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The impact of school management practices on educational performance: Evidence from public schools in São Paulo

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ABSTRACT

This study examines the causal impacts of a school management program on educational outcomes in São Paulo/Brazil, estimated with the use of a fuzzy regression discontinuity design. I conclude that specific management practices such as performance monitoring, targets setting and incentive schemes have significant positive impacts on 8th-graders' math scores, especially on low performance students. I was unable to obtain similar results for language. I further investigated whether these results were associated with student or staff selection and infrastructure investments or whether they were actually driven by changes to pedagogical and managerial practices. My findings suggest that the latter explanation is more plausible.

1. Introduction

For many years, economists have been working to understand why educational outcomes are persistently poor, especially in developing countries. Brazil, for example, is among the countries with the worst of the PISA rankings, despite the high investment in education.[1] The empirical literature has been dedicated to investigate whether and how the school inputs are able to affect learning in an attempt to identify effective public policies that can be deployed on a large scale. The knowledge and experience of the teachers are the few inputs that undoubtedly affect student performance (Cantrell, Fullerton, Kane, & Staiger, 2008; Clotfelter, Ladd, & Vigdor, 2007; Rivkin, Hanushek, & Kain, 2005; Rockoff, 2004). However, even among schools that are homogeneous in terms of student's family background and effective school inputs is possible to observe large variability in educational outcomes measured by proficiency on standardized tests.[2]

Adopting the approach of educational production function, if we suppose that the education industry is relatively rigid relative to their production technologies (Hanushek, 1979), the large differences in results between schools with the same inputs could be explained by variations in practices management. In this article, I provide empirical evidence to support this hypothesis, assessing the impact of a program that introduced management tools in public schools in São Paulo, Brazil.

According to industrial organization theory, the distribution of companies managers' talent is directly related to the size of plants within an industry. This relationship is associated with the effect of managerial technology on inputs and productivity (Lucas, 1978; Manne, 1965). This would

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[1] Since 2000, Brazilian students have been among the lowest 5% in terms of performance in PISA. However, in 2008, Brazil invested 5.3% of the GDP in education, a percentage similar to the OECD average.

[2] In São Paulo, in schools with homogeneous students' background (80% of parents with at least high school) and teachers' experience (more than 20 years), the 90/10 ratio of math scores for 8th-graders is approximately 2.

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indicate that, keeping the quantity and the quality of inputs fixed, different ways to manage companies can lead to very different results. The most recent literature, led by Nicholas Bloom and John van Reenen, takes up the theme and presents theoretical models and non-experimental and experimental evidence on the relationship between management practices and results in different industries. Indeed, several empirical studies have identified a strong association between management practices and productivity, profitability, growth and survival of the company and cross-country and within-country TFP (Bloom, Lemos, Sadun, Scur, & Reenen, 2014; Bloom & Van Reenen, 2007; Cappelli & Neumark, 2001; Ichniowski, Shaw, & Prennushi, 1997).

However, the term 'management' is quite broad and addresses everything from standardized procedures for the control of production processes to the leadership and charisma of managers. This complexity makes it difficult to define, measure and analysis of how the administration can affect the company's results. For this reason, the literature asks whether it is possible to identify management practices that can be universalized between organizations or if their effectiveness depends on the environment or the specificity of each firm or industry.

Recent studies have emphasized a set of specific management practices that comprise three elements: monitoring, goal setting and incentives. Bloom, Genakos, Sadun, and Reenen (2012) presented data from a survey of more than 10,000 organizations in 20 countries. Using an assessment tool that considers several key management practices, the authors created a score to classify companies according to their management qualities.

This methodology defines a poorly managed organization as one that "cannot monitor performance, lacks effective objectives, compensation and career bases on years of service and not have systems in place to deal with employees with persistently poor performance." In contrast, a well-managed organization is defined as one that "continuously monitors the performance and try to improve their processes, defines objective and rigorous goals and have a reward system for high-performance employees and the correction of underperforming employees." The authors show that the presence of these "modern management practices" is strongly correlated with the performance of companies in different industries and countries. The adoption of these practices also appears to have a positive impact on the productivity of Indian companies in certain industries.

The main findings of this paper give rise to some stylized facts on what is a well-managed organization. Applying those facts to educational systems' characteristics one can assume that public schools are poorly managed for many reasons. First, public organizations have worse management practices than private. The institutional environment of public education systems is characterized by the difficulty of hiring, firing and changes in wages and working hours, strong unionization of teachers and high stability in their careers. This is associated with poor management of human resources, particularly with regard to monitoring and incentives.

The administrator's academic training is also associated with management quality. In general, top-level managers are trained in excellent business schools. Particularly in Brazil, this is another unfavorable feature of school management, since most of the school principals are trained in pedagogy courses, which do not include administrative skills in their curricula.

A higher degree of market competition is also associated with better management practices. However, public schools face relatively low competition, as there are allocation rules who usually prevent or hinder parents from choosing the school where the children will study. In Brazil, for example, the allocation of students in schools follows geographical criteria. In addition, the gratuity of the educational service reduces the pressure for quality improvements. Finally, the management practices tend to be worse in developing countries. Together, these factors underscore the importance of this issue in designing policies to improve the quality of education in these countries.

Empirical research on Economics of Education provides some *indirect* evidence that elements of school management are associated with educational outcomes. Hoxby (1996) shows that the institutional environment of public education, characterized by the strength of teachers' unions, confers market power to public schools. This power, in turn, increases the amount of school inputs but reduces its productivity. There is also evidence that, for given resources, schools could improve students' performance if they could spend its resources – in terms of school management, teachers, supporting employees and materials – in the most productive way (Haelermans, De Witte, & Blank, 2012).

The school manager's profile and the way in which he was nominated to the position are also related to student learning. The school principal's management experience has a positive impact on students' grades (Béteille, Kalogrides, & Loeb, 2012). Principal's turnover is also related to student performance: low-performing schools experience more principal turnover and performance tend to fall when a principal leaves the school (Miller, 2013). Schools where principals are chosen by parents and teachers or by a selection process have a higher average performance than schools where principals are appointed by their administrative bodies (Barros & Mendonça, 1997).

Studies demonstrate that public school students could benefit when their school faces competition from school-choice policies (Winters, 2012). Competition influences parents' choice of high-performing schools, either through the direct possibility of changing schools (Hastings & Weinstein, 2008) or by granting school vouchers that can be used for enrollment in public or private schools (Angrist, Bettinger, & Kremer, 2006; Chakrabarti, 2008; Lamarche, 2008; Rouse, Hannaway, Goldhaber, & Figlio, 2013).

On the other hand, the effects of charter schools on its relative efficiency and on student performance are mixed (Booker, Gilpatric, Gronberg, & Jansen, 2007, 2008; Davis & Raymond, 2012; Dobbie & Fryer, 2011; Gronberg, Jansen, & Taylor, 2012; Hoxby & Murarka, 2009; Toma & Zimmer, 2012; Zimmer, Gill, Booker, Lavertu, & Witte, 2012). Moreover, monitoring schemes and performance-linked rewards or punishments also have mixed impacts on school officials' behavior and student learning (Ladd, 2001; Sims, 2013).

Bloom, Lemos, Sadun, and Van Reenen (2014) focuses specifically on the relationship between modern management practices and educational outcomes. The authors collected data in over 1800 schools educating 15-year-olds in

eight countries. In this sample, Brazil is among the countries with lower scores management, along with India. The authors show that there is a positive association between school performance and management practices related to operations, monitoring, target setting and people management.

In spite of those results, there is no direct evidence of the effect of management practices in public schools on educational outcomes.[3] This paper contributes to the literature by assessing the causal impact of a school management program implemented in public schools in São Paulo, Brazil. In an environment of hard accountability that combines monitoring, performance targets and financial incentives based on results, the program introduces an educational management model based on what is known in the literature as 'modern practices' of management. Implemented in 2008, the program includes administrative training for school managers, the development of diagnostics, monitoring and targets for learning-related indicators (e.g., compliance with school curricula and teacher and student absenteeism) and the development of specific action plans to solve problems and achieve short-term goals.

In order to estimate the program's impact on students' performance in 8th grade language and math, this study utilizes an arbitrary rule based set by the authority in charge of the program. Based on two rich databases containing information on students and schools, I deepen the analysis to investigate whether the program's impact is related to the selection of students or staff, investment in school inputs or changes in teaching practices and management activities.

