The Impact of Public-Private Partnerships on Private School Performance: Evidence from a Randomized Controlled Trial in Uganda

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We estimate the short-term impacts of a Public Private Partnership program on the performance of participating private secondary schools. The PPP program is part of a two-pronged strategy to absorb large increases in secondary enrollment following the introduction of the Universal Secondary Education initiative. Under the program, the government offers a per-student subsidy to participating *low-cost* private schools. Program implementation allowed for a randomized phase-in study design to estimate the causal impacts of the program on *private* school performance. While we find that the program successfully absorbed large numbers of eligible students in secondary schools, student performance in participating schools is significantly better. We find evidence both for increased input availability as well as positive selection of government aided students. Importantly, we don't find any adverse impacts on the governance of participating schools. In addition, participation in the program improves the likelihood of school survival, an outcome with some implications for the efficiency of this form of private secondary school provision. These short-term impacts suggest that PPPs represent a viable policy option for Governments to help absorb rapidly increasing school enrollments in secondary education in developing countries.

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Introduction

Many countries in sub-Saharan Africa have implemented policies to introduce universal access to primary or secondary education in the last two decades. These policies have led to sudden and massive increases in enrollments – which the public education systems are generally not equipped to absorb. A growing debate on the impact of these policies on learning has called for, on the one hand, a diminished role of the state (see Pritchett 2013, Andrabi et al. 2008, Dixon and Tooley 2005) and on the other hand, challenges to these claims (Lucas and Mbiti 2012) or concerns about private provision as a mechanism for maximizing efficiency (McLeod and Urquiola 2013).

The quality and efficiency arguments for private provision are generally countered by concerns about access. While public provision potentially increases access, especially by the poor, it is characterized by 'ossified' management of inputs and low cognitive achievement (Hsieh and Urquiola 2006). Policy-makers are increasingly developing partnerships with the private sector to help meet the goal of providing quality education to all (World Bank, 2009). One popular way to engage the private sector in education delivery is to develop public-private partnerships (PPPs) under which private schools contract with the government to deliver services. Partnerships range from the construction and management of infrastructure to the provision of services such as voucher programs and charter schools, covered widely under the school choice policies literature (Patrinos, Osorio, & Guáqueta, 2009; Hoxby, 2003b). Depending on the context, governments approach these programs with different goals, including increasing access, improving quality, reducing inequalities and reducing costs (Patrinos et al., 2009).

PPP arrangements provide a unique opportunity to wed the potentially inequality reducing impact of public financing of education to the efficient provision by private schools. Proponents of PPP's usually cite improved flexibility and accountability in education service delivery as major benefits of such programs. Generally, public school administrators have less autonomy in hiring teachers and organizing schools than the private sector does. In comparison, it has been argued that private schools deploy and use teachers more effectively (Andrabi et al 2008, World Bank, 2009). Further, private schools are generally held to a high level of accountability by the parents as a result of the direct financial transactions involved. Schools have to respond to demands of parents and provide high quality services in order to retain students. Finally, partnering with already-in-place private schools to increase access is cheaper than building new schools or classrooms and training teachers (Barrera-Osorio & Raju, 2014; Kim, Alderman & Orazem, 1999).

Another set of reasons for creating PPP's relates to their potential effects on public schools through increased competition. PPPs can create competition within education markets and thereby help promote innovative and more efficient approaches to education service delivery.[1] In education systems with per-capita funding formulas, the public sector has an incentive to react to this competition (the original argument was put forward by Friedman, 1962). PPPs can also improve the quality of education provided

[1] Hsieh and Urquiola (2006) find no evidence in support of this claim in the context of a very large reform in Chile.

by private schools by increasing the level and stability of resources available to them. It might also make the distribution of skills and competencies more equitable by making private schools accessible to low income households[2].

However, there are reasons to be cautious of potential negative effects of PPPs. Some have argued that these partnerships can reduce the government's control on a public service. Increasing the educational choices available to students and their families may increase socioeconomic segregation if better prepared students end up self-selecting into high-quality schools, thus further improving their outcomes. Similarly, if schools are allowed to select students, the market can be segmented with the best schools selecting the best students, as was the case in Chile (MacLeod and Urquiola, 2009). PPPs can then lead to poorer or less performing students being left behind in deteriorating public schools, or lower quality private schools that no longer receive the support of better educated and more affluent parents.

Despite an active policy agenda and theoretical interest, the empirical evidence of the causal effects of PPP on private schools is thin. Studies document that PPPs have been successful in increasing access in several countries including Tanzania, Colombia and Pakistan (Alderman, Kim, and Orazem, 2003; Barrera-Osorio et al 2011; Patrinos et al., 2009). Evidence on the impact of such programs on education quality, however, is also only just emerging. Research in Pakistan found some evidence of increased inputs – teachers, classrooms and blackboards (Barrera-Osorio and Raju, 2014). Evaluations of programs in India and Pakistan also point to the lower cost of education in the private schools but do not address productivity explicitly (Muralidharan and Sundararaman, 2013; Andrabi et al, 2007). MacLeod and Urquiola (2013), however, find no evidence of an increase in productivity when reviewing these evaluations, as well as programs in Colombia and Chile.

In addition to the concerns about private education provision (Macleod and Urquiola 2013), PPP arrangements as currently implemented could undermine the efficiency advantages of private schools in other ways. In particular, by introducing additional governance structures, increasing the number of students and the volume of public monies, PPP programs may dilute the quality of the private school learning environments both by crowding the classroom and crowding out good management. Alternatively, PPP programs may preserve the management advantages and ease liquidity and market constraints, particularly in poor credit market contexts (Andrabi et al 2015). This paper exploits a randomized phase-in of a PPP program with low-fee charging private secondary schools in Uganda to answer some of these emerging questions as PPPs are rolled out in education and other sectors.

Our intent-to-treat estimates suggest that schools that participated in the program successfully absorbed between 30 and 70 students per eligible grade. Despite this increase in enrollment, student performance in participating schools is significantly better. In particular, we find that the set of students exposed to more than a year of the PPP program have test scores in Math, English and Biology that are about 0.2 standard deviations better than students in non-participating private schools. We find evidence both for increased input availability as well as positive selection of government aided students. In particular, participating schools are more likely to have a laboratory; slightly more teachers and more importantly, teachers present in the classroom teaching. Crucially, we don't find any adverse impacts on the governance of participating schools even though program schools are more likely to discuss both teacher and head-

[2] It has been noted that in Uganda affluent households opt out of public schools in favor of the more expensive private schools (Deninger 2003).

teacher salaries. Finally, participation in the program improves the likelihood of school survival, an outcome with implications for the efficiency of PPPs.

The rest of the paper is organized as follows. In section 2 we discuss the context and outline the PPP policy and program; section 3 discusses the empirical strategy and study balance. Section 4 presents our results on enrollment and test scores as well as our exploration of potential mechanisms. Section 5 discusses the results and we conclude in section 6.

Context

In 2007, the Government of Uganda became the first country in sub-Saharan Africa to introduce and implement the Universal Secondary Education (USE) program, opening the doors of secondary education to its burgeoning population of primary school graduates. In order to accommodate the growth in students eligible to attend secondary school, the Ministry of Education developed short and long term policies to expand access.

