadvantage in test scores relative to public school

students is eight percentage points for secular private schools, seven percentage points for both types of private Muslim schools, and two percentage points for private other schools (but not significant). Results are similar for the junior secondary school and elementary school sub-samples. When family-level fixed effects are included for the full sample, on average students in private secular schools score nine percentage points lower than their public school peers, while both types of Muslim school students are only at a five percentage point disadvantage. Overall, the results suggest that there are two tiers of schools, with private secular and Muslim schools lagging behind public schools and other private schools.

Is the public school premium stronger for brighter students? Table 6 displays the results from an OLS regression on the full sample in which junior secondary school type is interacted with the student's elementary school test score quartile. Secular and both categories of Muslim private schools have the largest negative association with the test scores of students that scored in either the highest or lowest quartile on their elementary school test. The premium for the top and bottom quartile students is four to eight percentage points, whereas the public school premium for students in the middle two quartiles ranges from zero to four percentage points. Only the effect of students in the lowest quartile is statistically significant, however. Some public schools in Indonesia, particularly in urban areas, screen students based on their elementary school test score. Therefore, these results are consistent with the notion that the students with the lowest entering test scores benefit from attending public school with students of similar ability.

THE IMPORTANCE OF ELEMENTARY SCHOOL ACHIEVEMENT

Finally, we examine a secondary methodological question: How robust is the estimated effect of school type to exclusion of the elementary school test score from the model? Table 7 shows the public school premium for each sample and methodology, with and without two variables measuring academic performance in elementary school: the student's elementary school test score (and its square), and whether the student repeated a grade in elementary school. Excluding these elementary school academic performance

variables in a standard OLS regression raises the public school premium by seven to ten percentage points, relative to public Madrassahs and the four types of private schools. Because elementary school performance is strongly and positively associated with both public school attendance and subsequent junior secondary school test performance, its omission creates substantial upward bias in the estimated public school premium.

CONCLUSION

This paper focuses on how junior secondary school students' choice of school type influences their academic achievement. Students that attended public junior secondary schools, controlling for other characteristics, have higher test scores upon completion than those who attended private school. This finding is robust to three different estimation strategies: OLS, family-level fixed effects, and the use of regional measures of access to private schools as instruments for public school attendance. The estimates of the public school premium are generally in the range of four to eight percentage points. There was no difference in test score outcomes for public school students in secular schools and Madrassahs. Students that attended private Muslim schools, both Madrassah and non-Madrassah, fared no worse, on average, then students that attend private secular schools, while the performance of the small number of students in Christian, Catholic, and other non-Muslim religious junior secondary schools is comparable to their publicly-schooled peers. Moreover, the test score premium for public and non-Muslim religious private schools is highest for the brightest students. Finally, not surprisingly, indicators for achievement at the elementary school level are important covariates whose absence from the model substantially alters the results.

This research is a first step towards understanding the determinants of student achievement in Indonesia. Recognizing the gaps in the existing literature, the study assesses the returns to public junior secondary schooling in terms of test scores, in light of the general finding that public schools use higher quality inputs. Future research will hopefully identify the specific aspects of quality that drive these higher scores, in order to better understand how and why public schools outperform their private counterparts.

APPENDIX A

Proof that $\frac{\delta \Delta U^*}{\delta \sigma} > 0$, and $\frac{\delta \Delta U^*}{\delta Y_1} < 0$.

The household chooses to send their child to a public school if the maximum utility from the most desirable public school exceeds the maximum utility from the most desirable private school. The difference in utilities between the most desirable public and most desirable school is:

(A1) $$\Delta U^* = \ln Y_1^{pub} - \ln Y_1^{pri} + \delta \ln\left(Y_2 + \kappa A_{pub}\right) - \delta \ln\left(Y_2 + \kappa A_{pri}\right) + \sigma\left(A_{pub} - A_{pri}\right) + \gamma\left(O_{pub} - O_{pri}\right).$$

where

(A2) $$Y_1^{pub} = Y_1 - P_{pub},$$

(A3) $$Y_1^{pri} = Y_1 - P_{pri}$$, and

(A3) $$A_j = Q_j + aY_1 + b\sigma.$$

By assumption, $P_{pri} > P_{pub}$, which implies that $Y_1^{pub} > Y_1^{pri}$

Taking derivatives with respect to σ and Y_1 gives:

