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IMPACT OF SCHOOL DAY EXTENSION ON EDUCATIONAL OUTCOMES: EVIDENCE FROM *MAIS EDUCAÇÃO* IN BRAZIL[1]

Luis Felipe Batista de Oliveira[2] and Rafael Terra[3]

1 INTRODUCTION

There are many elements to the public policies required to reduce educational disparities among students. They include issues related to infrastructure, remuneration and training of education professionals, and debates regarding unifying content at the national level and on forms of public service provision and delivery. There are also suggestions regarding how students can best make use of their time to seek to expand their knowledge, relationships and school participation. While there are many initiatives that focus on all of these aspects, their impacts are not always subject to a causal analysis capable of providing the information necessary to improve them. This Working Paper provides evidence regarding the impact of the extended school days implemented under the *Programa Mais Educação* ('More Education' programme—PME), an initiative of the Brazilian federal government. The PME transfers funds directly to educational institutions, which, in turn, purchase educational materials and fund monitoring grants for extracurricular activities.

The proper approach to ensure the correct econometric identification of targets for the programme is found in 2012. This makes it possible to identify a discontinuity in the prioritisation of schools that have 50 per cent or more of their students as beneficiaries of the *Bolsa Família* programme (PBF). This then allows for a comparison of schools based on this criterion, made under quasi-experimental conditions. While this prioritisation likely represented a greater chance of selection for the intervention, no improvements have been found in learning (Portuguese and Mathematics) or performance (dropout, approval and failure rates).

As is widely documented, elementary schools in Brazil are primarily the responsibility of municipalities. Furthermore, they are significantly heterogeneous in terms of management and socio-economic conditions. The financing of elementary education has gone through a number of changes over the past three decades, including the adoption of compensation funds

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such as the Fund for the Maintenance and Development of Elementary Education and Appreciation of Teaching (FUNDEF) between 1996 and 2006 and the Fund for the Maintenance and Development of Elementary Education and Appreciation of Education Professionals (FUNDEB) from 2006 onwards, all implemented in an effort to promote higher equity in the system.

These funds are intended to reduce disparities in educational funding between states by allowing those that do not meet a minimum threshold in expenditures per student to receive additional funds from the federal government. As a federal initiative, the PME follows this tradition, as it is grounded as a federal intervention in schools whose students live in a state of vulnerability.

When listing relevant factors to explain Brazil's educational inequalities, the literature often points to the role of schools compared to the socio-economic characteristics of families, or even to the social environment in which students live. If, on the one hand, there are studies showing that much of the average performance of students is due to these factors (and, thus, is hardly influenced by any interventions), on the other hand, there is a large body of support for the hypothesis that there is strong heterogeneity between schools, including in the training of their teachers, their infrastructure and the quality of education (Medeiros and Oliveira 2014).

Nonetheless, despite this debate and the doubts raised regarding the efficacy of policies in the short and medium terms, a possible mitigation of educational disparities is known to produce positive effects on income distribution (Barros et al. 2007; Ferreira 2000). As such, reducing such disparities is one of the highest-priority objectives in public policymaking.

Policymakers will often seek to focus interventions on improving teaching conditions for the most vulnerable students. Vulnerability, in turn, is at times diagnosed based on the average performance of the schools where they study and, at times, by the conditions of their families, since it is believed that a there is a considerable correlation between these factors. In cases of greater vulnerability, it is common to see suggestions (regarding at least one of these aspects) to expand opportunities for these children, such as extending school days, improving infrastructure or even enhancing the learning conditions for the professionals teaching them.

The main studies on educational performance list family background, school effects, peer effects and individual characteristics as key determinants (Brooke and Soares 2008). However, studies in Brazil have rarely entailed a more rigorous analysis of the influence of non-observable characteristics and the correct econometric specification of the effects of public policy. This is due to the difficulties caused by older techniques when they fail to consider the design of the policy being assessed, or when it does not have baseline surveys, randomisation, or other tools that would provide comparable treatment and control groups. Studies, therefore, may often frustrate those who expect unbiased results.

One of the first studies to emphasise the role of social backgrounds on school stratification in Brazil was carried out by Silva and Souza (1986). Based on data from the 1976 National Household Sample Survey (*Pesquisa Nacional por Amostra de Domicílios*—PNAD) for men aged 20 to 64, the authors showed that both the explanatory power of the variables (R^2) and the respective individual effects on each level of education decline monotonically during school transitions. This fact contradicted the hypothesis put forth by Mare (1980). Thus, it is known that there is selectivity throughout the grades (years) of basic education, which can reduce the effects of social origins.

Avoiding aggregation bias Albernaz et al. (2002) used linear hierarchical models to show that about 80 per cent of the variance in performance between schools is due to the socio-economic composition of their students. However, these authors do not reject the importance of the quality of infrastructure and teacher training.

Barros et al. (2001) demonstrated that, for individuals aged 11 to 25 in urban areas of the Northeast and Southeast regions, family resources (summarised as per capita family income plus parental education) stand out as strong explanatory factors of educational attainment. One year of additional study by the parents leads to an increase of approximately 0.3 years of study for their children.[4] The mother's educational background is a particularly strong predictor of the children's educational attainment, proving stronger than the quality and availability of existing educational services, the opportunity cost of time, the volume of resources available to families and the volume of resources available to the community.

Authors who stress the school effects include Alves and Soares (2007). Using longitudinal data, they show that the effects of schools on student learning may be underestimated when using cross-sectional data. Moreover, they argue that there is room for school policies and practices that minimise the effects of resources associated with social origin. However, public policies are also needed that can improve both the schools and all students within the schools. This is because, as also concluded by Alves and Soares (2012), socio-economic status also solidly stratifies students and their schools.

When controlling for other levels of aggregation, such as class (Cesar and Soares 2001), school (Barbosa and Fernandes 2000) and municipality (Riani and Rios-Neto 2008), other non-negligible determinants also arise. For the latter, for instance, we see that the proportion of teachers with a higher education degree—a variable that expresses the quality of human resources—and the infrastructure factor—a proxy measurement of the quality of municipal schools—are indicative factors of the quality of educational services.

Internationally, the debate on the existence of a school effect dates back to the Coleman Report in the mid-1960s in the USA (Brooke and Soares 2008). In that and subsequent academic works, the authors tried to demonstrate that significant increases in educational spending are not synonymous with increments in the quality of education. For those economists aligned with works such as Hanushek (1996), the provision of educational services by the government without performance-related incentives for educators may generate few returns for students.

As for extending school days, the change necessarily involves some transfer of resources to the school, be it for the purchase of materials and/or to hire staff. Some studies show that extending the length of school days may be less effective than offering classes during school holidays, such as in 'summer schools' in the USA (Redd et al. 2012), since it is precisely during this period that the effects of educational stratification become more prominent. During this idle time, parents of wealthier students enrol their children in extracurricular activities, while those of the poorest stay at home and reduce their chances of incrementing their human or cultural capital.

In Brazil, the award-winning work by Oliveira (2008) maintains that extending school days from four to five hours is associated with a 0.20-point variation in the standard deviation of grade distribution. As for class size, the estimated effect of reducing the number of students per group from 38 to 30 is a 0.26-point change in the standard deviation of the distribution of proficiency. However, for the author, "a comparison of these two policies suggests that extending school days from four to five hours has a higher benefit–cost ratio compared to class size reduction policies", especially for small classes (33 students or less). Of course, this is because reducing class sizes involves additional spending on teachers and classrooms. In other words, they generate higher fixed costs than the alternative.

In a survey of eighth grade students from São Paulo, Kassouf and Aquino (2011) found no major differences in terms of proficiency and approval rates in students enrolled in the Full-Time School Programme (*Programa Escola de Tempo Integral*) when compared (through their propensity scores) to traditional school students. The authors argue that many of the activities carried out in the alternate school shift are not directly affected by the policy implemented. In addition, a certain precocity in the assessment may have ignored possible positive effects achieved at later stages of maturation, as well as other effects on variables such as child labour, exposure to computer skills and foreign languages, or even decreased exposure to a violent family environment.

The elements that make up the foundations of the PME include the academic works that synthesise the actions of the Ministry of Education (Ministério da Educação—MEC) when building the programme (Leclerc and Moll 2012) and the philosophical origins on which full-time education is based, according to pedagogues and other social scientists (Moll 2012). These studies help us understand how managers and policymakers alike perceive the matter.

Pereira (2011) assesses the first years of the intervention by using a difference-in-differences model. The treatment group was defined as the schools participating in the programme in 2009, while the control group was defined as schools that only joined the programme in 2010. The study found that dropout rates were reduced in both the initial and final cycles of elementary education, but no increases were seen in approval rates or grades.

The most recent assessment of the PME was conducted as part of a partnership between the World Bank and the Itaú Social Foundation (Almeida et al. 2015). The authors used propensity score matching to establish treatment groups—namely, schools that joined the programme in 2008 and remained in it until 2011—and compare them to the control group—schools that did not participate in the programme. They also found no evidence of reduced dropout rates or negative impacts on Maths exams. The authors also argue that the best results are seen in wealthier cities.

This Working Paper intends to study the impacts on student performance of lengthening school days and providing additional activities during the off-school (or 'alternate') shift. To do so, we have based our assessment on the criterion of discontinuity of the PME, as it relates to the use of the percentage of PBF beneficiary students as a criterion, beginning in 2012. It is expected that the econometric identification will enable the detection of causal relationships between lengthened school days and approval, dropout and rejection rates and Portuguese/Maths scores for students enrolled in elementary education. Our motivation is, of course, not based solely on this scenario: what is sought here is, rather, to understand how a new approach in predominantly vulnerable schools has attempted to better target the programme.

The relevance of this work to the current debate on the matter lies in the fact that full-time education is Target No. 6 in the National Education Plan (Plano Nacional de Educação - PNE), which aims to increase full-time education coverage to 50 per cent of public schools and 25 per cent of students by the beginning of the next decade.[5] This study breaks new ground in that it seeks to apply the design of the PME to its methodology; also, there is a shortage of studies on the impact of such interventions, or on this new focus on 'poor schools', especially those where the majority of students are members of PBF beneficiary families. As will be seen, this approach offers an opportunity to causally estimate the impact of the PME on educational indicators.

2 THE *MAIS EDUCAÇÃO* PROGRAMME

The PME started in 2008, and later underwent changes that sought both to expand and redefine its target audience. It is one of the initiatives of the 'Money Directly to Schools' programme (*Programa Dinheiro Direto na* Escola—PDDE) introduced over 20 years ago, under which schools can receive direct transfers from the federal government to a bank account in a regular retail bank. In general terms, it is a tool to strengthen self-management in schools, in both financial and educational terms.

In this regard, the PME aims to contribute to the education of children, adolescents and youth by coordinating different activities, projects and programmes in Brazilian states and municipalities (MEC 2007). The programme began with a few schools in its first year, with the focus shifting (in early 2009) to secondary schools in the state system in the 10 Brazilian states with the lowest Basic Education Development Index (*Índice de Desenvolvimento da Educação Básica*—IDEB), as well as (and especially) elementary schools that met the criteria set by the MEC (2009a).[6]

Some of the PME's objectives are conspicuously broad, and suggest only general intentions of the policy (Decree No. 7.083/2010). However, there are other, more specific objectives, outlined in the programme's management documents, whose elements are more susceptible to evaluation. A booklet created by the MEC (2009b) argues that one such objective is to reduce educational inequalities; to that end, it recommends a focus on students "subject to social vulnerability and lack of assistance", "in delayed grades/age", students in the fourth, fifth, eighth and ninth years of elementary school,[7] or on "contributing to the reduction of school dropout and failure" (MEC 2007).

The MEC (2009a) itself recommends that the Executing Units use these criteria to reimburse expenses on assistants, small services and materials hired/purchased for the activities developed in the alternate shift. It also establishes a pedagogical monitoring kit for a number of subjects (Portuguese, Mathematics etc.) and extracurricular activities (such as sports, human rights, the environment etc.). As such, it would be reasonable to expect some return from a programme of this nature in terms of educational indicators such as performance or even proficiency levels.

In 2011, a partnership was formed between the MEC and the Ministry of Social Development (Ministério do Desenvolvimento Social e Combate à Fome—MDS) (MDS and MEC 2015; 2013; 2011). The partnership remains active, and one of its results is that the PME was integrated (in 2012) with the set of actions under the 'Brazil Without Extreme Poverty' programme (*Brasil sem Miséria*), a larger framework of public initiatives created to coordinate services in the areas of education, social care, health care and housing. Consequently, a series of technical notes and joint documents issued by these two ministries allows for a better understanding of the selection criteria used to determine which schools would be prioritised by the PME.

The programme is operated by the Department of Basic Education (*Secretaria de Educação Básica*—SEB) of the MEC, which in turn makes use of the PPDE of the National Fund for Education Development (*Fundo Nacional de Desenvolvimento da Educação*—FNDE) to ensure that the relevant schools have the means to receive the funds in their own chequing accounts. In 2012 a list of institutions eligible for the programme was created based on criteria defined by the SEB in conjunction with the National Secretariat of Citizenship Income (Senarc) of the MDS. The funds transferred to the schools are meant to reimburse their expenditures on food and transport for the monitors responsible for carrying out the activities, acquiring consumables and/or permanent property, costing and/or capital expenses and the acquisition of equipment for the chosen activities (MDS and MEC 2015).