In an effort to expand educational opportunities for all children, the government of Uganda (GoU) introduced Universal Primary Education (UPE) in 1997 and USE in 2007 to make schooling more accessible. Following the adoption of USE, all students who receive an overall aggregate score of 28 or lower on the Primary Leaving Examination (PLE) are eligible to attend at no cost to their families, participating public secondary schools and vocational institutions[3].

The introduction of USE led to large increases in lower secondary school enrollment. For example total enrollment increased by nearly 25% between 2007 and 2012 (World Bank 2014). However, this boost to enrollment has not been accompanied by concomitant increases in input levels, straining resources and infrastructure. Increased enrollment has caused classes to be un-manageably large with more than the recommended 60 students per classroom, leading to a poorer learning environment. While the number of teachers on government payroll has increased by 14% since 2008, the country needs multiple interventions in order to accommodate rising enrollment and adequately address the problem of a crowded learning environment. At the outset of USE, the government implemented two policies to address short run needs. First, the government introduced double shifting in eligible and willing public secondary schools. Secondly, in sub-counties where (i) there were no participating public secondary schools, (ii) those government schools were crowded, or (iii) where the size of the sub-county would involve very long distances to public schools, the government contracted with private schools to provide schooling for USE students. Below, we describe the PPP program.

PPP in Uganda

In Uganda, the PPP program was initiated in 2007 under the umbrella of the Universal Secondary Education policy. Eligibility for this program was defined to include all registered and certified private schools charging 75,000 UGX per term or lower.[4] Under the partnership, private schools apply to the Ministry of Education and Sports (MoES) and must meet a set of certification and quality benchmarks. These include: (i) being registered with the MoES, (ii) have adequate infrastructure, (iii) show

[3] An aggregate 28 corresponds to an average of a passing grade in each of the four subjects tested: Math, English, Social Studies and Science.

[4] At the prevailing exchange rates at the time, this corresponds to about $30 per term for a total annual cost of no more than $90.

demonstrated support from locally elected officials and education officials, (iv) institute a board of governors with government and parental membership and (v) have sufficient certified teaching staff.

When schools are enrolled in the partnership, they enter into a contractual arrangement with the MoES through a memorandum of understanding. This contract stipulates that private schools will receive 47,000 UGX per term per student eligible under the USE policy to cover non-boarding fees, and that the school will not charge any other non-boarding fee to the student. Partnering schools become eligible to receive support from the government for USE, including the provision of textbooks and other teaching materials.[5] The program is phased into the entire school over the course of several years, with Senior 1 in the first year, and additional grades added as the first cohort progresses through secondary education. Participating schools have control over the student selection process, may enroll as many students as they want, and can continue to enroll non-USE students (private students) for a fee..Participating private schools must institute a board of governors, that makes decisions concerning budgets and expenses. The board of governors is expected to administer the property of the school as well as ensure that the school is operated in such a manner as to ensure the learning and safety of students and staff.

The number of participating schools has steadily grown. As of February 2010, there were 545 participating private schools. This number has grown to 874 schools as of the end of the 2014 school year. The percentage of USE students enrolled in private schools has grown from 25% in 2008 to 45% in 2014-2015 (*MoE (2015)).* Schools that participate in the PPP program in Uganda are typically not elite private schools catering for wealthier families. PPP schools are usually found in rural areas and were often started by communities or entrepreneurs in response to the lack of government-operated schools in the area. As such, these schools are not the high performing elite schools typically associated with the private school provision in advanced economies.

Given the novelty of the program in Uganda, research was required to understand if the private sector could support the expansion in access without compromising the quality of education provided to government voucher students. A related objective is determining how government funds are used by private schools in lieu of providing a quality learning environment. If private schools make more efficient allocations of resources, we would expect participation in a PPP program to translate into an increase in learning related inputs. The research set out to identify the preferences and priorities of school owners and managers as well their actual behavior. In particular, we measure the quality of the inputs that private schools provide including teacher recruitment, competence and effort as well as the presence of important instructional inputs such as science laboratories.

Data

Randomization and Data

Implementation of the program permits a randomized phase-in study design. From the 250 schools that applied to become part of the program in the 2011 school year and met the criteria for participation described above, 100 schools were selected as study schools.[6] These schools were randomly assigned to

[5] Instructional materials support is provided on a discretionary basis (communication from Private Secondary Institutions Department, MoE).
[6] 150 schools were considered critical to the program based on their location relative to local demand for USE.

one group (50 treatment schools) that implemented the program in 2011 and another group (50 control schools) that were invited to implement the program starting in the 2012 school year.

This study design allows us to compare schools that participate in the PPP program in 2011 with a similar set of non-participating schools in order to estimate the causal effect of the program. We estimate the impact of the program along three sets of variables: characteristics of the school, accountability mechanisms, and characteristics of the student body. This presents an estimate of the impact of the program on school inputs, relationships with parents and student selection.

Table 1 summarizes the data collected for the study. The baseline data was collected between December 2010 and April 2011. The majority of the baseline data was collected at the end of the 2010 school year prior to the random assignment. As a result of end of year activities, the survey teams were unable to collect data from 7 treatment schools and 9 control schools. Information was collected from head teachers, teachers and students. An attempt was made to interview three teachers in each school, randomly selecting an English, Math, and Science teacher. The baseline data comprises of interviews with 119 and 105 teachers in treatment and control schools, respectively. Up to 20 students per school were also interviewed when possible. Students were randomly selected from Senior 1 and 2 classes. In cases where there were not enough students from these two grades, Senior 3 students were interviewed. In total, 944 and 801 students were selected from treatment and control schools respectively.

Follow up unannounced surveys were administered at three different points in time (subsequently referred to as *check* 1, 2 and 3). Check 1 was administered in July 2011 in 96 schools, during the second school term. Check 2 was administered in September 2011 in 94 schools, during the third term of the school year. Check 3 was administered in 95 schools in February 2012, during the first term of the new school year, prior to the expansion of the program to the control schools. Check 3 also included student interviews with 1467 and 1261 students in treatment and control schools, respectively. Some common reasons for not reaching schools were weather conditions leading to lack of access or school closure. In addition, some schools closed permanently, an outcome we examine explicitly in the results.

In addition to surveys designed by the research team, the study partnered with the Uganda National Examinations Bureau (UNEB) to monitor student performance. UNEB conducts an annual standardized assessment in a nationally representative sample of 500 schools called the National Assessment of Progress in Education (NAPE). This mid-year assessment measures student proficiency in English, Mathematics and Biology for a group of 30 randomly selected students in Senior 2. In July 2011 and 2012, UNEB included the list of 100 schools from the study in addition to their national sample and administered the three assessments. In addition, UNEB administered an additional Mathematics test ("Math independent"), which the research team adapted from TIMSS, an international test[7], through discussions with psychometricians in Uganda. NAPE data was collected in 2011 for 1230 students from 48 treatment schools and 1126 from 45 control schools and in 2012 for 1268 students from 48 treatment schools and 990 from 45 control schools.

[7] The Trends in International Mathematics and Science Study (TIMSS) is a series of international assessments of the mathematics and science knowledge of students around the world. For this research, we used a balanced selection of openly available questions from Grade 4 TIMSS Mathematics tests across specified learning domains.