(A4) $$\frac{\delta \Delta U^*}{\delta \sigma} = \left(A_{pub} - A_{pri}\right) + \delta b\tau.$$

(A5) $$\frac{\delta \Delta U^*}{\delta Y_1} = \frac{1}{Y_1^{pub}} - \frac{1}{Y_1^{pri}} + \delta a\tau.$$

Where τ can be written as:

(A6) $$\tau = \frac{1}{Y_2 + kA_{pub}} - \frac{1}{Y_2 + kA_{pri}}.$$

Substituting τ into (A3) and rearranging gives:

(A6) $$\frac{\delta \Delta U^*}{\delta \sigma} = \left(A_{pub} - A_{pri}\right) * \left(1 - \frac{\delta bk}{\left(Y_2 + kA_{pub}\right)\left(Y_2 + KA_{pri}\right)}\right)$$

Equation (2) and the assumptions that a,b,σ are positive implies that:

(A7) $b < A_{pub}$

This inequality, together with the assumptions that $Y_2 > 1$, $0 < \delta < 1$, and $A>0$, implies that:

(A8) $\delta bk < kA + Y_2$, and

(A9) $1 < Y_2 + kA_{pri}$

which means that $\frac{\delta \Delta U^*}{\delta \sigma}$ is of the same sign as $A_{pub} - A_{pri}$, which is positive by assumption.

Meanwhile,

$$\frac{\delta \Delta U^*}{\delta Y_1} = \left(\frac{1}{Y_1^{pub}} - \frac{1}{Y_1^{pri}} \right) + \left(\frac{\delta a}{Y_2 + KA_{pub}} - \frac{\delta a}{Y_2 + KA_{pri}} \right) < 0$$

Since $Y_1^{pub} > Y_1^{pri}$ by assumption and $A_{pub} > A_{pri}$.

APPENDIX B

Sample Means

Academic Achievement in Elementary School	Mean	Standard Error
Elementary test score (normalized)	0.019	(0.018)
Elementary test score, squared (in thousands)	1.009	(0.024)
Didn't repeat grade	0.807	(0.007)
Household wealth after Junior Secondary School		
Log PCE	5.193	(0.014)
Log PCE, squared	27.514	(0.144)
Tile floor	0.299	(0.008)
Cement/Brick floor	0.392	(0.009)
Lumber floor	0.099	(0.004)
Bamboo floor	0.004	(0.001)
Dirt floor	0.066	(0.005)
District characteristics		
Average district Elementary test score	-0.003	(0.007)
Avg dist Elem test score, squared (in thousands)	0.215	(0.006)
# of schools in district	123.124	(1.308)
Parental Characteristics		
Mom attended junior secondary	0.155	(0.007)
Mom attended senior secondary	0.132	(0.006)
Mom attended university	0.028	(0.003)
Dad attended junior secondary	0.169	(0.007)
Dad attended senior secondary	0.220	(0.008)
Dad attended university	0.054	(0.004)
Christian	0.053	(0.004)
Catholic	0.020	(0.003)
Hindu	0.051	(0.002)
Other	0.009	(0.002)
Student Characteristics		
Female respondent	0.515	(0.009)
Not working in junior secondary	0.924	(0.005)
Somewhat Healthy	0.634	(0.009)
Somewhat unhealthy	0.051	(0.004)
Residence at age 12: Small town	0.291	(0.008)
Residence at age 12: Big city	0.161	(0.006)
Type of Elementary School		
Public Madrassah	0.040	(0.004)
Private Secular	0.031	(0.003)
Private Muslim, not Madrassah	0.033	(0.003)
Private Madrassah	0.040	(0.004)
Private Other	0.030	(0.003)
Type of Junior Secondary School		
Vocational junior secondary	0.029	(0.003)
Public Madrassah	0.051	(0.004)
Private Secular	0.143	(0.007)
Private Muslim, not Madrassah	0.080	(0.005)
Private Madrassah	0.066	(0.005)
Private Other	0.035	(0.003)