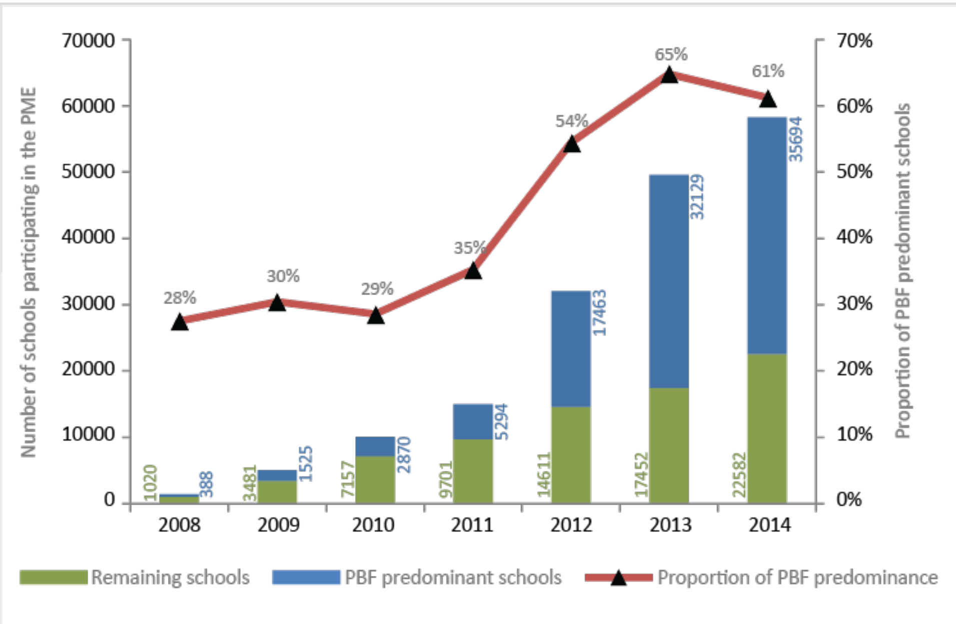
The MEC organises PME activities in 'macro-areas',[8] with each school allowed to choose three or four for development. Within each macro-area, schools can opt for five or six activities to be developed with their students. All schools must implement at least one activity under the 'Pedagogical Monitoring' macro-area. The MDS, in turn, reviews student records for PBF beneficiaries as part of its monitoring of the PBF conditionalities . This monitoring enables it to calculate the percentage of beneficiary students in each school, to help the MEC build the list of priority schools to take part in the PME.

This collaboration between ministries sought to improve the programme's focus in terms of criteria of social vulnerability—which, in previous years, had been mapped by the MEC through more diffuse means.[9] Thus, for the PME's current strategy, it was determined that the main criterion for the eligibility of schools would be the percentage of students from PBF beneficiary families, with the cutoff point defined as 50 per cent. As documented by the MDS (2012): "this set of 'PBF-predominant' schools was the reference for the pact established between the MEC (PME) and the MDS (PBF) in 2011, which led to impacts on the results achieved in terms of access to the PME in 2012 and continues to be a central reference for membership in 2013".

Moreover, the same document states that the partnership between the ministries "aims to ensure that the quality provided by full-time education is offered immediately to PBF beneficiary children and youth living in poverty, using the 'PBF-predominant' schools as the main selection criterion". Following this approach, these establishments became the de facto focus of the programme, more than trebling the number of schools compared to 2011, as shown in Figure 1. In 2012, the PME achieved a considerable increase in payments disbursed to schools, which amounted to over a billion Reais in the following years (See Table 1).

FIGURE 1

Number of schools participating in the PME, and proportion of PBF-predominant schools, 2008–2014



Source: MDS and MEC (2015).

TABLE 1

Financial resources dedicated to the PME in BRL millions

Year	Paid to schools	Increase
2008	BRL 29.208.276,40	-
2009	BRL 133.160.503,56	BRL 103.952.227,16
2010	BRL 370.427.152,01	BRL 237.266.648,45
2011	BRL 523.093.673,76	BRL 152.666.521,75
2012	BRL 894.941.872,59	BRL 371.848.198,83
2013	BRL 1.152.334.965,12	BRL 257.393.092,53
2014	BRL 1.096.020.462,06	-BRL 56.314.503,06

Source: FNDE/MEC—Sistema de Ações Educacionais.

Another approach that uses clear criteria, measurable against public databases at school level,[10] [11] is the observation of the schools with low IDEB scores. The *Operational Manual for Full-Time Education (Manual Operacional de Educação Integral)* (MEC 2012) established a selection criterion based on schools with IDEB scores below 4.2 in the early years of elementary education and below 3.8 in the final years. The year 2012 is, thus, a point of discontinuity in the PME's selection criterion, separating the newly treated schools by a fixed criterion. Those schools where more than 50 per cent of students are PBF beneficiaries are now on the right of the discontinuity timeline, with the others on the left. A similar situation would occur for schools with low IDEB scores,[12] which would have a better chance of participating in the intervention. These facts are a clear invitation to the adoption of a regression discontinuity design for the identification of the causal effects of the programme, with the added benefit that more new participating schools can be captured in that year than in any others. Before proceeding to this analysis, however, we dedicate the next section to an overview of the databases used to source data.

3 DATABASES

The databases used are summarised in Table 2, with educational institutions used as the observation unit. School performance indicators include dropout, failure and approval rates, as provided by the Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira (INEP) on its official website. The INEP also calculates the IDEB index based on data from *Prova Brasil* (Brazil Exam), compiling Portuguese and Maths approval and proficiency scores for students from the fifth and ninth years of elementary education.

Micro-data from the school census have made it possible to obtain enrolment numbers for each school at each educational stage. In addition, to control for covariates, we have calculated a School Infrastructure Index, based on physical resources and school services[13] available to schools in 2011 (i.e. the year before the beginning of the partnership between the MEC and the MDS). This calculation is made by principal component analysis, as seen in Soares and Sátyro (2010). Combining these elements into a single indicator enables comparison between eligible and non-eligible schools near the threshold.

Three additional databases were also used. These were not freely accessible but were made available following requests to the MDS and the MEC. The MDS has information (due to the

Attendance Project) on the number of PBF-beneficiary students in each school. This information was requested from the Department of Conditionalities (DECOM) of the MDS and, given the knowledge acquired from the new partnership with the MEC, allowed the identification of schools that had participated in the PME since 2008. This enabled an analysis focused only on newly participating schools that joined the PME in 2012. Since the monitoring of PBF students is carried out bimonthly, the October/November bimester of each year was chosen as a reference (based on advisory documentation (Melo 2015) and technical notes) to calculate the percentage of PBF-beneficiary students in each school.

Thus, the relationship between the presence of PBF-beneficiary students and the number of school enrolments should be seen as the composition of two variables that are not measured at the same time of year, since the latter is calculated by the school census, completed at the beginning of the year. Thus, a few inaccuracies may arise due to some degree of mobility of students between schools or even school systems within a given year. To avoid such inaccuracies, schools with 'over 100 per cent' PBF-beneficiary students were excluded from the analysis. Another important point, also based on advisory documents and technical notes (as well as management reports) is the fact that the PBF-predominant criterion was not defined on the basis of a single year. In other words, if a given school showed percentages above or below the cutoff in previous years, that fact would not be considered grounds for ineligibility to the PME.[14]

The MEC, in turn, granted us access to its interactive PDDE system, which records information[15] about schools participating in the PME (such as the number of students enrolled in the programme by school, and activities performed). At this point, it should be noted that the data held on the system do not allow users to obtain information on the students' level or the school grade in which PME participants are enrolled. The only available information is that the policy has a guideline to focus on students in the fourth, fifth, eigth and ninth years of elementary education, which will be the focus of the estimates presented.

Finally, the PME requires that schools have an Executing Unit to operationalise the transfer of funds. This means that schools can have their own bank account to receive and manage the money received for the programme. We also requested information from the FNDE regarding this information.[16] However, what we received were two spreadsheets with 2013 data, featuring a list of 'schools paid' and 'schools not paid' by the PME in that year. 'Schools not paid' were considered to be proxy schools without an Executing Unit[17] and, as such, were disregarded in the analysis.

TABLE 2

Databases used: institutions covered and periods

Database	Institution	Form of access and year
Performance rates (dropout, failure and approval)	INEP: school census	Website, 2012
IDEB, Maths and Portuguese proficiency	INEP: *Prova Brasil* (Brazil Exam) and school census	Website, 2013 [18]
Enrolment per school	(INEP, 2012)	Micro-data from the school census, 2012
Schools Infrastructure Index: covariates in the baseline.	INEP	Micro-data from the school census, 2011
Percentage of PME students per school, participation in the programme in previous years.	MDS	Database, 2010 onwards
Interactive PDDE system: number of students in the programme, activities to be developed.	MEC	Website
Executing Unit	FNDE: Coordination of the 'Money Directly to Schools' programme (CODDE)	Database

Source: Authors' elaboration.

4 EMPIRICAL STRATEGY

There is an array of techniques that can be used when assessing a public policy. Those include alternatives such as experiments and propensity score matching, as well as difference-in-differences, regression discontinuity and synthetic control models. In the context of the PME, as seen above, some of these techniques have already been employed. The contribution of this Working Paper is the use of the technique that most closely matches the experimental situation in question, with less need to control for other covariates: the regression discontinuity design. This is because it usually takes advantage of prior knowledge of public policy design—such as abrupt cuts in eligibility criteria—to obtain sufficiently similar groups. This procedure has been shown to be superior both for the control of observable variables and for the perception that unobservable effects, which might have an effect on the variable of interest, may be balanced between the groups (Imbens and Wooldridge 2009).

Ideally, it would be desirable to model the effect of the treatment—i.e. the school's participation in the PME—in the following manner: for each unit i, there are two potential outcomes—namely, when there is no exposure to treatment (let it be $\mathrm{Y_i(0)}$) and when there is exposure (let it be $\mathrm{Y_i(1)}$). The variable of interest is the difference between the two ($\mathrm{Y_i(1) - Y_i(0)}$). However, the main problem lies in the fact that this inference is not possible, since it would be impossible to observe pairs $\mathrm{Y_i(1)}$ and $\mathrm{Y_i(0)}$ at the same time. Thus, the usual approach is to focus on the average effects of this difference in sub-populations rather than at the individual level. Considering $\mathrm{D_i} \in \{0,1\}$ as the treatment indicator, the observed result can be written as (Imbens and Lemieux 2008):

$$\mathrm{Y_i = (1 - D_i).\,Y_i(0) + D_i.\,Y_i(1) = \begin{cases} Y_i(0) & \text{if} \quad D_i = 0, \\ Y_i(1) & \text{if} \quad D_i = 1. \end{cases}} \tag{1}$$

In addition to treatment $\mathrm{D_i}$ and result $\mathrm{Y_i}$, there may be interest in the effects of a vector of treatment variables or covariates $\mathrm{(X_i, Z_i)}$, in which $\mathrm{X_i}$ is a scalar and $\mathrm{Z_i}$ a dimensional vector M. For this study, $\mathrm{X_i}$ is the percentage of PBF beneficiary students in the school, calculated as $\max(\mathrm{PBF_{2010}, PBF_{2011}})$.

This variable can be associated with the educational indicator under study. However, it is assumed that the association takes place smoothly along X. As such, any discontinuity in the expected results of Y (conditioned to X) at the theshold c could be interpreted as evidence of a causal treatment effect.

Thus, a possible effect of the public policy on $\mathrm{c} = 0.50$ would be, for example, an increase in the average proficiency (or a decrease in dropout or failure rates) in PBF-predominant schools. When this occurs, the schools receiving the intervention can reach higher levels in the indicator of interest for the study. The question we wished to answer is how much of that shift is, in fact, causal and not related to other variables. Regression discontinuity design methods set a range around c wherein schools are sufficiently similar so that other forces would be unable to affect the indicator. Thus, when the discontinuity is sharp, the average causal effect of the treatment from the discontinuity point on is given by:

$$\tau_{\mathrm{sharp}} = \lim_{x \downarrow c} \mathrm{E[Y_i | X_i = x]} - \lim_{x \uparrow c} \mathrm{E[Y_i | X_i = x]}$$

$$= \mathrm{E[Y_i(1) - Y_i(0) | X_i = c]} \tag{2}$$

This type of identification is valid when c is defined exogenously. It can be argued that this occurs for the PME, since the calculation of the percentage of PBF-beneficiary students based on school attendance data is an assignment of the federal government, based on cross-checks made with data from the Attendance Project (MDS) and the school census. The latter, even when completed by the schools at the student level, does not collect information on PBF status,[19] since that programme belongs to the MDS. Moreover, there is a clear inflection in the policy and eligibility criteria for 2012: eligibility was based on data obtained prior to that year, so that the MDS could prepare a list of priority schools that could be accessed by the MEC.[20] Thus, both due to administrative capacity restrictions on the part of the bodies and levels of government involved[21] and in view of the time constraints in place, the eligibility criterion $(c = 0.50)$ certainly cannot be manipulated by an individual school or even a municipal administration.

While values higher than c provide a list of schools eligible to receive assistance, membership is not compulsory, as can be seen in MDS (2012). In this context, fuzzy regression discontinuity designs can cope with the possibility of self-selection, detaching the strict eligibility criterion for a selection likelihood *status*. Therefore, one is not to expect a 'jump' from 0 to 1 on the probability of selection from c onwards.

As seen in Imbens and Angrist (1994), the estimator of the average effect of the treatment for those who meet the selection criteria[22] is:

$$\tau_{RDif} = \frac{\lim_{x \downarrow c} E[Y|X = x] - \lim_{x \uparrow c} E[Y|X = x]}{\lim_{x \downarrow c} E[D|X = x] - \lim_{x \uparrow c} E[D|X = x]} \quad (3)$$

What is under discussion here, therefore, is the estimated relationship between two regressions: one of the change in educational indicator Y, and another related to treatment indicator D (Angrist and Pischke 2009). This is similar to what we see in studies with instrumental variables. According to Fan and Gijbels (1996), regressions can be estimated by local linear regression or non-parametrically (Hahn et al. 2001). In the first case, linear regression functions are estimated for observation with a distance of h on each side—left (l) and right (r)—such that $Y = \alpha_l + f_l(X - c) + \varepsilon$ and $Y = \alpha_r + f_r(X - c) + \varepsilon$.