Empirical Strategy

Models

The estimation is based on two main specifications. In the first model, the outcome variables (*Y*, enrollment and test scores) are regressed against a dummy variable indicating random assignment to treatment (*T*, 1=treatment; 0=control).

$$Y_{i,s,t} = \beta_0 + \beta_1 T_{s,t} + BX_{i,s,t} + \varepsilon_{i,s,t} \quad (1)$$

Outcome variable *Y* includes enrollment by grade and by gender, as well as NAPE test results by subject. Enrollment is measured as the total number of students enrolled in a particular grade. Test results are standardized to have a mean of zero and a standard deviation of 1. The regression is run at school or individual level, according to the outcome measure. *X* includes a rich list of control variables measured at baseline. These include the number of teachers working in the school, the proportion of female teachers, the number of permanent teachers, the number of teachers in the classroom at the time of visit, the number of teachers absent, the number of students enrolled, the number of toilets at the school, the availability of electricity, whether or not a library exists, and the existence of a board of governors (BOG)[8]. Standard errors are clustered at the school level.

The second main specification is similar to the first equation. In this second equation, the dependent variable *Z* includes three families of potential channels of school change.

$$Z_{i,s,t} = \beta_0 + \beta_1 T_{s,t} + BX_{i,s,t} + \eta_{i,s,t} \quad (2)$$

The dependent variable *Z* includes changes in school inputs (teacher characteristics and school infrastructure), changes in the school governance, and changes in the characteristics of students.

Program implementation

We use both administrative as well as survey reports of actual participation in the program. As figure 1 (administrative data) in the appendix shows, compliance to the random assignment is not perfect. In particular, about 60% of schools assigned to start the program in 2011 receive government transfers in 2011 and contrary to assignment, just under 20% of control schools participate in the program in 2011.

For the enrollment outcome we also report instrumental variables estimates of the impact of the program on schools induced to participate in the PPP program as a result of random assignment to implement in 2011. These results are simply a scaling of the intent to treat results outlined above by a factor of the inverse of the impact of assignment on actual take up.

Internal validity and sample description

Tables 2, 3 and 4 present the balance of the sample at baseline. These three tables, similar in structure, present baseline variables at the student, teacher and school level respectively. The first column presents the mean and standard deviation of each variable for the control schools, while the second column present similar information for the treatment schools. The third column presents the difference between these two columns (coefficient α_1) and standard errors. The equation used is described below:

[8] In order to maximize sample size, we replace missing values with the average value for the sample and add a dummy variable indicating that imputation.

$$X_{i,s,t} = \alpha_0 + \alpha_1 T_{s,t} + \gamma_{i,s,t} \quad (3)$$

where $X_{i,s,t}$ is the school, teacher or student attribute in question and $T_{s,t}$ is as above an indicator for assignment to treatment in 2011. We present the study balance results for students in S2 in 2011. On average, students interviewed were about 16 years old, with the treatment group slightly younger. Slightly more than half of control school students were male (57%) compared with 41% of those in treatment schools. Approximately 7% of control students reported having repeated the current grade compared to 5% of the treatment students; the proportion of students who have ever repeated is much higher at 34 and 25% respectively. On average, students reported more than 1 member of the household helped them with homework, and just over 70% reported that one parent or grandparent visited the school in the last year. More than half of students in control schools (52%) reported being absent at least 1 day in the previous week, compared with 40% in the treatment schools. Overall, approximately one third of students believed school was "irrelevant".

The average size of the household was slightly larger in the control group (9.1) than in the treatment group (8.7), while the ratio of child to adult was just over 1.5. A larger proportion of students in the control group reported their parents being from the same district they currently live in (63% and 56% respectively. On average, students in the control group were more likely to report that their parents were farmers than in the treatment group, with 63% of mothers and 48% of fathers, compared to 54% and 41% respectively in the treatment group. Students reported no significant difference in literacy rates, with 65% of mothers and 82% of fathers respectively. The index of household services represents a simple additive composite of four variables: roof, toilet, drinking water and electricity. There was no significant difference in reports from the two groups, with an average of 2.12 on the index.

Overall, table 2 shows a statistically significant difference between the two groups in nine different variables. The joint test confirms the imbalance in the two groups with a p-value for the Chi square test < 0.001.

Table 3 presents the baseline data from teacher interviews. Teachers in these schools are predominantly male (92%) with an average age of 32 years old. 60% of respondents report being permanent teachers at the school, and the typical respondent has slightly more than 2 years of teaching experience on average. Less than one third of teachers interviewed had a university degree. The average reported commuting time was 30 minutes. Slightly less than one quarter of teachers were able to show a lesson plan for the day of the visit. The only significant difference between the study arms was the reported salary, with teachers in treatment schools reporting a higher monthly wage. In contrast with the balance of student attributes, the overall test shows no significant difference between the two groups (Chi-square = 11.664, p=0.473).

Table 4 presents school level variables collected during the head teacher interviews. Panel A presents school characteristics and panel B presents characteristics of teachers and students. Most schools (97%) report having a BOG in place, though 62% of head teachers report the BOG only met once or not at all in the previous six months. On average, BOGs have ten members[9]. Most schools report having safe drinking

[9] MoES provides clear guidelines for BOGs which include a) governing the school b) administering the school's property c) administer school funds d) provide for the welfare of staff and students (Uganda Education Act 2008)

water (90%), while 39% report access to electricity and 44% have a library. On average, schools have 6.39 toilets. Schools have an average of 16 teachers, with treatment schools having a slightly higher proportion of female teachers. On average, teachers in treatment schools were more likely to be present and in the classroom on the day of the visit than those in control schools. Enrollment of students was slightly below 200 students, with no significant difference at baseline between schools. The overall test shows no significant difference between treatment and control schools (Chi-square = 29.981, p=0.15), which is particularly important given the treatment is done at the school level. Finally, it is important to notice that the majority of schools in the treatment group report having received transfers at Check 2 (60.5%) and slightly less than half at Check 3 (48%).

Results

Student enrollment

Table 5a presents the intent-to-treat estimates of the impact of the program on total school enrollment, as well as enrollment by grade and by gender. For each outcome, we present three regression coefficients: first with no controls, second with regional fixed effects (FE), and third with both regional fixed effects and baseline controls. The overall pattern of the results both across grades and study period are consistent with what we would expect. We observe large and significant effects for treated grades and small and always insignificant impacts for grades that were not part of the program. At Checks 1 and 2, in the first year of the program, we find an increased enrollment in grade 1 of 30 students using the most conservative estimate. This impact represents about a 50% increase in grade 1 enrollment relative to baseline enrollment. At Check 3, in the second year of implementation, we observe effects in enrollment at grade 1 (34 students) and grade 2 (38 students). While the observed effect in grade 2 is expected the increase in grade 1 reflects program implementation uncertainty that coincided with a tightening fiscal regime. In the bottom panel of Table 5 we show that the increase in enrollment is roughly proportionate across genders. If anything, female voucher beneficiaries account for slightly more than half of the voucher students at checks 1 and 2.

Table 5b shows the IV estimates which are about 2.5 times as large as the intent-to-treat estimates. In our preferred estimates from check 3, schools induced to participate in this program as a result of random assignment accept about 80 students per treated grade.

Student performance

Table 6 presents intent-to-treat estimates of the impact of the program on test scores from NAPE in 2011 and 2012. We include both years of the test given that tested cohorts are variously exposed to the PPP program, with the 2011 cohort exposed for 6 months while the 2012 cohort is exposed for 18 months. We report both on the overall test scores but also on the composition of students, a potential mechanism underlying the observed impacts that we discuss below. Panel A presents student characteristics reported on the day of the test. Panel B presents test scores results from the three NAPE tests and the independent Math test. Column (1) presents the mean and standard deviation for the control group. Column (2) presents the results of the regression with no controls. Columns (3) and (4) present the results of the regression with FE, and both FE and baseline school characteristics respectively. Column (5) includes these controls as well as contemporaneous student characteristics presented in Panel A. Coefficients in Panel B can be interpreted as standard deviations as student scores are standardized.

