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Financing Public Schools with Private Funds: Efficiency–Equity Trade-Off of Multi-Stakeholder School Financing in Punjab, Pakistan

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Abstract: Governments and development partners encourage public school authorities to mobilize private funds from diverse non-state stakeholders as a means to expand funding sources to provide quality education for all. While financing public schools with private funds is expected to promote the efficient use of resources due to increased accountability, it raises concerns about financial equity. Using public school panel data from Learning and Educational Achievements in Punjab Schools (LEAPS) in Pakistan, this study examines how private funds mobilized from different stakeholders are associated with efficiency in educating students at a given achievement level and equity in school finance. School fixed effects analyses show that schools relying on education fees or local community contributions were more likely to reduce inefficient capital expenditure. In girls' schools, financial dependency on private donors is also associated with a reduction in capital expenditure. However, the results suggest that a heavy reliance on education fees and private donors makes schools less efficient. I find no evidence that mobilizing private-fund revenue widened financial inequity. The findings demonstrate the importance of understanding the differential effects of private-fund revenue to develop effective multi-stakeholder financing systems that improve student achievement in a cost-effective

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manner and ensure financial equity.
Keywords: educational finance; efficiency; equity; accountability; public–private partnerships; Pakistan

Financiamiento de escuelas públicas con fondos privados: Equilibrio entre eficiencia y equidad del financiamiento de múltiples *stakeholders* en Punjab, Pakistán

Resumen: Los socios en los sectores gubernamentales y de desarrollo alientan a los líderes de las escuelas públicas a movilizar fondos privados de diversas *stakeholders* no estatales como un medio para expandir las fuentes de financiamiento para brindar una educación de calidad para todos. Si bien se espera que el financiamiento de las escuelas públicas con fondos privados promueva el uso eficiente de los recursos debido a una mayor *accountability*, plantea preocupaciones sobre la equidad financiera. Utilizando datos de panel de escuelas públicas de Learning and Educational Achievements in Punjab Schools (LEAPS) en Pakistán, este estudio examina cómo los fondos privados movilizados de diferentes *stakeholders* se asocian con la eficiencia en la educación de los estudiantes en un nivel de rendimiento determinado y la equidad en la financiación escolar. Los análisis de efectos fijos escolares muestran que las escuelas que dependen de las tasas educativas o de las contribuciones de la comunidad local tenían más probabilidades de reducir el gasto de capital ineficiente. En las escuelas de niñas, la dependencia financiera de los donantes privados también se asocia con una reducción de los gastos de capital. Sin embargo, los resultados sugieren que una gran dependencia de las tasas educativas y los donantes privados hace que las escuelas sean menos eficientes. No encuentro evidencia de que la movilización de fondos privados amplió la inequidad financiera. Los hallazgos demuestran la importancia de comprender los efectos diferenciales de los ingresos de fondos privados para desarrollar sistemas de financiamiento efectivos de múltiples partes interesadas que mejoren el rendimiento de los estudiantes de manera rentable y garanticen la equidad financiera.
Palabras-clave: finanzas educativas; eficiencia; equidad; *accountability*; asociaciones público-privadas; Pakistán

Financiamento de escolas públicas com fundos privados: Equilíbrio entre eficiência e equidade no financiamento de escolas com múltiplas *stakeholders* em Punjab, Paquistão

Resumo: Parceiros em setores governamentais e de desenvolvimento incentivam os líderes das escolas públicas a mobilizar fundos privados de diversos *stakeholders* não estatais como forma de expandir as fontes de financiamento para fornecer educação de qualidade para todos. Embora se espere que o financiamento de escolas públicas com fundos privados promova o uso eficiente de recursos devido ao aumento da *accountability*, isso levanta preocupações sobre a equidade financeira. Usando dados do painel de escolas públicas do Learning and Educational Achievements in Punjab Schools (LEAPS) no Paquistão, este estudo examina como os fundos privados mobilizados de diferentes *stakeholders* estão associados à eficiência na educação dos alunos em um determinado nível de desempenho e equidade no financiamento escolar. As análises de efeitos fixos das escolas mostram que as escolas que dependiam de taxas educacionais ou contribuições da comunidade local eram mais propensas a reduzir gastos de capital ineficientes. Nas escolas para meninas, a dependência financeira de doadores privados também está associada a uma

redução nas despesas de capital. No entanto, os resultados sugerem que uma forte dependência de taxas de educação e doadores privados torna as escolas menos eficientes. Não encontro evidências de que a mobilização de financiamento privado tenha ampliado a desigualdade financeira. Os resultados demonstram a importância de compreender os efeitos diferenciais da receita de fundos privados para desenvolver sistemas eficazes de financiamento multissetorial que melhorem o desempenho dos alunos de maneira econômica e garantam a equidade financeira.
Palavras-chave: finanças educacionais; eficiência; equidade; *accountability*; parcerias público-privadas; Paquistão

Financing Public Schools with Private Funds: Efficiency–Equity Trade-Off of Multi-Stakeholder School Financing in Punjab, Pakistan

Governments and development partners confront financial challenges to secure the right to education. Despite the global efforts to realize the Education for All goal, over 257 million children and adolescents are still unenrolled in school (UNESCO Institute for Statistics, 2021). Even more concerning is that of the children who are enrolled in school, 200 million will leave school without learning basic skills and knowledge (UNESCO, 2013). World leaders established Sustainable Development Goals with a commitment to achieve inclusive and equitable quality education for all by 2030. However, ensuring access to quality education requires massive financial resources. It is estimated that an additional 39 billion U.S. dollars will need to be mobilized annually to achieve the education target (UNESCO, 2015b). Increasing financial resources and promoting their efficient use—that is, improving educational outcomes at a lower cost—are thus key elements of the policy agenda, particularly in resource-constrained countries.

One policy response to this challenge is the mobilization of private funds from non-state stakeholders such as local communities, businesses, and non-profit organizations (Steer & Smith, 2015; UNESCO, 2015a). Particularly, local school authorities have the potential to reach out to untapped local resources through donations, sponsorships, and enterprise activities in decentralized education systems (Edwards & DeMatthews, 2014; Iftene, 2014). Private-fund revenue not only fills financial gaps but also increases financial accountability, leading to the efficient use of resources and better educational outcomes (Gershberg, 2002). Accordingly, several low- and middle-income countries have developed policies to facilitate the mobilization of private funds for public schooling. For instance, the governments of India and Pakistan legitimized the role of public schools in generating additional revenue from private sources in their national education policy (Government of India, 2020; Government of Pakistan, 2017). Some countries stimulate the private financing of public education by providing private donors with a tax credit for their contribution to public schools (e.g., Government of the Philippines, 2013).

However, there is concern that the engagement of non-state stakeholders in public education—which is underpinned by a neoliberal ideology that rationalizes privatization, deregulation, choice, competition, and a reduced role of the state—undermines equity in public education (e.g., Bulkley & Burch, 2011; Lipman, 2015). For example, affluent communities make greater investments in their schools, widening inequality in public education (Bray, 1999). Moreover, businesses and philanthropic organizations have their own priorities and thus do not necessarily support schools with the greatest need (Srivastava & Oh, 2010; Steiner-Khamsi, 2008). Ball (2012) argues that public education has become a marketplace infused by the logic of profit and power. Accordingly, some countries have introduced regulatory measures that limit the scope of fundraising

and the use of private funds or reallocate these funds within a district (Schaller & Nisbet, 2020). Governments face a dilemma when balancing efficiency and equity in public education in their efforts to raise private funds.

Although the advantages and disadvantages of the private financing of public education are discussed in the literature, few studies have examined the diversity of private funding sources. Public schools raise funds from various non-state stakeholders, such as parents, communities, firms, and philanthropic organizations. These stakeholders have diverging—and potentially conflicting—interests in school education. This creates multi-stakeholder school financing systems in which private funds raised from different stakeholders may affect the efficiency and equity of school education differently.

Using public school data from Learning and Educational Achievements in Punjab Schools (LEAPS) in Pakistan, this study examines how private funds raised from parents, local communities, and private donors are associated with efficiency in educating students at a given achievement level and equity in school finance. School fixed effects analyses and a series of robustness checks suggest that private-fund revenue can improve efficiency without undermining financial equity. However, these effects vary with the source of the private funds as well as schools' gender segregation and degree of financial dependency. The results underscore the importance of understanding the differential effects of private-fund revenue in context to develop effective multi-stakeholder financing systems that improve student achievement in a cost-effective manner and ensure financial equity.