The effect τ of the treatment is obtained by the difference between these two intercepts $(\tau = \hat{\alpha}_r - \hat{\alpha}_l)$.

More directly, a pooled regression must be estimated on both sides of the cutoff for a given distance h in such a manner that the interval $X - h \leq c \leq X + h$ is defined as that in which the regressions are estimated so as to obtain:[23]

$$Y = \alpha_l + \tau D + f(X - c) + \varepsilon \quad (4)$$

in which $f(X - c) = f_l(X - c) + D[f_r(X - c) - f_l(X - c)]$ and the eligibility variable is set to $X = \text{Percentage of PBF} = \max\{\text{PercPBF}_{2010}, \text{PercPBF}_{2011}\}$ as the maximum value of the percentage of PBF beneficiaries in years prior to 2012.

Although one cannot ascertain the exact effect throughout the PBF percentage distribution (external validity limitation), the regression discontinuity design provides increased internal validity, making its estimates more credible and causal than selection methods on observables, for example. It should be added that it is desirable to perform tests for slope changes on each side of the discontinuity (H_0: $\beta_2 = 0$). One way to do this would be the interaction of terms D and X around c. This process is described in the following expression, in the linear case:

$$Y = \alpha + \tau D + \beta_1 (X - c) + \beta_2 D(X - c) + \varepsilon \quad (5)$$

Since the problem in question constitutes a fuzzy discontinuity regression, we must estimate $\widehat{D}$ and $D\widehat{(X - c)}$ at a first stage, which is obtained by:

$$D = \gamma_1 + \delta_1 T + \delta_2 (X - c) + \delta_3 T(X - c) + v_1 \quad (6)$$

$$D(X - c) = \gamma_2 + \delta_4 T + \delta_5 (X - c) + \delta_6 T(X - c) + v_2 \quad (7)$$

in which Y is the variable of interest in terms of impacts, D is a dummy variable that denotes whether the school received treatment, $(X - c)$ is the distance to the eligibility variable cutoff, T is an instrument that denotes whether the school was above or below the eligibility criteria to receive the policy, and ε, v are random error terms.

There may also be interest in the heterogeneous effects (R) of the policy. This is because a given school may enrol a greater number of students on alternate shift activities, or provide more or fewer pedagogical monitoring activities, which could lead to some variation beyond the average treatment effects obtained from the previous equations. Thus, the regressions below specify those situations in the specific bandwidths of the eligibility criteria (to ensure that the econometric identification is similar), and also address the issue that even very similar schools may participate to different degrees. Consequently, we have the following two-stage model, the first of which instrumentalises the heterogeneous effect R:

$$Y = \alpha + \tau R + \theta_1 T(X - c) + \theta_2 (1 - T)(X - c) + \varepsilon \quad (8)$$

$$R = \gamma + \varphi_1 T + \varphi_2 T(X - c) + \varphi_3 (1 - T)(X - c) + v \quad (9)$$

The criterion of low IDEB score for prioritising schools was not taken into account in econometric identification, because there was no empirical evidence[24] of discontinuity changes on the probability of being treated around IDEB's thresholds. Thus, the PBF-majority criterion became the only relevant one for our case, allowing a much simpler analysis in which the framework described in this article is sufficient for econometric identification.[25]

5 RESULTS

5.1 GENERAL RESULTS

When using a regression discontinuity design, the choice of the appropriate bandwidth does not always occur based on a single criterion. There are cross-validation methods that seek to find optimal bands, but they are not always adopted, be it due to the significant reduction in sample size or the selection of bands that do not represent an equilibrium of other characteristics between the observation units. Taking this into consideration, the results shown in this study are reported for five different bandwidths—namely, 10 per cent, 5 per cent, 2.5 per cent, 1.25 per cent and 0.5 per cent above or below c.

Table 3 denotes the difference between PBF-minority and PBF-majority schools, with a comparison of mean differences between the two sides of the cutoff threshold and the p-value for the mean difference tests. It summarises the differences in location, size (number of employees), infrastructure and services (such as the availability of school meals) for these schools. For the last two, we show both the synthetic indicator (calculated from multiple variables via principal component analysis) and some of the individual variables that it comprises.

The largest bandwidth indicates schools that differ from each other in several aspects. PBF-minority schools are more concentrated in the South and Midwest than in the North and Northeast regions, and have better infrastructure and more employees than PBF-majority ones. Differences decrease for the next bandwidth (5 per cent), and there is no fundamental difference in infrastructure in the 2.5 per cent, 1.25 per cent and 0.5 per cent bands.

Figure 2 confirms this point. The synthetic infrastructure indicator decreases (as expected) for schools with higher percentages of PBF-beneficiary students. Furthermore, no discontinuity is perceived in the vicinity of the cutoff line. This fact ensures that, for those bands, it is possible to compare very similar schools in terms of practically any characteristic. As a result, any variation in the likelihood of these schools participating in the PME and then improving (or not) their educational indicators can be attributed exclusively to their participation in the programme.

Thus, Figure 3 indicates that urban schools to the right of the cutoff line seem to have about a 20 percentage point higher chance of being selected than schools to the left of the cutoff line exclusively as a result of the eligibility criterion. This fact is verified both by the linear quadratic adjustment lines (see Appendix A1). Moreover, we see a similar pattern in terms of selection for early and final years of elementary education. The same graphs are presented in the appendix for rural schools. We note that, in these cases, the PBF-majority criterion was not essential for the eligibility of schools.[26]

The 'jump' in the likelihood of selection is perceived in the same way in the first-stage regressions (Table 3). Indeed, the mere fact that the schools are above or below the eligibility criterion accounted for a change of about 20 percentage points in the likelihood of participation in the PME in 2012. This situation occurs in specifications both with and without interaction terms. The latter, in turn, does not seem to indicate slope changes in each side of the cutoff line, which is why the results of the second stage of this specification are attached to the appendix.

As already seen from Table 3, similar schools tend to be found very close to the cutoff, in particular at distances of 2.5 percentage points or less. Now, with the results of the first-stage regressions, intervals $h = 0.0250$ and $h = 0.0125$ emerge as ideal. This is because smaller approximations ($h = 0.0050$) reduce the statistical significance and return more rarified observations. Thus, these two bands will be more significant in estimating the impact of the programme and, subsequently, the heterogeneous effects of interest.

TABLE 3

Mean difference between PBF-minority and PBF-majority urban schools in different bandwidths

General mean	h = 0.1000	h = 0.0500	h = 0.0250	h = 0.0125	h = 0.0050
			Region		
2.91	0.346*** (0.000)	0.160*** (0.000)	0.0470 (0.417)	-0.0244 (0.767)	0.0463 (0.722)
			Infrastructure		
1.23	0.390*** (0.000)	0.133** (0.005)	0.0918 (0.169)	-0.000551 (0.995)	0.0523 (0.736)
			Number of employees		
50.05	2.277*** (0.000)	1.401 (0.052)	1.110 (0.269)	-0.406 (0.773)	-2.284 (0.309)
			Number of rooms		
12.54	1.060*** (0.000)	0.298 (0.161)	-0.522 (0.075)	-1.229** (0.008)	-1.551* (0.017)
			Number of computers		
20.71	2.171*** (0.000)	1.313 (0.186)	1.010 (0.077)	1.181 (0.102)	1.476 (0.218)
	Existence of principal's room	id_principal's_room	id_principal's_room	id_principal's_room	id_principal's_room
0.95	0.00259 (0.667)	-0.000914 (0.915)	0.0128 (0.284)	0.00727 (0.675)	0.0192 (0.413)
	Existence of teacher's room	id_principal's_room	id_principal's_room	id_principal's_room	id_principal's_room
0.87	0.0776*** (0.000)	0.0590*** (0.000)	0.0574** (0.002)	0.0660* (0.014)	0.0617 (0.147)
	Power from public utility	id_public_ utility_power	id_public_ utility_power	id_public_ utility_power	id_public_ utility_power
1	-0.000243 (0.386)	-0.000533 (0.348)	-0.00108 (0.351)	0 (,)	0 (,)
	Internet	id_internet	id_internet	id_internet	id_internet
0.92	0.0402*** (0.000)	0.0125 (0.258)	0.00928 (0.556)	0.0127 (0.560)	0.0736* (0.043)
	Periodic garbage collection	id_periodic_garbage _collection	id_periodic_garbage _collection	id_periodic_garbage _collection	id_periodic_garbage _collection
0.99	0.00743** (0.008)	-0.000182 (0.961)	-0.00672 (0.156)	-0.0145* (0.036)	-0.0225 (0.081)
			Water from public utility		
0.93	0.0121* (0.047)	0.000545 (0.949)	-0.00140 (0.905)	-0.0222 (0.170)	0.0235 (0.392)
			Sewage (public utility)		
0.65	0.0756*** (0.000)	0.00978 (0.562)	-0.0176 (0.465)	-0.0354 (0.300)	-0.0344 (0.531)
	Library	id_library	id_library	id_library	id_library
0.59	0.0376** (0.002)	0.0157 (0.349)	0.00507 (0.832)	-0.00239 (0.944)	0.00605 (0.912)
	Open-air sports court	id_open_air_ sports_court	id_open_air_ sports_court	id_open_air_ sports_court	id_open_air_ sports_court
0.29	0.0624*** (0.000)	0.0278* (0.039)	0.0166 (0.390)	0.0176 (0.503)	0.0233 (0.550)
	School meal availability	id_school_meal	id_school_meal	id_school_meal	id_school_meal
0.8	-0.0169*** (0.000)	-0.00474 (0.330)	0.00507 (0.447)	0.00451 (0.555)	0.0179 (0.122)

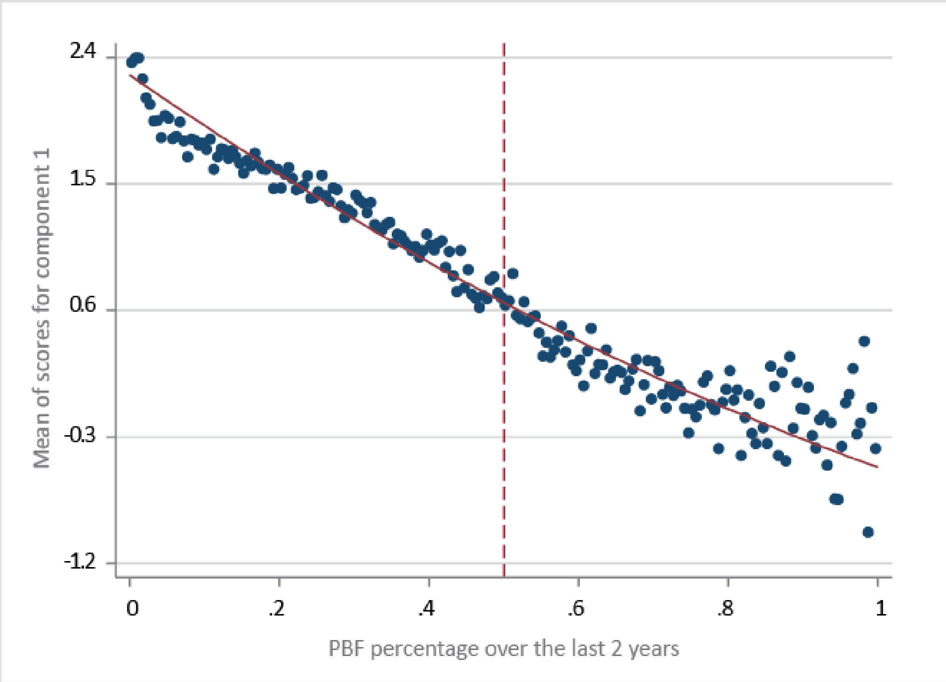
(†) It is possible that universal access to electricity has generated no variation in certain bandwidths, in the category 'Power from public utility'.

Note: p-value in parentheses (* p <.05; ** p<.01; and *** p <.001).

Source: Authors' elaboration.

FIGURE 2

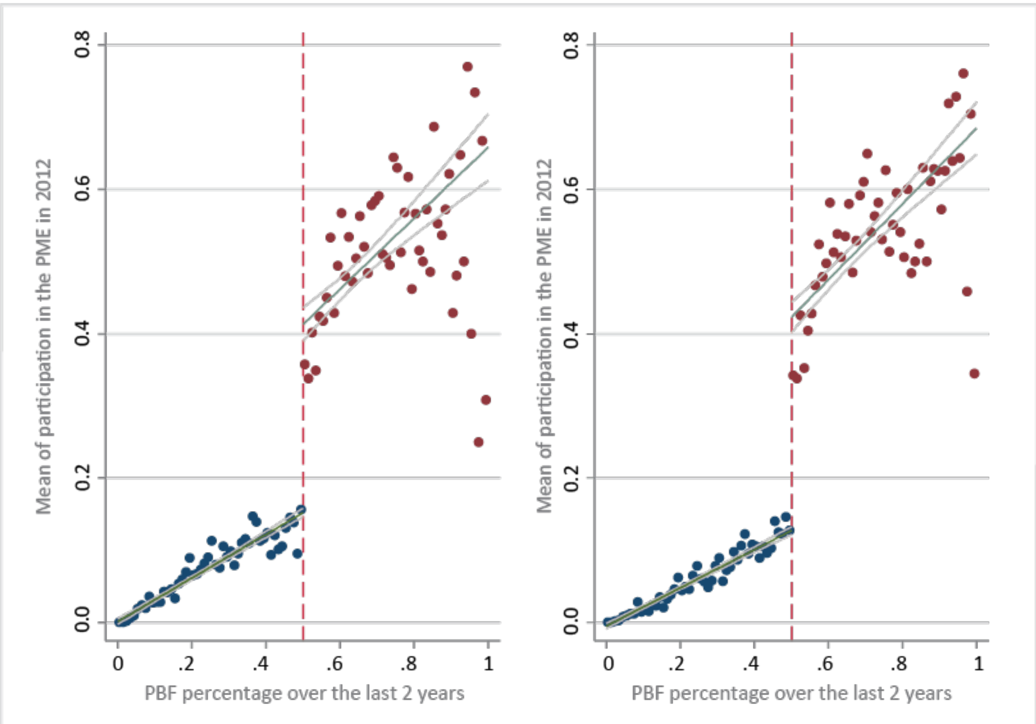
Infrastructure indicator in 2011 throughout the PBF distribution (per cent): quadratic adjustment, urban schools



Source: Authors' elaboration.