Since NAPE 2011 was administered to S2 students a few months after the program started, we anticipated no significant difference on tests and characteristics. However, when district fixed effects are included as controls, three of the four test estimates are positive, indicating students score higher in treatment schools. When the estimation includes the full set of controls, the coefficients decrease in size and they become insignificant, with the exception of the independent math test.

NAPE 2012 results are overall positive and significant. Using the regression with full controls in Column (5), the effects on test scores range from 0.204 SD to 0.257 SD. These effects are quite stable when different controls are included or not. It is important to notice that full controlled regressions had lower number of observations because of missing information for contemporaneous characteristics. In order to rule out problems of composition of the sample, we restricted all regressions to the sample of the full controlled equation and found similar results (not shown in the table).

Overall, the impact of the program can be summarized as an increase in student enrollment, proportional across gender, and higher test scores on average.

The instrumental variables estimates (not shown) are considerably larger than those shown in Table 6 but are also less precise

What could be driving changes in student performance?

Changes in School Governance

One of the main hypotheses considered relates to school governance. On the one hand, it is possible that public financing might undermine the management of school inputs that has been considered the comparative advantage of private schools. Firstly, the establishment of an additional governance structure, a Board of Governors, a requirement for all licensed secondary schools, whose membership includes a number of public officials[10] and where decisions are made by majority vote, could undermine management quality. Secondly, the power and incentive structures of school governance may be fundamentally altered by the infusion of public money and it is conceivable that as a result of PPP private schools become less responsive to the parents, shift the power away from parents to government officials in school management/governance, and (as a result) provide less information to parents. These potential impacts on school governance could in turn impact student performance.

On the other hand, a PPP approach could improve governance in private schools by increasing the level and stability of resources available. It can also be argued that public funding may in fact empower a broader spectrum of lower- and higher-income parents to exercise greater influence in school matters, since under USE private "ownership" and "control" of schooling is radically transformed to a "contracting out" model of *public* education service delivery.

To test these hypotheses, each of the three surveys (Check 1, Check 2 and Check 3) asked questions about the presence of Board of Governors, frequency of meetings, changes in ownership etc. Table 7 presents measures of program impact on school governance and accountability from checks 1 to 3. For ease of interpretation, we only present the full models with both regional fixed effects and baseline characteristics of the school. The program does not appear to impact school governance in a systematic way. The

[10] These include a local government representative and a local council representative. Other members include two members of school staff (nominated by the staff); two parents and two alumni.

likelihood of having a Board of Governors, the frequency of meetings and the presence of members is not impacted. There is no significant impact on ownership of the school even though treatment schools are three times as likely to have an ownership change. However, the program seems to influence some of the topics discussed at the meeting. Specifically, there seems to be increased discussion of teacher motivation and decreased attention to infrastructure issues in PPP schools.

Changes in School Inputs

The second hypothesis we explore is whether schools use the funds to change the school inputs which could in turn impact student performance. The structure of the program can be expected to directly impact investments in the quantity and quality of school inputs and resources. First, certain investments might be necessary for accommodating additional enrollments. Secondly, private schools might strategically invest in school inputs to create a favorable impression on public officials (who have influence on school's continued participation in the program), parents and students (especially those that continue to pay fees), and teachers (to maintain motivation in the face of increased class sizes). On the other hand, given that there is limited capacity to enforce expenditure guidelines, the level of per-student subsidy is fairly modest, and some of these institutions are ultimately profit-making entities, input availability per-student in these private schools might in fact decline with program participation.

Table 8 presents the impact of the program on two critical sets of school inputs - teachers and school infrastructure. Treatment schools had a similar number of teachers, with no systematic changes in teacher composition in terms of percentage of female teachers and permanent teachers. However, even though levels remain similar, there appear to be significant differences in the utilization of the teacher input. We see that a higher proportion of treatment teachers was present and more likely to be in class at the time of the unannounced school visits.

In terms of school infrastructure, the only discernible impact of the program was on the presence of a science laboratory in schools; with approximately 20% more treatment schools reporting having a science laboratory. There do not appear to be significant differences in other conditions, such as working toilets, class cleanliness, or number of furniture for students. These results seem logical. Given the limited transfer amount, it seems unlikely that schools would be able to invest significantly in school infrastructure. However, it appears that participating private schools are using at least part of the government transfers to adapt existing infrastructure and purchase equipment for school laboratories.

The flow of public resources to participating private schools, while not manifesting strongly in observable inputs, does appear to significantly and positively impact the overall likelihood of school survival. A total of 7 schools closed permanently throughout the entirety of the study, with 2 closing from treatment group schools and 5 from control.

These, admittedly marginal, improvements in school stability and availability of school inputs, in terms of teacher effort and science laboratories, could explain part of the observed improvements in student performance.

Changes in Student Composition

The third hypothesis tested is whether participating schools are in effect enrolling different 'types' of students. With participation in the PPP program, private schools might find themselves faced with excess demand – more applications than available seats – which would make it possible for them to introduce

selection criteria for enrollment. Such excess demand is particularly likely to occur if: there are few other secondary schools (public or private) present in the community; available public schools are overcrowded and of low-quality; and/or the association of a low-cost private school with public funding is perceived as a positive signal of school quality by parents.

Table 9 presents student characteristics collected at Check 3. Column (1) includes the mean and standard deviation of the control group. Columns (2) and (3) present the results of the regression with and without fixed effects at the district level. Students in treatment schools are younger on average. They also appear more likely to be coming from households that are: (i) more invested in children's schooling (parents reported to be more likely to visit the school), (ii) are financially more secure (have a higher index of assets); and (iii) are more educated (students in treatment schools report a higher education level for their father). More directly capturing differences in unobservables as shown in figure 2, students in the treatment group perform better on the primary leaving exam than students in the control group. We are able to reject the Wilcoxon-Kolmogorov test that the distribution of treatment test scores is drawn from the same distribution as the control group.

Overall, it seems that students in treatment schools are different from their peers in control schools. Specifically, they come from backgrounds that are positively associated with student achievement. These results strongly suggest student selection on the part of low-cost private schools associated with the PPP program. Such selection presents a very plausible explanation for the observed gains in student performance in PPP schools.

Discussion

The explicit objective of the PPP program is to use the private sector to help absorb an increased student population in secondary schools without adversely impacting the quality of education service delivery. Our evaluation of the Uganda PPP program along these dimensions shows that not only does the program help successfully increase student enrollment, but student performance in participating private schools actually improves.

We examine the three most likely explanations for this positive impact of the program on student achievement: (i) changes in school management and governance; (ii) changes in school inputs; and (iii) changes in student composition through selection. We find no changes in school governance but modest positive changes in availability of school inputs to students (school stability, teacher presence, and science laboratories). We also find significant changes in student composition suggesting that participating private schools could be systematically selecting students from more educationally-favorable backgrounds.