The results indicate that adopting modern management practices leads to a significant and positive impact on students' math grades. These positive effects are mainly observed on students at the lower end of the test-score distribution. The magnitude of this impact (six points on the proficiency scale) is equivalent to raising the average students' learning by nearly 40%. The program had no effect on students' performance in language grades. I will argue and provide evidence that the program's effects on math grades are not associated with the selection of better students, the attraction of better teachers and administrators to the treated schools, nor the investments in infrastructure or school inputs.

I also argue that although there is evidence of minor changes in teaching practices, the means by which the program improves learning are related to basic administrative changes. I find important differences between treated and untreated schools concerning management team's involvement in developing of school planning, managers' knowledge of educational indicators, shared performance indicators among teachers and parents and the use of assessments and targets for curriculum management and teachers' work.

This paper is organized as follows. Section 2 provides information on the administrative structure and accountability system in São Paulo. Section 3 describes the program details. The data and identification strategies are discussed in Sections 4 and 5. The results are analyzed in Section 6, and concluding remarks are presented in Section 7.

2. Background: Administrative structure and accountability system in São Paulo

São Paulo is the richest and most populated state in Brazil. It has the most extensive public education system in the country, with 4.5 million students enrolled in elementary and high school[4] and 230,000 teachers. The administrative structure is composed of the Secretary of Education (SEE), 91 school districts (SD) and 5828 schools. These numbers refer to the state public education system, which is responsible for 75% of enrollments in the second cycle of primary education and 97% of enrollments in public high school. The municipalities also have their own school systems and provide 98% of the available early childhood education stablishments and 70% of the schools in the first cycle of basic public education.

The SEE is responsible for defining the curriculum and the mandatory pedagogical content required in each grade. It also designs and implements educational programs and is responsible for defining criteria for hiring teachers and other staff and public procurement or other selection processes. School districts provide educational and administrative support to schools in the implementation of policies designated by the SEE, allocating students and teachers to schools, distributing educational materials, students meals and school transport, guiding and monitoring the fulfillment of mandatory statistical surveys, organizing the application of proficiency tests and collecting data from teachers and staff for the purposes of attendance control, payments and retirement.

Teaching supervisors operate in each school district. They are responsible for visiting schools to attend pedagogical meetings, monitoring students' performance indicators and coordinating teacher training activities, combating school violence, conducting vaccination and health campaigns and supporting school programs. School principals are responsible for the allocation of classes and teachers, human and financial resources management and the implementation of governmental educational programs. There is also an educational coordinator for each grade in each school. This professional shares responsibility with the principal for preparing the pedagogical plan and school calendar, organizing educational meetings and conducting curricular activities.

Supervisors, principals and educational coordinators do not follow pre-established management standards for directing and monitoring school activities. They do not even have consensus on how to measure students' performance. The 'culture of evaluation' is foreign to them and is not yet well established in Brazilian public schools.[5] The state

[3] Bloom et al. (2012) also note the great heterogeneity in management practices among schools in four developed countries and the high correlation between those practices and educational outcomes, as measured by PISA.

[4] In Brazil, compulsory education includes the levels of preschool, elementary school divided into two cycles (first cycle: 1st to 4th grades and second cycle: 5th to 8th grades) and high school (9th through 11th grades).

[5] One anecdotal example illustrates this fact: the teachers' union has demanded the creation of proficiency examinations with a lower degree of difficulty for students with learning delays and the nondisclosure of school performance rankings, claiming that there is a stigmatizing effect on low-performing students and schools.

government accountability system – composed of standard proficiency tests (SARESP), a school quality index (IDESP), a system of public disclosure of results and performance-based bonuses – was created only in 2007.

The SARESP (Sistema de Avaliação do Rendimento Escolar de São Paulo [Evaluation System of Educational Achievement of São Paulo]) is a standardized exam applied to all students in the 2nd, 4th, 6th and 8th grades of elementary school and the 11th grade of high school. Language and math performances are assessed every year, and natural sciences and the humanities are evaluated in alternate years.

The main measure of school quality – IDESP (Índice de Desenvolvimento da Educação do Estado de São Paulo [Education Development Index of São Paulo]) – is an index scaled from 0 to 10. For each educational grade, a score is calculated from the average pass rates and distributions of students in proficiency levels: below basic, basic, adequate and advanced. Those levels are defined by score ranges and are based on the learning expectations for each grade.

Students at the below-basic and basic levels demonstrate insufficient mastery of the content or the minimum expected performance for the grades they enroll. This corresponds to a one-year or a six-month lag in learning, respectively. Students at the adequate and advanced levels do not exhibit learning gaps and demonstrate full mastery in the subject.

Based on 2007 IDESP, the SEE has established a plan of specific annual goals for each school and grade for the period between 2008 and 2030. At the end of 2030, it is expected that schools achieve IDESP performances comparable to those currently observed in OECD countries. About 20% of students were performing at an adequate or advanced level in 2007. The target set for 2030 requires this proportion to increase to 80%.

As the annual targets are based on IDESP 2007, different schools are required to apply different levels of effort to achieve their long-term goals. Given the way IDESP is calculated, the purpose is to encourage improvements in learning without increasing the rates of failure and dropout. In other words, gaming the system should be discouraged, such as reproving students with lower performances. Every year, SARESP and IDESP results and the goals for the following year are published in a bulletin available to the school management team, teachers, parents and students on the Internet (Appendix A Figure 1 provides a bulletin example).

The fulfillment of IDESP goals is the basis for calculating the school bonus. If a school meets or exceeds its goals at all grades, the supervisor, the principal, the teachers and other school employees receive the equivalent of 2.4 monthly wages. If the school improves but not enough to meet the annual IDESP targets, the bonus amount is proportional to the progress achieved, which means that as long as the school shows some improvement its staff will receive a bonus. In 2008, US $350 million were allocated for the payment of bonuses to over 195,000 employees.

Because IDESP comprises an objective measure of student learning and the time it takes to complete their studies, it is intended that IDESP should become the school quality parameter for parents' and students' assessment and the main tool for management and administration of schools and the design of educational policies.

3. The results-based school management program

The 2007 IDESP report revealed the poor quality of public education in São Paulo and a great school heterogeneity. For example, in the 8th grade of elementary school, 30% of pupils reached adequate and advanced proficiency levels in language, while in math, the proportion was only 6%. Among schools at the bottom 5% of 2007 IDESP distribution, 73% of students had a below-basic proficiency level in math.

To support schools' implementations of the IDESP goals, the SEE developed a support program for low-performing schools, known as the Programa de Gestão Escolar por Resultados [Results-based School Management Program] (PGER). In 2008, PGER was implemented as a pilot program to improve school management, [6] and the SEE's priority was to set it in the schools with the worst educational outcomes. Thus, the eligibility criterion was based on an arbitrary rule: all schools at the bottom 5% of 2007 IDESP distribution of each grade level were selected.

A total of 379 schools were assigned to PGER. Of them, 184 schools (48.5%) offered 1st to 4th grades of elementary education, 343 schools (90.5%) offered 5th to 8th grades, and 302 schools (79.7%) provided high school education. The program's selection rule required that each participating school was among the worst 5% in the IDESP distribution in a given grade, but not necessarily in all the grades assessed. In fact, among the participating schools, 102 (26.9%) were included due to their low performances in the 4th grade, while poor results in the 8th grade of elementary school and the 11th grade of high school were responsible for the inclusion of 184 schools (48.5%) and 167 schools (44.1%), respectively.

The PGER's main role was to introduce a management model at the school level focused on promoting the improvement of learning. Program activities can be divided into the following three stages: a) training b) strategic planning and goal setting and c) goal management.

The training stage consisted of a course on school management for principals and educational coordinators, dedicated to discussing the criteria of good school management. The course began with a two-day meeting. On the first day, principals and coordinators attended a lecture on the meaning of student academic performance and how to measure it objectively through standardized proficiency tests and indicators. The purpose was to sensitize these professionals to the importance of having clear school goals and to prioritize and focus on proficiency and educational flow indicators. That is because before the introduction of the accountability system, there were no objective measures for students' performance that were broadly used.

On the second day, the managers received training to help them understand which competences and abilities are evaluated by SARESP in each grade and subject. The training also teaches how IDESP is calculated, how to interpret the information in the performance bulletins of SARESP and IDESP schools and, finally, how the payment of bonuses is calculated based on schools' achievement of IDESP targets.