FIGURE 3

Likelihood of treatment throughout the PBF distribution (per cent): linear adjustment, urban schools, early years (A) and final years (B)



Source: Authors' elaborationAuthors' elaboration.

In the second stage, 24 regressions are estimated via bootstrap with 1000 repetitions,[27] separated into 12 variables of interest for early years (first to fifth) and 12 for the final years (sixth to ninth) of elementary education. These variables are: 2012 performance rates (dropout, rejection and approval) for each stage and also in the specific years for which the policy is recommended (fourth, fifth, eighth and ninth years) of elementary education; Maths and Portuguese proficiency; and IDEB scores. Regarding the latter, it should be noted that it is also a way to capture the persistence of the policy, since the IDEB of interest is measured in 2013—i.e. after two years of treatment for schools participating in the programme.

One notices, again for the five intervals adopted, no positive impact in performance indicators for students in the first five years (early years) of elementary education (see Table 5). It is also not possible to observe, especially in intervals $h = 0.0250$ and $h = 0.0125$, statistically significant improvements in all the educational indicators of interest within the 95 per cent confidence interval. There is only one positive result at this confidence level, but only in interval $h = 0.0125$ and only for Portuguese scores. However, this result does not seem to be robust, since it is not repeated in any other indicator or any other bandwidth. Therefore, there is no way to be certain that this represents a significant gain attributable to the policy, rather than, for example, a simple statistical fluctuation.

Table 6, in turn, confirms similar results for the final years of elementary education. In summary, there is no evidence of causal impacts of the programme on the educational indicators of urban schools participating in the PME in 2012 or on IDEB indices and proficiency in 2013. However, it can be seen that the recent partnership between the MEC and the MDS did, in fact, lead to vulnerable schools being selected, based on the programme's focus on PBF-majority schools.

TABLE 4

First-stage results

	Model without interaction					Model with interaction				
D	h = 0.1000	h = 0.0500	h = 0.0250	h = 0.0125	h = 0.0050	h = 0.1000	h = 0.0500	h = 0.0250	h = 0.0125	h = 0.0050
T	0.193 ***	0.193 ***	0.188 ***	0.198 ***	0.113	0.183 ***	0.188 ***	0.181 ***	0.216 ***	0.098
	(0.020)	(0.030)	(0.042)	(0.059)	(0.090)	(0.020)	(0.030)	(0.042)	(0.061)	(0.109)
(X-c)	1.061 ***	0.913 *	1.068	-0.214	22.776	0.492 **	0.214	-0.155	3.712	20.602
	(0.174)	(0.513)	(1.440)	(4.150)	(15.186)	(0.226)	(0.695)	(1.888)	(5.364)	(17.426)
T(X-c)						1.392 ***	1.540	2.923	-9.768	9.112
						(0.353)	(1.031)	(2.919)	(8.462)	(35.678)
Constant	0.219 ***	0.203 ***	0.197 ***	0.180 ***	0.238 ***	0.189 ***	0.186 ***	0.182 ***	0.201 ***	0.233 ***
	(0.011)	(0.016)	(0.023)	(0.030)	(0.044)	(0.014)	(0.020)	(0.027)	(0.036)	(0.047)
N	7205	3530	1738	866	356	7205	3530	1738	866	356
D(X-c)										
T						-0.002 **	-0.001	-0.001	0.000	0.000
						(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
(X-c)						0.142 ***	0.175 ***	0.197 ***	0.183 ***	0.166 ***
						(0.013)	(0.020)	(0.028)	(0.038)	(0.050)
T(X-c)						0.418 ***	0.288 ***	0.256 ***	0.156 ***	0.358 ***
						(0.020)	(0.030)	(0.043)	(0.060)	(0.103)
Constant						-0.001	0.000	0.000	0.000	0.000
						(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
N						7205	3530	1738	866	356

Note: Urban schools with over 100 students.

Source: Authors' elaboration.

TABLE 5

Second-stage results: performance, proficiency and IDEB rates in early years of elementary education

	Dropout years 1–5	Dropout year 4	Dropout year 5	Failure years 1–5	Failure year 4	Failure year 5	Approval years 1–5	Approval year 4	Approval year 5	Maths year 5	Portuguese year 5	IDEB early years
	h = 0.1000									h = 0.1000		
D (estimated)	0.012	0.011	0.01	0.01	0.015	0.036	-0.022	-0.026	-0.047	-0.167	-2.567	-0.292
	(0.008)	(0.010)	(0.011)	(0.018)	(0.028)	(0.025)	(0.022)	(0.032)	(0.030)	(7.322)	(6.327)	(0.303)
(X-c)	0.037 *	0.049 *	0.054 *	0.132 ***	0.225 ***	0.111 *	-0.17 ***	-0.274 ***	-0.165 **	-98.319 ***	-79.716 ***	-3.395 ***
	(0.022)	(0.027)	(0.028)	(0.047)	(0.071)	(0.065)	(0.058)	(0.081)	(0.076)	(19.258)	(16.600)	(0.789)
Constant	0.012 ***	0.012 ***	0.015 ***	0.075 ***	0.08 ***	0.069 ***	0.913 ***	0.908 ***	0.916 ***	205.19 ***	189.168 ***	4.97 ***
	(0.003)	(0.003)	(0.003)	(0.006)	(0.009)	(0.008)	(0.007)	(0.010)	(0.010)	(2.347)	(2.022)	(0.097)
N	5819	5526	5528	5819	5526	5528	5819	5526	5528	4620	4620	4620
	h = 0.0500									h = 0.0500		
D (estimated)	0.011	0.022 *	0.002	0.008	0.021	0.029	-0.019	-0.043	-0.031	4.963	0.363	-0.102
	(0.012)	(0.013)	(0.015)	(0.027)	(0.039)	(0.039)	(0.033)	(0.043)	(0.045)	(10.615)	(9.277)	(0.439)
(X-c)	0.048	-0.005	0.109	0.145	0.191	0.162	-0.193	-0.187	-0.271	-126.442 ***	-97.091 **	-4.549 **
	(0.050)	(0.056)	(0.068)	(0.115)	(0.160)	(0.164)	(0.140)	(0.179)	(0.189)	(43.904)	(38.387)	(1.822)
Constant	0.013 ***	0.008 **	0.017 ***	0.077 ***	0.08 ***	0.074 ***	0.91 ***	0.911 ***	0.908 ***	203.187 ***	187.848 ***	4.891 ***
	(0.004)	(0.004)	(0.005)	(0.008)	(0.012)	(0.012)	(0.010)	(0.013)	(0.013)	(3.204)	(2.792)	(0.132)
N	2873	2731	2719	2873	2731	2719	2873	2731	2719	2260	2260	2260
	h = 0.0250									h = 0.0250		
D (estimated)	0.014	0.005	0.006	0.023	-0.011	0.035	-0.037	0.006	-0.04	9.354	9.851	0.298
	(0.015)	(0.019)	(0.019)	(0.040)	(0.060)	(0.055)	(0.046)	(0.066)	(0.063)	(15.861)	(14.024)	(0.654)
(X-c)	0.011	0.142	0.065	0	0.483	0.167	-0.012	-0.625	-0.231	-179.714	-198.51 *	-8.693 *
	(0.117)	(0.148)	(0.156)	(0.291)	(0.430)	(0.405)	(0.344)	(0.475)	(0.461)	(121.125)	(106.479)	(5.003)
Constant	0.011 ***	0.013 **	0.015 ***	0.073 ***	0.091 ***	0.073 ***	0.915 ***	0.896 ***	0.912 ***	202.519 ***	185.57 ***	4.806 ***
	(0.004)	(0.005)	(0.006)	(0.012)	(0.017)	(0.016)	(0.014)	(0.019)	(0.018)	(4.571)	(4.018)	(0.188)
N	1406	1339	1339	1406	1339	1339	1406	1339	1339	1096	1096	1096
	h = 0.0125									h = 0.0125		
D (estimated)	0.029	0.027	0.013	0.022	-0.049	-0.029	-0.051	0.021	0.016	35.076 *	36.338 **	1.247
	(0.019)	(0.023)	(0.027)	(0.054)	(0.082)	(0.080)	(0.063)	(0.089)	(0.090)	(20.278)	(17.990)	(0.867)
(X-c)	-0.178	-0.291	-0.009	-0.013	1.231	1.269	0.191	-0.939	-1.26	-593.089 **	-643.29 ***	-23.8 **
	(0.259)	(0.293)	(0.339)	(0.729)	(1.059)	(1.096)	(0.850)	(1.168)	(1.236)	(262.631)	(231.311)	(11.277)
Constant	0.006	0.006	0.013 *	0.073 ***	0.098 ***	0.089 ***	0.921 ***	0.895 ***	0.899 ***	196.188 ***	179.334 ***	4.595 ***
	(0.005)	(0.006)	(0.007)	(0.015)	(0.023)	(0.022)	(0.017)	(0.025)	(0.025)	(5.572)	(4.920)	(0.236)
N	716	678	677	716	678	677	716	678	677	562	562	562
	h = 0.0050									h = 0.0050		
D (estimated)	0.044	-0.017	0.04	0.017	-0.016	-0.176	-0.061	0.033	0.136	91.645 *	88.213 *	4.01 *
	(0.049)	(0.053)	(0.068)	(0.142)	(0.209)	(0.196)	(0.162)	(0.224)	(0.222)	(55.301)	(48.880)	(2.293)
(X-c)	-1.141	1.512	-1.483	0.552	0.701	9.834	0.589	-2.213	-8.35	-3812.89 *	-3597.17 *	-172.513 *
	(1.828)	(2.429)	(2.675)	(5.773)	(8.562)	(8.159)	(6.514)	(9.261)	(9.111)	(2296.858)	(2012.854)	(94.415)
Constant	0.003	0,02	0.006	0.079 *	0.101 *	0.133 **	0.918 ***	0.88 ***	0.861 ***	177.2 ***	162.367 ***	3.71 ***
	(0.013)	(0.016)	(0.019)	(0.042)	(0.060)	(0.057)	(0.047)	(0.065)	(0.064)	(15.964)	(14.040)	(0.660)
N	297	278	281	297	278	281	297	278	281	225	225	225

Note: Urban schools with over 100 students. Each regression used a bootstrap with 1000 repetitions.
Source: Authors' elaboration.

TABLE 6

Second-stage results: performance, proficiency and IDEB rates in final years of elementary education