Multi-Stakeholder Financing in Education

Effects on Efficiency

Public agencies, including schools, operate according to top-down hierarchical accountability relationships in which they meet expectations and mandates set by government authorities (Bovens, 2007; Hooge et al., 2012). However, schools also form horizontal accountability relationships with local communities, which are increasingly involved in school management and finance (Hooge et al., 2012). Accountability in public education has been further complicated by the increasing number of private partners engaging in school education. These private partners play integral roles in school operation and are important interest groups to whom schools must be accountable (Acar et al., 2012). Accordingly, schools develop a series of principal–agent relationships in which schools, as agents, are motivated to act on behalf of multiple principals in the political, administrative, professional, and public service realms (Adnett, 2004; Ferris, 1992).

Since they are accountable to non-state stakeholders, schools face pressure to provide quality education at lower costs—that is, to improve school efficiency. For instance, by sharing the cost of education, local communities increase their interest in their children's education and demand that schools be held accountable for school outcomes and the efficient use of resources (Bold et al., 2011; Gershberg, 2002). Parental engagement is also an important mechanism for improving school performance, as parents have direct incentives to improve their children's education (Barrera-Osorio et al., 2009). The collection of tuition fees may generate especially strong accountability pressure since parents pay these fees in return for instructional services for their children (Bold et al., 2013). On the other hand, whether financial contributions from private partners increase efficiency depends on the partners' purposes in supporting schools (Bhanji, 2012).

However, organizations are unlikely to meet the expectations and demands of each stakeholder equally (Jawahar & McLaughlin, 2001). Since the government's priorities and other stakeholders' interests are not necessarily compatible with one another, schools decide which

interests to prioritize (Bauch, 2001; Begley & Zaretsky, 2004). According to resource dependency theory, organizations prioritize the interests of stakeholders who provide resources that are critical for the organizations' survival and development (Pfeffer & Salancik, 1978). This suggests that the influence of non-state stakeholders on school efficiency increases as their contribution to a school's budget grows relative to other revenue sources.

Efficiency gains can also be derived from the nature of private funds themselves. If privately funded revenue is less restrictive than central government funds, it allows schools to be more flexible in purchasing an appropriate mix of inputs to produce desired outcomes (Jimenez & Paqueo, 1996). Thus, a greater reliance on private funds has the potential to increase the efficiency of school education.

Empirical evidence on the efficiency effects of the private financing of school education is scarce. However, the available studies suggest that a greater reliance on locally raised private funds improves the efficiency of school education. For instance, a cost function analysis in the Philippines found that the share of school expenditure raised from local contributions was negatively associated with total school expenditures controlling for school outcomes, suggesting that schools that rely on local contributions are more cost effective (Jimenez & Paqueo, 1996). Using an instrumental variables approach, another cost function study found that schools receiving a greater proportion of their revenue from local, private sources were more efficient in education service delivery in Indonesia (James et al., 1996).

While these studies provide useful results, they are limited in their consideration of the diversity of private funding sources. The studies aggregated all locally raised contributions under a single umbrella even though the funds were raised from various non-state stakeholders including parents, local communities, and firms. Since stakeholders have unique interests and stakes in school education, the efficiency gain identified in the literature may reflect the contributions of particular stakeholders.

Effects on Financial Equity

The private financing of education raises concerns about financial equity. In the United States, evidence suggests that parents' contributions and fundraising exacerbate resource disparities within and across districts (Posey-Maddox, 2016). In Asia, trends in education spending in China, Indonesia, and the Philippines indicate that the gap in per-pupil education expenditures between wealthier and poorer areas has grown due to increased variation in the ability to raise local resources (King & Guerra, 2005). Moreover, a study of autonomous school programs in Nicaragua found that school revenue raised from parental contributions was negatively associated with the extent of poverty in the surrounding community (Gershberg & Meade, 2005).

However, these studies do not always consider financial contributions from other private partners. A survey of elementary schools in Los Angeles found that the mobilization of private funds did not necessarily cause inequality in school finance. Although schools in wealthier communities raised more funds from parents, schools in lower-income communities attracted greater contributions from firms and philanthropic organizations that preferred to support schools with the greatest need (Zimmer et al., 2003).

Unfortunately, not all donors are entirely altruistic. According to the warm-glow theory, donors make contributions due to the internal satisfaction they gain from the act of giving (Andreoni, 1990). Similarly, strategic philanthropies support specific institutions to achieve their organizational goals (Srivastava & Oh, 2010; Steiner-Khamsi, 2008). Such donors may make contributions to schools that already have access to rich resources. Therefore, whether financial

contributions from parents and local communities exacerbate inequity in school finance depends on both community wealth and the existence and nature of contributions from other private donors.

Overall, the literature suggests that the efficiency–equity trade-off must be re-examined in consideration of multi-stakeholder financial arrangements. To understand whose money really counts, this study examines how private funds raised from different stakeholders are associated with the efficiency and financial equity of public school education in resource-constrained settings in Pakistan.

Country Context

Pakistan is an Islamic country located in South Asia. The country consists of the four provinces of Balochistan, Khyber Pakhtunkhwa, Punjab, and Sindh; two autonomous territories; and one federal territory. It has the world's fifth-largest population, with 238 million people. Over half of the population is under 25 years old, and 63% resides in rural areas (Central Intelligence Agency, 2021). The real gross domestic product per capita is $4,960 (in 2010 dollars), ranking Pakistan 178th in the world (Central Intelligence Agency, 2021). One in four people lives below the poverty line, although income inequality (Gini coefficient of 0.36) is not particularly high compared to the rest of the world (Central Intelligence Agency, 2021).

Education in Pakistan is overseen by the federal and provincial governments. Although the federal government formulates education policies at the national level, the provincial governments develop and implement their own education plans, which include legislation, budgeting, teacher training, and student assessment, among other items. Under the federal education system, no national curriculum framework or minimum quality standards existed prior to 2016/2017 (Ministry of Federal Education and Professional Training, 2016, 2017).

Although the federal and provincial governments have made efforts to provide quality education to the large youth population, these efforts have fallen short of their targets. While free and compulsory basic education is a constitutional right (Ahsan, 2003), the net enrollment rates remain at 76% and 53% at the primary and secondary levels, respectively, leaving over 10 million children out of school (UNESCO Institute for Statistics, 2018, 2021). Moreover, despite the policy priorities to improve the quality of education (Ahsan, 2003; Bengali, 1999), many children perform significantly below their grade level (Andrabi et al., 2007; ASER Pakistan, 2019). Given the government's limited capacity to provide access to quality education, the private school sector has expanded to meet the excess demand in the country. However, private schools tend to be clustered in affluent communities (Andrabi et al., 2007). Thus, the public school sector continues playing an important role in ensuring the right to education for all.

Improving the cost-effectiveness of public education is one of the key policy challenges in meeting the demand for quality education (Ahsan, 2003). The provincial governments have invested about 20% of their budget in education (Husain et al., 2003). Such large educational investments would be, in part, due to the inefficiency of the public education system. In fact, the cost of educating a child in public school is twice that of private school education, where students perform better (Andrabi et al., 2007).

The federal and provincial governments responded to this challenge by implementing decentralization reform, which transferred the responsibility for education management to local stakeholders who know the education needs of children in their communities better than the governments. Accordingly, participatory school governing bodies such as school management committees (SMCs) and school councils, which represent parents, community members, and school personnel, were established (Ahsan, 2003; Bengali, 1999; Khan, 2003). These governing bodies have

the authority to manage and finance their schools (Shah, 2003). For instance, school councils in the Punjab province can acquire local resources from parents and philanthropists, in addition to government grants, and use these funds to meet their schools' needs (Government of the Punjab, 2000). Public schools in Pakistan leverage private funds to improve the efficiency of school education, thus providing the ideal venue for this study's investigation.