[6] This pilot initiative did not have an official name in 2008. In 2012, the activities implemented in the pilot are part of the Priority Schools Program, which also includes investments in infrastructure and the integration of educational residents (graduate and undergraduate pedagogy students).

Principals and coordinators analyzed the bulletin data of their schools and compared their performances with other schools in the district, the county and the state, with technical support from SEE experts.

The rest of the course included distance learning modules dedicated to discussing how to define indicators and quantify targets, how to share results and goals with the school team and how to define and delegate responsibilities and create monitoring tools as indicators and mechanisms for correcting problems.

The activities of the second stage – strategic planning and goal setting – were developed by the principal and the educational coordinator under the guidance of an expert from SEE. The strategic planning consisted of developing a school diagnostic report, which considered numerous indicators on infrastructure, communications, equipment and teaching materials, mandatory teaching practices and curriculum adequation, teacher–student exposure, school context and other student resources.

The analysis of this diagnosis was used to identify factors that supposely influence the results of students' educational performance (proficiency and educational flow) and to prepare the 2008 Education Policy Project (Projeto Político-Pegadogógico – PPP). The PPP is the official planning document, that instruct all the activities of the school year. Its preparation is mandatory for all state schools in São Paulo. Although teaching supervisors receive PPPs for schools in their areas of responsibility, there is no well-defined practice for the evaluation of these documents or for the imposition of sanctions when schools do not meet the requirements. There is also no standard model to be followed in their preparation. Therefore, these documents vary widely in form and content. It is common to find subjective goals, such as 'promoting citizenship' or 'increasing the self-esteem' of students, and unfeasible ones, such as 'ending school dropout' or 'promoting learning equity among all students'.

In goal setting stage, a PPP preparation guide was developed for the PGER participant schools. The concept was that to achieve the IDESP goals (the ultimate goal), each school must establish objective and attainable goals for the indicators related directly or indirectly to student performance (intermediate goals). The PPP should also include 'action plans' for the activities/attitudes necessary to meet the interim targets by the end of 2008. For example, if the average rate of student absenteeism in 2007 was 15%, the school could set a goal to reduce it to 5% in one year. One activity related to the achievement of this goal could be to communicate monthly student absences to parents and/or to contact parents to determine the reason for each absence.

The goal management stage consists of monitoring those indicators, based on the time comparison between the observed indicator and the established goal. The percentage achieved/deviated from goal of each indicator informs us of the feasibility of achieving the yearly target set for it among three levels: satisfactory, attention and critical. Indicators at the 'critical' and 'attention' levels indicate the need for corrective measures or changes in planned actions. Indicators are tracked daily, weekly or monthly. In administrative and teaching meetings, the follow-up reports of indicators have become the main decision-making instruments (see Appendix Figure 2 for an example of the reporting of monitoring indicators). At the end of the program, the school management team and the technician allocated to assist them prepared a document describing the activities undertaken during the year and the changes made to the school management. This was performed to record the best practices considered fundamental to fulfilling the goals of the PPP.

The PGER is designed in a scenario where a new accountability system was being introduced in public schools in São Paulo, combining incentives with setting and monitoring targets and indicators. However, why should expect that this intervention will affect learning? One reasonable explanation is that policies that provide information about incentives may make individuals more adept at making better choices (Bettinger, Long, Oreopoulos, & Sanbonmatsu, 2012; Chetty & Saez, 2013; Duflo, Gale, Liebman, Orszag, & Saez, 2006; Liebman & Luttmer, 2015).

The provision of information on IDESP calculation and bonuses together with basic tools for monitoring indicators can, thus, provide the necessary incentives for the principals' performance in increasing productivity of reallocating resources that are thought to relate to the improvement of learning. For example, if the monitoring of interim goals indicates delays in meeting the curriculum standard, as found in the SARESP tests, the principals may intensify their supervision of teacher absences, even if this activity is costly to them and is not directly linked to the receipt of a bonus.

4. Data

The data used in this research are obtained from two sources: SARESP microdata and the Brazilian School Census.

The SEE has conducted SARESP annually since 2007, and the exam covers all the public schools in São Paulo. The results of standardized proficiency tests in language and math are available for each student of the 4th and 8th grades of elementary school and the 3rd grade of high school. The database also contains the IDESP of each school at each stage of education. In addition, it contains a) student data on family backgrounds, socioeconomic status and attitudes about education and work and b) data on the functional and socioeconomic status of school officials, their professional activities, school management routines, education practices and opinions on school climate and interpersonal relationships.

The School Census is an annual survey conducted by the Brazilian Ministry of Education since 1995; it encompasses all the public and private schools in the country. The Census contains detailed information at the school level on location, facilities, infrastructure and learning resources, methods and levels of education offered and access to government educational programs. It also holds a collection of the students' and teachers' demographic data and professional information and data on teachers' academic training.

As a measure of student performance, I used the language and mathematics scores for 2007 and 2008 and the positions at the proficiency levels: below-basic, basic, adequate and advanced. The SARESP questionnaires and the School Census data were used to investigate the mechanisms by which the program should operate. I studied the program's impact on students in the 8th grade of elementary school.

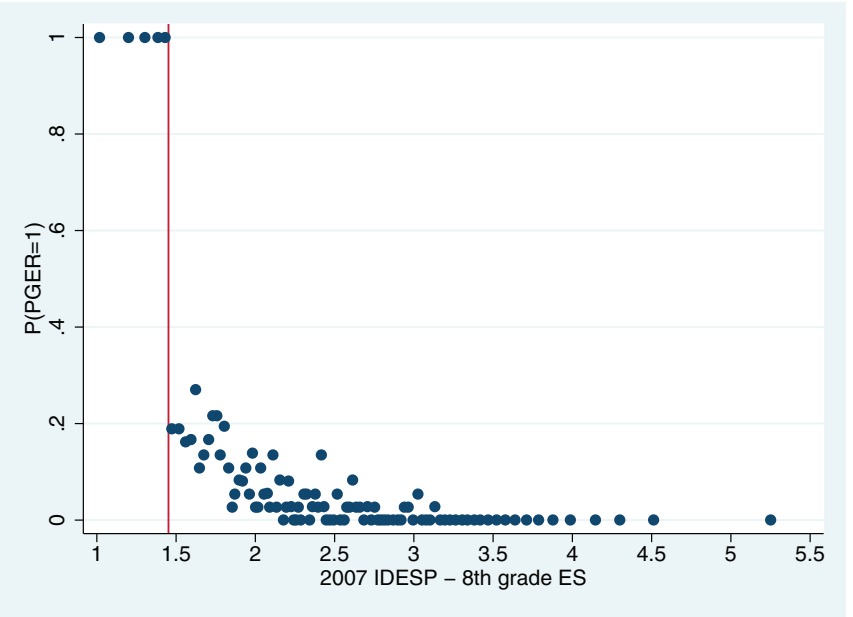

Fig. 1. Probability of treatment according to IDESP 2007 distribution (8th grade ES).

5. Identification strategy

The consistent estimation of the causal impact of school management on educational outcomes is not an easy task. First, the schools' unobservable characteristics may be correlated with different management practices and, simultaneously, with students' educational results. In the context of PGER implementation, results based on naïve regressions would provide biased estimates of the impact of school management on student performance. This is because compared to other schools, those participating have more students with socioeconomically disadvantage (a higher proportion of nonwhite poor students with less educated parents) and teachers with lower levels of qualifications and less experienced principals and coordinators. These differences would, therefore, cause a downward bias in the estimates of these regressions.

Moreover, PGER was not the only policy implemented in 2008. In the same year, the SEE initiated an education reform that introduced a system of *hard accountability* with external evaluations and performance-based bonuses; the system included curriculum standardization for all schools and the restructuring of the teaching materials. These changes affected all the state schools in São Paulo and may have impacted student performance. It is reasonable to assume that these universal policies have decreasing marginal returns and, thus, exert a greater impact on the performances of students with poor backgrounds studying in the unfavorable schools that were selected for participation in the program.

The empirical approach exploits the PGER's assignment rule, by which every school with at least one grade among the bottom 5% of IDESP distribution took part of the program. The participation in the PGER is closely associated with a poor performance, so the mere comparison between treated and untreated schools will not allow us to identify the causal impact of the program. In that sense, the discontinuity generated by the assignment rule constitutes a valuable source of exogenous variation on the probability of participating in the program.

