Breaking Barriers: Extended Schooling Hours and Racial Disparities on College Admission Tests

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VERY PRELIMINARY - PLEASE DO NOT CIRCULATE

Abstract

This paper investigates the impact of full-day schooling programs on addressing racial disparities in ENEM scores in Brazil. Utilizing a comprehensive dataset from the National Institute of Educational Studies and Research (INEP) and the State Secretariat for Education of Pernambuco (SSE) covering the period from 2009 to 2018, we employ a difference-in-differences (DD) and event-study approach to analyze the program's effectiveness. Our findings reveal that full-day schooling significantly improves ENEM scores across all racial and gender groups, though the extent of improvement varies. While black and mixed-race students, particularly men, demonstrate substantial gains in certain subjects, white students generally exhibit more consistent improvements. Additionally, we observe that maternal education and parental income play critical roles in shaping educational outcomes. The results highlight the potential of full-day schooling to mitigate educational inequalities and underscore the need for targeted interventions to ensure equitable benefits across all demographic groups.

JEL codes:
Keywords: Educational Inequality; Full-Day Schooling; Racial Disparities; ENEM Scores.

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1 Introduction

Educational inequality remains a pressing issue in developing countries, often exacerbated by socio-economic disparities and systemic biases. In Brazil, these inequalities are starkly visible in the performance outcomes of students from different racial and socio-economic backgrounds. The National High School Examination (ENEM) serves as a primary gateway to higher education, yet significant gaps in scores persist, particularly among black, mixed-race, and white students. Addressing these disparities is crucial for fostering equitable access to educational and economic opportunities. This paper examines the potential of full-day schooling programs to mitigate these inequalities, leveraging comprehensive data and robust econometric methods to assess the impact on ENEM scores across diverse student populations.

In this paper, we explore the effects of extended school days on addressing racial disparities in ENEM scores by employing data from the National Institute of Educational Studies and Research (INEP) and the State Secretariat for Education of the state of Pernambuco (SSE). By constructing an individual-by-school-by-year panel dataset from 2009 to 2018, we apply a difference-in-differences (DD) and event-study specification to identify the causal impact of full-day schooling. This approach allows us to compare outcome trajectories between treated and control groups, enabling a detailed analysis of how the introduction of extended school days affects students from different racial and socio-economic backgrounds. Our analysis provides new insights into the efficacy of full-day schooling in narrowing educational gaps and highlights the importance of tailored interventions to achieve equitable educational outcomes.

Our results reveal that full-day schooling significantly improves ENEM scores across all racial and gender groups, though the magnitude of improvement varies. Black and mixed-race students, particularly men, show substantial gains in subjects such as Essay and Languages and Codes, indicating progress in reducing the racial achievement gap. However, white students generally demonstrate more consistent improvements across subjects, suggesting that while the program is beneficial for all, it may not fully equalize outcomes. The analysis also underscores the critical role of maternal education and parental income in shaping educational performance. Students with mothers who have higher educational attainments or parents earning around two minimum wages tend to benefit more from the program, highlighting existing socio-economic disparities that influence academic success. These findings underscore the necessity for additional targeted measures to ensure that full-day schooling yields equitable benefits for all students, regardless of racial or socio-economic background.

Our findings align and extend the discussion on the impact of extended school day programs. Araujo et al. [2020] demonstrated positive effects on college admission test scores, suggesting that increased instructional and extra-class hours are key drivers of these im-

provements. Similarly, Rosa et al. [2022] found that full-day schooling significantly boosts math and language scores, underscoring the importance of additional instructional time. Our study corroborates these results and further explores the differential impacts across racial groups. Additionally, our findings complement the broader Latin American context discussed by Alfaro et al. [2015] and Almeida et al. [2016], who highlight the mixed results of extended school day programs. While our results affirm the potential for positive outcomes, they also reveal the need for context-specific implementations to maximize benefits. Finally, Bruns et al. [2012] emphasize the critical role of consistent policy efforts in enhancing educational quality, a notion supported by our evidence of sustained improvements with full-day schooling. This approach underscores the multifaceted nature of educational inequality and the necessity for comprehensive policy frameworks.

Beyond full-day schooling, a broader literature on the effects of full-time schooling provides additional context for our findings. Lavy [2015], analyzing PISA 2006 data from developed and developing countries, shows that instructional time has a significant positive effect on student achievement, though the effect is less pronounced in developing countries. Furthermore, Lavy finds that instructional productivity is higher in countries with robust school accountability measures or those granting schools autonomy in budgetary and staffing decisions. This suggests that while increasing instructional time is beneficial, its effectiveness is enhanced when accompanied by systemic improvements in school governance and accountability. Rivkin and Schiman [2015] also underscore the importance of instructional time, finding that its impact on academic achievement depends significantly on classroom quality and the environment in which it is implemented. Their analysis of PISA 2009 data highlights that the benefits of additional instructional hours are contingent upon the quality of instruction and the rate at which students convert classroom time into learning gains.

Moreover, Huebener et al. [2017] present evidence from Germany, showing that increased instruction hours can improve overall student performance, yet the benefits are not uniformly distributed. They reveal that low-performing students benefit less than their high-performing peers, suggesting that without careful implementation, extended schooling can inadvertently widen the performance gap. Similarly, Battistin and Meroni [2016] investigate the short-term effects of additional instruction time in Southern Italy and find that while the intervention raises scores in mathematics, the positive effects are primarily driven by higher-achieving students. These findings echo the results from Taylor [2014], who notes that remedial classes significantly improve math achievement but that the initial gains diminish over time. This pattern of decaying effects is observed across various educational interventions and highlights the importance of sustained efforts to consolidate and reinforce the initial improvements. Furthermore, Cortes and Goodman [2014] discuss the implementation of a double-dose algebra policy in Chicago, which led to significant gains in math achievement through increased instructional time and ability tracking, though these gains were often accompanied by peer skill level sorting.