	Dropout years 6–9	Dropout year 8	Dropout year 9	Failure years 6–9	Failure year 8	Failure year 9	Approval years 6–9	Approval year 8	Approval year 9	Maths year 9	Portuguese year 9	IDEB final years
					h = 0.1000						h = 0.1000	
D (estimated)	-0.018	-0.018	-0.018	-0.013	-0.013	-0.013	0.031	0.031	0.031	-4.679	-1.462	0.032
	(0.021)	(0.021)	(0.021)	(0.032)	(0.032)	(0.032)	(0.041)	(0.041)	(0.041)	(7.497)	(6.860)	(0.329)
(X-c)	0.182 ***	0.182 ***	0.182 ***	0.209 **	0.209 **	0.209 **	-0.391 ***	-0.391 ***	-0.391 ***	-32.321 *	-38.948 **	-2.578 ***
	(0.056)	(0.056)	(0.056)	(0.085)	(0.085)	(0.085)	(0.109)	(0.109)	(0.109)	(19.417)	(18.091)	(0.848)
Constant	0.055 ***	0.055 ***	0.055 ***	0.136 ***	0.136 ***	0.136 ***	0.809 ***	0.809 ***	0.809 ***	240.848 ***	234.987 ***	3.782 ***
	(0.007)	(0.007)	(0.007)	(0.010)	(0.010)	(0.010)	(0.013)	(0.013)	(0.013)	(2.374)	(2.150)	(0.104)
N	4001	4001	4001	4001	4001	4001	4001	4001	4001	2978	2978	2978
					h = 0.0500						h = 0.0500	
D (estimated)	-0.031	-0.031	-0.031	0.026	0.026	0.026	0.004	0.004	0.004	-1.282	-2.366	0.028
	(0.028)	(0.028)	(0.028)	(0.044)	(0.044)	(0.044)	(0.056)	(0.056)	(0.056)	(10.473)	(9.591)	(0.469)
(X-c)	0.221 *	0.221 *	0.221 *	0.016	0.016	0.016	-0.237	-0.237	-0.237	-50.511	-34.279	-2.423
	(0.115)	(0.115)	(0.115)	(0.184)	(0.184)	(0.184)	(0.232)	(0.232)	(0.232)	(43.013)	(39.860)	(1.940)
Constant	0.059 ***	0.059 ***	0.059 ***	0.128 ***	0.128 ***	0.128 ***	0.813 ***	0.813 ***	0.813 ***	239.359 ***	234.588 ***	3.752 ***
	(0.009)	(0.009)	(0.009)	(0.013)	(0.013)	(0.013)	(0.017)	(0.017)	(0.017)	(3.130)	(2.842)	(0.141)
N	1949	1949	1949	1949	1949	1949	1949	1949	1949	1450	1450	1450
					h = 0.0250						h = 0.0250	
D (estimated)	0.007	0.007	0.007	0.021	0.021	0.021	-0.028	-0.028	-0.028	-17.874	-19.045	-0.451
	(0.043)	(0.043)	(0.043)	(0.066)	(0.066)	(0.066)	(0.085)	(0.085)	(0.085)	(15.374)	(13.811)	(0.670)
(X-c)	-0.143	-0.143	-0.143	0.043	0.043	0.043	0.099	0.099	0.099	90.726	116.795	2.12
	(0.332)	(0.332)	(0.332)	(0.499)	(0.499)	(0.499)	(0.650)	(0.650)	(0.650)	(112.619)	(103.958)	(5.019)
Constant	0.049 ***	0.049 ***	0.049 ***	0.13 ***	0.13 ***	0.13 ***	0.82 ***	0.82 ***	0.82 ***	244.48 ***	239.67 ***	3.899 ***
	(0.013)	(0.013)	(0.013)	(0.019)	(0.019)	(0.019)	(0.025)	(0.025)	(0.025)	(4.502)	(4.024)	(0.195)
N	966	966	966	966	966	966	966	966	966	722	722	722
					h = 0.0125							
D (estimated)	0.031	0.031	0.031	0.072	0.072	0.072	-0.103	-0.103	-0.103	-2.508	-0.03	-0.323
	(0.053)	(0.053)	(0.053)	(0.089)	(0.089)	(0.089)	(0.114)	(0.114)	(0.114)	(20.174)	(18.772)	(0.887)
(X-c)	-0.467	-0.467	-0.467	-1.262	-1.262	-1.262	1.728	1.728	1.728	-173.514	-212.836	0.304
	(0.772)	(0.772)	(0.772)	(1.263)	(1.263)	(1.263)	(1.619)	(1.619)	(1.619)	(274.371)	(253.830)	(12.608)
Constant	0.042 ***	0.042 ***	0.042 ***	0.115 ***	0.115 ***	0.115 ***	0.843 ***	0.843 ***	0.843 ***	241.098 ***	235.374 ***	3.902 ***
	(0.015)	(0.015)	(0.015)	(0.024)	(0.024)	(0.024)	(0.031)	(0.031)	(0.031)	(5.655)	(5.276)	(0.250)
N	477	477	477	477	477	477	477	477	477	358	358	358
					h = 0.0050						h = 0.0050	
D (estimated)	0.165	0.165	0.165	0.07	0.07	0.07	-0.235	-0.235	-0.235	-7.147	0.723	0.015
	(0.137)	(0.137)	(0.137)	(0.250)	(0.250)	(0.250)	(0.298)	(0.298)	(0.298)	(53.083)	(50.111)	(2.333)
(X-c)	-7.344	-7.344	-7.344	-1.858	-1.858	-1.858	9.202	9.202	9.202	296.533	-31.941	-4.857
	(6.001)	(6.001)	(6.001)	(10.172)	(10.172)	(10.172)	(12.225)	(12.225)	(12.225)	(2174.091)	(2028.848)	(94.396)
Constant	0.004	0.004	0.004	0.112	0.112	0.112	0.884 ***	0.884 ***	0.884 ***	243.642 ***	236.466 ***	3.855 ***
	(0.038)	(0.038)	(0.038)	(0.072)	(0.072)	(0.072)	(0.085)	(0.085)	(0.085)	(15.624)	(14.710)	(0.683)
N	206	206	206	206	206	206	206	206	206	144	144	144

Note: Urban schools with over 100 students. Each regression used a bootstrap with 1000 repetitions. Source: Authors' elaboration.

The results found here are not generalisable for the entire distribution of schools in other years of the programme or even rural schools. This is because the methodology used in this Working Paper, as noted above, is capable of detecting causal relationships around the eligibility criterion but has some external validity limitations. The following subsection demonstrates that there is no possibility of manipulation of the PME participation by the schools.

5.1.1 McCrary test

A sufficient condition for identification is the continuity in the density of the assignment variable. This hypothesis would not be plausible if the agents were able to manipulate this variable—for example, to gain access to the programme (McCrary 2008). One example often cited in the literature occurred in Colombia, specifically involving the manipulation of a poverty index to allow cities to receive social programme subsidies (Camacho and Conover 2011).

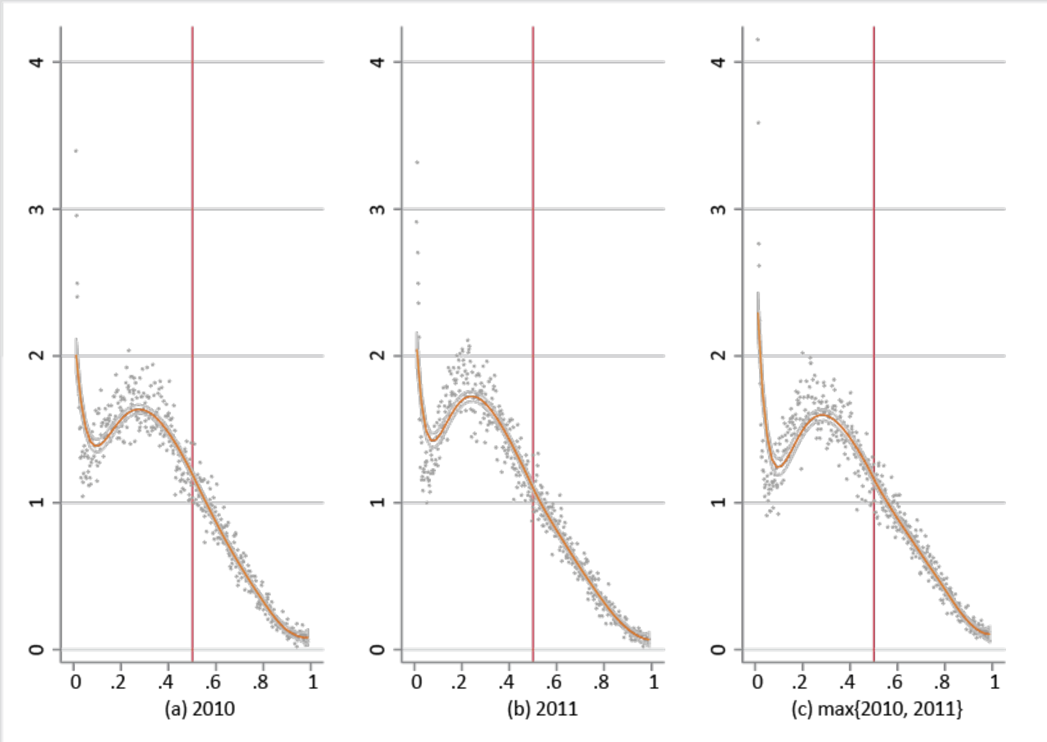
To test whether this occurred with the PME, two key points must be considered. One has to do with the institutional separation from the agency responsible for calculating the percentage of PBF-beneficiary students to generate the list of priority eligible schools. Another has to do with the way the eligibility variable is built. Even if it is at the maximum value for the two-year period, at no point is it construable as an attempt by the school (or by the city government) to manipulate access to the programme.

To understand this fact, one need only consider that the MDS calculates the percentage of PBF-beneficiary students based on its own records for the Attendance Project—whose data are restricted—and on enrolment data from the school census. In addition, Sections 2 and 4 show that the choice of 2012 as the basis for our selection—i.e. when the MEC–MDS partnership began, including the definition of the priority schools list based on data from the previous year—did not show evidence of strategic behaviour. This scenario, by itself, not only represents a strong institutional argument against the hypothesis of manipulation but also attests to the fact that choosing the first year of this partnership was a wise decision regarding our search for correct identification.

Approximately 45,000 of the 53,000 PBF-majority schools in 2011 also met the criterion in 2010. Because of this, there was concern from policymakers regarding the need to ensure that the criterion was not overly ‘strict’ when excluding schools. As stated above, PBF-majority schools that maintained that status for over a year were confirmed as priorities. This scenario, however, does not characterise any possibility of individual self-selection by the participating schools, based on unobservable variables, that would render moot the comparison between ‘treated’ and ‘control’ schools around the cutoff line. Note that no sign of discontinuity is found in the percentage of PBF-beneficiary students enrolled in the schools for (a) 2010; (b) 2011; and (c) $\max\{2010,2011\}$ (see Figure 4). This fact ensures that the identifying assumption is good.

FIGURE 4

Density of the eligibility variable



Notes: (a) Percentage of PBF-beneficiary students in 2010;

(b) Percentage of PBF-beneficiary students in 2011; and

(c) Maximum percentage of PBF-beneficiary students in 2010 or 2011.

Since there is a significant number of schools without any PBF-beneficiary students and schools where all students were PBF beneficiaries, visual inspections of the chart become impaired. Therefore, to build them, the estimates comprised all schools where between 1 per cent and 99 per cent of students were PBF beneficiaries.

Urban schools with over 100 students.

Source: Authors' elaboration.

5.2 HETEROGENEOUS RESULTS

Given that no robust evidence has been found in terms of effects of the average treatment, new specifications were carried out to observe any heterogeneity in the participation of schools. The intention here is to test the hypothesis of whether schools that enrolled a higher percentage of students in the programme or used a higher number of pedagogical monitoring activities (in addition to the compulsory ones) would obtain better results than the others. All regressions are estimated only around bandwidths, as described hitherto. The difference here is that results are now only estimated around $h = 0.0250$ and $h = 0.0125$, because we already know that the schools are more similar, with a positive and statistically significant likelihood of selection.

The coefficients in Table 7 are based on the first-stage heterogeneous effect equations shown in Section 4.1. Now variable R remains a dummy variable to be instrumentalised. It takes the value of 1 when the school has two or more macro-areas defined as 'Pedagogical Monitoring Activity', and 0 otherwise. In another situation, R is a continuous variable that denotes the percentage of students that the school wishes to enrol in activities during the alternative shift. Note that being above the eligibility criterion T remains a statistically significant instrument.

TABLE 7

Heterogeneous effects: first-stage results

	Percentage of students in the PME				Two or more pedagogical monitoring macro-areas			
	h = 0.0250		h = 0.0125		h = 0.0250		h = 0.0125	
T	0.08	***	0.086	**	0.095	***	0.132	**
	(0.028)		(0.039)		(0.036)		(0.052)	
T(X-c)	3.442	**	-1.112		2.398		-2.821	
	(1.486)		(4.153)		(1.875)		(5.589)	
(1-T)(X-c)	-0.341		3.862		1.038		0.801	
	(1.261)		(3.404)		(1.591)		(4.581)	
Constant	0.093	***	0.113	***	0.118	***	0.119	***
	(0.018)		(0.023)		(0.023)		(0.031)	
N	1738		866		1738		866	

Note: Urban schools with over 100 students.

Source: Authors' elaboration.

The second stage indicates the absence of positive and non-linear effects in accordance with the intensity with which the school enrols its students in the PME. In the two bands selected, students of the schools do not seem to obtain better performance rates, nor does their proficiency in the early years (Table 8) and final years (Table 9) of elementary education seem to be affected. Similarly, one cannot affirm that there are positive effects in schools that report more than one macro-area in their educational support activities.

TABLE 8

Heterogeneous results according to the percentage of students in the PME and educational monitoring activities: early years of elementary education