The rule states that a school is assigned if any of its grades is below the threshold. So if a school is eligible because of its performance on 8th grade, that is, if the 8th grade IDESP is less than or equal to 1.452016 (the 5th percentile), then all grades will be treated. That is because the program treats the school as a whole, once management practices should not be grade-specific. As a result, one might expect some schools above the cutoff to be part of the program. In that sense, the rule causes the probability of being assigned to PGER to drop rapidly, but not sharply, as the grade crosses the threshold (Fig. 1).

One can see that even when a school does not meet the eligibility criteria it is still among the poorest performers: as the Fig. 2 shows, most schools below the 5th percentile of the 2007 IDESP distribution in the 8th grade of ES (1.452016) also have poor performance in the 4th grade of ES and mainly in the 3rd grade of HS.[7]

Formally, let S be a continuous pre-treatment characteristic (the 2007 IDESP, in this case) and let the eligibility cutoff be $S = \bar{s}$. The PGER rule implies that there is a discontinuity in the probability of participating ($I = 1$) at the threshold:

$$\lim_{\bar{s}\to 1{,}45^{-}} \Pr[I=1|S=\bar{s}] \neq \lim_{\bar{s}\to 1{,}45^{+}} \times \Pr[I=1|S=\bar{s}], \quad S \in [0, 10]$$

[7] The simple correlations between the percentiles in which the schools are located in the IDESP distribution in two grades are 0.67 (4th and 8th grade elementary), 0.70 (8th grade elementary and 3rd grade high school) and 0.56 (4th grade elementary and 3rd grade high school).

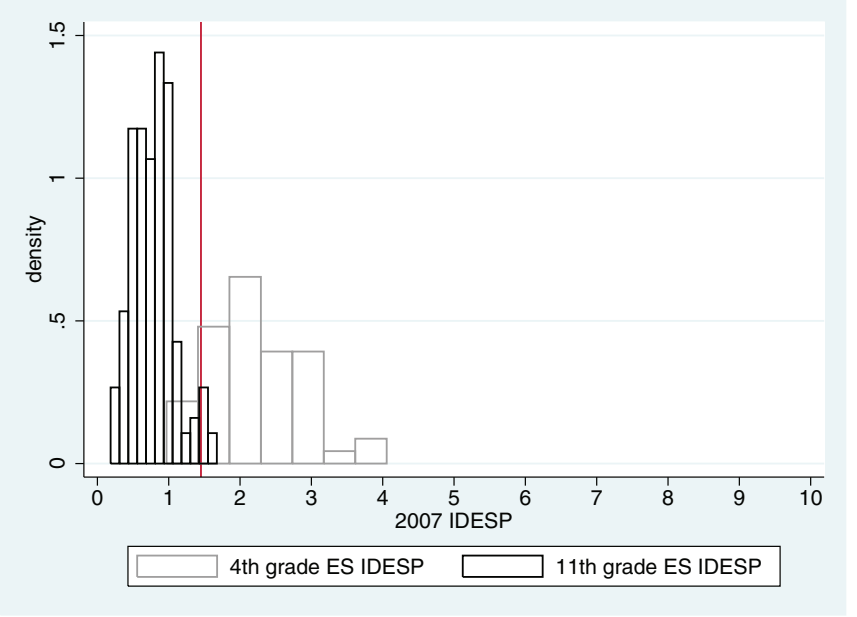

Fig. 2. Distribution of the IDESP 2007 quantiles of 4th grade ES and 3rd year HS.

Besides, as all eligible schools were treated and part of the non-eligible also participated, it is straightforward that $\lim_{\bar{s}\to 1,45^{-}} \Pr[I=1|S=\bar{s}]=1$ and $\lim_{\bar{s}\to 1,45^{+}} \Pr[I=1|S=\bar{s}]>0$.

So, the design of the rule implies that I use the strategy to the so called of a *partially fuzzy RDD* (Battistin & Rettore, 2008). This design allows me to identify the causal effect of PGER by adopting the IDESP score as an instrumental variable for the participation in the program. More specifically, it is possible to recover the mean impact for non-participants at the margin of the cutoff by estimating the following parameter:

$$\tau = \frac{E\left[Y|S=1,45^{-}\right]-E\left[Y|S=1,45^{+}\right]}{1-\Pr\left[I=1|S=1,45^{+}\right]},$$

where Y is the observed outcome variable. This parameter can be obtained by running a 2SLS model, taking S as a running variable, for samples sufficiently close to the cutoff:

$$Y=\alpha+\tau I+f(S)+u$$
$$\mathrm{I}=\gamma+\beta Z+g(S)+\varepsilon,$$

where Z is a dummy variable for $S<\bar{s}$, $f(\cdot)$ and $g(\cdot)$ are flexible functions of the 2007 IDESP percentile.

The main identification assumptions here are that $E[Y_0|S]$, where Y_0 is a potential outcome under no treatment, is a continuous function at $S=\bar{s}$, so that in the neighborhood of the cutoff non-eligible schools are valid counterfactuals for the eligible ones.[8] These assumptions are essentially non-testable because they involve potential outcomes, which are not observed for the full sample. Even so, the next section brings some approximate tests.

The outcomes are measures of student learning given by SARESP scores in language and math – both the overall means and the means by each proficiency level (below basic, basic, adequate and advanced). Regressions are estimated for 8th grade students. This choice is justified by the fact that this is the grade offered by most of the schools included in the program (90.5%). The benchmark models consider the sample of 8th grade classes located between the 3rd and 8th percentiles of the IDESP distribution. Standard deviations are computed using cluster correction at the school level.

It is important to note that the causal effect is valid only locally. Battistin and Rettore (2008) argue that because it is the half fuzzy RDD, the average treatment effect identified in this exercise is on at the cutoff point non-participating schools. So, it measures what the students in those schools would have gained in case they took part of the program, which is subtly different of the results of a standard fuzzy RDD.

Although I cannot claim the external validity of the results, the profile of schools for which these estimates are valid provides an interesting analysis: schools serving students with an unfavorable family background. In Brazil as a whole, the performance of 37% of all public schools is similar to the PGER-treated schools.[9] Therefore, although the program's impact intrinsically depends on the quality of the school, i.e., it only applies to schools with low-performing students, it shall be valid to a significant portion of Brazilian public schools. Thus, the results of these exercises

[8] It is important to highlight that, unlike regular fuzzy RDD, this specific design exempt us from the monotonicity assumption (Battistin & Rettore, 2008).

[9] The percentage of Brazilian schools with average grades less than or equal to 242 in the language and 231 in math for the 8th grade of elementary school in the 2007 Prova Brasil (national proficiency exam, applied to all Brazilian public schools). These scores represent the highest scores achieved by PGER schools in 2007, as measured by the 95th percentile of the distribution of scores in this group.

should provide evidence of the importance of school management to educational outcomes in developing countries.

Furthermore, one could argue that the success of a school management program such as PGER could interact with the system of hard accountability. For example, the engagement of the principal and educational coordinator with the program's implementation and the effective development of their activities could be (positively) correlated with the expectative of performance disclosure or receiving bonuses. If it is the case, the parameter identifier is the causal effect of PGER on proficiency conditional on the existent hard accountability program that affects all schools in São Paulo.

6. Results and discussion

6.1. Validity tests

Compared to other schools in the state, those participating in PGER have students with socioeconomic disadvantage: in these schools there are higher proportions of nonwhite, poor students, with less educated parents. In addition, the participating schools are larger, with more students per class and a lower availability of teaching resources. These schools also have less experienced principals and coordinators (see Appendix Table 1 for descriptive statistics of pretreatment selected variables for treated and untreated schools).

Because those differences, validity tests were conducted to assess the credibility of the RDD strategy. Among the schools that have 8th grade IDESP ranging from 1.26 to 1.58 (those located between the 3rd and 8th percentiles), I found no differences in the observable pretreatment characteristics linked to student performance – family and educational background; academic training and experience of teachers, educational coordinators and principals; and schools' infrastructure and teaching resources. I also did not observe significant differences in the average scores in language and mathematics between the treated and untreated schools in the benchmark sample (see Appendix Table 2 for RDD estimates of PGER on pretreatment characteristics and students' performance). This is not surprising because a school's selection for treatment intrinsically depends on student performance. Nonetheless, it is interesting because it suggests that there are also no differences in the unobservable characteristics between the schools in the sample before treatment, which must be embedded in the SARESP grades.