Additionally, studies like Agüero and Beleche [2013] and Bellei [2009] reinforce that extending the school day can yield positive results but emphasize the importance of context. Agüero and Beleche [2013] analyze the effects of varying school year lengths in Mexico and find a positive albeit diminishing marginal return on student performance, particularly influenced by school resources. Bellei [2009] study of Chile's full school day program shows that while the program improved student achievement overall, the effect varied with socioeconomic status and regional implementation differences. Meyer and Van Klaveren [2013], in a randomized field experiment in the Netherlands, find that extended day programs had no significant effect on math or language achievement, again highlighting the mixed results of such interventions.

Our results are consistent with the broader literature, indicating that while full-day schooling has the potential to significantly improve educational outcomes, the benefits are not evenly distributed among all students. Cabrera-Hernandez [2020]showed that extending the school day in Mexico improved language and math skills, particularly in poorer schools, though the lowest-performing schools did not benefit as much. Similarly, Banerjee et al. [2007] found that remedial education and computer-assisted learning in urban India significantly raised test scores, especially for lower-performing students, though gains diminished over time. These studies highlight that while extended schooling can enhance educational outcomes, its effectiveness varies by context and target populations.

The remainder of this paper is structured as follows. Section 2 provides background information on Brazilian Full-Time School in Brazil. Section 3 details our data sources and research design, including the methodological approach and identification strategy. Section 4 presents the main results of our analysis, while Section 5 concludes.

2 Background

2.1 Full-Time School in Brazil

Full-day schooling has become an essential strategy for improving high school education quality in Brazil, with Pernambuco leading one of the most prominent programs. As shown in previous studies [1], The initiative began in 2008 with 47 state schools adopting the full-day model. The expansion was both gradual and selective, initially focusing on schools with the necessary infrastructure and implementing the program in phases, starting with the first year of high school and adding subsequent years incrementally.

The Integral Education Program (PEI) was designed to develop and improve the quality of education in Pernambuco's public school network and achieve better results in national assessments. The policy aimed to extend high-quality education beyond the metropolitan area of Recife and into the interior regions of the state. By improving management, monitoring,

[1] Araujo et al. [2020] and Rosa et al. [2022]

and evaluation tools, the PEI sought to create a more uniform educational experience across Pernambuco's diverse micro-regions. This gradual interiorization of high-quality education was necessary due to the significant increase in instructional hours and the infrastructure required for full-day schooling.

The implementation process within schools was structured as follows: in the first year, selected schools offered full-day or semi-full-day classes for the first year of high school; in the second year, they added classes for the first and second years; and by the third year, they fully implemented the program, offering classes for all three years of high school. Importantly, the transition only affected new cohorts starting in the first year, so students already in the second and third years continued with their regular schedule. All schools that fully or partially adopted the program were subsequently designated as High School Reference Schools (EREMs).

The phased implementation strategy allowed for better preparation and resource optimization, including comprehensive training for teachers and administrators. This sustainable approach highlighted the program's commitment to scalable improvement. The extended school day, averaging 8 hours compared to the 5 hours typical in regular schools, has prompted important discussions regarding the impact of increased instructional time on student performance.

3 Data

Our study utilizes data sourced from two primary agencies: the National Institute of Educational Studies and Research (INEP) and the State Secretariat for Education of Pernambuco (SSE). From INEP's repository, we acquired publicly accessible datasets, specifically the ENEM datasets ranging from 2009 to 2018. These datasets provided us with individual-level information on ENEM scores, student characteristics, and household characteristics for each year. Additionally, we obtained school-level data from the SSE in 2019 through a direct request. This dataset enabled the identification of schools as either full-time or quasi full-time for each year. Following the data construction methodology used by Araujo et al. [2020], we merged these datasets to form an extensive individual-by-school-by-year panel covering the period from 2009 to 2018. This rigorous data construction allows us to employ a difference-in-differences strategy and an event-study approach to analyze the effects across different gender and racial groups, enhancing the comprehensiveness of our inequality assessment.

4 Empirical Strategy

To evaluate the impact of full-day schooling on inequality in ENEM scores in Brazil, we utilize a two-way fixed effects model, given that schools enter the program at varying times. As

students generally take the national college admission test (ENEM) in their final year of high school, the first group of fully treated students from a participating school will not sit for the test until two academic years after the school has entered the program. Consequently, in a specific year t, untreated public schools and those within the first two years of program implementation act as control groups, whereas public schools that joined the program in year $t-1$ or earlier are considered treated. This approach is formalized in a difference-in-differences (DD) regression framework, as outlined in the following specification:

$$EnemScore_{str} = \alpha + \beta_1 \times (Post_t \times Treated\ School_s) + \theta_s + \gamma_t + \varepsilon_{str} \tag{1}$$

Where $EnemScore_{str}$ is the Enem score for school s, year t, and racial group r. $Post_t$ is a dummy variable indicating the post-treatment period. $TreatedSchools_s$ is a dummy variable that equals one if school s received the treatment. Our parameter of interest is β_1, which, under the parallel trends assumption, measures the impact of the treatment on the Enem scores. θ_s are a set of school fixed-effects, while γ_t represent year fixed-effects. ϵ_{str} is an error term, clustered at the school level.