While both explanations (ii) and (iii) could account for the observed improvements in student performance, we suspect the phenomenon is driven largely by (iii) – student selection. There are two key reasons for this. First, improvements in student performance start to manifest in NAPE 2011, merely months after treated schools became a part of the PPP program and before the first set of government transfers to these schools would have had a chance to impact school inputs. Secondly, the magnitude of student performance effects is quite large and therefore unlikely to be fully accounted for by marginal improvements in teacher presence or science equipment.

This analysis suggests that the phenomenon of student selection by participating private schools needs to be examined further as it has important implications for the efficacy and effectiveness of the PPP program.

Conclusions

In this paper we examine the causal impacts of a PPP program in Uganda, aimed at helping absorb enrollment increases in secondary education. We find that the PPP program succeeds in absorbing a considerable number of USE students. In particular we find that that total enrollment increases by just over 100 students after one year of participating in the PPP program. Across forms 1 -3, average enrollment increased by between 30 and 38 additional students. In addition, the observed expansion in enrollment is evenly distributed between male and female students.

Secondly, schools were found to have equivalent teacher composition, with comparable numbers of total, female and permanent teachers regardless of whether the school received the PPP program in Phase I. However, significantly, more teachers were present in class at the time of visit among Phase I PPP schools. We also report a discernible impact of the program on infrastructure: an increase in reported science laboratories in treatment schools. More importantly, we show that the survival rate of PPP schools is considerably larger -- 10% of non-PPP schools closed compared to just under 4% of PPP schools.

In addition, the program does not appear to change school governance in any systematic way. The likelihood of having an active Board of Governors, measured by the frequency of meetings and attendance of meetings, does not appear to be affected by inflows of public funding to private schools. While we find the PPP program influences topics discussed at meetings, as far as we can tell, school ownership and control remains unchanged.

Finally, using data from the Uganda National Examinations post-primary NAPE test results, students in PPP program schools achieve higher scores in Biology, English and Mathematics. The measured learning gains of between 0.2 and 0.25 standard deviations are statistically distinguishable from zero for English and Math, but not for Biology. These results appear to be mainly driven by student selection – given that students in treatment schools are significantly more likely to come from households with better education, more resources, and more involved parents.

Overall, the results indicate that the PPP program successfully utilizes excess capacity in private schools and enables these schools to operate at a scale that more efficiently utilizes teacher and other instructional inputs. These results establish the viability for private schools to partner with the Government and support the countrywide goal of quality education for all, at potentially lower unit costs than government provision.

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APPENDIX

Table 1. Sample size and collection of data

	Baseline	Check 1	NAPE 2011	Check 2	Check 3	NAPE 2012
Time	Dec 2010/April 2011	July 2011	July 2011	Sept 2011	Feb 2012	July 2012
Head Teachers Survey						
Treated School	43	48	48	48	49	48
Control	41	48	45	46	46	45
Teachers						
Treated School	119					
Control	105					
Students						
Treated School	944		1230		1467	1268
Control	801		1126		1261	990

Table 2. Baseline Student Survey: description and balance

	Control	Treatment	Treatment-Control
Panel A. Student characteristics			
Age	16.66	15.84	-0.822**
	(2.10)	(1.55)	(0.34)
Gender (male=1)	0.57	0.41	-0.159***
	(0.50)	(0.49)	(0.04)
Repeating grade	0.07	0.05	-0.029
	(0.26)	(0.21)	(0.02)
Ever repeat	0.34	0.26	-0.079
	(0.47)	(0.44)	(0.05)
Help with homework	1.46	1.2	-0.261
	(1.31)	(1.25)	(0.17)
Household visit sch	0.75	0.72	-0.022
	(0.44)	(0.45)	(0.04)
Any day absent	0.52	0.4	-0.123
	(0.50)	(0.49)	(0.08)
Absent because of fees	0.54	0.48	-0.066
	(0.50)	(0.50)	(0.09)
Schools is irrelevant	0.33	0.29	-0.042
	(0.49)	(0.50)	(0.05)
Sample size	771	955	1726
Date	Dec 2010/April 2011		
Test for jointly significance			
Chi2	52.46		
Prob>Chi2	<0.001		

	Control	Treatment	Treatment-Control
Panel B. Household Characteristics			
Household Size	9.12	8.73	-0.394
	(4.84)	(6.19)	(0.56)
Child to adult	1.68	1.45	-0.226
	(1.81)	(1.31)	(0.17)
Parent local	0.63	0.56	-0.073
	(0.48)	(0.50)	(0.06)
Mother farm	0.63	0.54	-0.091
	(0.48)	(0.50)	(0.06)
Father farm	0.48	0.41	-0.068
	(0.50)	(0.49)	(0.05)
Mother literate	0.61	0.66	0.049
	(0.49)	(0.47)	(0.06)
Father literate	0.84	0.8	-0.037
	(0.37)	(0.40)	(0.03)
Mother education	2.97	3.3	0.329*
	(1.40)	(1.50)	(0.18)
Father education	3.55	3.81	0.257*
	(1.39)	(1.53)	(0.15)
Index of hh services	2.08	2.22	0.139
	(0.85)	(0.79)	(0.12)
	771	955	1726

Table 3. Baseline Teacher Survey: Description and Balance

	Control	Treatment	Treatment-Control
Gender (1=male)	0.92	0.88	-0.048
	(0.27)	(0.33)	(0.04)
Age	31.9	30.68	-1.219
	(9.08)	(7.93)	(1.20)
Teacher is permanent	0.6	0.63	0.024
	(0.49)	(0.49)	(0.08)
Teaching experience (months)	29.78	24.88	-4.908
	(30.15)	(23.93)	(4.23)
Perc of teacher with O-level	0.02	0.01	-0.011
	(0.14)	(0.09)	(0.02)
Perc of teacher with A-level	0.22	0.24	0.023
	(0.42)	(0.43)	(0.07)
Per of teacher with university	0.3	0.38	0.088
	(0.46)	(0.49)	(0.07)
Per of teachers, other education	0.47	0.37	-0.1
	(0.50)	(0.48)	(0.08)
Commute (in minutes)	30.18	28.49	-1.69
	(27.47)	(26.84)	(4.54)
Teacher walk to schools (perc)	0.56	0.53	-0.036
	(0.50)	(0.50)	(0.08)
Teacher has a plan for semester (perc)	0.32	0.33	0.007
	(0.47)	(0.47)	(0.09)
Teachers has a lesson plan (perc)	0.24	0.2	-0.04
	(0.43)	(0.40)	(0.08)
Salary (UGX; approx. 2500 UGX=1 US$)	123049.5	143865.6	20816.041*
	(70244.63)	(68420.92)	(12289.05)
Number of observations	105	119	224
Date		Dec 2010 / April 2011	
Test for jointly significance			
Chi2			11.664
Prob>Chi2			0.473

Table 4. Baseline Head Teacher Survey: Description and Balance

	Control	Treatment	Treatment-Control
Panel A. School Characteristics			
School has a BOG	0.97	0.95	-0.023
	(0.16)	(0.22)	(0.04)
Frequency of BOG meeting	3.41	3.54	0.128
	(1.12)	(0.85)	(0.23)
BOG rarely meets	0.62	0.67	0.051
	(0.49)	(0.48)	(0.11)
BOG monitors teachers absence	0.49	0.61	0.119
	(0.51)	(0.50)	(0.12)
BOG monitors infrastructure	0.59	0.58	-0.016
	(0.50)	(0.50)	(0.12)
BOG members	10.24	11.47	1.237
	(3.77)	(3.34)	(0.82)
Number of toilets in the school	6.39	7.67	1.276
	(3.79)	(4.55)	(0.92)
School has electricity	0.39	0.37	-0.018
	(0.49)	(0.49)	(0.11)
School has a library	0.44	0.49	0.049
	(0.50)	(0.51)	(0.11)
Source of drinking water	0.9	0.93	0.028
	(0.30)	(0.26)	(0.06)
Number of observations (max)	41	43	84
Date			
Test for jointly significance			
Chi2			
Prob>Chi2			