Treatment assignment could still be endogenous: for example, schools could manipulate the running variable to be included in the program. In the case of PGER, the possibility of manipulation is not plausible because the program was announced after the publication of the SARESP and IDESP results. Furthermore, I performed a visual inspection of the distributions of IDESP 2007 for the 8th grade of elementary school between the 3rd and 8th percentiles and conducted a McCrary test for the continuity of the density of IDESP 2007 for the 8th grade and found that the density function is not discontinuous in the cutoff (see Appendix Figs. 3 and 4). This evidence points to the random assignment of treatment around the threshold.

6.2. The effects of PGER on educational outcomes

To investigate PGER's impact on the educational outcomes of students in the 8th grade, benchmark regressions considered the sample of schools that have 8th grade IDESP ranging from 1.26 to 1.58 (those located between the 3rd and the 8th percentiles of the 2007 IDESP distribution). This sample includes 221 schools and 25,151 students. To evaluate the program's effect on the average performances of the treated schools, I considered student-level regressions for the scores obtained in the 2008 SARESP examinations in language and mathematics. Regressions were also estimated separately for the samples of student at each proficiency level (below basic, basic, adequate and advanced) according to 2008 classification to investigate possible heterogeneous effects on students of different learning stages.

The first and second columns of Table 1 present the coefficients of these estimations via OLS, which considers the students in all the schools in the state of São Paulo (over 400,000 students in more than 3000 schools). The results indicate a negative correlation between program participation and SARESP grades in language and mathematics, even when covariates are included. This is reasonable because schools are included in PGER precisely due to their low performance. These negative correlations between treatment status and students' proficiency estimated by naïve regressions are straightforward result of the PGRE's selection rule, based on school performance in 2007. If school performance is persistent at least in the short period, low-performing schools in 2007 remain low-performing schools in 2008.

In fact, when estimating these models using *partially fuzzy RDD*, the point estimates of the treatment coefficient increase and, in general, become positive. In the case of language scores, I found no evidence that the change in the school management model introduced by PGER had any impact on performance. In the case of mathematics, the program had a significant positive impact at 1% level of significance (column 3).

These results are robust to inclusion of covariates, and changes in the functional form of the function $f(S_i)$ (quadratic and cubic) and the window around the cutoff defining the sample (schools that have 8th grade IDESP ranging from 1.34 to 1.54 – those between the 4th and 7th percentiles of the 2007 IDESP distribution) (columns 4–10), as well to nonparametric estimation (Figs. 3 and 4). The PGER's had an impact on math performance of nearly five to eight points on the proficiency scale. This is equivalent to approximately 0.14–0.22 standard deviations[10] or, in other words, increasing a typical student's annual learning by 32–50%.[11]

When investigating the heterogeneity of the program's impact on students at different learning stages, interesting results emerge: it can be noted that the program exclusively impacts students with greater academic difficulties. This is because the estimates of the dummy treatment coefficient are positive and significant at the 1% level when considering the subsample of students at the below-basic proficiency

[10] Considering the standard deviation of math scores in the 8th grade in 2007 (37 points).

[11] On the SARESP grade scale, the annual average student learning is 0.44 standard deviations per year/grade.

Table 1
OLS and RDD estimates of PGER on students' performance.

Language	OLS		[3–8th percentile, linear]		[3–8th percentile, quadratic]		[3–8th percentile, cubic]		[4–7th percentile, linear]	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Score, all students	−14.848***	−6.806***	3.054	2.926	3.907	4.123	1.543	2.265	2.497	3.293
	(0.606)	(0.631)	(2.306)	(2.335)	(2.403)	(2.538)	(2.566)	(2.801)	(2.673)	(2.940)
	{418,416}	{417,751}	{25,153}	{25,115}	{25,153}	{25,115}	{25,153}	{25,115}	{16,947}	{16,909}
Score, students in below basic	−1.208***	−0.817***	1.088	1.169	1.269	1.450*	1.256	1.494	1.482	1.880*
	(0.194)	(0.198)	(0.795)	(0.774)	(0.856)	(0.839)	(0.984)	(0.973)	(0.946)	(0.959)
	{109,079}	{108,891}	{9,426}	{9,412}	{9,426}	{9,412}	{9,426}	{9,412}	{6,438}	{6,424}
Score, students in basic	−3.469***	−1.484***	0.728	0.690	1.033	1.059	0.280	0.420	1.305	1.523
	(0.219)	(0.228)	(0.970)	(0.987)	(0.910)	(0.962)	(1.113)	(1.180)	(1.146)	(1.240)
	{236,054}	{235,632}	{13,499}	{13,476}	{13,499}	{13,476}	{13,499}	{13,476}	{9,046}	{9,023}
Score, students in adequate	−2.289***	−1.101***	−1.587	−1.576	−1.345	−1.297	−0.927	−0.736	−0.569	−0.289
	(0.256)	(0.264)	(1.141)	(1.151)	(1.177)	(1.189)	(1.392)	(1.415)	(1.362)	(1.351)
	{65,246}	{65,141}	{2,064}	{2,063}	{2,064}	{2,063}	{2,064}	{2,063}	{1,365}	{1,364}
Score, students in advanced	−2.563***	−1.894**	0.124	0.432	−1.219	−0.673	−5.736*	−6.373*	−5.334	−5.630
	(0.708)	(0.734)	(3.347)	(3.232)	(3.249)	(3.201)	(3.363)	(3.247)	(3.495)	(3.280)
	{8,107}	{8,087}	{164}	{164}	{164}	{164}	{164}	{164}	{98}	{98}
Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Math										
Score, all students	−14.229***	−5.841***	5.667***	5.145**	7.904***	7.435***	6,267***	6.140***	5.519**	4.965**
	(0.600)	(0.627)	(2.268)	(2.068)	(2.328)	(2.230)	(2.444)	(2.351)	(2.651)	(2.513)
	{418,508}	{417,773}	{25,151}	{25,113}	{25,151}	{25,113}	{25,151}	{25,113}	{16,952}	{16,914}
Score, students in below basic	−0.030	0.459	5.145***	5.106***	5.778***	5.756***	5.903***	5.994***	5.865***	5.948***
	(0.205)	(0.212)	(0.872)	(0.867)	(0.949)	(0.993)	(0.894)	(0.993)	(1.034)	(1.156)
	{144,600}	{144,345}	{11,974}	{11,955}	{11,974}	{11,955}	{11,974}	{11,955}	{8,210}	{8,191}
Score, students in basic	−3.876***	−1.611***	1.033	0.884	1.509	1.394	0.519	0.492	0.344	0.227
	(0.223)	(0.227)	(0.983)	(0.939)	(1.045)	(1.028)	(1.209)	(1.204)	(1.188)	(1.195)
	{225,694}	{225,295}	{11,990}	{11,971}	{11,990}	{11,971}	{11,990}	{11,971}	{8,017}	{7,998}
Score, students in adequate	−2.480***	−1.186***	−0.177	−0.317	0.360	0.259	−0.208	−0.364	−1.594	−2.121
	(0.346)	(0.355)	(1.783)	(1.737)	(1.593)	(1.554)	(2.226)	(2.144)	(2.300)	(2.230)
	{42,754}	{42,678}	{1,120}	{1,120}	{1,120}	{1,120}	{1,120}	{1,120}	{684}	{684}
Score, students in advanced	−2.414*	−2.033	9.513**	5.252	7.238	4.503	5.728	−0.735	−12.880	−11.450
	(1.287)	(1.380)	(4.527)	(4.341)	(4.454)	(4.409)	(5.742)	(5.550)	(20.569)	(13.694)
	{5,460}	{5,455}	{67}	{67}	{67}	{67}	{67}	{67}	{41}	{41}
Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes

Significance level: *10%, **5%, ***1%. Standard error clustered at school level, in parentheses. Number of observations in brackets. Covariates includes students' demographic characteristics and family background (age, gender, color/race, parents' education), teachers' demographics (age), principals' academic training, length of the school day (average class hours) and class sizes (number of students per class).

level. However, they are not significant for students in the basic and adequate levels. Because the students in the schools participating in PGER are concentrated in the below-basic (68%) and basic (31%) proficiency levels in mathematics, this result suggests that the program prioritized students with greater learning deficits.