To verify if treatment and control schools exhibited similar trends in ENEM scores over different periods after program implementation, we also estimate an event-study specification as described in Equation 2. This analysis is particularly important for the first two years of program adoption, during which college admission test-takers experienced only program components other than increased class and extra-class time.

$$\begin{aligned} EnemScore_{str} = \sum_{\tau=-6}^{5} \beta_\tau Treated\ School_s \times I(\tau = t) \\ + \theta_s + \gamma_t + \varepsilon_{str} \end{aligned} \tag{2}$$

Equation 2 represents a more flexible version of Equation 1, allowing us to empirically test the common trends assumption. The primary distinction is that this specification includes as many parameters of interest as there are years in our panel (minus one). The summation term $\sum_{\tau=-6}^{5} \beta_\tau Treated\ \ Schools_s \times I(\tau = t)$ captures the effect of treatment over a range of years relative to the treatment year, where τ is the relative time period, ranging from -6 (six years before the treatment) to 5 (five years after the treatment). $TreatedSchools_s$ is a dummy variable that equals one if school s received the treatment. $I(\tau = t)$ is an indicator function that equals one if the relative time period τ is equal to the actual time period t, and zero otherwise. This term helps in identifying β_τ, which are the coefficients that measure the impact of the treatment on Enem scores at different time intervals relative to the treatment year.

5 Results

The extended school day program has a positive and statistically significant impact on ENEM scores across various subjects for both men and women, with notable differences among racial groups. For both genders, the program significantly improves scores in Mathematics, Sciences, Humanities, Language and Codes, and Essay, particularly benefiting Mixed-Race and White students. While Black students also show improvements, the effects are generally less pronounced and not always statistically significant. The program's impact is more substantial for Mixed-Race and White students across most subjects, indicating that these groups benefit more from the extended school day.

Table 1 shows that for Mathematics, the program significantly improves scores for Mixed-Race and White students, with increases of 0.166 and 0.291 standard deviations, respectively, while the effect for Black students is positive but not statistically significant (0.0876 standard deviations). Similarly, in Sciences, the program leads to significant score improvements for all racial groups, with the highest effect observed for White students (0.194 standard deviations), followed by Mixed-Race (0.183 standard deviations) and Black students (0.194 standard deviations).

In Humanities and Language and Codes, the program continues to show positive and significant effects for Mixed-Race and White students. For Humanities, the increases are 0.0965 standard deviations for Mixed-Race and 0.184 standard deviations for White students, while the effect for Black students is positive but not significant (0.122 standard deviations). In Language and Codes, the increases are 0.115 standard deviations for Mixed-Race and 0.203 standard deviations for White students, with a positive but non-significant effect for Black students (0.0799 standard deviations). These results indicate that the program is particularly effective for Mixed-Race and White students in these subjects.

For Essay scores, the program has a significant positive impact across all racial groups, with increases of 0.266 standard deviations for White students, 0.191 standard deviations for Mixed-Race students, and 0.266 standard deviations for Black students. The constant terms across all subjects and racial groups are positive and statistically significant, indicating a baseline level of scores before the treatment. Overall, the extended school day program demonstrates a robust positive effect on ENEM scores, particularly benefiting Mixed-Race and White students, with varying degrees of impact across different subjects.

Table 2 shows the impact on ENEM scores for women. In Mathematics, the program significantly improves scores for Mixed-Race and White women, with increases of 0.166 and 0.291 standard deviations, respectively, while the effect for Black women is positive but not statistically significant (0.0876 standard deviations). Similarly, in Sciences, the program leads to significant score improvements for all racial groups, with the highest effect observed for White women (0.194 standard deviations), followed by Mixed-Race (0.183 standard deviations) and Black women (0.194 standard deviations).

In Humanities and Language and Codes, the program continues to show positive and significant effects for Mixed-Race and White women. For Humanities, the increases are 0.0965 standard deviations for Mixed-Race and 0.184 standard deviations for White women, while the effect for Black women is positive but not significant (0.122 standard deviations). In Language and Codes, the increases are 0.115 standard deviations for Mixed-Race and 0.203 standard deviations for White women, with a positive but non-significant effect for Black women (0.0799 standard deviations). These results indicate that the program is particularly effective for Mixed-Race and White women in these subjects.

For Essay scores, the program has a significant positive impact across all racial groups, with increases of 0.266 standard deviations for White women, 0.191 standard deviations for Mixed-Race women, and 0.266 standard deviations for Black women. The constant terms across all subjects and racial groups are positive and statistically significant, indicating a baseline level of scores before the treatment.

Table 3 presents the estimated effects of the extended school day program on ENEM scores for men. n Mathematics, the program significantly improves scores for Mixed-Race and White men, with increases of 0.150 and 0.197 standard deviations, respectively, while the effect for Black men is positive but not statistically significant (0.0677 standard deviations). Similarly, in Sciences, the program leads to significant score improvements for all racial groups, with the highest effect observed for White men (0.174 standard deviations), followed by Mixed-Race (0.180 standard deviations) and Black men (0.174 standard deviations).

In Humanities and Language and Codes, the program continues to show positive and significant effects for Mixed-Race and White men. For Humanities, the increases are 0.128 standard deviations for Mixed-Race and 0.199 standard deviations for White men, while the effect for Black men is positive but not significant (0.119 standard deviations). In Language and Codes, the increases are 0.148 standard deviations for Mixed-Race and 0.186 standard deviations for White men, with a positive but non-significant effect for Black men (0.119 standard deviations). These results indicate that the program is particularly effective for Mixed-Race and White men in these subjects.

For Essay scores, the program has a significant positive impact across all racial groups, with increases of 0.241 standard deviations for White men, 0.214 standard deviations for Mixed-Race men, and 0.263 standard deviations for Black men. The constant terms across all subjects and racial groups are positive and statistically significant, indicating a baseline level of scores before the treatment. Overall, the extended school day program demonstrates a robust positive effect on ENEM scores for men, particularly benefiting Mixed-Race and White men, with varying degrees of impact across different subjects.