Data and Sample

Data

This study used school-level panel data derived from three rounds of the LEAPS survey from 2004–2006. The survey targeted Punjab, the most populous province in Pakistan. Using geographical stratification, LEAPS selected three districts (Punjab-Attock, Faisalabad, and Rahim Yar Khan). Within these districts, 112 villages were randomly selected from a pool of rural villages with at least one private school but fewer than 25 public and private schools. The survey identified over 800 schools offering primary education in the villages and within a 15-minute walking distance from any house in the village (Andrabi et al., 2007).

The survey developed a roster of all Grade 3 students (13,735) in these sample schools.[1] In 2004, the survey administered achievement tests in mathematics, English, and Urdu. All the students in the initial roster were tracked and retested in 2005 and 2006 if they were present at any school in the villages in any grade. Questionnaires were also administered annually to school owners, principals, teachers, and a sample of 10 randomly selected students in the tested grade in each of the schools to collect information regarding school administration, teachers' background, and demographic characteristics of students and their families. These surveys were typically conducted before the new academic year started in April. I developed school-level panel data by aggregating these data according to the school level.

Sample

This study used a sample of only public schools because public and private schools, which have different functions in society, develop different accountability relationships with parents and local communities (Anderson, 1992). I also limited the sample to those reporting both expenditures and enrollment, as this information is necessary to compute per-pupil expenditure as an outcome variable. Tests of differences suggest that the missing data are not completely at random. Therefore, this study estimated the parameters of public schools that provided per-pupil expenditure information.[2] The sample was further limited to schools that appeared in all three survey rounds, resulting in a balanced panel of 375 public schools. The restricted sample has missing values for some variables, accounting for as much as 7.02% of the sample. Therefore, I used multiple imputation to replace the missing values with a set of plausible values predicted by other variables in the dataset.[3]

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[1] Although children aged 7–8 are expected to enter Grade 3, the majority of the students were 8–11 years old.
[2] Although imputation for missing data in outcome variables is technically possible, it does not produce a meaningful gain unless there are auxiliary variables that are strongly correlated with the outcome variables (Williams, 2018).
[3] I performed multiple imputation by chained equations with the Stata "mi impute" command to add 20 imputations to the dataset (StataCorp, 2017).

Methods

Analysis of Efficiency

This study used cost function analyses to examine how the reliance on private funds raised from various non-state stakeholders is associated with the efficiency of school education. Within an education production function framework, school education is a process using input factors (e.g., teachers and learning materials) to produce education outcomes in a given environment. Therefore, school cost is a function of the educational outcomes, prices of inputs, school and student characteristics, and environmental factors (see Golebiewski, 2011 for a review of education cost functions).

One common functional form used for education cost function analysis is the Cobb–Douglas equation, which takes the natural logarithm of dependent and independent variables. The restrictive form assumes that a proportionate change in the predictor variables results in a change in the cost in the same proportion. In the present study, I used a variant of the Cobb–Douglas form in which variables expressed as a percentage do not take natural logarithms (Duncombe & Yinger, 2005). The estimation model is specified below.

$$\begin{aligned}\ln Cost_{svt} = {} & \beta_0 + \beta_1 \ln Score_{svt} + \beta_2 \ln Laborprice_{vt} + \boldsymbol{SCHcharacter_{svt}}\boldsymbol{\beta_3} + \boldsymbol{STUcharacter_{svt}}\boldsymbol{\beta_4} \\ & + \beta_5 RevshareFee_{svt} + \beta_6 RevshareCommunity_{svt} + \beta_7 RevshareDonor_{svt} \\ & + \beta_8 lnSMCmeeting_{svt} + \beta_9 lnCompetition_{svt} + \delta_s + \theta_t + \varepsilon_{svt} \end{aligned} \quad (1)$$

The outcome (*Cost*) is per-pupil expenditure in school *s* in village *v* in year *t*. Per-pupil expenditure was computed for five categories: total, capital, current, instructional, and non-instructional expenditures.[4]

The model estimates the average spending for schools at a given achievement level by including student achievement (*Score*) as a school outcome. The LEAPS survey scored and equated the achievement tests across the survey rounds using item response theory (IRT) so that the scores are comparable over time.[5] The raw IRT scores in mathematics, English, and Urdu were linearly transformed to scale scores[6] and then averaged and aggregated for each school.[7] Evidence suggests that basic resources matter for student achievement in resource-constrained environments (Glewwe et al., 2011). Therefore, I hypothesized that learning gains come with an increased cost.

The per-pupil expenditure at a given level of student achievement is estimated as a function of the labor input price (*Laborprice*) in village *v*, the characteristics of schools (*SCHcharacter*) and students (*STUcharacter*) that create cost variation, and a set of environmental factors affecting school efficiency. The labor input price is measured by the village-mean monthly salary of teachers, which

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[4] Capital expenditure is an amount spent on building construction and furniture/fixtures, and current expenditure is an amount spent on educational materials, utilities, rent, and remuneration of teachers and non-teaching staff. Current expenditure is further divided into instructional expenditure (educational materials and teacher remuneration) and non-instructional expenditure (utilities, rent, and non-teaching staff remuneration). Total expenditure is a sum of current and capital expenditures plus spending on other components.

[5] See online appendix of Andrabi et al. (2017) for details.

[6] Parameters in an IRT model are invariant up to a linear transformation (Templin, 2012).

[7] The scores of those who transferred schools within the villages and those who repeated the same grade or were double-promoted were included in the computation of school mean scores since schools incurred the cost of educating these students as well. The cost affected by dropout was accounted for by including enrollment in the model.

includes both public and private school teachers.[8] As teacher remuneration accounts for a large share of school expenditures, teacher salary serves as an appropriate measure of input price. School characteristics include enrollment, percentage of students by education level, school facilities, access to electricity, and geographic isolation. Student demographic characteristics include average household wealth and the proportion of female students, which may capture a need for different education programs and environments.

It is also necessary to account for the difference in school efficiency to estimate the cost, which is a minimum level of expenditure required to educate students at a given level of performance. Given the national initiative to decentralize the education system, I assumed that local participation in school finance and management affected school efficiency. Education decentralization is expected to improve the effectiveness and efficiency of education service delivery by bringing the responsibility of education finance and management to local stakeholders who know their children's educational needs and their local education system better than the central government (Barrera-Osorio et al., 2009). The positive effects can be realized through various channels, including enhanced transparency of school operations, increased accountability for outcomes, a better match between students' needs and school offerings, and a decrease in administrative cost due to a reduction in intermediate levels of bureaucracy and reliance on voluntary committees to manage schools. (Barrera-Osorio et al., 2009; Edwards & DeMatthews, 2014).

The degree of local participation in school finance is measured by the proportion of school revenue raised from education fees paid by parents (*RevshareFee*), local community contributions (*RevshareCommunity*), and contributions from other private donors (*RevshareDonor*).[9] Education fees are the sum of the admission and school fund fees charged to parents. Local community contributions are the revenue raised from a broader set of community members, such as sport fees, examination and paper funds, and funds raised through community events. Private donors' contributions are the funds raised from donor programs, trusts, religious charities, and other private donors. The degree of local involvement in school management is measured by the number of SMC meetings held (*SMCmeeting*). As a measure of school competition (*Competition*), the model also includes the number of other schools that a given school's students could attend instead, as competition may incentivize schools to be more efficient.

It is important to note two decisions made in the model specification. First, to allow the value of zero to take a natural logarithm, I added a small value (0.1) to per-pupil expenditures, the number of SMC meetings, and the school competition measure.[10] Second, I did not control for an experimental program implemented by the LEAPS survey, which disseminated report cards to schools in one-half of the sample villages in September 2004. The experiment increased both enrollment and achievement (Andrabi et al., 2017). The model does not include the program's implementation because the data imputation models did not converge with the variable indicating program implementation, and the analysis already controls for enrollment and student achievement.