For robustness checks, I also estimated PGER's impact on false cutoffs, considering two school samples based on their locations in the 2007 IDESP distribution: those between percentiles 3rd and 5th – all treated – and those between percentiles 6th and 8th – all untreated (Appendix Table 3). Furthermore, the impact of the program is only observed in the true cutoff.

The following sections investigate the ways in which PGER might have acted on the increases in the math grades of students in the 8th grade of elementary school.

6.3. Impact on selection

The previous section presented evidence that PGER has a causal effect on student proficiency in 8th grade, especially among low-performing students. This impact may be related to the increased managerial skills of school administrators, but it may also result from changes in the composition of students, faculty and school management staff (principals and educational coordinators). In this and in the following sections, I discuss some possible explanations for these results, i.e., the mechanisms by which PGER acts to increase student learning.

The implementation of a program to improve school management can, for example, raise the cost of labor of school administration and monitoring of employees, encouraging the departure of less hardworking managers and teachers. Furthermore, it is possible that more motivated administrators will feel challenged to work in schools with a new model of school management. More committed teachers may prefer to work in treated schools because they understand that this management model provides complementary inputs to their work, such as the management team's disposition to maintain an adequate infrastructure and teaching resources for the school and to monitor classroom discipline.

Another change possibly brought about by the program's implementation may be observable in the composition of the

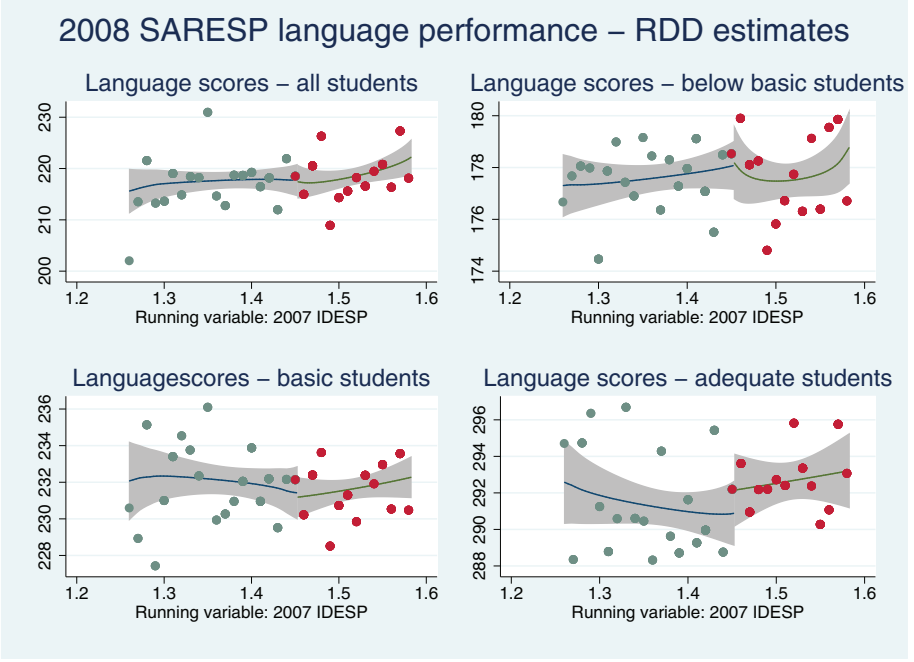

Fig. 3. Impact of PGER on language proficiency – robustness check.

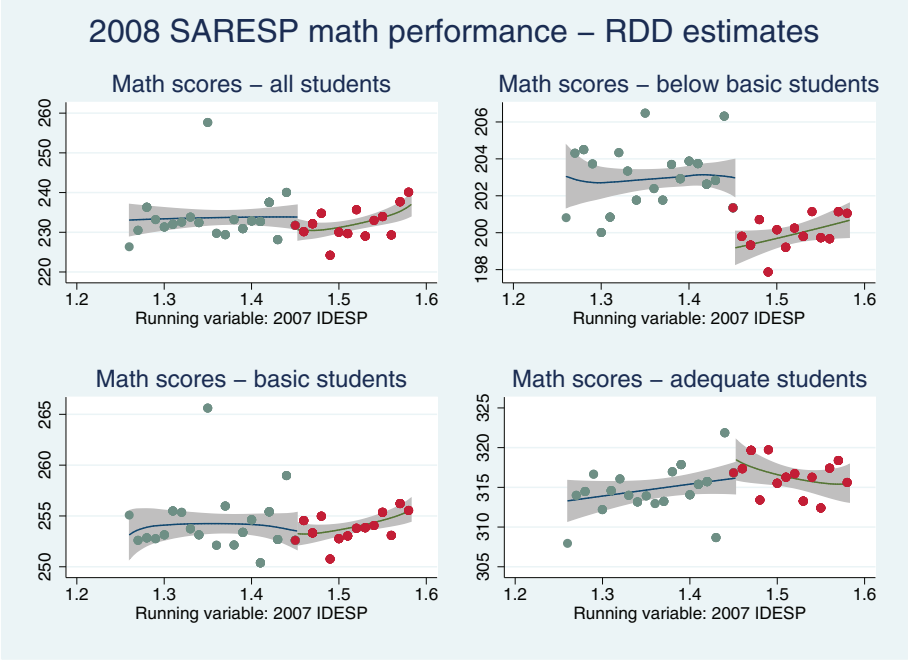

Fig. 4. Impact of PGER on math proficiency – robustness check.

student population. Parents who are more concerned with their children's academic educations and more knowledgeable about the educational policies introduced by the state government may view PGER deployment as an improvement in the quality of the treated schools and decide to enroll their children in those schools. There may also be an interaction between all these effects: higher-quality managers who are attracted to the program may select students with better backgrounds and hire better teachers.

Although these effects are possible, the context of the allocation of staff and students in public schools of São Paulo makes them unlikely. This is because in the 2008 school-year, the allocation of staff and students occurred before the program was announced. In addition, student enrollment strictly

Table 2
RDD estimates of PGER on selection.

Student characteristics		
Boy	0.013	(0.018)
White	0.041	(0.052)
Age	−0.007	(0.066)
Maternal education	−0.015	(0.034)
Income indicator (TV)	−0.056	(0.052)
Income indicator (car)	0.035	(0.036)
Income indicator (computer)	0.051	(0.034)
Teacher characteristics		
Age	0.515	(0.745)
White	0.031	(0.033)
Higher education	0.002	(0.014)
Coordinator characteristics		
Age (under 40 years)	−0.087	(0.115)
Tenure (up to 3 years)	0.021	(0.089)
Has another job	0.000	(0.088)
Principal characteristics		
Age (under 40 years)	−0.203**	(0.101)
Tenure (up to 3 years)	0.035	(0.163)
Has another job	−0.229	(0.157)
# Observations	221 principals and 221 coordinators 460 teachers 22,438 students	

Significance level: *10%, **5%, ***1%. Standard error in parentheses.

Table 3
RDD estimates of PGER on infrastructure.

School characteristics		
Piped water	−0.040	(0.067)
Electrical power	-	-
Sewerage	−0.065	(0.123)
Garbage collection	-	-
Room for director	−0.074	(0.055)
Room for teachers	−0.003	(0.051)
Computer Lab	0.065	(0.045)
Science lab	−0.095	(0.137)
Library	0.151	(0.105)
Audiovisual resources (TV)	-	-
Audiovisual resources (video)	0.016	(0.110)
Audiovisual resources (DVD)	−0.010	(0.035)
Audiovisual resources (projector)	−0.206*	(0.117)
Number of computers	−0.040	(1.817)
Internet access	−0.006	(0.074)
Lunch	0.007	(0.007)
Number of students	−163.261	(188.659)
Offers only one level of education	0.065	(0.085)
School day	−16.645	(17.469)
Number of students per class	−1.545	(1620)
# Observations	221 schools	

Significance level: *10%, **5%, ***1%. Standard error in parentheses.

follows geographical criteria: each student must be allocated to the school nearest his home. The mobility of each school's management team is also small: once a principal or educational coordinator has been appointed to a school, the process of change is slow and bureaucratic.[12]

Teachers' mobility between schools from one year to the next is greater. Their allocation follows a selection process based on the teacher's tenure: older teachers take preference in the allocation of classes and schools, and, ultimately, younger teachers have no choices and are allocated to the remaining schools. In this process, principals do not have the autonomy to hire or fire teachers.