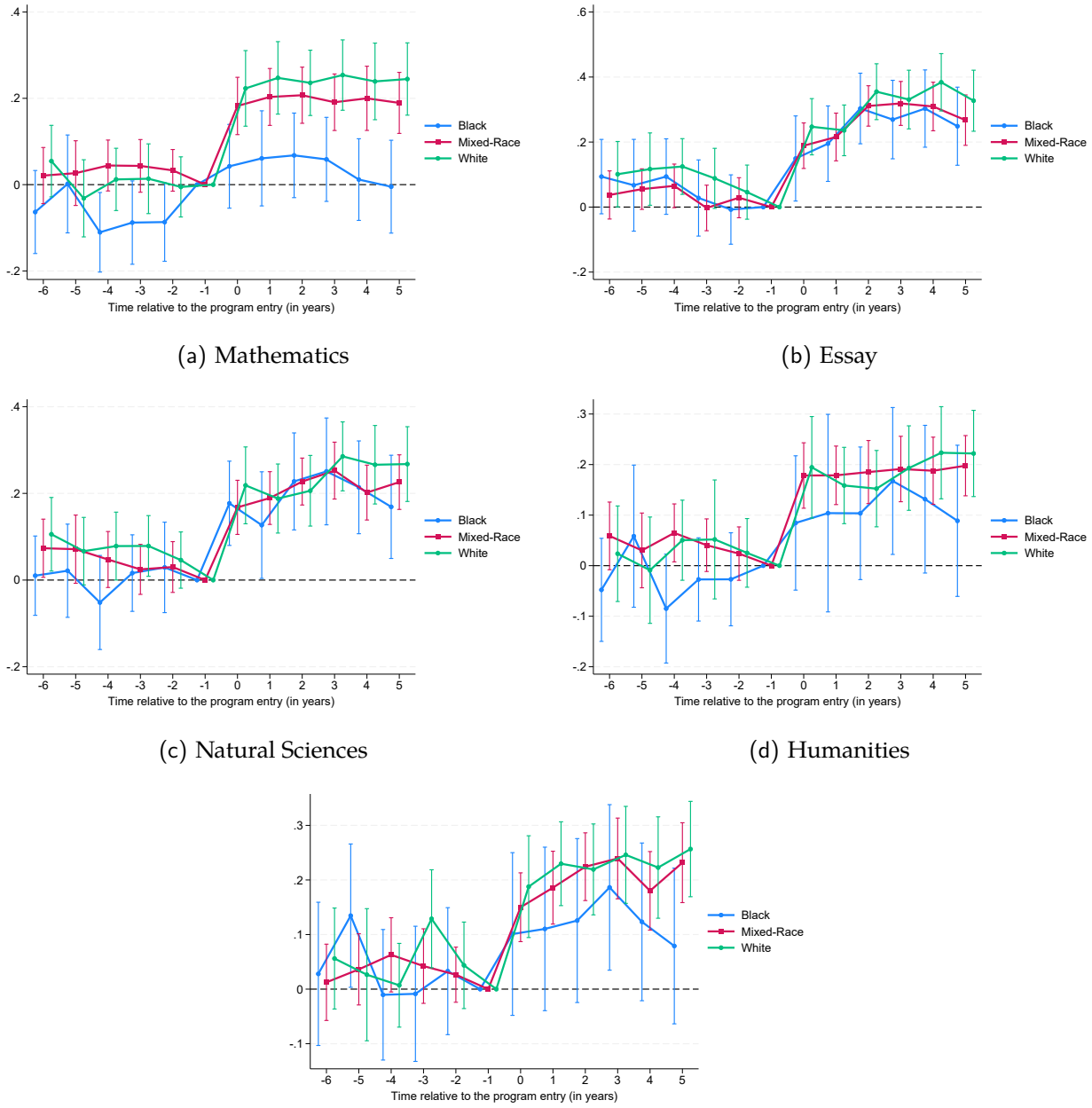
The results shown in the tables align with the trends observed in the figures below, providing a comprehensive view of the impact of the extended school day program on ENEM scores. The tables highlight significant improvements in scores across various subjects for

both men and women, particularly for Mixed-Race and White students, which is visually corroborated by the figures. The figures illustrate the upward trends in scores post-implementation of the program, with more pronounced gains for Mixed-Race and White students, consistent with the statistical significance reported in the tables. These visual representations complement the tabular data, offering a clearer understanding of how the program benefits different racial groups over time. This seamless transition from the quantitative results in the tables to the graphical trends in the figures underscores the program's effectiveness in enhancing academic performance across diverse demographic groups.

5.1 Evaluating Racial Disparities in ENEM Scores Through Full-Day Schooling: Comparative Analysis by Gender and Race

For Mathematics in Figure 1, In the pre-treatment period, the lines for Black, Mixed-Race, and White students are relatively stable and close to zero. After year 0, which marks the implementation of the program, there is an increase in scores for all groups. The lines for Black and Mixed-Race students show a more pronounced upward trend compared to White students. However, the lines for all groups run almost parallel, indicating that scores improve for all racial groups without significant differences in the rate of improvement among them. In Essay scores, initially, the lines for Black, Mixed-Race, and White students are close to zero and relatively stable. Post-implementation, scores for all groups rise, but the increase is slightly more pronounced for Black and Mixed-Race students. This suggests that these groups benefit more from the program in this area. The overall trend shows an improvement in scores for all groups.

Figure 1: Impact of Full-Day Schooling in ENEM Scores Across Different Subjects



(a) Mathematics

(b) Essay

(c) Natural Sciences

(d) Humanities

(e) Languages and Codes

Notes. Figure 1 illustrates the impact of full-day schooling programs on racial disparities in ENEM scores across different subjects. Each graph shows the evolution of scores over time, in years, relative to the program entry, for three racial groups: Black, Mixed-Race, and White.