The model includes school fixed effects (δ) to control for unobserved time-invariant school characteristics. The estimated parameters may be biased if unobserved school characteristics correlate with both the independent and dependent variables. For instance, a long-term cooperative relationship between the school and community may affect both private-fund revenue and school

[8] I also estimated the models with the average public school teacher salary in robustness checks.
[9] Schools also received grants from the government. Although the data does not indicate whether the funds were allocated from the federal or provincial government, the vast majority of government funds for primary and secondary education are allocated by the provincial government (Khichi et al., 2015).
[10] I added the value of 0.1 since this is smaller than any non-zero value in the variables.

spending. School fixed effects remove the effect of such time-invariant characteristics, allowing the model to assess the net effects of variables that vary within schools over time. In other words, the fixed effects estimation tells, in a given school, how changes in a school's financial dependency on private funds are associated with changes in per-pupil expenditure, holding student achievement, labor input price, school and student characteristics, and other efficiency factors constant. The model also includes year fixed effects (θ) to account for the overall trends over time. ε is an error term. Robust standard errors are used for estimation. A detailed description of the variables is presented in the Appendix.

Table 1 presents the description of the sample schools. The average per-pupil total expenditure was 3,057 rupees (about 50 U.S. dollars at the 2005 exchange rate), 85.27% of which was spent on instructional items. The high standard deviation suggests that there is a large variation in per-pupil expenditures, even among public schools. Although the government has envisioned free primary education, the schools relied on private funds to provide educational services. In addition to grants from the government, schools raised 56.49% of their revenue from education fees paid by parents. Schools' revenue was supplemented by contributions from local communities and private donors, which accounted for 5.81% and 1.45% of revenue, respectively.

Table 1

Summary Statistics of Public Schools, Non-Imputed Balanced Panel Data

Variable	All years	2004	2005	2006
	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)
Dependent variables				
Per-pupil expenditure: Total	3,056.73 (2,319.91)	2,867.73 (2,647.61)	2,997.39 (1,772.17)	3,305.07 (2,433.75)
Per-pupil expenditure: Capital	169.62 (1,339.23)	163.27 (2,050.06)	171.46 (737.79)	174.14 (801.90)
Per-pupil expenditure: Current	2,871.49 (1,896.76)	2,676.81 (1,665.24)	2,812.45 (1,634.70)	3,125.20 (2,293.69)
Per-pupil expenditure: Instructional	2,606.33 (1,713.95)	2,399.20 (1,422.06)	2,562.33 (1,441.24)	2,857.47 (2,149.65)
Per-pupil expenditure: Non-instructional	265.15 (455.87)	277.61 (484.92)	250.12 (413.22)	267.73 (467.21)
Independent variables				
Student achievement	260.72 (38.70)	239.01 (37.21)	259.59 (34.63)	285.45 (28.43)
Village-mean monthly teacher salary	5,139.20 (1,274.54)	4,933.74 (1,131.11)	5,057.52 (1,211.69)	5,426.33 (1,415.21)
Enrollment	178.27 (150.55)	167.78 (141.08)	177.10 (146.19)	189.94 (163.07)
% students: Pre-primary	33.22 (19.14)	34.77 (20.44)	33.77 (18.58)	31.14 (18.20)
% students: Primary	58.53 (18.16)	57.34 (19.41)	58.26 (17.30)	59.98 (17.66)

Variable	All years	2004	2005	2006
	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)
% students: Middle	6.66	6.36	6.48	7.14
	(12.69)	(12.62)	(12.27)	(13.19)
% students: Secondary	1.59	1.53	1.49	1.75
	(4.87)	(4.84)	(4.57)	(5.20)
School facility index	1.40	1.39	1.42	1.40
	(0.18)	(0.17)	(0.18)	(0.18)
Electricity access index	1.46	1.43	1.47	1.49
	(0.47)	(0.47)	(0.47)	(0.48)
Geographic isolation index	3.21	3.20	3.20	3.24
	(0.71)	(0.67)	(0.71)	(0.75)
Household asset index	1.53	1.49	1.53	1.57
	(0.10)	(0.09)	(0.09)	(0.09)
% female students	45.46	45.54	44.80	46.03
	(43.82)	(44.62)	(43.74)	(43.2)
% revenue:	56.49	61.90	55.41	52.30
Parents' education fees	(44.14)	(42.22)	(43.88)	(45.78)
% revenue:	5.81	6.44	5.83	5.18
Local community contributions	(16.65)	(17.42)	(16.57)	(15.96)
% revenue:	1.45	2.19	1.29	0.88
Private donors' contributions	(10.59)	(12.73)	(10.43)	(8.14)
No. of SMC meetings	5.27	5.21	5.41	5.19
	(3.58)	(3.71)	(3.68)	(3.34)
No. of other schools	9.09	6.94	10.06	10.17
	(6.63)	(4.90)	(6.95)	(7.23)
Observations	1,125	375	375	375

Note: See the Appendix for the definition of variables.

Analysis of Financial Equity

Next, I performed regression analyses to estimate the association between private-fund revenue and equity in school finance within villages. I excluded 18 schools from the school-level data used in the efficiency analysis; schools were excluded if they were a village's sole school and it was not possible to calculate within-village financial equity. Accordingly, the analyses used balanced panel data from 357 public schools, allowing this study to estimate financial equity based on the same set of schools over the years. The regression model is specified as follows.

$$Inequity_{svt} = \gamma_0 + \gamma_1 RevGovernment_{svt} + \gamma_2 RevFee_{svt} + \gamma_3 RevCommunity_{svt} + \gamma_4 RevDonor_{svt} + \boldsymbol{SCHcharacter_{svt}\gamma_5} + \boldsymbol{STUcharacter_{svt}\gamma_6} + \delta_s + \theta_t + \varepsilon_{svt} \quad (2)$$

The outcome is the degree of financial inequity (*Inequity*) faced by school *s* in village *v* in year *t*, which is measured as the absolute value of standardized per-pupil expenditure.[11] Per-pupil expenditure is standardized for each village and year. The absolute value of the standardized expenditure describes how many standard deviations the per-pupil expenditure of a given school is away from the village average. Unlike other equity measures computed at the district and state levels (e.g., Odden & Picus, 2014; Springer et al., 2009), this measure of inequity allows schools in the same village to take different values. As a result, this study can examine how changes in school-level variation in private-fund revenue affect financial equity. The inequity measure ranges from 0.00 to 2.55 and indicates that, on average, schools' per-pupil total expenditure was 0.75 standard deviations away from their village mean. This suggests that there was some financial inequality among public schools even within the same village, although it may be driven by the differences in school and student characteristics in addition to private funds mobilized.

The outcome is estimated as a function of per-pupil revenue raised from the government *(RevGovernment*), education fees paid by parents *(RevFee*), local community contributions (*RevCommunity*), and private donors' contributions (*RevDonor*). By including revenue from all four sources in the model, this study examined how a particular type of private-fund revenue is associated with financial inequity, holding all other revenues constant.

The model controls for school characteristics (*SCHcharacter*), which were used in the previous efficiency analysis but not in natural logarithm form, and student characteristics (*STUcharacter*). The latter category includes average student achievement, household asset wealth, and the percentage of female students. The model also includes school fixed effects (δ) and year fixed effects (θ), and robust standard errors are used for estimation. The fixed effects estimation describes how changes in private-fund revenue in a given school are associated with changes in financial inequity the school faces, holding other revenues and the school and student characteristics constant.

Results

Efficiency of School Education

Table 2 presents the fixed effects estimation of the association between per-pupil expenditures and a range of cost factors.

Table 2
Results of Cost Function Analysis

Variable	Log per-pupil expenditure				
	(1) Total	(2) Capital	(3) Current	(4) Instructional	(5) Non-instructional
Log achievement	-0.027	-0.838	0.241	-0.041	0.422
	(0.182)	(1.240)	(0.449)	(0.510)	(0.652)
Log village-mean monthly teacher salary	0.152	0.507	0.398	0.260	-1.583*
	(0.369)	(1.589)	(0.414)	(0.491)	(0.880)

[11] The absolute value was used because the study estimated the degree of inequity (i.e., variability) of expenditure, not an amount (i.e., quantity) of expenditure.