Therefore, although it appears unlikely that PGER has had an effect on the composition of students, faculty and school management staff (principals and educational coordinators), I investigated this possibility formally. If a change in this composition had been observed, would expect that the variations in the observable characteristics of students, teachers and administrators between 2007 and 2008 would be substantially different between the treated and untreated schools in the benchmark sample.

After the balancing of these variables had been checked for 2007, it was only necessary to assess whether there were systematic differences in these observable characteristics for the schools in the sample in 2008. Table 2 shows that there were no differences between the 8th grade elementary students in the treated and untreated schools in terms of gender, age, proxies of income and maternal education; this reinforces the hypothesis that the program does not influence the selection of better students for the treated schools. The results also provide evidence that PGER did not affect mobility (entering or leaving treated schools) of teachers, principals or coordinators. This is because there are no significant differences between the treated and untreated school officials regarding their ethnics, gender, age, experience, tenure and academic training.

6.4. Impact on physical inputs and student services

The implementation of a program to improve school management, such as PGER, can theoretically affect the allocation of a school's physical resources. This may occur because the monitoring indicators of a school's infrastructure and the adequacy and use of its learning resources and student services may reveal deficiencies in these dimensions. If school administrators consider that these inputs positively affect student performance, they would decide to increase the quantity or quality of its physical resources and services provided to assist students.

Table 3 demonstrates that in 2008, there were no differences between the treated and untreated schools in the sample in terms of their infrastructure, such as access to public services including water, electricity, garbage collection and sanitation. Similarly, no differences were observed between the amounts of available equipment (TV, DVD, video and computers), the allocation of the school's physical space (such as library and science and computer labs), school size (number of students) and the availability of services for the student (lunch). Given that in 2007, the treated and untreated schools in the sample also exhibited no significant differences in these dimensions, these results provide evidence that PGER did not affect the number of physical resources of the schools that participated in the program. It is noteworthy

[12] This process is called removal and must be requested directly from the SEE by the employee. Authorization depends on the availability of another employee to fill the position and the justification for the transfer (transfers are usually granted due to changes in the city of residence, changes in spouse's employment, etc.). The average time for the removal process (between request and authorization) is approximately one year. Removal became less attractive after 2007, when the SEE began to grant salary benefits to school management employees who stayed for more than three years in the same school.

that given the nature of the available data, cannot be definitive about investments in the quality of this type of input. However, if PGER impacted the quality of schools' infrastructure, would expect to observe significant differences in the number of at least some physical inputs between the treated and untreated schools.

These results are not surprising because the decision to allocate the infrastructure of public schools of São Paulo is centralized in the SEE. Every year, the SEE produces a specific 'investment plan' for each school, where infrastructure projects are planned along with the purchases of furniture, goods, equipment and permanent materials. This plan is based on data from the School Census for the previous year, which was fulfilled by the principal. Throughout the year, principals may submit exceptional requests to the SEE that are not included in the investment plan, justified by events such as theft, vandalism, fire or damage caused by natural disasters.

Each school also has its own budget, the resources for which come from its own state of São Paulo and the federal government. On average, each school receives US $15 per student annually, according to the 2008 SEE budget. The allocation decisions are made by what is known as the budget management council, which is attended by the principal, the association of parents and teachers and the student body. Approximately 90% of the budget is allocated to expenditures on maintenance, upkeep and minor repairs to the school and purchases of consumables. Thus, school administrators have little autonomy over investment decisions, as the volume of resources available to principals is small. After deducting school maintenance expenses, few resources remain for financing substantial investments.

One could even argue that principals interested in increasing the level of investment in their schools could complete the School Census using imprecise data. Despite this possible strategy, it is unlikely that principals are able to considerably underestimate the physical conditions or availability of school resources because they all receive in site visits by SEE employees who perform any adjustments to the investment plans. In the context of PGER implementation, this appears even less likely because the schools' investment plans for 2008 were based on data from the School Census 2007, which was fulfilled before the program's implementation.

Furthermore, I find no evidence that the schools participating in the program changed the lengths of their school days or class sizes (number of students per class), even if they specialized in the provision of a given level of education.

6.5. Impact on school activities, teaching and management practices

In the two previous subsections, I presented evidence that the introduction of PGER did not affect the compositions of the student, faculty or school management staff of the participating schools. The infrastructures of the treated schools were also not significantly changed by their participation in the program. Therefore, what changes were experienced in the schools that would explain the increase in the students' math proficiency? I used information from the 2008 SARESP questionnaires to speculate on such mechanisms, assessing the extent to which the treated and untreated schools differed in terms of their administrative and educational practices.

Before describing the results, I must emphasize that the data come primarily from self-reports of students and, therefore, are subjective measures of those dimensions. Although I believe that the estimates presented in these exercises provide a good proxy of the mechanisms by which PGER acts on proficiency in mathematics, I am not able to ascertain whether these pedagogical and managerial changes caused the increase in math performance.

Parents and students provided information about their opinions about the school, the teaching practices, attendance of students' in extracurricular activities and use of school environments. Parents with children in the treated schools appear to receive more information about their children's performance. This may indicate that the managers of PGER schools understand and/or appreciate the importance of family to learning and share more information on the students' progress in school with their parents. There were no other impacts neither on other parent's opinions about the school dealing on students' absenteeism, homework, and parent meetings nor on use of school facilities. The results also suggest that teachers in the PGER schools made small changes in their teaching practices – like proposing more text production activities (language teachers) and assigning more homework tasks (math teachers) – and that the proportion of pupils from treated schools who claim to attend math tutoring is higher than in the untreated schools.[13] This suggests that the managers of treated schools seek to introduce changes that should, in principle, positively affect student performance (Table 4).

Questionnaires filled by coordinators and principals provide information about development and activities of educational planning, use of results students' assessments, opinion about activities most performed by staff and school's most serious problems. Observing the results of coordinators' or principals' regressions (Table 5), I can find some interesting changes on management routine of treated schools.[14] There must be more interaction between managers in decision making when planning the school year and the planning undertaken at the beginning of the school year appears to be more important in guiding the work of the school management team: in treated schools, the proportion of coordinators who claim to have participated in drawing up the PPP and that your work plan is appropriated to it is higher. PPP monitoring is a predominant subject in educational meetings and the goals set in it are used in managing the curriculum. This document also is reassessed and redirected based on student performance.

The results also suggest changes in managers' priorities when they take part in the school's educational planning. 'Intra- and extra-school factors' and 'better interaction

[13] This finding could explain, at least partially, the causal effect observed on math achievement. To investigate this, run a regression of math proficiency on the proportion of pupils attending math tutoring and the interaction of this variable with treatment dummy. are not able to conclude that attending math tutoring is associated with higher math achievement on treated schools. The results are available upon request.

[14] The interpretation of coefficients is based on regressions that consider coordinators' or principals' opinions. Some coefficients are statistically significant just in one regression.

Table 4
RDD estimates of PGER on school activities and teaching practices.

Opinion of parents about school		
Parents receive information about their children's performance	0.062*	(0.036)
School conducts regular parent meetings	−0.024	(0.021)
Parents feel that the school does not care when the child misses school	−0.017	(0.018)
The school gives homework every day	0.005	(0.032)
Attendance of students in extracurricular activities		
Recovery/strengthening classes in language	0.045	(0.033)
Recovery/strengthening classes in mathematics	0.078**	(0.038)
Frequency of use of school environments		
Computer Lab	−0.041	(0.087)
Science lab	−0.107	(0.071)
Library	0.034	(0.064)
Activities carried out by language teacher		
Assigns homework tasks	0.007	(0.042)
Corrects homework	0.062	(0.041)
Proposes text production activities	0.065*	(0.036)
Assigns reading of literature books	0.018	(0.033)
Assigns reading newspapers and magazines	0.028	(0.029)
Organizes text presentations in public	0.025	(0.021)
Proposes written work to be done in a group	0.013	(0.028)
Activities carried out by math teacher		
Assigns homework tasks	0.074*	(0.042)
Corrects homework	0.036	(0.043)
Proposes solutions to various problems	0.023	(0.032)
Applies studied content to everyday situations	0.023	(0.027)
Uses games and play activities	0.022	(0.025)
Shows application of content in other disciplines	0.028	(0.027)
# Observations	22,438 students	

Significance level: *10%, **5%, ***1%. Standard error clustered at school level in parentheses.

between students and teachers' are less relevant to administrators of PGER schools when they decide what activities will be developed throughout the year. Moreover, school planning appears to be strongly based on goal setting, defining priority actions and strategies for development and analysis of good teaching practices that can be disseminated. This demonstrates that the management teams of the treated schools seem to put more importance on objective and feasible measures when choosing which factors associated with student performance to employ. They also seem to use educational evaluations to allocate students into more homogeneous groups according to their performance, to review teaching practices and revise content and skills for students presenting greater difficulties. This suggests that the management teams of PGER schools monitor performance measures and utilize this information for the continuous improvement of learning.