The Natural Sciences panel shows Before the program's implementation, the lines for Black, Mixed-Race, and White students are relatively stable and close to zero. After year 0, scores for all groups increase, with Black and Mixed-Race students showing a more signifi-

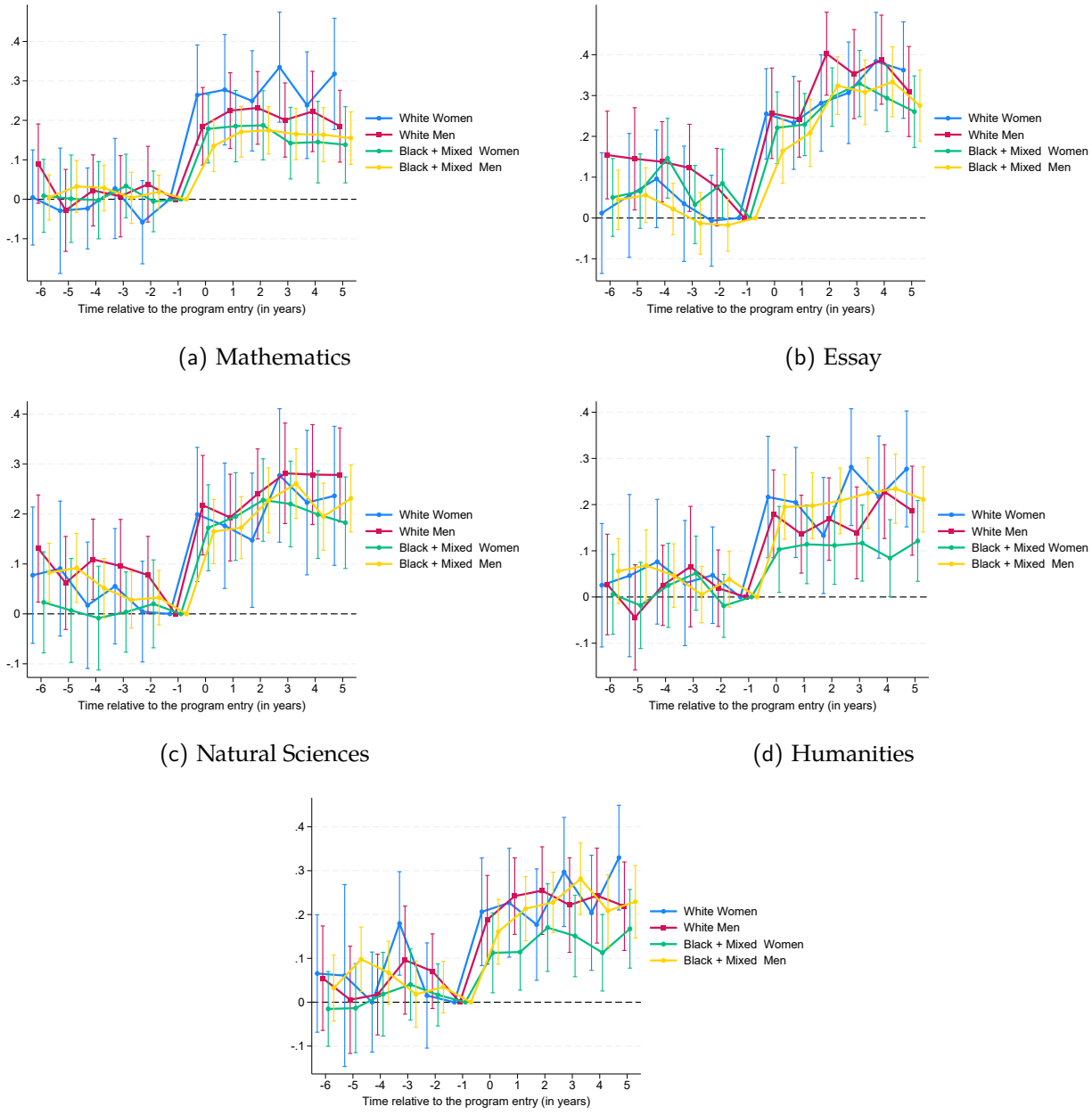
cant upward trend. The lines for these groups diverge slightly from the White students' line, suggesting a more pronounced improvement for Black and Mixed-Race students. The same can be said about Humanities and Languages Codes, but the lines for these groups, after the program's implementation, diverge slightly from the White students' line, indicating a more significant improvement for Black and Mixed-Race students.

This suggests that while the program is beneficial in increasing overall scores for all racial groups, it does not significantly alter the racial gap.Overall, the full-day schooling program positively impacts ENEM scores for all racial groups, with a more pronounced benefit for Black and Mixed-Race students in most subjects. Generally, the racial gap either remains stable or slightly narrows, depending on the subject. These findings suggest that the full-day schooling program enhances academic performance across racial groups while either narrowing or maintaining the racial gap. This implies that the program has the potential to reduce educational inequalities and elevate student achievement in college admission tests.

In the Mathematics for figure 2, The lines for Black & Mixed Men and Black & Mixed Women show a more pronounced upward trend compared to White Men and White Women. However, the lines for all groups run almost parallel, indicating that scores improve for all groups without significant differences in the rate of improvement among them. For Essay, scores for all groups rise, but the increase is slightly more pronounced for Black & Mixed Men and Black & Mixed Women. This suggests that these groups benefit more from the program in this area. The overall trend shows an improvement in scores for all groups.