	Control	Treatment	Treatment-Control
Panel B. Teachers and Student			
Number of teachers	16.22	16.79	0.571
	(4.62)	(5.89)	(1.16)
Number of female teachers	2.85	3.77	0.914**
	(1.67)	(2.50)	(0.47)
Percentage of female teachers	0.18	0.21	0.037*
	(0.11)	(0.10)	(0.02)
Percentage of permanent teachers	0.59	0.65	0.066
	(0.50)	(0.48)	(0.11)
Teacher is in class right now	0.1	0.23	0.135*
	(0.30)	(0.43)	(0.08)
Teacher is absent	0.49	0.28	-0.209**
	(0.51)	(0.45)	(0.10)
Number of Students in Grade 1	57.35	68.07	10.72
	(43.55)	(44.25)	(9.65)
Number of Students in Grade 2	42.08	48.81	6.739
	(27.26)	(36.02)	(7.05)
Number of Students in Grade 3	41.6	48.79	7.191
	(31.16)	(38.85)	(7.77)
Number of Students in Grade 4	46.13	48.72	2.596
	(37.13)	(38.26)	(8.29)
Number of Students in Grade 5	6.17	11.84	5.662
	(12.65)	(20.83)	(3.82)
Number of Students in Grade 6	5.63	10.42	4.794
	(12.51)	(18.05)	(3.43)
Number of Students	198.95	236.65	37.701
	(128.48)	(158.93)	(31.87)
Number of Female Students	94.08	110.19	16.115
	(63.82)	(85.60)	(16.74)
	41	43	84
Dec. 2010/April 2011			
29.981			
0.15			

Table 5a. Impact on enrollment: treatment versus control

	Check 1			Check 2			Check 3		
Total number of	64.957	66.703	65.496	96.000*	93.566	83.079	129.777*	131.619*	104.907
Students	(56.91)	(57.77)	(54.47)	(57.20)	(58.27)	(53.50)	(67.30)	(68.55)	(68.07)
Students, grade 1	36.745***	36.298**	31.716**	37.468***	36.174**	30.225**	40.886**	42.015**	33.943*
	(13.88)	(14.18)	(13.83)	(13.91)	(14.20)	(13.60)	(17.34)	(17.81)	(18.37)
Students, grade 2	6.085	6.394	3.347	15.826	15.379	11.095	44.503***	44.433***	38.051**
	(13.05)	(13.17)	(13.46)	(12.98)	(13.25)	(13.40)	(15.87)	(16.30)	(16.62)
Students, grade 3	9.766	9.571	10.673	19.315	18.207	16.221	16.468	17.048	10.188
	(12.95)	(13.17)	(12.65)	(11.97)	(12.22)	(11.63)	(14.71)	(14.89)	(15.10)
Students, grade 4	5.596	8.189	11.762	13.308	14.802	15.011	10.823	12.2	8.144
	(12.50)	(12.66)	(11.27)	(12.64)	(12.85)	(11.29)	(11.93)	(12.12)	(11.36)
Students, grade 5	5.213	4.736	5.355	7.599	6.814	7.878	8.939	8.206	8.45
	(7.35)	(7.51)	(7.81)	(7.25)	(7.39)	(7.14)	(7.66)	(7.72)	(7.97)
Students, grade 6	1.553	1.514	2.643	2.483	2.191	2.649	8.157	7.717	6.131
	(7.35)	(7.49)	(7.75)	(7.45)	(7.62)	(7.62)	(6.92)	(7.12)	(7.24)
Female students, S1	20.021***	19.325***	17.950**	21.716***	20.110***	15.896**	20.334**	20.551**	16.062*
	(6.94)	(7.09)	(7.20)	(7.09)	(7.19)	(6.77)	(8.83)	(9.04)	(9.56)
Female students, S2	4.532	4.458	3.497	11.012	10.264	8.538	25.178***	24.444***	20.845**
	(6.39)	(6.47)	(6.58)	(6.81)	(6.94)	(7.17)	(8.12)	(8.30)	(8.56)
Female students, S3	7.128	7.213	8.117	10.727*	10.360*	9.895*	8.306	8.416	4.079
	(5.68)	(5.83)	(5.46)	(5.69)	(5.83)	(5.49)	(5.95)	(6.04)	(5.77)
Female students, S4	4.53	5.469	6.853	9.071	9.442	9.841*	6.622	6.763	5.065
	(6.51)	(6.60)	(6.10)	(6.33)	(6.46)	(5.90)	(6.62)	(6.75)	(6.57)
Female students, S5	2.362	2.122	2.085	2.859	2.579	2.595	3.306	2.96	2.857
	(2.77)	(2.82)	(2.93)	(2.21)	(2.25)	(2.13)	(2.32)	(2.35)	(2.41)
Female students, S6	1.404	1.072	0.705	1.128	0.973	0.593	2.6	2.394	1.665
	(2.37)	(2.39)	(2.53)	(1.85)	(1.86)	(1.72)	(2.32)	(2.39)	(2.41)
Regions FE	N	Y	Y	N	Y	Y	N	Y	Y
Baseline Controls	N	N	Y	N	N	Y	N	N	Y
Number of schools	94	94	94	93	93	93	94	94	94

Table 5b. IV Impact on enrollment: treatment versus control

	Check 1	Check 2	Check 3
Total number of students	168.362	215.064	238.154
	(131.588)	(131.119)	(147.440)
Students, grade 1	81.529**	78.241**	77.054*
	(35.426)	(33.492)	(39.598)
Students, grade 2	8.603	28.722	86.382**
	(31.079)	(31.710)	(37.915)
Students, grade 3	27.435	41.991	23.127
	(30.389)	(29.139)	(31.323)
Students, grade 4	30.236	38.858	18.489
	(26.664)	(26.848)	(23.516)
Students, grade 5	13.766	20.394	19.184
	(18.328)	(17.178)	(16.998)
Students, grade 6	6.794	6.857	13.918
	(17.855)	(17.654)	(15.092)
Female students, grade 1	46.141**	41.151**	36.463*
	(18.866)	(16.666)	(20.098)
Female students, grade 2	8.990	22.103	47.322**
	(15.221)	(17.232)	(19.647)
Female students, grade 3	20.865	25.614*	9.259
	(13.664)	(13.711)	(11.831)
Female students, grade 4	16.556	25.475*	11.499
	(13.400)	(13.860)	(13.596)
Female students, grade 5	5.360	6.719	6.486
	(6.840)	(5.134)	(5.137)
Female students, grade 6	1.811	1.534	3.779
	(5.811)	(3.968)	(4.941)
Regions FE	Y	Y	Y
Baseline Controls	Y	Y	Y
Number of schools	94	93	94