Variable	Log per-pupil expenditure				
	(1) Total	(2) Capital	(3) Current	(4) Instructional	(5) Non-instructional
Log enrollment	-0.971***	-0.869	-0.810***	-0.879***	-0.235
	(0.112)	(0.688)	(0.198)	(0.213)	(0.588)
% students: Pre-primary	0.000	-0.003	0.001	0.002	0.007
	(0.002)	(0.012)	(0.003)	(0.003)	(0.010)
% students: Middle	0.016*	0.000	0.019**	0.033*	0.017
	(0.009)	(0.032)	(0.009)	(0.017)	(0.021)
% students: Secondary	0.014	0.002	0.010	0.016	0.044
	(0.010)	(0.045)	(0.011)	(0.026)	(0.046)
Log school facility index	0.396	3.444**	0.289	0.315	0.126
	(0.380)	(1.742)	(0.390)	(0.471)	(0.970)
Log electricity access index	0.270	-0.265	0.218	0.183	3.496***
	(0.265)	(0.753)	(0.265)	(0.270)	(0.613)
Log geographic isolation index	0.036	-1.255	0.208	0.317	-0.346
	(0.119)	(0.768)	(0.170)	(0.252)	(0.432)
Log household asset index	0.853	3.386	0.735	1.162*	-2.912
	(0.586)	(3.258)	(0.626)	(0.673)	(2.385)
% female students	0.001	0.013	-0.001	-0.001	0.004
	(0.002)	(0.011)	(0.001)	(0.001)	(0.005)
% revenue: Parents' education fees	-0.001	-0.014***	0.000	0.000	0.002
	(0.001)	(0.004)	(0.001)	(0.001)	(0.002)
% revenue: Local community contributions	0.001	-0.017**	0.004	0.004	0.004
	(0.001)	(0.008)	(0.002)	(0.003)	(0.004)
% revenue: Private donors' contributions	0.000	-0.013	0.001	0.002	0.014**
	(0.001)	(0.010)	(0.001)	(0.001)	(0.006)
Log number of SMC meetings	-0.043**	0.094	-0.050**	-0.064**	-0.065
	(0.020)	(0.128)	(0.025)	(0.030)	(0.085)
Log number of other schools	-0.062	0.431**	-0.079	-0.116	-0.149
	(0.054)	(0.194)	(0.064)	(0.079)	(0.115)
School fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Probability (F statistic)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Observations	1,125	1,125	1,125	1,125	1,125

Note. Coefficients and standard errors in parentheses. The percentage of students enrolled at the primary level and the percentage of revenue raised from the government are omitted as a reference category. Significance level: *$p < 0.1$. **$p < 0.05$. ***$p < 0.01$.

Private-Fund Mobilization

Column 1 shows that, on average, financial dependency on education fees, local community contributions, and private donors' contributions are not significantly associated with per-pupil total expenditure required to educate students at a given achievement level. However, column 2 shows that one-percentage-point increases in the proportion of school revenue raised from education fees and local community contributions are associated with reductions in per-pupil capital expenditure of 1.4% and 1.7%, respectively.[12] This suggests that schools relying more on education fees or local community contributions were more likely to reduce inefficient capital expenditure. However, improved efficiency is not evident in total expenditure, suggesting that funds saved in capital expenditure were not a large enough component of total school expenditure or were used for other purposes that do not contribute to learning in the tested subjects.

On the other hand, column 5 shows that financial dependency on private donors is associated with an increase in non-instructional expenditure. This indicates that schools relying more on private donors spent more on expenditures such as utilities, building rent, and non-teaching staff to achieve a given level of learning outcomes. These results suggest that the effects of private-fund mobilization on school efficiency differ by the source of private funds.

Other Factors

The results also provide evidence of other cost factors. Student achievement has a non-significant association with per-pupil instructional expenditure. This result may reflect a lack of credence in the relationship between school input and student performance (e.g., Hanushek, 2006; Monk, 1992). Otherwise, it may indicate that, based on the analytical model, public schools in the Punjab province did not necessarily make good use of financial resources to improve learning outcomes.

With regards to school characteristics, a one-percent increase in enrollment is associated with a decrease in per-pupil total expenditure of 0.97% on average, suggesting that schools realized economies of scale. The statistically significant coefficients in columns 3 and 4 suggest that the increased efficiency is derived from reductions in current expenditure, particularly instructional expenses. School education levels also create cost differentials. A one-percentage-point increase in the proportion of students enrolled at the middle school level is associated with a 1.9% increase in per-pupil current expenditure. The cost of education may be higher at the middle school level due to the difference in curricula and a need for qualified and trained teachers for upper-level courses.

With respect to other efficiency factors, a one-percent increase in the number of SMC meetings is associated with a decrease of 0.04% in per-pupil total expenditure. This small increase in efficiency seems to be derived from a reduction in instructional expenditure, suggesting that local school management has contributed to reducing inefficient investment in teachers and educational materials. In addition, school competition is associated with an increase in capital expenditure, indicating that schools facing greater competitive pressure invested more in construction and furniture, which did not sufficiently contribute to improved learning. This may indicate the presence of information asymmetry in which these schools might have updated their infrastructure to attract students in the absence of other information accessible to parents for assessing the quality of schools.

[12] Coefficients involving log-transformed dependent or independent variables are interpreted in terms of percent change (Wooldridge, 2013).

Efficiency of School Education by School Gender Type

Although the proportion of female students is included in the model, cost differentials by gender may be derived from whether a school is a co-educational or single-sex school. For instance, education costs in co-educational schools may differ from those in single-sex schools if special arrangements are needed to accommodate both boys and girls in the same school. The cost of education may also differ between girls' and boys' schools if they provide different facilities, curricula, and teachers due to religious and gender considerations. Finally, they might have different accountability relationships with parents, local communities, and private donors. To assess these heterogeneous effects, I performed efficiency analyses for co-educational, girls', and boys' schools separately.

In the LEAPS survey, schools did not report whether they were single-sex or co-educational. Therefore, the schools were categorized according to the genders of the enrolled children. Out of the sample of 375 public schools, 110 were identified as co-educational, along with 73 girls' schools and 108 boys' schools. The remaining 84 schools changed categories over the three years and were not included in the analysis. The results are presented in Tables 3, 4, and 5.

Table 3

Results of Cost Function Analysis, Co-Educational Schools

Variable	Log per-pupil expenditure				
	(1) Total	(2) Capital	(3) Current	(4) Instructional	(5) Non-instructional
Log achievement	0.124	-0.975	0.448	0.435	-0.085
	(0.275)	(2.273)	(0.472)	(0.475)	(1.477)
Log village-mean monthly teacher salary	1.237**	2.135	1.236**	1.181*	0.715
	(0.537)	(3.189)	(0.617)	(0.636)	(1.788)
Log enrollment	-0.858***	-0.913	-0.675**	-0.666**	-0.422
	(0.131)	(0.979)	(0.285)	(0.285)	(1.035)
% students: Pre-primary	0.003	0.003	0.007	0.006	0.004
	(0.002)	(0.018)	(0.005)	(0.005)	(0.020)
% students: Middle	-0.013**	0.077	-0.012	-0.011	-0.104
	(0.006)	(0.110)	(0.008)	(0.009)	(0.069)
% students: Secondary	0.040***	0.053	0.039***	0.031***	0.274***
	(0.006)	(0.054)	(0.007)	(0.007)	(0.043)
Log school facility index	-0.392	3.444	-0.641	-0.697	1.082
	(0.645)	(2.479)	(0.650)	(0.653)	(1.568)
Log electricity access index	0.244	1.076	0.097	0.103	4.000***
	(0.159)	(1.175)	(0.152)	(0.179)	(0.934)
Log geographic isolation index	0.214	-0.625	0.539	0.514	-1.172
	(0.225)	(1.522)	(0.435)	(0.437)	(0.923)
Log household asset index	1.111	3.845	0.647	0.742	-2.512
	(0.761)	(4.340)	(0.930)	(0.945)	(4.025)
% female students	-0.002	0.014	-0.004	-0.003	0.003
	(0.005)	(0.024)	(0.006)	(0.006)	(0.022)

Variable	Log per-pupil expenditure				
	(1) Total	(2) Capital	(3) Current	(4) Instructional	(5) Non-instructional
% revenue: Parents' education fees	0.000	-0.001	0.001	0.001	0.006
	(0.001)	(0.005)	(0.001)	(0.001)	(0.004)
% revenue: Local community contributions	0.002	-0.024*	0.008	0.009	0.010
	(0.003)	(0.013)	(0.008)	(0.008)	(0.009)
% revenue: Private donors' contributions	0.000	-0.009	0.000	-0.001	0.023**
	(0.001)	(0.008)	(0.002)	(0.002)	(0.012)
Log number of SMC meetings	-0.031	-0.004	-0.028	-0.025	-0.140
	(0.022)	(0.205)	(0.025)	(0.025)	(0.194)
Log number of other schools	-0.128	-0.015	-0.145	-0.142	0.083
	(0.099)	(0.328)	(0.130)	(0.130)	(0.185)
School fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Probability (F statistic)	< 0.001	0.430	< 0.001	< 0.001	< 0.001
Observations	330	330	330	330	330

Note. Coefficients and standard errors in parentheses. The percentage of students enrolled at the primary level and the percentage of revenue raised from the government are omitted as a reference category. Significance level: *$p < 0.1$. **$p < 0.05$. ***$p < 0.01$.