The Natural Sciences panel shows after year 0, scores for all groups increase, with Black & Mixed Men and Black & Mixed Women showing a more significant upward trend. The lines for these groups diverge slightly from the lines for White Men and White Women, suggesting a more pronounced improvement for Black & Mixed Men and Black & Mixed Women. In Humanities and Languages and Codes, the pre-treatment period displays some variability but remains mostly around zero. Following the implementation of the program, scores for all groups increase, with Black & Mixed Men and Black & Mixed Women showing more pronounced gains. The lines for these groups diverge slightly from the lines for White Men and White Women, indicating a more significant improvement for Black & Mixed Men and Black & Mixed Women.

Figure 2: Impact of Full-Day Schooling on Racial and Gender in ENEM Scores Across Different Subjects



(a) Mathematics

(b) Essay

(c) Natural Sciences

(d) Humanities

(e) Languages and Codes

Notes. Figure 2 illustrates the racial and gender gaps in ENEM scores for full-time schools across different subjects over time. Each panel represents a distinct subject: (a) Mathematics, (b) Essay, (c) Natural Sciences, (d) Humanities, and (e) Languages and Codes. The x-axis depicts the time relative to the entry into the program (in years), with year 0 marking the entry year, while the y-axis shows the score differences between groups, specifically comparing white women, white men, black women, and black men. The vertical bars represent the confidence intervals for each estimated effect.

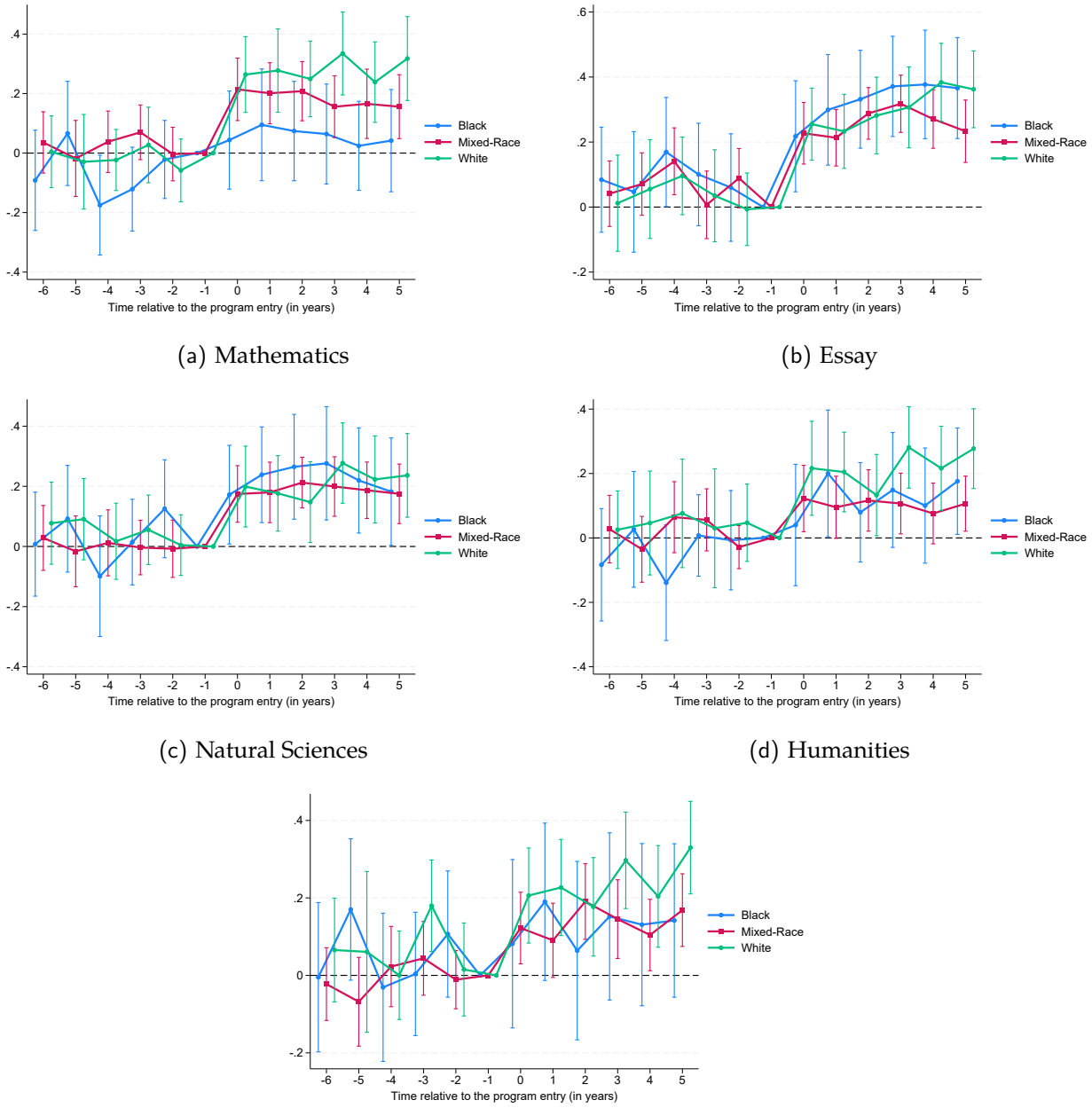
In general, the full-day schooling program positively impacts ENEM scores for all groups, with a more pronounced benefit for Black & Mixed Men and Black & Mixed Women for most subjects in ENEM. These findings highlight the need for additional measures to ensure that improvements in educational outcomes are equitable across all demographic groups.