Table 6. Impact on test scores: treatment versus control

	NAPE 2011					NAPE 2012				
	Control Mean and SD	Treatment-Control	Treatment-Control	Treatment-Control	Treatment-Control	Control Mean and SD	Treatment-Control	Treatment-Control	Treatment-Control	Treatment-Control
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
A. Characteristics of Students and Households										
Students' age	16.22	-0.271**	-0.181*	0.001		16.19	-0.301**	-0.148	-0.244	
	(1.44)	(0.13)	(0.10)	(0.14)		(1.49)	(0.14)	(0.09)	(0.17)	
Gender (1 male)	0.51	-0.045	-0.003	-0.023		0.53	-0.049*	-0.02	0.039	
	(0.50)	(0.03)	(0.03)	(0.05)		(0.50)	(0.03)	(0.03)	(0.03)	
Index infrastructure	1.69	0.06	0.031	0.113		1.44	0.038	-0.018	0.023	
	(0.76)	(0.08)	(0.08)	(0.09)		(0.68)	(0.07)	(0.06)	(0.11)	
Index assets	2.58	0.303	0.276	0.26		3.08	0.252	0.053	-0.262	
	(1.97)	(0.26)	(0.30)	(0.37)		(1.70)	(0.19)	(0.21)	(0.23)	
PLE Score (4 = highest; 36 = lowest)						21.34	-0.057	-0.688	-0.988	
						(5.14)	(0.48)	(0.61)	(0.76)	
B. Test scores results										
Math (official)	-0.06	0.108	0.208**	0.181	0.172	-0.07	0.116	0.253***	0.263**	0.257***
	(0.96)	(0.09)	(0.09)	(0.14)	(0.16)	(0.95)	(0.09)	(0.08)	(0.11)	(0.08)
Math (independent)	-0.07	0.138*	0.196**	0.272***	0.295**	-0.09	0.157**	0.225***	0.286**	0.228**
	(0.95)	(0.08)	(0.08)	(0.10)	(0.12)	(0.94)	(0.07)	(0.09)	(0.13)	(0.10)
English	-0.08	0.148	0.157**	0.124	0.068	-0.14	0.249***	0.343***	0.269**	0.204*
	(0.97)	(0.10)	(0.07)	(0.10)	(0.12)	(0.96)	(0.09)	(0.09)	(0.13)	(0.12)
Biology	-0.04	0.073	0.132	0.079	0.08	-0.1	0.183*	0.305***	0.203	0.233
	(0.98)	(0.11)	(0.11)	(0.16)	(0.18)	(0.95)	(0.11)	(0.11)	(0.24)	(0.20)
Fixed effects district		No	Yes	Yes	Yes		No	Yes	Yes	Yes
Baseline controls		No	No	Yes	Yes		No	No	Yes	Yes
Contemperanous Characteristics		No	No	No	Yes		No	No	No	Yes
Number of obs.	1126	2356	2356	2356	2085	983	2249	2249	2249	1968

Note. Column (1) report mean and standard deviation for the control group. Columns (2) , (3) and (4) report the estimate of effects of a regression of each outcome variable against the treatment indicator. Test scores are demeaned by test mean and divided by standard deviation. Standard errors are cluster at the school level.

Table 7. Changes in the schools: governance

	Check 1		Check 2		Check 3	
	Control Mean and SD	Treatment-Control	Control Mean and SD	Treatment-Control	Control Mean and SD	Treatment-Control
	(1)	(2)	(1)	(2)	(1)	(2)
Presence of BOG	0.94	-0.07	0.96	-0.093*	0.93	-0.053
	(0.24)	(0.06)	(0.21)	(0.05)	(0.25)	(0.05)
BOG meets seldom	0.51	-0.054	0.55	-0.024	0.44	0.054
	(0.51)	(0.12)	(0.50)	(0.13)	(0.50)	(0.12)
BOG discusses infrastructure	0.53	0.239*	0.62	0.013	0.71	-0.317**
	(0.51)	(0.14)	(0.49)	(0.14)	(0.46)	(0.14)
BOG discusses teacher	0.38	0.108	0.46	0.044	0.39	0.298**
Motivation	(0.49)	(0.14)	(0.51)	(0.16)	(0.50)	(0.14)
Percent of BOG members	0.21	0.025	0.24	0.004	0.18	0.02
absent at last meeting	(0.17)	(0.04)	(0.21)	(0.06)	(0.11)	(0.04)
Ownership change	0.02	0.045	0.07	-0.001	0	0.025
	(0.14)	(0.05)	(0.25)	(0.05)	(0.00)	(0.04)
Number of observations	48	96	46	93	45	94
Control (baseline and region fixed ef.)		Yes		Yes		Yes

Table 8. Changes in the schools: teachers and infrastructure

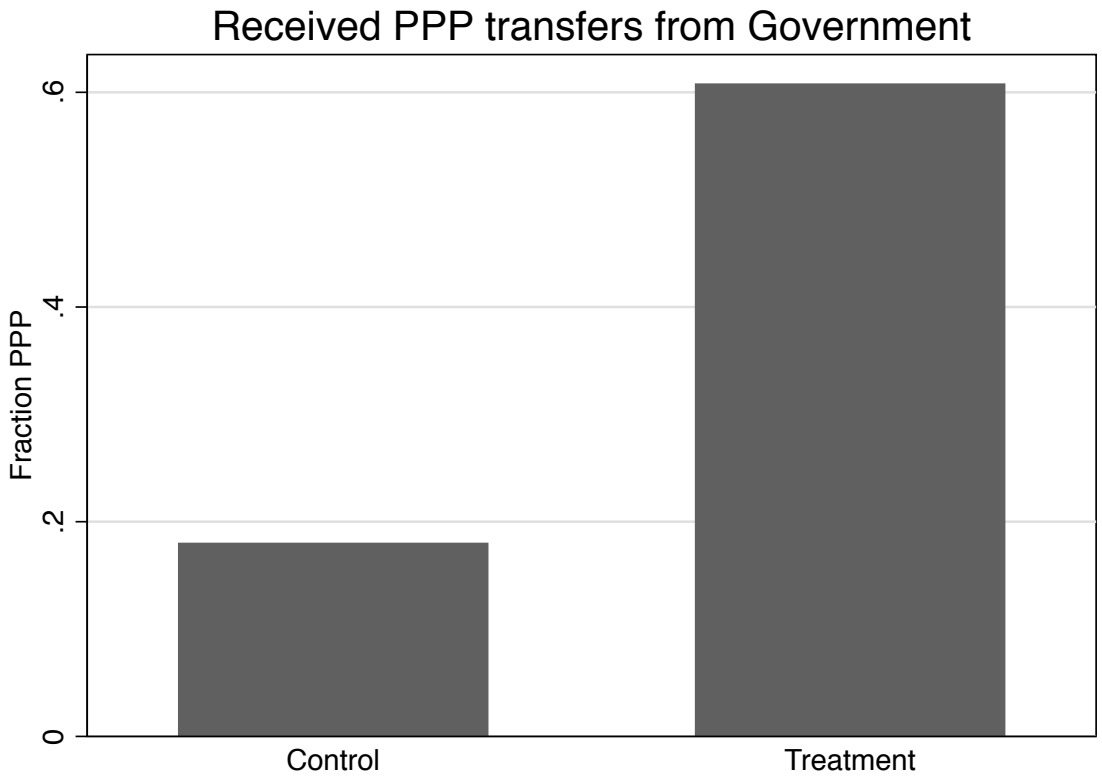
	Check 1		Check 2		Check 3	
	Control Mean and SD	Treatment-Control	Control Mean and SD	Treatment-Control	Control Mean and SD	Treatment-Control
	(1)	(2)	(1)	(2)	(1)	(2)
A. Teachers						
Number of teachers	15.27	0.969	17.04	2.444	22.02	-1.187
	(4.12)	(1.02)	(4.61)	(1.79)	(11.08)	(1.82)
Percent female	0.19	0.009	0.19	0.014	0.21	-0.029
	(0.11)	(0.02)	(0.09)	(0.02)	(0.10)	(0.02)
Percent permanent	0.64	0.064	0.63	0.042	0.58	-0.014
	(0.23)	(0.05)	(0.20)	(0.05)	(0.19)	(0.04)
Percent in class	0.22	0.069*	0.21	0.082**	0.23	0.025
	(0.15)	(0.04)	(0.13)	(0.03)	(0.12)	(0.03)
Percent absent	0.29	-0.092*	0.28	-0.012	0.31	-0.028
	(0.26)	(0.05)	(0.20)	(0.04)	(0.20)	(0.04)
Percent with secondary			0.09	-0.039	0.06	0.092***
or lower			(0.16)	(0.03)	(0.10)	(0.03)
B. Infrastructure						
Students per chair, grade 1	2.2	-0.048	2.36	-0.227	2.14	0.013
	(1.45)	(0.32)	(2.51)	(0.46)	(0.92)	(0.20)
Students per chair, grade 2	2.07	-0.219	1.81	-0.023	2.26	-0.22
	(1.27)	(0.24)	(0.88)	(0.19)	(1.05)	(0.24)
Index of class: condition,	7.72	0.179	7.67	0.212	8.01	0.033
noise, cleanliness	(1.46)	(0.31)	(1.39)	(0.29)	(1.44)	(0.28)
Library (yes or no)			0.26	0.095	0.38	-0.085
			(0.44)	(0.10)	(0.49)	(0.10)
Number of working toilets			7.2	1.362	7.15	0.097
			(5.38)	(1.19)	(6.26)	(1.28)
Laboratory			0.67	0.177*	0.57	0.200*
			(0.47)	(0.09)	(0.50)	(0.11)
Index of instruments (lab)			6.46	0.364	8.44	0.176
			(3.48)	(0.69)	(1.42)	(0.32)
Number of observations	48	96	46	93	45	94
Control (baseline and region fixed ef.)		Yes		Yes		Yes