Table 4

Results of Cost Function Analysis, Girls' Schools

Variable	Log per-pupil expenditure				
	(1) Total	(2) Capital	(3) Current	(4) Instructional	(5) Non-instructional
Log achievement	1.363	-3.266	3.971	4.279	-3.315**
	(0.969)	(4.394)	(3.406)	(3.482)	(1.626)
Log village-mean monthly teacher salary	0.300	-0.307	1.264	1.460	-1.196
	(0.694)	(3.043)	(1.110)	(1.432)	(1.166)
Log enrollment	-1.060**	3.424	-0.744	-1.280	-1.924*
	(0.418)	(2.415)	(1.245)	(1.617)	(1.007)
% students: Pre-primary	-0.010	-0.007	-0.025	-0.032	0.046**
	(0.008)	(0.033)	(0.018)	(0.020)	(0.020)
% students: Middle	0.022*	-0.078*	0.007	0.023	0.084***
	(0.013)	(0.041)	(0.023)	(0.030)	(0.022)
% students: Secondary	0.037	0.015	0.004	0.125*	0.011
	(0.024)	(0.093)	(0.036)	(0.074)	(0.044)
Log school facility index	-0.929	-1.826	0.032	-0.387	-8.046***
	(0.823)	(4.595)	(1.168)	(1.714)	(2.382)
Log electricity access index	0.257	-5.143***	0.420	0.388	1.685
	(0.246)	(1.835)	(0.435)	(0.574)	(2.257)

Variable	Log per-pupil expenditure				
	(1) Total	(2) Capital	(3) Current	(4) Instructional	(5) Non-instructional
Log geographic isolation index	0.444	1.384	0.605	0.852	0.324
	(0.303)	(1.504)	(0.509)	(0.726)	(0.731)
Log household asset index	0.988	-0.620	3.036	3.456	-6.693
	(1.144)	(11.352)	(2.460)	(3.133)	(4.727)
% female students	-	-	-	-	-
% revenue:	-0.002	-0.035***	-0.003	-0.005	-0.005
Parents' education fees	(0.002)	(0.011)	(0.003)	(0.004)	(0.003)
% revenue:	-0.002	-0.053***	0.000	-0.004	0.015**
Local community contributions	(0.002)	(0.015)	(0.004)	(0.006)	(0.006)
% revenue:	-0.001	-0.085***	0.008	0.007	0.005
Private donors' contributions	(0.002)	(0.015)	(0.008)	(0.008)	(0.006)
Log number of SMC meetings	-0.006	-0.186	-0.069	-0.079	-0.068
	(0.031)	(0.292)	(0.080)	(0.087)	(0.172)
Log number of other schools	-0.003	0.095	-0.031	0.011	-0.039
	(0.073)	(0.473)	(0.120)	(0.173)	(0.251)
School fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Probability (F statistic)	0.004	< 0.001	0.232	0.081	0.056
Observations	219	219	219	219	219

Note. Coefficients and standard errors in parentheses. The percentage of students enrolled at the primary level and the percentage of revenue raised from the government are omitted as a reference category. Significance level: *$p < 0.1$. **$p < 0.05$. ***$p < 0.01$.

Table 5

Results of Cost Function Analysis, Boys' Schools

Variable	Log per-pupil expenditure				
	(1) Total	(2) Capital	(3) Current	(4) Instructional	(5) Non-instructional
Log achievement	-0.433	-0.927	-0.547**	-1.202**	-0.323
	(0.274)	(1.690)	(0.250)	(0.506)	(0.961)
Log village-mean monthly	-0.416	2.326	-0.366	-1.179	-1.115
teacher salary	(0.938)	(3.185)	(0.938)	(1.154)	(1.632)
Log enrollment	-1.174***	0.309	-1.171***	-1.316***	-0.115
	(0.375)	(1.389)	(0.376)	(0.483)	(0.763)
% students: Pre-primary	-0.002	-0.035	-0.001	0.002	0.015
	(0.006)	(0.031)	(0.005)	(0.007)	(0.017)
% students: Middle	0.026	0.059	0.028	0.064*	0.005
	(0.020)	(0.055)	(0.021)	(0.037)	(0.027)

Variable	Log per-pupil expenditure				
	(1) Total	(2) Capital	(3) Current	(4) Instructional	(5) Non-instructional
% students: Secondary	0.019	-0.204**	0.019	0.002	0.018
	(0.016)	(0.099)	(0.017)	(0.030)	(0.043)
Log school facility index	3.201*	8.796**	3.113*	3.522*	1.424
	(1.616)	(3.664)	(1.605)	(1.798)	(2.025)
Log electricity access index	0.205	1.238	0.201	0.153	2.971***
	(0.574)	(1.097)	(0.571)	(0.572)	(0.811)
Log geographic isolation index	0.081	-3.266**	0.169	0.492	-0.949
	(0.325)	(1.461)	(0.326)	(0.620)	(0.861)
Log household asset index	2.506	-12.014	3.240	4.623*	2.598
	(2.140)	(7.859)	(2.096)	(2.429)	(3.909)
% female students	-	-	-	-	-
% revenue:	-0.002	-0.022***	-0.001	-0.002	-0.004
Parents' education fees	(0.001)	(0.008)	(0.001)	(0.002)	(0.005)
% revenue:	0.004	-0.009	0.004	0.004	-0.017**
Local community contributions	(0.005)	(0.016)	(0.005)	(0.006)	(0.008)
% revenue:	-0.003	-0.019	-0.002	-0.002	0.001
Private donors' contributions	(0.003)	(0.020)	(0.003)	(0.003)	(0.013)
Log number of SMC meetings	-0.081	0.644**	-0.094	-0.111	-0.274
	(0.066)	(0.318)	(0.068)	(0.102)	(0.186)
Log number of other schools	-0.069	1.101***	-0.097	-0.262	-0.126
	(0.165)	(0.408)	(0.163)	(0.221)	(0.210)
School fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Probability (F statistic)	0.010	< 0.001	0.019	0.228	0.050
Observations	324	324	324	324	324

Note. Coefficients and standard errors in parentheses. The percentage of students enrolled at the primary level and the percentage of revenue raised from the government are omitted as a reference category. Significance level: *$p < 0.1$. **$p < 0.05$. ***$p < 0.01$.

Private-Fund Mobilization

Efficiency effects derived from education fees and local community contributions are identified at the 5% significance level in single-sex schools only. Tables 4 and 5 indicate that a one-percentage-point increase in the proportion of school revenue raised from education fees is associated with a decrease in per-pupil capital expenditure of 3.5% in girls' schools and 2.2% in boys' schools. An increase in financial dependency on local community contributions is also associated with a decrease in capital expenditure in girls' schools (5.3%) and non-instructional expenditure in boys' schools (1.7%). Girls' schools also realized efficiency gains in terms of capital expenditure from funds mobilized from private donors with greater magnitudes (8.5%).

On the other hand, the reduction in efficiency is identified in co-educational schools only.[13] Table 3 shows that an increase in financial dependency on private donors is associated with an increase in per-pupil non-instructional expenditure. This indicates that private donors' contributions could affect school efficiency positively or negatively depending on school type. Overall, the results provide evidence that the effects of private funds upon efficiency differ not only by its source but also by school type.