	Dropout years 1–5	Dropout year 4	Dropout year 5	Failure years 1–5	Failure year 4	Failure year 5	Approval years 1–5	Approval year 4	Approval year 5	Maths year 5	Portuguese year 5	IDEB early years
					h = 0.0250						h = 0.0250	
per cent students in PME	0.019	0.012	-0.003	0.046	-0.063	0.044	-0.066	0.051	-0.042	15.021	18.809	0.529
	(0.036)	(0.049)	(0.049)	(0.091)	(0.142)	(0.134)	(0.108)	(0.157)	(0.153)	(37.223)	(32.289)	(1.542)
T(X-c)	0.067	0.113	0.176	-0.028	0.955	0.223	-0.039	-1.068	-0.399	-124.535	-208.239	-9.381
	(0.285)	(0.416)	(0.371)	(0.630)	(1.018)	(0.915)	(0.776)	(1.134)	(1.072)	(261.860)	(226.072)	(10.851)
(1-T)(X-c)	-0.035	0.104	0.032	-0.03	0.412	0.196	0.065	-0.516	-0.228	-166.124	-148.686	-6.236
	(0.134)	(0.115)	(0.172)	(0.320)	(0.490)	(0.457)	(0.377)	(0.533)	(0.503)	(133.385)	(117.123)	(5.481)
Constant	0.011 **	0.013 **	0.016 **	0.073 ***	0.095 ***	0.075 ***	0.915 ***	0.893 ***	0.908 ***	202.968 ***	186.121 ***	4.839 ***
	(0.004)	(0.006)	(0.006)	(0.012)	(0.019)	(0.018)	(0.014)	(0.021)	(0.020)	(4.954)	(4.278)	(0.203)
N	1370	1307	1305	1370	1307	1305	1370	1307	1305	1069	1069	1069
					h = 0.0125						h = 0.0125	
per cent students in PME	0.076	0.073	0.028	0.076	-0.062	-0.127	-0.151	-0.011	0.099	75.216	79.287 *	2.856
	(0.050)	(0.054)	(0.064)	(0.134)	(0.197)	(0.182)	(0.157)	(0.208)	(0.212)	(48.043)	(42.808)	(2.070)
T(X-c)	-0.503	-0.428	-0.242	-0.431	-0.657	2.034	0.935	1.085	-1.791	-301.132	-409.009	-18.665
	(0.448)	(0.420)	(0.510)	(1.062)	(1.732)	(1.539)	(1.296)	(1.836)	(1.768)	(386.614)	(351.996)	(16.653)
(1-T)(X-c)	-0.264	-0.463	0.044	-0.139	2.852	1.258	0.404	-2.389	-1.302	-999.29 **	-1023.04 **	-35.835 *
	(0.431)	(0.495)	(0.610)	(1.345)	(1.935)	(1.846)	(1.544)	(2.124)	(2.135)	(491.725)	(425.761)	(20.938)
Constant	0.004	0.004	0.013	0.069 ***	0.104 ***	0.095 ***	0.926 ***	0.892 ***	0.892 ***	193.383 ***	176.512 ***	4.491 ***
	(0.007)	(0.008)	(0.010)	(0.021)	(0.030)	(0.028)	(0.024)	(0.032)	(0.032)	(7.258)	(6.381)	(0.309)
N	701	666	663	701	666	663	701	666	663	552	552	552
					h = 0.0250						h = 0.0250	
Pedag Monit> 2	0.016	0.01	-0.002	0.039	-0.053	0.037	-0.055	0.043	-0.035	12.648	15.838	0.446
	(0.030)	(0.041)	(0.041)	(0.077)	(0.120)	(0.113)	(0.091)	(0.132)	(0.129)	(31.343)	(27.189)	(1.299)
T(X-c)	0.095	0.13	0.172	0.037	0.866	0.286	-0.132	-0.996	-0.458	-103.162	-181.476	-8.628
	(0.240)	(0.353)	(0.311)	(0.519)	(0.843)	(0.751)	(0.643)	(0.939)	(0.883)	(215.804)	(186.035)	(8.940)
(1-T)(X-c)	-0.059	0.089	0.035	-0.086	0.489	0.143	0.145	-0.578	-0.177	-184.375	-171.54	-6.879
	(0.152)	(0.143)	(0.202)	(0.385)	(0.591)	(0.557)	(0.451)	(0.644)	(0.615)	(160.719)	(140.597)	(6.595)
Constant	0.011 **	0.013 **	0.016 **	0.073 ***	0.095 ***	0.075 ***	0.916 ***	0.892 ***	0.909 ***	202.873 ***	186.002 ***	4.836 ***
	(0.005)	(0.006)	(0.007)	(0.013)	(0.020)	(0.019)	(0.015)	(0.022)	(0.021)	(5.181)	(4.474)	(0.213)
N	1370	1307	1305	1370	1307	1305	1370	1307	1305	1069	1069	1069
					h = 0.0125						h = 0.0125	
Pedag Monit> 2	0.049	0.047	0.018	0.049	-0.04	-0.082	-0.099	-0.007	0.064	48.979	51.63 *	1.86
	(0.033)	(0.035)	(0.042)	(0.087)	(0.128)	(0.118)	(0.103)	(0.135)	(0.138)	(31.285)	(27.876)	(1.348)
T(X-c)	-0.449	-0.375	-0.222	-0.376	-0.701	1.942	0.825	1.077	-1.72	-246.606	-351.531	-16.595
	(0.421)	(0.393)	(0.480)	(1.004)	(1.646)	(1.461)	(1.225)	(1.748)	(1.672)	(366.286)	(333.203)	(15.731)
Constant	-0.012	-0.219	0.136	0.114	2.646 *	0.835	-0.102	-2.427	-0.971	-748.073 *	-758.229 **	-26.295
	(0.334)	(0.389)	(0.464)	(1.035)	(1.484)	(1.435)	(1.189)	(1.657)	(1.659)	(385.572)	(330.895)	(16.310)
(1-T)(X-c)	0.007	0.006	0.014 *	0.072 ***	0.102 ***	0.091 ***	0.921 ***	0.892 ***	0.896 ***	196.05 ***	179.324 ***	4.592 ***
	(0.005)	(0.006)	(0.007)	(0.016)	(0.023)	(0.021)	(0.018)	(0.025)	(0.025)	(5.646)	(4.945)	(0.239)
N	701	666	663	701	666	663	701	666	663	552	552	552

Note: Urban schools with over 100 students. Each regression used a bootstrap with 1000 repetitions. Source: Authors' elaboration.

TABLE 9

Heterogeneous results according to the percentage of students in the PME and educational monitoring activities: final years of elementary education

	Dropout years 6–9	Dropout year 8	Dropout year 9	Failure years 6–9	Failure year 8	Failure year 9	Approval years 6–9	Approval year 8	Approval year 9	Maths year 9	Portuguese year 9	IDEB final years
					h = 0.0250						h = 0.0250	
per cent	-0.001	-0.02	0.027	-0.001	0.184	0.11	0.001	-0.164	-0.137	-29.371	-30.373	-0.661
students in PME	(0.104)	(0.121)	(0.106)	(0.157)	(0.185)	(0.152)	(0.208)	(0.231)	(0.189)	(36.875)	(33.872)	(1.607)
T(X-c)	0.125	0.31	-0.024	0.526	-0.786	-0.621	-0.651	0.476	0.645	-10.652	-0.312	-3.338
	(0.728)	(0.861)	(0.848)	(1.145)	(1.382)	(1.107)	(1.491)	(1.734)	(1.434)	(255.321)	(236.480)	(11.330)
(1-T)(X-c)	-0.344	-0.226	-0.59	-0.203	-0.473	-0.702	0.547	0.699	1.292 **	194.1	219.615 **	6.663
	(0.381)	(0.416)	(0.385)	(0.515)	(0.513)	(0.484)	(0.693)	(0.677)	(0.637)	(121.896)	(110.989)	(5.369)
Constant	0.048 ***	0.048 ***	0.042 ***	0.132 ***	0.089 ***	0.064 ***	0.82 ***	0.863 ***	0.894 ***	245.279 ***	240.432 ***	3.939 ***
	(0.014)	(0.017)	(0.013)	(0.021)	(0.023)	(0.019)	(0.027)	(0.029)	(0.024)	(4.827)	(4.378)	(0.211)
N	939	886	864	939	886	864	939	886	864	705	705	705
					h = 0.0125						h = 0.0125	
per cent	0.041	-0.061	0.073	0.098	0.352	0.045	-0.138	-0.29	-0.117	0.25	1.75	-0.437
students in PME	(0.129)	(0.151)	(0.135)	(0.216)	(0.231)	(0.205)	(0.280)	(0.281)	(0.256)	(46.969)	(42.772)	(2.105)
T(X-c)	-0.18	0.708	-0.034	0.286	-1.741	1.872	-0.106	1.033	-1.837	-369.257	-341.545	-11.141
	(0.955)	(1.057)	(1.084)	(1.769)	(1.939)	(1.770)	(2.297)	(2.436)	(2.122)	(371.168)	(357.879)	(17.339)
(1-T)(X-c)	-0.46	0.192	-1.156	-2.574	-3.186	-2.177	3.034	2.994	3.333	77.769	15.686	13.464
	(1.483)	(1.878)	(1.494)	(2.228)	(2.364)	(2.234)	(2.863)	(2.933)	(2.897)	(510.265)	(449.205)	(22.593)
Constant	0.043 **	0.055 **	0.034 *	0.111 ***	0.06 *	0.061 **	0.846 ***	0.885 ***	0.904 ***	241.933 ***	236.495 ***	3.965 ***
	(0.020)	(0.026)	(0.020)	(0.032)	(0.034)	(0.030)	(0.041)	(0.042)	(0.038)	(7.432)	(6.623)	(0.326)
N	467	446	429	467	446	429	467	446	429	350	350	350
					h = 0.0250						h = 0.0250	
Pedag Monit> 2	-0.001	-0.017	0.022	-0.001	0.155	0.093	0.001	-0.138	-0.115	-24.732	-25.575	-0.556
	(0.087)	(0.102)	(0.090)	(0.133)	(0.156)	(0.128)	(0.175)	(0.194)	(0.159)	(31.051)	(28.522)	(1.353)
T(X-c)	0.124	0.282	0.014	0.525	-0.525	-0.465	-0.649	0.242	0.45	-52.442	-43.528	-4.278
	(0.603)	(0.717)	(0.717)	(0.952)	(1.148)	(0.920)	(1.234)	(1.444)	(1.202)	(209.126)	(193.788)	(9.328)
(1-T)(X-c)	-0.343	-0.202	-0.622	-0.202	-0.696	-0.836	0.545	0.898	1.458 **	229.787	256.519 *	7.465
	(0.462)	(0.518)	(0.451)	(0.628)	(0.628)	(0.584)	(0.840)	(0.831)	(0.754)	(148.516)	(134.797)	(6.510)
Constant	0.048 ***	0.049 ***	0.042 ***	0.132 ***	0.088 ***	0.063 ***	0.82 ***	0.864 ***	0.895 ***	245.466 ***	240.625 ***	3.944 ***
	(0.015)	(0.018)	(0.014)	(0.022)	(0.024)	(0.020)	(0.029)	(0.031)	(0.025)	(5.051)	(4.584)	(0.220)
N	939	886	864	939	886	864	939	886	864	705	705	705
					h = 0.0125						h = 0.0125	
Pedag Monit> 2	0.027	-0.04	0.047	0.064	0.229	0.029	-0.09	-0.189	-0.076	0.163	1.14	-0.285
	(0.084)	(0.098)	(0.088)	(0.140)	(0.151)	(0.134)	(0.182)	(0.183)	(0.166)	(30.585)	(27.852)	(1.371)
T(X-c)	-0.15	0.663	0.018	0.356	-1.486	1.904	-0.206	0.822	-1.923	-369.076	-340.276	-11.458
	(0.902)	(1.014)	(1.028)	(1.670)	(1.826)	(1.670)	(2.165)	(2.310)	(2.003)	(354.168)	(340.863)	(16.506)
Constant	-0.324	-0.013	-0.914	-2.248	-2.012	-2.027	2.572	2.025	2.941	78.603	21.531	12.004
	(1.195)	(1.503)	(1.208)	(1.758)	(1.892)	(1.791)	(2.274)	(2.354)	(2.347)	(396.402)	(349.467)	(17.695)
(1-T)(X-c)	0.045 ***	0.053 ***	0.037 **	0.115 ***	0.072 ***	0.063 ***	0.841 ***	0.875 ***	0.9 ***	241.942 ***	236.557 ***	3.95 ***
	(0.016)	(0.021)	(0.016)	(0.025)	(0.026)	(0.023)	(0.031)	(0.032)	(0.030)	(5.845)	(5.185)	(0.255)
N	467	446	429	467	446	429	467	446	429	350	350	350

Note: Urban schools with over 100 students. Each regression used a bootstrap with 1000 repetitions.

Source: Authors' elaboration.

6 CONCLUSION

Given the many duties of a school, such as social relationships, integration, exchanges with the community in which it operates, the exercise and learning of citizenship, the stimuli of non-cognitive skills and many others, we know that the indicators presented in this study are not direct representatives of everything that a school must provide. However, such issues as those analysed here have indirect relationships with the quality of education, the flow of students through an environment of lower dropout and failure rates, and the learning of the canonical languages of reading and logical reasoning. As such, these dimensions are included in the performance and proficiency indicators listed in this Working Paper.

The PME is an attempt to introduce a large-scale extension of the school day through activities developed for the alternate shift for public school students. Many of these activities have not been assessed individually and require further study. However, the methodology does provide causal responses that can support any restatements. This is because the average treatment effects, as obtained from comparisons of very similar schools around the programme's eligibility criterion, were not statistically significant for 12 educational indicators in either the early or final years of elementary education.

At a glance, one can see that the partnership between the MEC and the MDS has allowed the PME to reach vulnerable schools, and that the eligibility criterion being based on the percentage of PBF beneficiaries was crucial for the selection of schools. However, as reported, no improvements were found in dropout, approval or failure rates or in Portuguese, Maths or IDEB scores. This means that, comparing very similar schools that began to participate in 2012, no advances were perceived in the key educational indicators related to the monitoring and evaluation of public policies. Nor were advances captured in their IDEB and proficiency (Portuguese and Mathematics) scores in the following year (2013). In addition, the indicators remained insensitive to a greater participation of students in the programme and monitoring of schools' pedagogical activities.

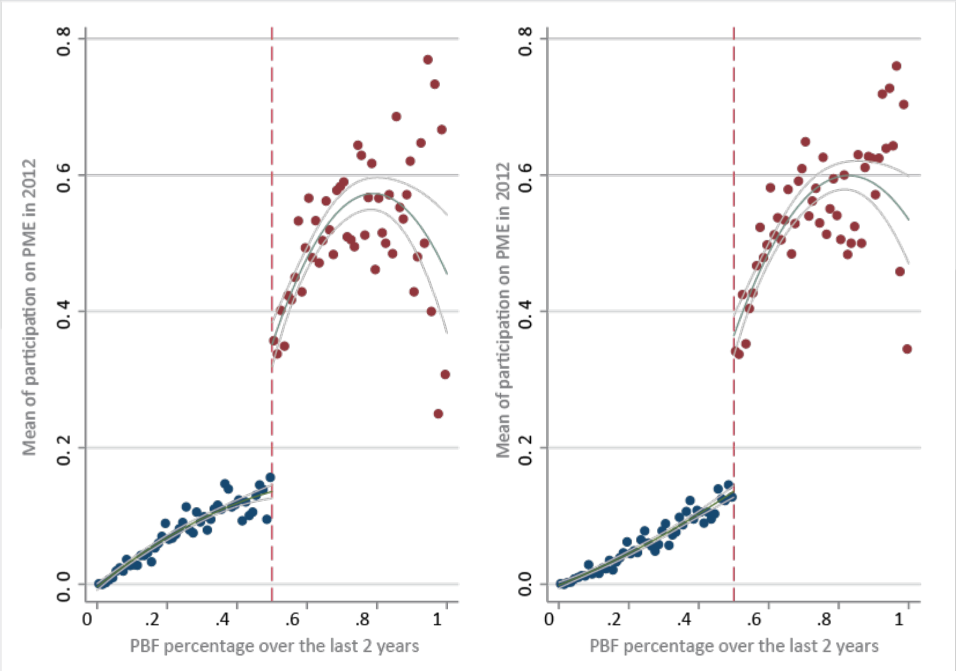
This scenario highlights that, after up to two years of participation in the PME and greater emphasis on the inclusion of vulnerable students, schools have failed to reap the benefits of the policy. Going forward, this assessment also indicates that the framework of the relationship established by the federal government (namely, the transfer of resources to the school without any kind of requirement that improvements be made by the staff who work at the other end of the policy) needs to be revised. Such a review should be framed not only in terms of building mechanisms that lead to the engagement of professionals (such as monitors, teachers and headmasters) and their encouragement to participate, but also considering the inclusion of state and municipal departments in the process, so that any efforts to achieve better results can be carried out more closely and effectively.