Languages spoken at home		
Indonesia	0.287	(0.007)
Java	0.381	(0.007)
Sunda	0.145	(0.006)
Bali	0.033	(0.002)
Batak	0.025	(0.003)
Bugis	0.019	(0.002)
Cina	0.009	(0.002)
Madura	0.029	(0.003)
Sasak	0.025	(0.002)
Minang	0.068	(0.003)
Banjar	0.038	(0.003)
Bima	0.010	(0.002)
Makassar	0.008	(0.002)
Nias	0.000	(0.000)
Palembang	0.017	(0.002)
Sumbawa	0.004	(0.001)
Toraja	0.006	(0.001)
Lahat	0.003	(0.001)
Sumatra selatan	0.022	(0.002)
Betawi	0.013	(0.002)
Lampung	0.003	(0.001)
Location of Junior Secondary School		
North Sumatra	0.069	(0.001)
West Sumatra	0.082	(0.001)
South Sumatra	0.047	(0.001)
Lampung	0.045	(0.001)
West Java	0.129	(0.001)
Central Java	0.132	(0.002)
Yogyakarta	0.065	(0.001)
East Java	0.131	(0.001)
Bali	0.049	(0.001)
West Nusa Tenggara	0.044	(0.000)
South Kalimantan	0.035	(0.001)
South Sulawesi	0.042	(0.001)
Other Province (non-IFLS)	0.001	(0.001)

APPENDIX C

Determinants of junior secondary school test score

Academic Achievement in Elementary School	
Elementary test score	0.44**
Elementary test score, squared	0.07**
Didn't repeat grade	0.24**
Household wealth after Junior Secondary School	
Log PCE after junior secondary	0.18
Log PCE after junior secondary, squared	-0.01
Tile floor	-0.06
Cement/Brick floor	-0.07
Lumber floor	-0.22*
Bamboo floor	0.05
Dirt floor	-0.15
District characteristics	
Average district Elementary score	0.03
Average district Elementary score, squared	0.01
# of schools in district	0.001**
Parental Characteristics	
Mom attended junior secondary	-0.03
Mom attended senior secondary	0.09
Mom attended university	0.23
Dad attended junior secondary	0.08
Dad attended senior secondary	0.13**
Dad attended university	0.33**
Christian	0.06
Catholic	0.05
Hindu	0.21
Other	0.07
Student Characteristics	
Female respondent	-0.02
Not working in junior secondary	-0.49**
Somewhat healthy	-0.04
Somewhat unhealthy	-0.09
Residence at age 12: Small town	0.02
Residence at age 12: Big city	-0.01
Type of Elementary School	
Public Madrassah	-0.03
Private Secular	0.17
Private Muslim, not Madrassah	0.10
Private Madrassah	0.19*
Private Other	0.30*
Type of Junior Secondary School	
Vocational junior secondary	0.10
Public Madrassah	0.004
Private Secular	-0.23**
Prvate Muslim, not Madrassah	-0.23**
Private Madrassah	-0.27**
Private Other	0.03

Languages spoken at home	
Indonesia	0.01
Java	0.15*
Sunda	0.06
Bali	0.05
Batak	-0.31*
Bugis	-0.01
Cina	0.47*
Madura	0.01
Sasak	0.06
Minang	0.04
Banjar	0.08
Bima	0.16
Makassar	-0.72*
Nias	0.00
Palembang	-0.004
Sumbawa	-0.25
Toraja	-0.42
Lahat	-0.38
Sumatra selatan	-0.07
Betawi	0.10
Lampung	-0.13
Location of Junior Secondary School	
North Sumatra	0.29**
West Sumatra	0.41**
South Sumatra	0.33
Lampung	0.05
West Java	-0.05
Central Java	0.66**
Yogyakarta	0.65**
East Java	0.50**
Bali	0.24
West Nusa Tenggara	-0.03
South Kalimantan	0.24
South Sulawesi	1.01**
Other Province (non-IFLS)	0.27
Constant	-1.27
Observations	2767
R-squared	0.47

Notes: Robust standard errors in parentheses. * significant at 5%; ** significant at 1%. Controls for missing information related to repeating elementary, flooring, self-reported health, school type, residence at age 12, location of junior secondary school, vocational status of junior secondary school, and parental education.