5.2 Racial and Gender Impact of Full-Day Schooling on ENEM Scores: An Analysis of Men and Women Across Different Subjects

Figure 3 presents the impact in ENEM scores for integral (full-time) schools by gender, focusing exclusively on women from different racial groups—black, mixed-race, and white.After the implementation of the full-day schooling program, there is a noticeable increase in ENEM scores for Black, Mixed-Race, and White women across all subjects. In Mathematics, the scores for all groups improve, with Black and Mixed-Race women showing a more pronounced upward trend compared to White women. Similarly, in Essay, scores rise for all groups, but the increase is slightly more pronounced for Black and Mixed-Race women, indicating that these groups benefit more from the program in this area.

In Natural Sciences, Humanities, and Languages and Codes, the program leads to significant improvements in scores for all groups. Black and Mixed-Race women show a more substantial upward trend compared to White women, suggesting a more pronounced benefit from the program. The full-day schooling program positively impacts ENEM scores for Black, Mixed-Race, and White women, with Black and Mixed-Race women experiencing more significant gains in most subjects.

Figure 3: Impact of Full-Day Schooling on ENEM Scores for Women Across Different Subjects



(a) Mathematics

(b) Essay

(c) Natural Sciences

(d) Humanities

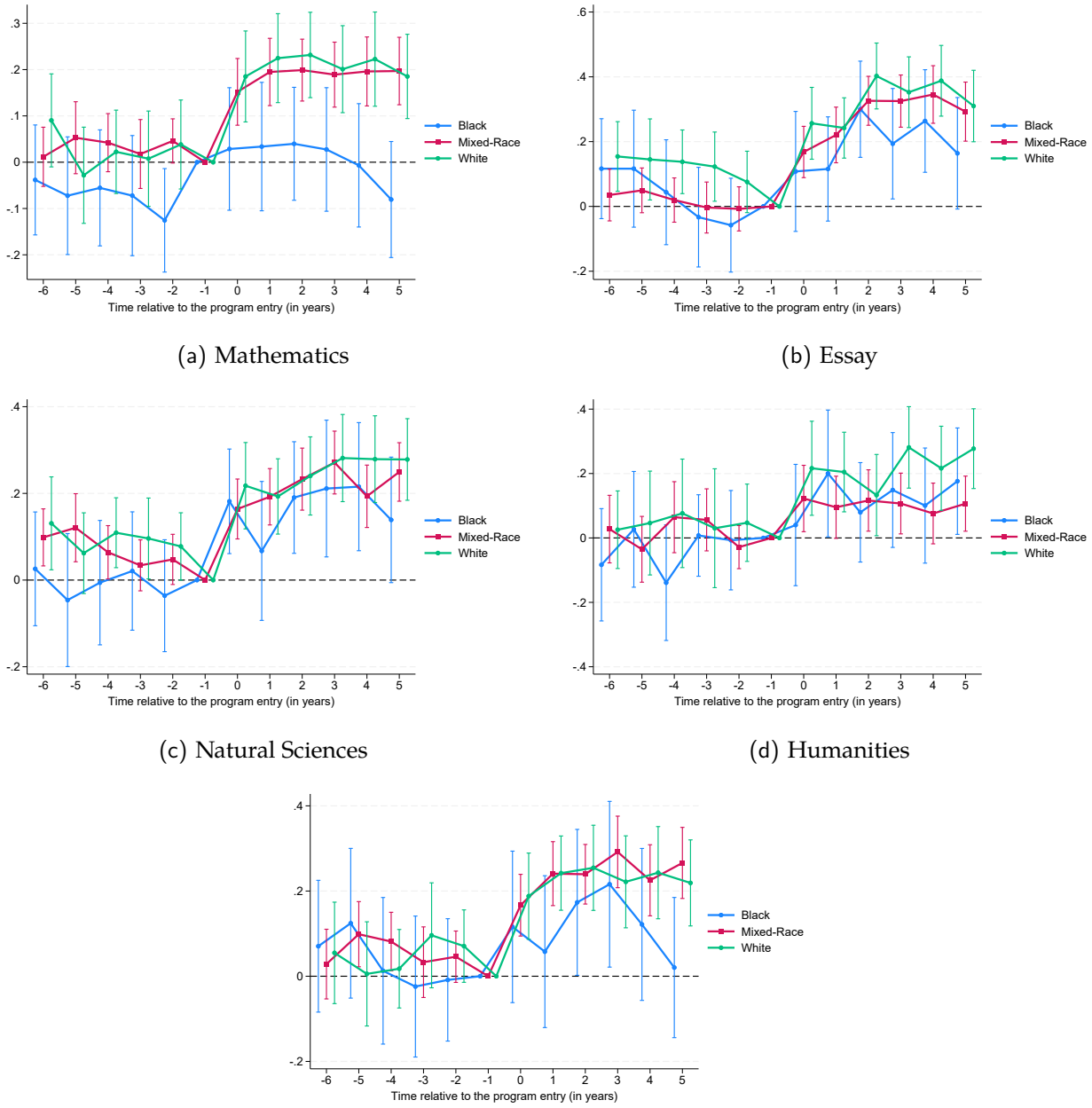
(e) Languages and Codes

Notes. Figure 3 presents the racial gap in ENEM scores for integral (full-time) schools by gender, focusing exclusively on women from different racial groups—black, mixed-race, and white. Each panel represents a distinct subject: (a) Mathematics, (b) Essay, (c) Natural Sciences, (d) Humanities, and (e) Languages and Codes. The x-axis depicts the time relative to the entry into the program (in years), with year 0 marking the entry year, while the y-axis shows the score differences between racial groups. Vertical bars reflect the confidence intervals for each estimated effect.

Figure 4 presents the impact in ENEM scores for integral (full-time) schools by gender, focusing exclusively on men from different racial groups—black, mixed-race, and white. For Mathematics, the scores for all groups improve, with Black and Mixed-Race men showing a more pronounced upward trend compared to White men. Similarly, in Essay, scores rise for all groups, but the increase is slightly more pronounced for Black and Mixed-Race men, indicating that these groups benefit more from the program in this area.