Finally, and as previously highlighted, this study estimated a result with great internal validity, but with limitations in terms of external validity. This is confirmed by the fact that one may not claim that the PME had no positive impact on years prior to 2012, or on the rest of the distribution of PBF-beneficiary students in schools. However, since this is not a randomised programme, the problem would persist should other techniques be used. In other words, studies using different techniques would not be free of variable omission bias, unobservable effects and other limiting factors in any estimates found.

APPENDIX

A 1

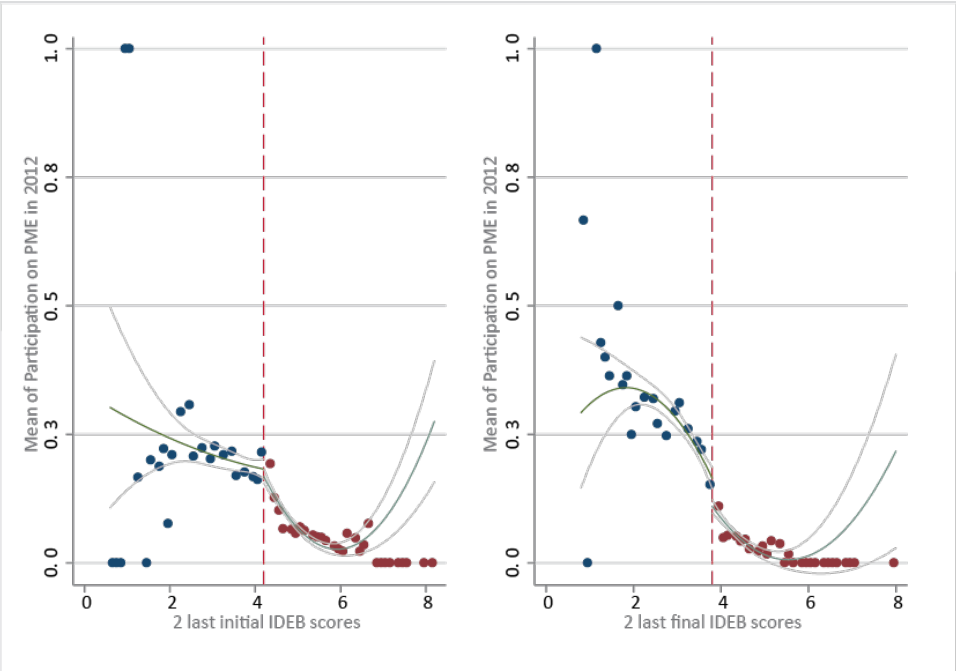
Likelihood of treatment throughout the PBF distribution (per cent): quadratic adjustment, urban schools, early years (a) and final years (b) of elementary education



Source: Authors' elaboration.

A 2

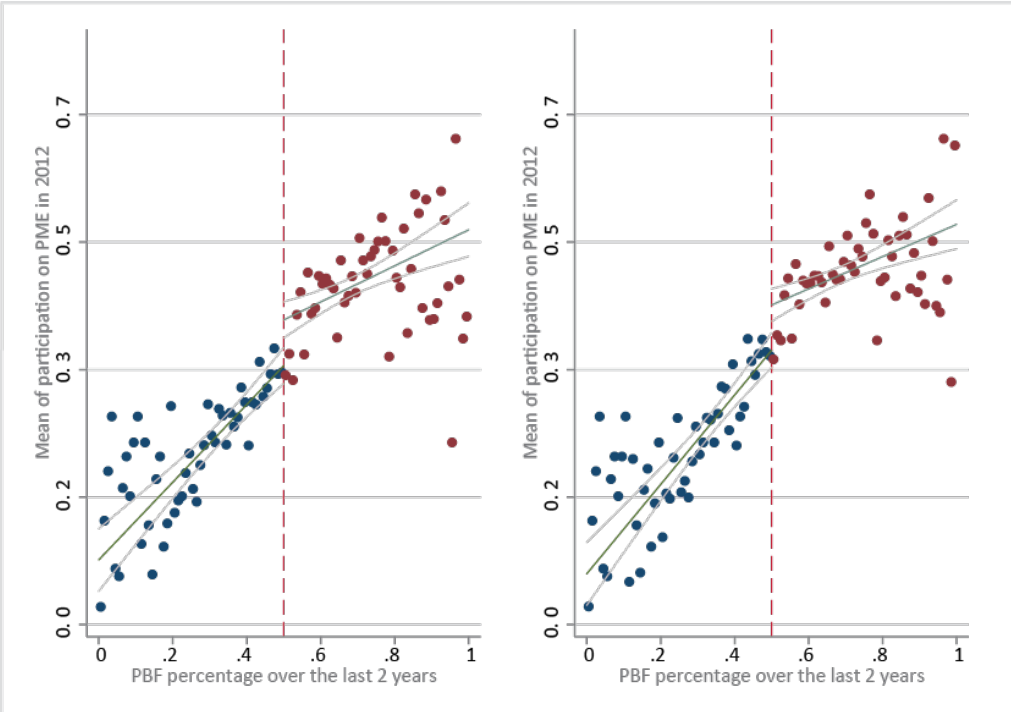
Likelihood of treatment throughout IDEB scores: quadratic adjustment, urban schools, early years (a) and final years (b) of elementary education



Source: Authors' elaboration.

A 3

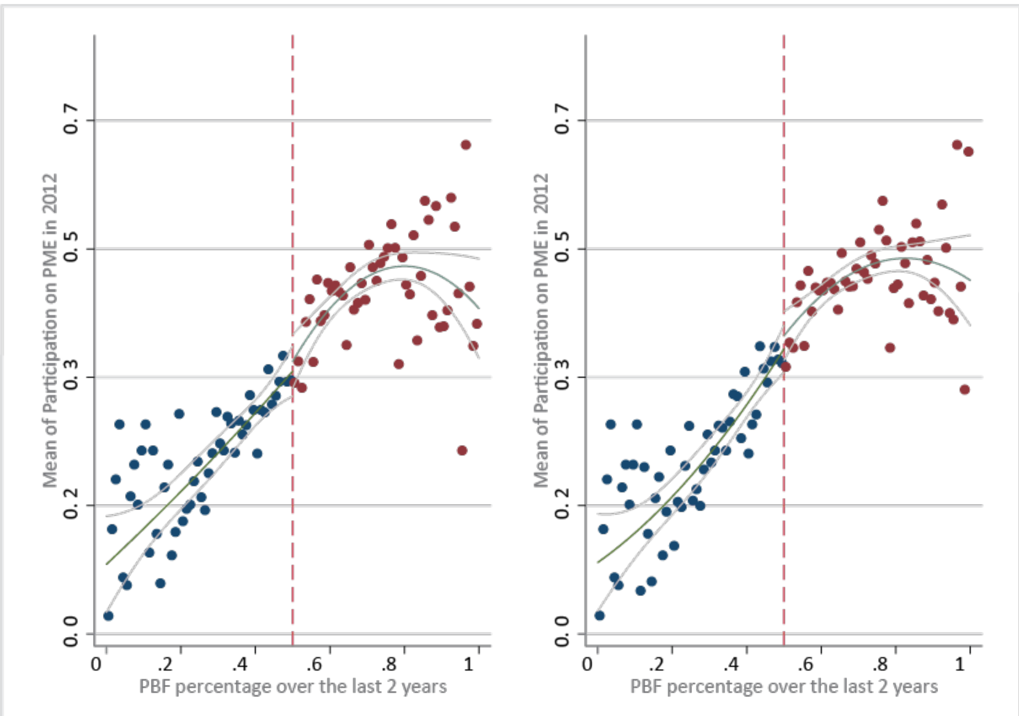
Likelihood of treatment throughout the PBF distribution (per cent): linear adjustment, rural schools, early years (a) and final years (b)



Source: Authors' elaboration.

A 4

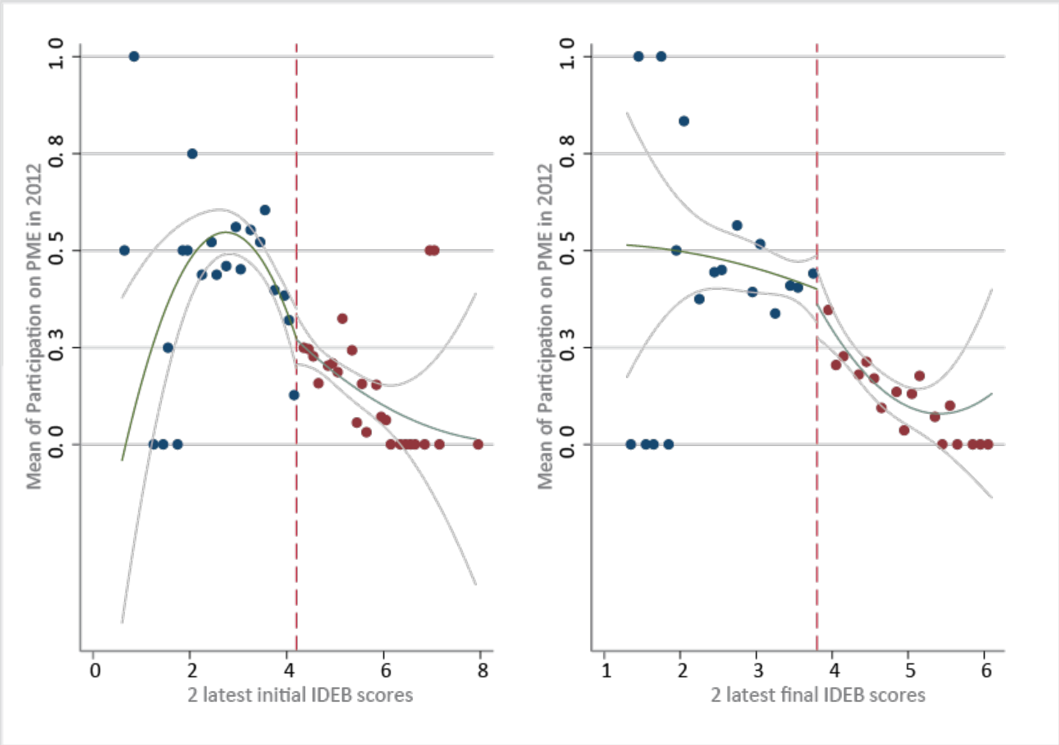
Likelihood of treatment throughout the PBF distribution (per cent): quadratic adjustment, rural schools, early years (a) and final years (b)



Source: Authors' elaboration.

A 5

Likelihood of treatment throughout IDEB scores:
quadratic adjustment, rural schools, early years (a) and final years (b)



Source: Authors' elaboration.

A 6

Second-stage results (with interaction term): performance, proficiency and IDEB rates in early years of elementary education

	Dropout years 1–5	Dropout year 4	Dropout year 5	Failure years 1–5	Failure year 4	Failure year 5	Approval years 1–5	Approval year 4	Approval year 5	Maths year 5	Portuguese year 5	IDEB early years
					h = 0.0500						h = 0.0500	
D (estimated)	0.011	0.022 *	0.002	0.008	0.021	0.029	-0.02	-0.043	-0.031	5.023	0.416	-0.099
	(0.012)	(0.013)	(0.015)	(0.027)	(0.039)	(0.039)	(0.033)	(0.043)	(0.045)	(10.657)	(9.299)	(0.440)
(X-c)	0.618 **	0.225	0.65	0.222	-0.251	0.797	-0.84	0.026	-1.447	-260.229	-246.902	-16.607
	(0.307)	(0.325)	(0.429)	(0.645)	(0.952)	(0.986)	(0.790)	(1.071)	(1.162)	(257.729)	(220.562)	(10.742)
D*(X-c)	-0.142	-0.074	-0.09	0.077	0.268	-0.082	0.065	-0.195	0.172	-46.818	-21.548	0.531
(estimate)	(0.088)	(0.095)	(0.118)	(0.204)	(0.302)	(0.297)	(0.246)	(0.339)	(0.345)	(79.252)	(67.403)	(3.241)
Constant	0.011 ***	0.008 **	0.015 ***	0.077 ***	0.081 ***	0.072 ***	0.912 ***	0.911 ***	0.913 ***	204.001 ***	188.622 ***	4.943 ***
	(0.003)	(0.004)	(0.004)	(0.008)	(0.012)	(0.011)	(0.010)	(0.013)	(0.013)	(3.097)	(2.679)	(0.127)
N	2873	2731	2719	2873	2731	2719	2873	2731	2719	2260	2260	2260
					h = 0.250						h = 0.0250	
D (estimated)	0.014	0.005	0.006	0.023	-0.011	0.035	-0.037	0.006	-0.041	9.432	9.614	0.285
	(0.014)	(0.018)	(0.019)	(0.039)	(0.059)	(0.055)	(0.046)	(0.066)	(0.062)	(15.694)	(13.899)	(0.648)
(X-c)	0.358	0.395	0.288	-0.264	0.286	0.273	-0.094	-0.681	-0.56	39.223	-264.947	-14.022
	(0.923)	(1.237)	(1.143)	(1.987)	(3.068)	(2.844)	(2.431)	(3.423)	(3.274)	(844.320)	(724.224)	(34.322)
D*(X-c)	-0.1	0.019	-0.025	0.081	0.395	0.08	0.019	-0.414	-0.055	-192.433	-116.77	-4.355
(estimate)	(0.271)	(0.308)	(0.354)	(0.626)	(0.976)	(0.891)	(0.743)	(1.064)	(1.001)	(254.654)	(221.208)	(10.420)
Constant	0.011 ***	0.013 ***	0.015 ***	0.074 ***	0.091 ***	0.072 ***	0.916 ***	0.897 ***	0.913 ***	202.444 ***	186.006 ***	4.829 ***
	(0.004)	(0.005)	(0.006)	(0.011)	(0.017)	(0.016)	(0.013)	(0.019)	(0.018)	(4.396)	(3.880)	(0.182)
N												
					h = 0.0125						h = 0.0125	
D (estimated)	0.03	0.027	0.016	0.024	-0.007	-0.044	-0.054	-0.02	0.028	27.809	29.986 *	1.089
	(0.020)	(0.023)	(0.026)	(0.049)	(0.074)	(0.073)	(0.058)	(0.081)	(0.084)	(18.585)	(16.885)	(0.800)
(X-c)	-0.904	0.063	-1.477	-0.883	-21.142	7.604	1.787	21.079	-6.127	3585.564	3139.591	78.245
	(3.302)	(3.462)	(4.277)	(9.657)	(14.258)	(12.838)	(11.188)	(15.599)	(14.495)	(3451.279)	(3039.878)	(146.712)
D*(X-c)	0.047	-0.308	0.356	0.207	6.449	-0.607	-0.254	-6.141	0.251	-1477.25	-1417.54 *	-43.102
(estimate)	(0.879)	(0.967)	(1.189)	(2.734)	(3.971)	(3.669)	(3.114)	(4.369)	(4.138)	(972.820)	(845.824)	(41.400)
Constant	0.007	0.006	0.013 *	0.073 ***	0.099 ***	0.088 ***	0.92 ***	0.894 ***	0.899 ***	196.004 ***	179.171 ***	4.591 ***
	(0.005)	(0.006)	(0.007)	(0.015)	(0.023)	(0.022)	(0.017)	(0.025)	(0.025)	(5.650)	(4.980)	(0.240)
N	716	678	677	716	678	677	716	678	677	562	562	562