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Table 1: Determinants of school type

	(1) private nonreligious	(2) private Muslim	(3) other private
Household wealth			
per capita expenditure (log) & square	-0.026**	-0.024**	0.007
Tile floor	0.05*	-0.004	0.02*
Cement/Brick floor	0.03	-0.004	0.02*
Lumber floor	0.002	-0.09*	0.04
Bamboo Floor	-0.04	-0.01	-0.03**
Dirt Floor	0.01	-0.01	0.03
Academic Achievement in Elementary school			
Elementary test score & square	-0.09**	-0.07**	-0.02**
Didn't repeat grade	-0.02	-0.01	0.004
Parental Characteristics			
Mom attended junior secondary	-0.02	-0.01	0.02
Mom attended senior secondary	-0.01	-0.001	0.03**
Mom attended university	-0.06	-0.04	0.06
Dad attended junior secondary	0.03	-0.03	-0.004
Dad attended senior secondary	0.001	-0.03	0.003
Dad attended university	-0.01	-0.01	0.003
Observations	2767	2767	2767

Notes: Multinomial logit model; robust standard errors in parentheses. Omitted category is public school attendance. * indicates significance at 5%; ** at 1%. Regression includes controls for missing flooring, missing parental education and other control variables listed in Appendix B.

Table 2: Effect of public school attendance on junior secondary school test score

Specification:	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) Family fixed effects
Sample:	Full sample	Junior secondary Sample	Junior secondary Sample and Variables	Elementary Sample	Elementary Sample and Variables	Full sample
Attended Public SMP	0.189	0.214	0.214	0.215	0.243	0.25
	(0.030)**	(0.073)**	(0.037)**	(0.037)**	(0.043)**	(0.043)**
Observations	4442	882	2767	2767	1978	1978
R-squared	0.44	0.74	0.47	0.46	0.5	0.48

Notes: Robust standard errors in parentheses. * significant at 5%; ** significant at 1%.

Table 3: Correlates of local public school access

	(1) Pct of schools public in district	(2) Pct of schools public in village
Academic Achievement in Elementary school		
Elementary test score score	0.065	1.066
	(0.268)	(0.572)
Elementary test score score , squared	-0.207	0.001
	(0.173)	(0.388)
Didn't repeat grade	0.211	0.96
	(0.549)	(1.173)
District Characteristics		
Average district elementary test score	-2.6	7.237
	(0.647)**	(1.629)**
Avg district elem test pctile, squared (/1000)	0.223	-10.078
	(0.780)	(2.093)**
Parental Characteristics		
Mom attended junior secondary	0.262	-3.949
	(0.660)	(1.501)**
Mom attended senior secondary	0.656	-3.27
	(0.865)	(1.906)
Mom attended university	1.383	0.125
	(1.305)	(3.523)
Dad attended junior secondary	-1.698	-2.993
	(0.630)**	(1.424)*
Dad attended senior secondary	-0.254	-1.507
	(0.734)	(1.502)
Dad attended university	1.280	6.913
	(1.178)	(2.452)**
Observations	4442	2173
R-squared	0.52	0.34

Notes: Robust standard errors in parentheses. * significant at 5%; ** significant at 1%.