Table 9. Impact on student characteristics

	Check 3		
	Control Mean and SD	Treatment-Control	Treatment-Control
	(1)	(2)	(3)
A. Characteristics of Students: Demographics			
Students' age	15.82	-0.519***	-0.385***
	(1.95)	(0.17)	(0.10)
Gender (1 male)	0.49	-0.008	-0.012
	(0.50)	(0.03)	(0.02)
B. Characteristics of Students: Education			
PLE Score	22.63	-1.093*	-0.85
	(5.59)	(0.57)	(0.66)
Absence, last week	0.43	-0.056	-0.045
	(0.50)	(0.03)	(0.03)
Repeated a grade	0.51	-0.033	-0.025
	(0.50)	(0.05)	(0.04)
Walks to school	0.9	-0.046**	-0.03
	(0.30)	(0.02)	(0.02)
Help on homework	3.05	0.083	0.125
	(1.19)	(0.12)	(0.11)
Hhold visits school	0.6	0.145***	0.175***
	(0.49)	(0.04)	(0.03)
C. Characteristics of Students: Household			
Hhold Assets	2.15	0.273***	0.130*
	(1.07)	(0.09)	(0.07)
Hhold service	2.56	0.052	-0.032
	(0.82)	(0.08)	(0.04)
Hhold size	9.14	-0.361	-0.282
	(4.76)	(0.33)	(0.25)
Mothers education	2.77	0.203*	0.038
	(1.36)	(0.11)	(0.08)
Fathers education	3.3	0.351***	0.235**
	(1.44)	(0.10)	(0.09)
D. School characteristics according to student			
Answered question	0.94	0.002	-0.012
	(0.24)	(0.01)	(0.02)
Noise in classroom	0.41	0.039	0.013
	(0.49)	(0.04)	(0.04)
Shares desk	2.16	-0.023	0.058
	(0.91)	(0.11)	(0.11)
Fixed Effects District level		No	Yes
Number of obs.	1261	2728	2728

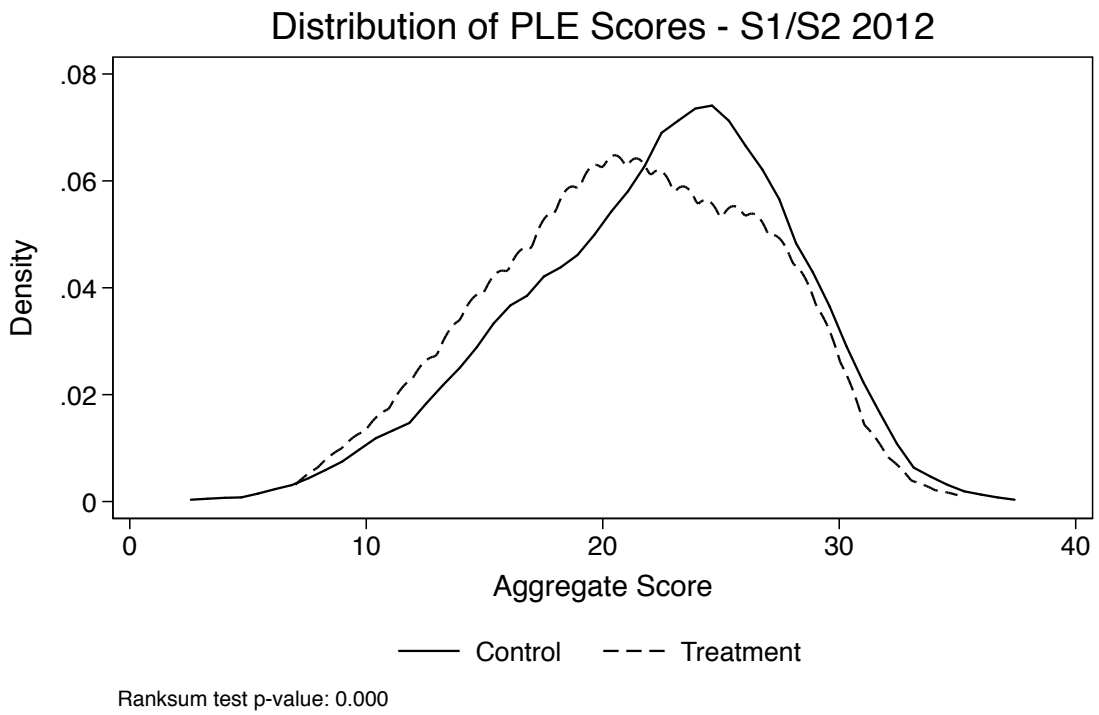
Note. Column (1) report mean and standard deviation for the control group. Columns (2) and (3) report the estimate of effects of a regression of each outcome variable against the treatment indicator. Standard errors are cluster at the school level.

Figure 1: Compliance to Treatment Assignment



Note. Graph of share of schools receiving transfers in 2011 using administrative data from Ministry of Education.

Figure 2: Evidence for Selection of Students into Participating Schools



Note. Kernel density of aggregate Primary Leaving Exam for non-repeating Senior 1 and 2 cohorts across treatment and control schools in February 2012.