Note: Urban schools with over 100 students. Each regression used a bootstrap with 1000 repetitions. The 10 and 0.5 percentage point bandwidths were excluded to facilitate visualisation of the data.

Source: Authors' elaboration.

A 7

Second-stage results (with interaction term): performance, proficiency and IDEB rates in early years of elementary education

	Dropout years 6–9	Dropout year 8	Dropout year 9	Failure years 6–9	Failure year 8	Failure year 9	Approval years 6–9	Approval year 8	Approval year 9	Maths year 9	Portuguese year 9	IDEB final years
					h = 0.0500						h = 0.0500	
D (estimated)	-0.03	-0.03	-0.03	0.027	0.027	0.027	0.004	0.004	0.004	-1.164	-2.223	0.032
	(0.028)	(0.028)	(0.028)	(0.044)	(0.044)	(0.044)	(0.056)	(0.056)	(0.056)	(10.497)	(9.611)	(0.470)
(X-c)	-0.188	-0.188	-0.188	-0.162	-0.162	-0.162	0.349	0.349	0.349	-199.641	-222.059	-7.64
	(0.667)	(0.667)	(0.667)	(1.069)	(1.069)	(1.069)	(1.388)	(1.388)	(1.388)	(249.950)	(232.495)	(11.202)
D*(X-c)	0.277	0.277	0.277	0.065	0.065	0.065	-0.343	-0.343	-0.343	10.331	33.349	-0.093
(estimate)	(0.215)	(0.215)	(0.215)	(0.340)	(0.340)	(0.340)	(0.433)	(0.433)	(0.433)	(80.629)	(73.704)	(3.478)
Constant	0.06 ***	0.06 ***	0.06 ***	0.128 ***	0.128 ***	0.128 ***	0.812 ***	0.812 ***	0.812 ***	239.964 ***	235.257 ***	3.775 ***
	(0.009)	(0.009)	(0.009)	(0.013)	(0.013)	(0.013)	(0.017)	(0.017)	(0.017)	(3.086)	(2.779)	(0.137)
N	1949	1949	1949	1949	1949	1949	1949	1949	1949	1450	1450	1450
					h = 0.250						h = 0.0250	
D	0.007	0.007	0.007	0.021	0.021	0.021	-0.028	-0.028	-0.028	-18.001	-19.154	-0.457
(estimated)	(0.043)	(0.043)	(0.043)	(0.065)	(0.065)	(0.065)	(0.085)	(0.085)	(0.085)	(15.264)	(13.702)	(0.666)
(X-c)	1.474	1.474	1.474	2.814	2.814	2.814	-4.288	-4.288	-4.288	-971.453	-967.739	-40.886
	(2.255)	(2.255)	(2.255)	(3.518)	(3.518)	(3.518)	(4.561)	(4.561)	(4.561)	(781.039)	(716.725)	(34.553)
D*(X-c)	-0.581	-0.581	-0.581	-0.793	-0.793	-0.793	1.375	1.375	1.375	379.625	404.461 *	14.295
(estimate)	(0.712)	(0.712)	(0.712)	(1.055)	(1.055)	(1.055)	(1.376)	(1.376)	(1.376)	(244.323)	(224.697)	(10.609)
Constant	0.047 ***	0.047 ***	0.047 ***	0.127 ***	0.127 ***	0.127 ***	0.826 ***	0.826 ***	0.826 ***	245.875 ***	241.055 ***	3.958 ***
	(0.013)	(0.013)	(0.013)	(0.018)	(0.018)	(0.018)	(0.024)	(0.024)	(0.024)	(4.434)	(3.966)	(0.191)
N	966	966	966	966	966	966	966	966	966	722	722	722
					h = 0.0125						h = 0.0125	
D	0.021	0.021	0.021	0.036	0.036	0.036	-0.057	-0.057	-0.057	0.286	1.965	-0.115
(estimated)	(0.048)	(0.048)	(0.048)	(0.082)	(0.082)	(0.082)	(0.104)	(0.104)	(0.104)	(17.950)	(16.997)	(0.787)
(X-c)	4.93	4.93	4.93	18.946	18.946	18.946	-23.876	-23.876	-23.876	-1751.31	-1302.44	-126.589
	(10.012)	(10.012)	(10.012)	(16.158)	(16.158)	(16.158)	(20.812)	(20.812)	(20.812)	(3579.946)	(3329.912)	(158.176)
D*(X-c)	-1.686	-1.686	-1.686	-5.955	-5.955	-5.955	7.641	7.641	7.641	267.335	116.085	32.088
(estimate)	(2.956)	(2.956)	(2.956)	(4.611)	(4.611)	(4.611)	(5.957)	(5.957)	(5.957)	(1033.041)	(946.536)	(45.724)
Constant	0.042 ***	0.042 ***	0.042 ***	0.113 ***	0.113 ***	0.113 ***	0.845 ***	0.845 ***	0.845 ***	241.408 ***	235.627 ***	3.923 ***
	(0.015)	(0.015)	(0.015)	(0.025)	(0.025)	(0.025)	(0.031)	(0.031)	(0.031)	(5.812)	(5.394)	(0.256)
N	477	477	477	477	477	477	477	477	477	358	358	358

Note: Urban schools with over 100 students. Each regression used a bootstrap with 1000 repetitions. The 10 and 0.5 percentage point bandwidths were excluded to facilitate visualisation of the data.

Source: Authors' elaboration.

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NOTES

4. Both according to the PNAD and the Survey of Living Standards (*Pesquisa de Padrões de Vida*—PPV) of the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística*—IBGE).

5. More information is available at: <http://pne.mec.gov.br/> and <http://www.observatoriodopne.org.br/>.

6. Those include: the state or municipal schools that had already been included in the programme in 2008; state or municipal schools in the cities of metropolitan areas or surroundings of state capitals with more than 100,000 inhabitants, IDEB index (as calculated in 2007) below the average of the municipality and more than 99 enrolments according to the 2008 school census; state or municipal schools located in municipalities with over 50,000 inhabitants in states of low population density, which will act as 'local hubs'; and state and municipal schools located in municipalities covered by the National Programme for Public Security with Citizenship (PRONASCI) of the Ministry of Justice.

7. This is a recommendation. However, the requirement is that each class has 30 students, who can be of various ages or grades, depending on the characteristics of each activity.

8. In 2012 the macro-areas were: pedagogical monitoring; environmental education; sports and leisure; human rights education; culture, arts and heritage education; digital culture; health promotion; communication and media use; research in the field of natural sciences; economic education/creative economy.

9. See footnote 6.

10. The criteria that guided the eligibility of rural schools were largely unrelated to the specific characteristics of the school, but rather to more general criteria regarding the external environment in which they operate. They included: schools located in municipalities considered to be poor rural areas (poverty rates greater than or equal to 25 per cent); schools located in municipalities where illiteracy rates for individuals 15 or older were greater than or equal to 15 per cent; schools located in municipalities with rural teachers without a higher education degree (rate greater than or equal to 20 per cent); schools in municipalities with rural populations (rate greater than or equal to 30 per cent); schools in municipalities with agrarian reform settlements (100 families or more); schools located in rural areas with 74 or more enrolled students; and schools located in *quilombola* (marron/refugee slave-descendant) communities with 74 or more enrolled students (MEC 2012, 42). For urban schools, the use of the PBF-predominant and of the low-IDEB criteria facilitates the identification strategy, as will be seen in due course.

11 For urban schools, the PBF majority criterion and the low IDEB criterion facilitate the identification strategy, as will be seen further.

12. The low-IDEB criterion does not seem to be relevant for school selection in 2012. As seen in Figures A2 and A5 of the Appendix, schools with an IDEB index below 4.2 in the early years of elementary education or 3.8 in the final years showed no discontinuity in the probability of selection. Therefore, the choice of the IDEB index as an additional eligibility variable, defining the econometric identification as a problem of multiple discontinuities, does not appear to be something that would need to be econometrically modelled.

13. Variables used included access to water (filtered water, public utility, artesian well, water from holes, river water, no access to water); access to electricity (public utility, generator, other types of source, no power supply); access to sewage (public utility, septic tank, no sewage); access to garbage management (periodic collection, waste burning, garbage disposal (i.e. thrown in another area), waste disposal (recycling), waste disposal (burying)); and school infrastructure (headmaster's office, teacher's office, computer lab, science lab, room for specialised educational services, indoor court, open-air court, kitchen, library, playground, toilet (outside and/or inside the building), toilets adapted for persons with disabilities, facilities and paths adapted for persons with disabilities, TV, video recorder, DVD player, satellite dish, photocopier, overhead projector, printer, computer, internet, and school meals for students).

14. It is argued later in this work that this change was not caused by self-selecting schools trying to exploit the programme, but rather as part of the good intentions of the partnership between the MEC and the MDS, which sought to ensure that vulnerable schools would not be left out 'by a hair's breadth'. As defined in the methodology, it is still possible to correctly identify the eligibility variable based on such a design.

15. We requisitioned a set of spreadsheets from this system, divided by major geographical region and broken down to the school level, collectively called an Activity Report. The data in the spreadsheets were compiled until a single database could be obtained for the year of interest.

16. Costa (2013) shows that this resource decentralisation in the PDDE has positive effects on the infrastructure conditions and performance of rural schools.

17. Since, in general, they do not have a Corporate Taxpayer ID (CNPJ), which is what characterises an Executing Unit, these schools have to be tied to municipal governments and education departments (for example) to receive any transfers. More information is available in MEC and FNDE (2009).

18. Since the study focuses on the year in which the PME switched to the PBF-predominant school criterion (2012), Brazil Exam data from 2013 will serve to measure the impact. However, for the IDEB criterion (i.e. index below 4.2 for the early years of elementary education and 3.8 in the final years), the reference data relate to 2009. This is because the Brazil Exam

is biannual, and 2011 data on the test had not been made available to the MEC (SEB) and MDS teams at the cutoff date for selection of eligible schools for the following year.

19. In recent school censuses, the question about whether the student belonged to the PBF or not was withdrawn because schools were not responding accurately. To calculate that indicator, one must resort to cross-referencing the data with the Single Registry *(Cadastro Único)* and the Attendance Project databases, a task accomplished by the SENARC/MDS.

20. News from 2011 (<http://portal.aprendiz.uol.com.br/arquivo/2011/12/12/mec-quer-45-milhoes-de-estudantes-no-programa-mais-educacao-em-2012/>) shows that eligible schools were indeed already defined in December 2011, even before schools completed the school census, which usually occurs in May of each year (<http://portal.inep.gov.br/descricao-do-censo-escolar>).

21. Since the MDS is the body that calculates the percentage of PBF-beneficiary students, using databases that are not public.

22. The units that comply with the rule are defined in the literature as *compliers*. They are such that $\lim_{x \downarrow X_i} D_i(x) = 0$ and $\lim_{x \uparrow X_i} D_i(x) = 1$. In other words, they differ from those that always try to participate in the programme (*alwaystakers*) or always try to avoid it (*nevertakers*).

23. The models in this section follow the notation by Lee and Lemieux (2010).

24. See the Appendix; there has been no change in the probability of participation in the programme based on the IDEB index.

25. For a better understanding of multidimensional discontinuity criteria, see Papay et al. (2011) and Wong, Steiner and Cook (2013).

26. Which is expected. The criteria for the selection of rural schools were specific, generally related to territories and regions, with few references to individual school indicators. See footnote 13.

27. This was chosen to avoid bias caused by missing data. This is because the number of schools without Maths, Portuguese and IDEB scores is usually smaller than the number of observations of schools with information regarding performance.

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