Table 4: Effect of public school attendance on test score

	(1)	(2)	(3)	(4)	(5)	(6)
Sample:	Full sample	Junior secondary sample	Elementary school sample	Full sample	Junior secondary sample	Elementary school sample
Instrumental variables:	district % of schools public	district % of schools public	district % of schools public	village % of schools public	village % of schools public	village % of schools public
Attended Public SMP	0.277	0.379	0.424	0.452	0.204	0.532
	(0.224)	(0.259)	(0.303)	(0.273)	(0.295)	(0.341)
Observations	4442	2173	2767	1549	1978	1169
R-squared	0.44	0.40	0.46	0.42	0.50	0.45

Notes: Robust standard errors in parentheses. * significant at 5%; ** significant at 1%.

Table 5: Effect of school type on test score

Specification:	(1) OLS	(2) OLS	(3) OLS	(4) Fixed Effects
Sample:	Full sample	Junior secondary sample	Elementary school sample	Full sample
Public Madrassah	0.077	-0.004	-0.019	0.287
	(0.076)	(0.082)	(0.083)	(0.176)
Private:				
Secular	-0.228	-0.231	-0.282	-0.289
	(0.037)**	(0.045)**	(0.052)**	(0.092)**
Muslim	-0.188	-0.225	-0.241	-0.161
	(0.051)**	(0.068)**	(0.086)**	-0.108
Muslim Madrassah	-0.136	-0.270	-0.279	0.045
	(0.060)*	(0.064)**	(0.073)**	(0.155)
Other	-0.026	0.028	-0.009	0.050
	(0.073)	(0.092)	(0.114)	(0.143)
Observations	4442	2767	1978	1082
R-squared	0.44	0.47	0.50	0.75

Notes: Robust standard errors in parentheses. * significant at 5%; ** significant at 1%.

Table 6: Effect of school type by elementary school test quartile

	Quartile of elementary school test score			
	0-25th percentile	25th-50th percentile	50-75th percentile	75th-100th percentile
Public Madrassah	-0.081	0.437	0.079	0.050
	(0.106)	(0.179)*	(0.173)	(0.187)
Private:				
Secular	-0.154	-0.030	-0.147	-0.357
	(0.053)**	(0.072)	(0.077)	(0.160)*
Muslim	-0.116	-0.129	0.023	-0.344
	(0.073)	(0.090)	(0.145)	(0.164)*
Muslim Madrassah	-0.118	-0.056	0.096	-0.192
	(0.085)	(0.115)	(0.142)	(0.258)
Other	-0.150	0.059	0.135	0.266
	(0.145)	(0.200)	(0.193)	(0.185)
Observations	4442			
R-squared	0.45			

Notes: Robust standard errors in parentheses. * significant at 5%; ** significant at 1%.

Table 7: Effect of school type excluding academic achievement in elementary school

	(1)	(2)	(3)	(4)	(5)	(6)
Sample:	Full Sample		Junior Secondary Sample		Elementary School Sample	
Specification:	Excluded	Included	Excluded	Included	Excluded	Included
Public Madrassah	-0.147	0.077	-0.231	-0.004	-0.241	-0.019
	(0.083)	(0.076)	(0.089)**	(0.082)	(0.094)*	(0.083)
Private*:*						
Secular	-0.579	-0.228	-0.549	-0.231	-0.621	-0.282
	(0.037)**	(0.037)**	(0.046)**	(0.045)**	(0.052)**	(0.052)**
Muslim	-0.484	-0.188	-0.515	-0.225	-0.554	-0.241
	(0.054)**	(0.051)**	(0.071)**	(0.068)**	(0.090)**	(0.086)**
Muslim Madrassah	-0.388	-0.136	-0.504	-0.270	-0.510	-0.279
	(0.066)**	(0.060)*	(0.069)**	(0.064)**	(0.078)**	(0.073)**
Other	-0.284	-0.026	-0.197	0.028	-0.213	-0.009
	(0.084)**	(0.073)	(0.114)	(0.092)	(0.143)	(0.114)
Observations	4442	4442	2767	2767	1978	1978
R-squared	0.29	0.44	0.33	0.47	0.36	0.50

Notes: Robust standard errors in parentheses. * significant at 5%; ** significant at 1%. Excludes/Includes indicates if elementary school test score and an indicator for grade repetition at the elementary level are in the specification.