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Inequality in school resources and academic achievement: Evidence from Peru☆

Gianmarco León [a,*], Martín Valdivia [b]

[a] Department of Economics and Business, Universitat Pompeu Fabra and Barcelona GSE, Spain
[b] Grupo de Análisis para el Desarrollo (GRADE), Peru

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ABSTRACT

This paper goes further in the discussion on the determinants of school attainment in developing countries. To properly estimate the effects of school resources on academic achievement, we need to take into account the large geographical inequalities in the distribution of school resources and the supply constraints faced by students living in poor areas. We do so by implementing a two-step correction that accounts for the constraints in school choice. Our findings suggest that failing to account for these constraints leads to an underestimation of the effect of school resources on school achievement of about 100%. This underestimation is particularly important for girls and in Math. Additionally, the contribution of school resources in explaining the gap in test scores between rich and poor students is doubled once we account for the constrained choices.

1. Introduction

Despite the large body of studies assessing the effect of traditional school resources on academic achievement, there is still an active debate on whether they play a significant role in improving academic achievement of poor children in developing countries. Most of the available evidence suggests that improvements in traditional school resources (e.g., teacher education and experience, school facilities, etc.) have a low chance of effectively helping improve the academic performance of children in developed and developing countries.[1] This evidence has led the policy debate to lean toward the need to work on the structures of school incentives, connecting rewards to teachers or schools to specific outcomes (e.g. Duflo et al., 2014; Das et al., 2013). However, these incentives can result in the exacerbation of within and between school inequalities, since those who often adjust to the new incentives are already better off students, schools and teachers.[2]

In this paper, we take a new look at the evidence on the importance of school material and human resources as determinants of school achievement and the associated inequalities. Using data from public schools in contained in the Peruvian school census, along with pupil-level characteristics and standardized test scores, we show that school and teacher characteristics are important determinants of student performance. However, these characteristics become empirically relevant only once we properly account for the constraints in school choices faced by parents. Using a two-stage procedure, we model a constrained school choice and estimate the determinants of educational attainment. Our results show that failing to account for these constraints leads to an underestimation of the effect of school resources on school achievement of about 100%. This underestimation is particularly important for girls, and in Math. Furthermore, the contribution of school resources in explaining the gap in test scores between rich

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* Corresponding author. Tel.: +34 93 542 1757; fax: +34 93 542 1746.
E-mail addresses: gianmarco.leon@upf.edu (G. León), jvaldivi@grade.org.pe (M. Valdivia).

[1] Hanushek (2003) provides a very detailed literature review of the evidence in developed and developing countries. Earlier reviews include Hanushek (1997), Rivkin et al. (2005), Case and Yogo (1999) for developed countries, and Hanushek (1995) for developing countries.

[2] Galiani et al. (2008), for instance, show how the restructuring of incentives associated to decentralization exacerbated inequalities in Argentina. Glewwe et al. (2009) show that providing textbooks to school children does not affect average test scores, but increase within school inequalities.

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and poor students doubles once we account for the geographical distribution of resources.

The relationship between school characteristics and educational quality has generated a very rich strand of literature with a great deal of debate about the interpretation of the empirical results. The Coleman Report (Coleman et al., 1966) found that family characteristics are more relevant determinants of academic achievement than school resources. In a reevaluation of the evidence 40 years later, Gamoran and Long (2006) and Gamoran (2001) find that these results are still relevant, and predict that the pattern will hold under different forecasting scenarios. However, Hanushek (2003) provides an extensive review of the evidence for developed countries (not only the US), concluding that the association between school resources and educational attainment is not robust enough to draw conclusions. Nonetheless, this does not necessarily imply that there are not significant differences between schools or that these differences are not relevant for educational performance. The analysis of this relationship in developing countries is mixed, with findings showing that certain types of traditional school resources make a difference in educational achievement, while others are not relevant at all. Kremer et al. (2013) review a large number of recent randomized control trails, and conclude that traditional school resources do not increase test scores, mainly because students are already lagging behind by the time the interventions are implemented. Moreover, some of these interventions increase within-classroom inequalities, benefiting only already better-off students.[3] On the other hand, Glewwe et al. (2011) in a review of the literature for developing countries find that, in some contexts, school infrastructure or teacher characteristics have a positive and significant effect on academic achievement.