Other Factors

Some associations are consistent across school types. For instance, enrollment is negatively associated with per-pupil total expenditure in all types of schools. This indicates that economies of scale could be an important mechanism for improving efficiency in the public school sector in rural Punjab. On the other hand, some cost factors play differential roles depending on the school type. For example, mean teacher salary is positively associated with per-pupil total expenditure in co-educational schools only. This suggests that the teacher labor market for co-educational schools and single-sex schools may differ. Similarly, the proportion of students enrolled at the secondary school level is positively associated with per-pupil total expenditure in co-educational schools only. This indicates that the education cost differential between primary and secondary levels is larger in co-educational schools than single-sex schools, possibly because educating male and female students of secondary school age in the same school is costly in Pakistan.

Robustness Checks of Efficiency Analysis

I examined whether the analytical results are sensitive to the selection of model specifications. First, I estimated models using per-pupil expenditures computed based on the assumption that monthly expenditure items are expensed for nine (rather than 12) months a year. Second, I estimated models with mathematics scores instead of an average score of mathematics, English, and Urdu to mitigate the potential influence of home language on test scores.[14] Third, I estimated models using an average monthly salary of public school teachers as the labor input price, assuming that public and private school teachers are in different labor markets. Fourth, I estimated models by adding the pupil–teacher ratio to account for differences in class size.[15] Fifth, I estimated models by using per-pupil expenditures that exclude payments of teacher allowances. This check addresses the possibility that some public schools reported payment of teacher allowances as an expenditure but paid the allowances with government funds not recorded as school revenue in the LEAPS survey.[16] Sixth, I conducted robustness checks with regard to the treatment of zero values for log transformation. I estimated models by adding 0.01 (rather than 0.1) to school expenditures, the number of SMC meetings, and the number of other schools to assess whether the results are sensitive to the selection of the increment value.

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[13] Although Table 4 shows a positive relationship between local community contributions and non-instructional expenditure in girls' school, the F-test suggests that the predictors are jointly significant only at the 10% level.

[14] Although language factors affect mathematics achievement as well (Abedi & Lord, 2001), I assumed that the impact on mathematics scores would be smaller than that on English/Urdu scores.

[15] The pupil–teacher ratio was not included in the original model to prevent over-control bias.

[16] Comparing school revenue and expenditure figures between the LEAPS data and the Annual School Census 2012 (Punjab Education Sector Reform Programme, 2013), I found that the school expenditures in the LEAPS data were remarkably higher than those in the School Census due to high spending on teacher allowances, which were mainly paid by government funds.

The results show that most statistically significant associations between dependency on private-fund revenue sources and per-pupil expenditures remain significant, retaining the same sign and similar magnitude. The exceptions are the negative association between local community contributions and non-instructional expenditure in boys' schools and the positive association between private donors' contributions and non-instructional expenditure in co-educational schools; both become significant only at the 10% level in some of the models. Overall, the robustness checks corroborate the evidence that schools relying on education fees or local community contributions were more likely to cut inefficient capital expenditure and that these efficiency gains were most likely to be realized in single-sex schools. In girls' schools, financial dependency on private donors is also associated with a reduction in capital expenditure.

In addition, I examined whether per-pupil expenditures have quadratic relationships with log enrollment, financial dependency on private funds, and log number of SMC meetings by adding a squared term for each of these variables to the model, respectively. I identified only two quadratic relationships at the 5% significance level, which indicate diminishing returns to financial dependency on private funds. The analysis using the sample of all schools suggests that increasing the proportion of revenue raised from education fees from 0% to 1% is associated with a decrease in per-pupil capital expenditure of 6.4%. Similarly, an increase in financial dependency on private donors from 0% to 1% is associated with a decrease in per-pupil non-instructional expenditure of 4.4%. However, the marginal effects on efficiency disappear and turn negative when the proportion of revenue raised from education fees and private donors' contributions increase to 68% and 33%, respectively, indicating that a heavy reliance on private funds makes schools less efficient.

Equity in School Finance

Table 6 presents the results of the fixed effects estimation of inequity in per-pupil expenditure. The results show that the revenue per pupil raised from any of the private sources is not associated with inequity in per-pupil expenditures in any category at the 5% significance level, controlling for other revenues and characteristics of schools and students. The results suggest that, even though the sample schools mobilized private funds that accounted for over 60% of their total revenue on average, the private funds did not necessarily create within-village inequity in per-pupil expenditure.

Table 6

Results of Equity Analysis

Variable	Within-village inequity in per-pupil expenditure				
	(1) Total	(2) Capital	(3) Current	(4) Instructional	(5) Non-instructional
Per-pupil revenue: Government	0.000***	0.000**	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Per-pupil revenue: Parents' education fees	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Per-pupil revenue: Local community contributions	0.001	-0.001	0.001	0.000	-0.001
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
Per-pupil revenue: Private donors' contributions	0.000	-0.001*	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Variable	Within-village inequity in per-pupil expenditure				
	(1) Total	(2) Capital	(3) Current	(4) Instructional	(5) Non-instructional
Covariates: School characteristics	Yes	Yes	Yes	Yes	Yes
Covariates: Student characteristics	Yes	Yes	Yes	Yes	Yes
School fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Probability (F statistic)	<0.001	0.378	0.417	0.160	0.145
Observations	1,071	1,071	1,071	1,071	1,071

Note. Coefficients and standard errors in parentheses. The outcome is the absolute value of standardized per-pupil expenditure, which indicates how many standard deviations the per-pupil expenditure is away from the village average. School characteristics include enrollment, the percentage of students by education level, school facility index, electricity access index, and geographic isolation index. Student characteristics include achievement, household asset index, and the percentage of female students. Significance level: * $p<0.1$; ** $p<0.05$; *** $p<0.01$.

Robustness Checks of Equity Analysis

As in the efficiency analysis, I examined whether the results from the original models change using four robustness checks: per-pupil expenditure based on monthly expenditures multiplied by nine months, mathematics scores instead of average scores of three subjects, including the pupil–teacher ratio, and excluding teacher allowances from expenditures.

The analytical results for privately funded revenue are insensitive to the selection of models except for one association. In the model where teacher allowances are excluded from expenditures, the relationship between local community contributions and financial inequity in per-pupil total expenditures becomes negative and statistically significant at the 5% level. In this model, an increase in per-pupil local community contributions of 10 rupees (0.17 U.S. dollars at the 2005 exchange rate) is associated with a decrease in within-village inequity in per-pupil total expenditures of 0.02 standard deviations. Since schools are unlikely to reduce their expenditures as a result of receiving additional revenue, the results imply that local community contributions may have allowed low-spending schools to close the spending gap with high-spending schools.

Limitations

This study has several limitations. First, the sample is limited to public schools in rural areas with information on per-pupil expenditures. This limits the generalizability of the findings. Second, school revenue is subject to measurement errors. Price information for education fees at the pre-primary and secondary education levels is not available and is therefore proxied by the price charged in the grades closest to them. Third, I performed the efficiency analyses using the restrictive functional form. A more flexible functional form used in cost function analysis is the trans-log form. However, using a trans-log functional form was not feasible due to the small sample size.

Fourth, the estimations are subject to bias due to omitted variables. Especially, cost functions do not necessarily capture a variation in spending well, and their results are often sensitive to the selection of variables (Costrell et al., 2008). Although the school fixed effects models control for time-invariant school characteristics, the estimates would be biased if unobserved time-variant

characteristics are correlated with both the dependent and independent variables. In particular, fixed effects models work under strict exogeneity, which assumes that past outcomes do not have independent effects on independent variables in the future. This assumption might not be met if schools that had increased per-pupil expenditure by raising private funds recognized the importance of school resources and tried to mobilize more private funds in the next year. Another source of endogeneity in the fixed effects models is the use of panel data with a small number of time periods, which creates a correlation between regressors and error (Nickell, 1981). Therefore, no causality can be established in this study.[17]

Keeping in mind the limitations mentioned above, I discuss the findings of this study and their implications for multi-stakeholder school finance.

Discussion and Conclusion

Efficiency and Equity Implications of Multi-Stakeholder School Finance

This study found that, on average, public schools relying more on education fees paid by parents and local community contributions were more efficient in their capital expenditure. These schools spent less on school construction and furniture to educate students at a given achievement level. Although collecting tuition fees in public schools at the basic education level is often criticized from the perspective of equity, this result implies that user fees might create strong provider–client accountability relationships that hold schools financially accountable for the efficient use of resources and educational outcomes. Similarly, local community contributions might create accountability pressures to reduce inefficient capital expenditure, even if the funds are mobilized without explicit linkages to the delivery of instructional services.