Staff's opinion about schools' main problems also differs between treated and untreated schools: PGER's coordinators and principals reported 'teacher absences' and 'lack of teachers for some subjects' as problems affecting student performance less frequently. This result may be related to the fact that administrative control over the presence of teachers is higher in schools participating in the program, although cannot state that the program has alleviated the teacher shortage. Furthermore, this suggests that the program may have affected the management of human resources in the participating schools.

PGER also seems to impact mangers' allocation of time: they spend less time scheduling the use learning environments, participating in meetings with student/school council and assisting students with disciplinary problems and more time participating in meetings with management team/educational supervisors, visiting classrooms and organizing educational replanning activities.

These estimates indicate fundamental changes in the management activities of the schools that participated in the program. These schools use the PPP as a tool to support the planning of educational and administrative activities. They monitor process and outcome indicators more frequently, and this information is shared between teachers and parents. Moreover, the targets set in the PPP seem to aid managerial decision making. This information appeared to influence the management of human resources and the implementation of actions intended to improve learning: rules for the allocation of classes, tutoring via content review and additional lessons and the analysis and dissemination of good practice in teaching. These findings are consistent with PGER characteristics and modern practice in management, based on monitoring and goal setting.

7. Final comments

This paper contributes to the literature on the Economics of Education with evidence about the importance of school management in the improvement of educational outcomes. In 2008, the State Department of Education of São Paulo/Brazil implemented a program to support schools with low performances (the PGER). The program offered training in basic management tools to the managers of schools that were among the worst 5% of in the state in 2007. Furthermore, standards were instituted to monitor student

Table 5
RDD estimates of PGER on management practices.

		Coordinator		Principal	
Development and utilization of Education Policy Project (PPP)	Participated in drawing up the PPP in 2008	0.393***	(0.131)	−0.101	(0.152)
	Work plan is appropriate to PPP	0.268**	(0.124)	0.070	(0.158)
	Uses PPP in managing the curriculum	0.137	(0.138)	0.312**	(0.136)
	Uses PPP in organizing meetings with parents and student council	0.017	(0.052)	−0.134	(0.148)
	Uses PPP in planning activities to support teachers	−0.116	(0.104)	−0.032	(0.099)
	The PPP is reassessed and redirected based on student performance	0.194	(0.157)	0.148**	(0.082)
Activities prioritized in educational planning	Analysis of intra- and extra-school factors	−0.253**	(0.129)	−0.027	(0.121)
	Analysis of actions with major impacts on learning for dissemination	0.632***	(0.137)	0.431***	(0.152)
	Development of teaching plans that articulate different grades and subjects	0.058	(0.142)	0.146	(0.162)
	Strategies for better interaction between students and teachers	−0.071	(0.139)	−0.186**	(0.105)
	Proposition of goals, priorities and strategic actions	−0.081	(0.153)	0.788***	(0.122)
	Discussions of the student assessment system	0.045	(0.124)	0.223	(0.148)
	Surveying teachers' demands in educational meetings	0.095	(0.094)	−0.050	(0.090)
Activities most performed by her	Organization of the use of learning environments (e.g., laboratories)	−0.083***	(0.009)	0.000	(0.020)
	Participation in meetings with parents	−0.002	(0.005)	−0.028*	(0.016)
	Participation in meetings with management team	0.068***	(0.013)	0.047***	(0.016)
	Participation in meetings with student council and school council	−0.029*	(0.016)	−0.002	(0.005)
	Visiting classrooms	0.011*	(0.006)	0.002	(0.014)
	Assistance to students with learning problems	0.016	(0.110)	−0.003	(0.019)
	Assistance to students with disciplinary problems	−0.01	(0.016)	−0.025*	(0.014)
	Participation in meetings with educational supervisors	0.038**	(0.018)	0.033**	(0.017)
	Participation in meetings with school services officials	0.008	(0.014)	0.017	(0.016)
	Organization of educational replanning activities	0.052**	(0.020)	0.027	(0.021)
Subjects predominant in educational meetings	PPP monitoring	0.337***	(0.114)	0.259*	(0.149)
	Analysis of and search for solutions to learning problems	0.175	(0.139)	−0.067	(0.067)
	Definition of criteria and procedures for student assessment	−0.004	(0.004)	0.007	(0.032)
	Analysis of and search for solutions to disciplinary problems	−0.055*	(0.033)	−0.027	(0.035)
	Implementation of curricular proposals	−0.171	(0.115)	−0.165	(0.122)
	Sharing of successful experiences	0.094	(0.070)	0.024	(0.060)
School's most serious problems	Lack of teachers for some subjects or grades	−0.063	(0.082)	−0.520***	(0.138)
	Teacher turnover	−0.111	(0.121)	−0.019	(0.115)
	Teacher absenteeism	−0.171*	(0.097)	−0.290**	(0.120)
	Student absenteeism	0.004	(0.079)	0.033	(0.036)
Use of results of assessments of student performance	Inform parents of their children's performance	−0.042	(0.121)	−0.033	(0.125)
	Make decisions about approval and disapproval of students	−0.169	(0.146)	−0.104	(0.158)
	Group students according to didactic purposes	0.429***	(0.139)	0.610***	(0.142)
	Compare the school's performance with the state or national average	0.240	(0.151)	−0.089	(0.165)
	Evaluate teachers' work	0.009	(0.155)	−0.202	(0.163)
	Revise content and skills with which students have difficulties	0.243***	(0.073)	0.029	(0.068)
	Review teaching practices	0.116	(0.105)	0.147*	(0.078)
# Observations		221 coordinators		221 principals	

Significance level: *10%, **5%, ***1%. Standard error in parentheses.

performance, and process indicators were introduced relating to learning in different dimensions: teacher–student exposure, teaching practices and curricular adequacy, infrastructure, communication, adaptation and the use of equipment and teaching materials. Goals were set and action plans developed for performance in each indicator throughout 2008, based on a diagnosis of the school's situation in 2007. Performance monitoring, goal setting and a bonus policy for school staff were configured in what is referred to in the literature as 'modern management practices'.

This study explored an arbitrary selection of schools for the program to estimate the program's impact on 8th grade elementary school students' development in language and math. I also investigated the ways in which the program operated with respect to the effects of the selection of students or staff, investments in physical inputs or services provided to students or changes in teaching practices and management activities. Fuzzy RDD estimates, which are robust to different specifications and samples, demonstrate that participation in the program had a positive impact of nearly five to eight points on the proficiency scale in math (0.14–0.22 standard deviations). The program affected the learning of the students with greater academic difficulties: students with below-basic proficiency level.

PGER's positive effect did not result from the selection of better students nor by attracting better teachers and administrators to treated schools. There is also no evidence that these results were due increased school inputs or infrastructure improvements. Although observed positive correlations between participation in the program and small changes in teaching practices, such as tutoring, these do not appear to be responsible for the increase in students' grades in math in PGER schools.

Therefore, I believe that the program acts to improve learning via basic administrative changes. An analysis of data taken from the managers' questionnaires suggests that

participation in PGER has affected the school management practices in some dimensions. These practices include the involvement of the entire management team in the development of school planning, the sharing of performance indicators among teachers and parents, the use of assessments and targets for curriculum management and teachers' work and the improved management of human resources.

The estimates are valid for a specific group of schools that serve students with unfavorable family backgrounds. However, if the program's impact depends intrinsically on the quality of each school, it can still be extended to the nearly 40% of Brazilian public schools, which average performance is similar to those of the PGER-treated schools. Therefore, the results provide evidence of the importance of improving school management in developing countries. This is particularly important in public school systems, where the institutional environment, characterized by strict labor regulations, low competition pressure and poor managerial training, disadvantages management practices aimed to improve inputs productivity and educational achievement.

Supplementary Materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.econedurev.2015.05.002.

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