Many of the papers reviewed by Hanushek (2003) estimate a production function for educational attainment, as measured by the scores children obtain in standardized tests, considering family, household, school, and community variables, using either a contemporaneous or value-added specification.[4] Authors measure school quality with variables such as average public and/or private expenditure in the school, teacher–pupil ratio, and teachers' formal training, experience and wages. The key difficulty in this estimation is that the type of school where a child attends, and its characteristics, are not exogenous, but it is result of a decision (by their parents), which makes it challenging to disentangle the effect of parent's preferences from the school quality. Ignoring this decision stage in the estimation may substantially bias the effects of school characteristics on educational attainment.

Further, the sign of that bias is not clear, since it depends on the nature of the selection process. On one hand, students from more educated or richer households, or whose parents put a higher value on education, are concentrated in higher quality schools, while the opposite happens with low quality schools. If this is the case, ignoring the school choice decision will lead to an overestimation the effect of school characteristics, attributing the effect of family background to school resources. On the other hand, if the decision is constrained by the availability of schools, so families living in poorer areas cannot access schools with better teachers or better infrastructure, regardless of their preferences, then the effect of school characteristics will be underestimated.

Most of the literature in education and economics so far has only accounted for the demand side of the selection, for example analyzing the effects of conditional cash transfers on school performance (Behrman et al., 2011). The studies that exploit a demand side shock to identify the school selection tend to find larger estimates of school resources on academic achievement. Studies that exploit supply side shocks to identify the school resources often rely on aggregated data (Hanushek, 2003), which may hide relevant relationships.

The discussion about the relevance of observable resources at the school level of student performance in developed countries can potentially be quite different in developing countries, where the investment in education still falls largely below the average expenditure in OECD countries (Glewwe and Kremer, 2006). Studies in developing countries with clear identification strategies based on randomized trials offer mixed results. For instance, provision of textbooks or workbooks improved children's academic performance in Nicaragua (Jamison et al., 1981) and the Philippines (Tan et al., 1997), but not in Kenya (Glewwe et al., 2009). Radio instruction in Nicaragua (Jamison et al., 1981) and computer-assisted learning programs in India (Banerjee et al., 2007) showed the important contribution technology could make to improve learning in developing countries. On the other hand, experiments in Kenya showed little impact on test scores from reductions in class size (Duflo et al., 2014), flip charts (Glewwe et al., 2004) and deworming medicine (Kremer and Miguel, 2004).

Recent studies on returns to education, using an instrumental variable approach, and identifying the school decision based on supply constraints, have found that the IV results are larger than the OLS (see Duflo, 2001; Card, 2001; Carneiro et al., 2003). Card and Krueger (1992), using longitudinal data from the United States, find a significant and robust association between school resources and returns to education. Initially, these results represented a complex puzzle, however, one can interpret them as being associated with the heterogeneity of the effect of education and the decreasing returns to educational resources. Particularly, one would expect the effect of supply side constraints to be larger for groups that have been more affected by supply-side constraints. The underlying idea is that the estimated coefficient using instruments associated with school access and quality will correspond to the returns to education of the groups that were more affected by these constraints, and not the average return. Nevertheless, this estimate would arguably be the most useful one in evaluating the effects of improvements of school resources for the least favored children.[5]

Heyneman and Loxley (1982, 1983a, 1983b), using cross-country data, have argued that in low-income countries the effect of school and teacher quality on academic achievement in primary school is comparatively greater. These seminal studies have been followed by a great amount of work studying the "Heyneman–Loxley Effect", finding supporting evidence for this hypothesis using both cross-country and within-country evidence.[6]

A hypothesis that might reconcile these opposing views is that the relationship between school resources and student performance is non-linear, being more important at lower levels, but insignificant after a certain threshold.[7] This hypothesis becomes important when interpreting the current evidence from

[3] Many studies argue that increases in educational resources have a limited impact on learning in distorted educational systems (Hanushek, 1995; Pritchett and Filmer, 1999).

[4] Todd and Wolpin (2007) provide a detailed description of each of these approaches and the assumptions required for the corresponding estimates to be reliable.

[5] Card and Krueger (1992) analyze the returns to education of the generation of males born between 1920 and 1949, who attended school between 1926 and 1949, a period in which the average level of expenditures in education was lower than and more scattered than the one observed during the seventies and eighties, the period to which most of the studies revised by Hanushek (2003, 1997) correspond.

[6] See for example: Fuller and Heyneman (1989), Baker et al. (2001, 2002), and Chudgar and Luschei (2009, 2011).

[7] The STAR study, which applied an experimental design to analyze the effect of class size on the performance of students from a sample of schools in Tennessee, favors the hypothesis of the non-monotonic association between these variables (see Word et al., 1990). This hypothesis is also suggested in Hanushek (2003).