The opportunity to cut inefficient capital expenditure may not always be available since capital investment is often lumpy and made in short periods of time. However, it is considered that public schools in the Punjab province made a choice to invest in capital items due to high need: 35% of the sample schools did not have a wall or fence around the premises; 11% did not even have a permanent classroom; only 30% used desks and chairs as their main seating arrangements; 77–94% reported a lack of staff rooms, halls, and libraries; and 41% had no toilet.

Schools' ability to adjust their spending patterns is better understood by examining the link between expense items and revenue sources. The largest component of capital expenditure is the construction of buildings. Among the schools that invested in building construction, 87.03% used government funds as a primary funding source. However, over half of these schools reported that government funds allocated to their school council were the primary funding source. These funds are used at the discretion of school councils, which include parents and local community members. This indicates that schools had a certain level of flexibility to adjust their investment in capital items. Schools relying on financial contributions from parents and local communities might have been incentivized to use their flexibility to cut inefficient capital expenditure that does not contribute to student learning.

The analyses by school type suggest that the aforementioned efficiency effects were most likely to be realized in single-sex schools. Interestingly, girls' schools realized efficiency gains in capital expenditure by mobilizing funds from private donors in larger magnitudes. This implies that public–private partnerships (PPPs) might accelerate the efficient use of capital expenditure to educate students in girls' schools. The presence of female principals may partially explain why

[17] Use of instrumental variables is a common approach to addressing the issue of endogeneity. However, no instruments meeting the required assumptions are found in the data.

increased efficiency was mostly found in girls' schools. In the study sample, girls' schools had female principals and boys' schools had male principals except in a few cases, reflecting gender norms in the country. Studies in the Punjab province found that, compared to male principals, female principals are more flexible and open to local demands (Khan, 2007) and have better managerial skills in preparing school budgets and planning to improve school performance (Khan et al., 2009). Female principals' open-mindedness and managerial skills could explain why girls' schools were more likely to realize efficiency gains from private-fund mobilization.

Importantly, schools' ability to leverage private funds to improve efficiency would depend on their degree of financial dependency. This study suggests that schools relying on education fees and private donors at a moderate level are more likely to cut inefficient capital and non-instructional expenditures. However, a heavy reliance on private funds could make schools less efficient, possibly due to an increased administrative burden or excessive influence exerted by parents and private donors. Thus, finding the right balance between public and private funds is important for achieving efficient school operations.

With respect to financial equity, this study found no statistical evidence that mobilizing revenue through private sources such as education fees, local community contributions, or PPPs contributed to increasing inequity in school finance. Rather, the robustness checks imply that an increase in local community contributions was associated with an improvement in equity in per-pupil total expenditure. These findings provide important implications for cost-sharing policies. Informal fees and contributions, such as uniform fees, sports fees, and paper funds, are often criticized as hidden schooling costs incurred by parents. However, this study suggests that mobilizing financial contributions other than formal education and tuition fees could provide low-spending schools with a means to meet their financial needs and mitigate financial inequity.

Conclusion

In the current global education landscape, public school authorities are encouraged to mobilize private funds from diverse non-state stakeholders as a means of expanding and diversifying funding sources to provide quality education for all (UNESCO, 2015a). Such multi-stakeholder finance systems have been promoted in the hope of addressing resource constraints and inefficiency in public school education in the rise of neoliberalism. However, there is concern that school finance systems that rely on local community wealth and engage private partners who only support schools that align with their interests threaten equity in public school education (e.g., Srivastava & Oh, 2010; Thompson et al., 2019). The advantages and disadvantages of multi-stakeholder partnerships for school finance have been discussed in a normative sense. However, there is little empirical evidence on how revenue raised from different non-state stakeholders affects the efficiency and equity of public school education in multi-stakeholder financing systems.

This study provides evidence from the Punjab province in Pakistan that engaging non-state stakeholders in public school finance is not necessarily a balancing act between efficiency and equity. The findings suggest that mobilizing private funds can improve efficiency without undermining the financial equity of public school education. However, these effects vary with the source of private funds, school type, and degree of financial dependency.

Maximizing the efficiency of education service delivery is not the goal of public education. However, given the shortage in public education budget, assessing the differential effects of privately funded revenue in context and developing effective multi-stakeholder financing systems, which improve student achievement in a cost-effective manner and ensure financial equity, are crucial to meeting the demand for quality education. The findings and implications are particularly relevant to low-income countries with decentralized education systems where public schools mobilize local

resources from diverse stakeholders and juggle public and private funds to provide quality education services.

The findings also provide insights into the role of non-state stakeholders in public education. Gerrard (2015) argues the importance of developing a nuanced understanding of how the public school system has evolved to fulfill its mandate and create public value with the policy options made available by neoliberal innovations. This approach promises to move beyond dichotomous conceptions of education, such as public–private, state–market, and efficiency–equity. Such research would support the development of innovative policy solutions to achieve equitable, quality education for all beyond the public and private boundaries.

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Appendix

Table A1
List of Variables

Variable	Definition
Outcomes	
Per-pupil expenditure	Per-pupil expenditure, expressed in a real price in the 2005 Pakistan Rupee.
- Total	- A sum of annual expenditure and monthly expenditure, which was multiplied by 12.
- Capital	- A sum of annual expenditure on building construction and furniture/fixtures.
- Current	- A sum of annual expenditure on educational materials and monthly expenditure on utilities, building rent, teacher remuneration, and non-teaching staff remuneration, which was multiplied by 12.
- Instructional	- A sum of annual expenditure on educational materials and monthly expenditure on teacher remuneration, which was multiplied by 12.
- Non-instructional	- A sum of monthly expenditure on utilities, building rent, and non-teaching staff remuneration, which was multiplied by 12.
Inequity in per-pupil expenditure	The absolute value of within-village standardized per-pupil expenditure.
Labor input price	
A village-mean teacher salary	A village-mean monthly salary of teachers in schools identified in the surveys, expressed in a real price in the 2005 Pakistan Rupee.
School characteristics	
Enrollment	The number of students in school.
A percentage of students by school level	A percentage of students enrolled at pre-primary, primary (grade 1–5), middle (grade 6–8), and secondary (grade 9–12) levels, respectively.
School facility index	The average of 11 dummy variables that indicate whether school has a given facility (classroom, staffroom, library, hall, storage, sport equipment, fence, toilet, blackboard, personal computer, and fan/cooler).
Electricity access index	Access to electricity weighted by hours for which school can use electricity in absence of a power outage, assuming that school personnel can check a power outage 12 hours per day for six days a week.
Geographic isolation index	The average of five variables that measure a distance from a given school to the nearest telephone, bank, healthcare center, public transportation, and council-level office in a six-point-scale.

Variable	Definition
Student demographic characteristics	
Average test score	The average of student test scores in three subjects (mathematics, English, and Urdu) aggregated to school level. The raw IRT score was transformed to a scale score in the equation: scale score = 300 + 50θ.
Household asset index	A school-mean asset wealth of student's household, which is measured by the average of 13 dummy variables that indicate whether student's family possesses a given consumer durable good (bed, table, chair, radio, TV, telephone, fridge, fan, watch, bicycle, motorcycle, motor rickshaw, and car).
A percentage of female students	A percentage of students who are female.
School revenue	
Per-pupil revenue by funding source	Per-pupil school revenue, expressed in a real price in the 2005 Pakistan Rupee.
- Government	- School council funds and other grants allocated by the government.
- Parents' education fees	- Annual admission and school fund fees. Since the price information is available only for grades 1–8, the fee revenue for the pre-primary level was computed based on the fee prices for grade 1–3 and the fee revenue for grades 9–12 was calculated based on the fee prices for grade 6–8.
- Local community contributions	- Additional revenue raised as sports fees, examination/paper funds, and through community events and others.
- Private donors' contributions	- External grants received from local and international donor programs, trusts, religious charities, and other donors.
Efficiency factors	
A share of school revenue raised from non-state stakeholders	A percentage of school revenue raised from parents' education fees, local community contributions, and private donors' contributions, respectively.
A degree of local participation in school management	The number of meetings of SMC/School Council/Parent-Teacher Associations held.
A degree of school competition	The number of other schools that students of a given school could attend instead.

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