In Natural Sciences, Humanities, and Languages and Codes, the program leads to significant improvements in scores for all groups. Black and Mixed-Race men show a more substantial upward trend compared to White men, suggesting a more pronounced benefit from the program. Overall, the full-day schooling program positively impacts ENEM scores for Black, Mixed-Race, and White men, with Black and Mixed-Race men experiencing more significant gains in most subjects.

Figure 4: Impact of Full-Day Schooling in ENEM Scores for Men Across Different Subjects



(a) Mathematics

(b) Essay

(c) Natural Sciences

(d) Humanities

(e) Languages and Codes

Notes. This figure presents the racial gap in ENEM scores for integral (full-time) schools by gender, focusing exclusively on men from different racial groups—black, mixed-race , and white. Each panel represents a distinct subject: (a) Mathematics, (b) Essay, (c) Natural Sciences, (d) Humanities, and (e) Languages and Codes. The x-axis depicts the time relative to the entry into the program (in years), with year 0 marking the entry year, while the y-axis shows the score differences between racial groups. Vertical bars reflect the confidence intervals for each estimated effect.

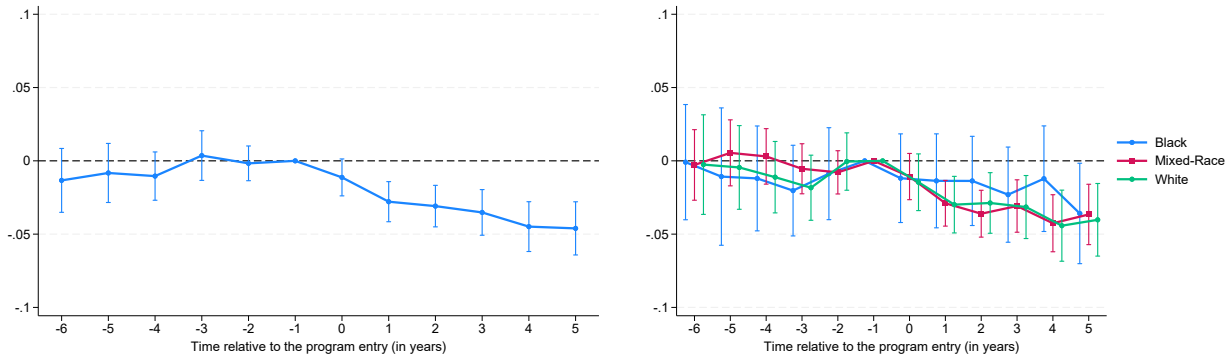
Nonetheless, the program has a positive impact across all racial groups of men and high-

light its potential to improve educational outcomes and reduce racial disparities.

5.3 Influence of maternal education levels on ENEM scores

Figure 5 and Figure 6 present the racial gaps in educational outcomes, highlighting the influence of maternal education levels on ENEM scores for students in integral (full-day) schools. The analysis of Figures 5 and 6 reveals important insights into how maternal education levels intersect with racial disparities in educational outcomes. In both figures, the overall impact of full-day schooling appears to be consistent across racial groups, despite different maternal education levels. For students with mothers who have only elementary education (Figure 5), the slight reduction in scores suggests a marginal negative impact, but this trend is uniform across racial groups. The consistency of the program's benefit across races indicates that full-day schooling effectively moderates the influence of low maternal education on student performance, providing equitable gains.

Figure 5: Propensity of Mothers with 0 to 8 Years of Education



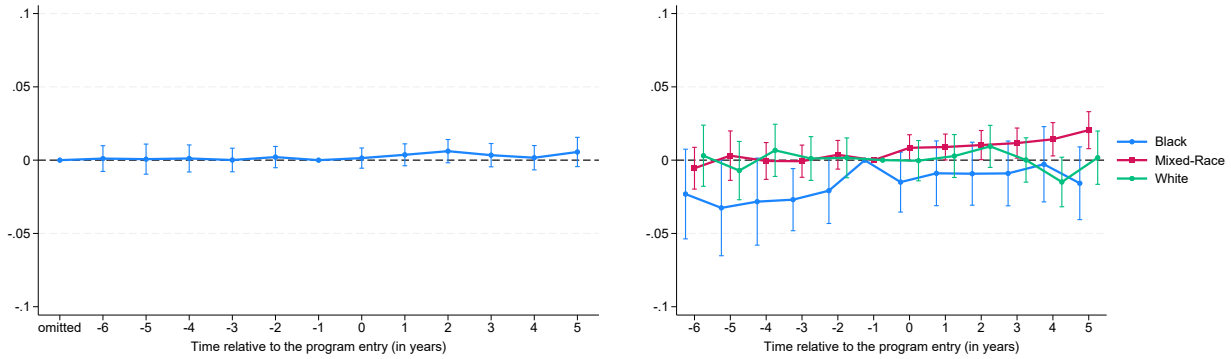
(a) All sample (b) race heterogeneity

Notes. Figure 5 focuses on the propensity of students whose mothers have completed only 0 to 8 years of education, corresponding to elementary education. The figure5a shows the overall trend for all racial groups combined. We observe a slight downward slope in ENEM scores over time, indicating a marginal negative impact of low maternal education on scores. The trend remains relatively stable across the years, with no significant fluctuations. The figure 5b breaks down the trends by racial groups—black, mixed-race, and white. Before the program's implementation, the differences among racial groups are small. Post-implementation, the lines remain relatively close, showing that even among students whose mothers have low levels of education, the program's impact is fairly uniform across racial groups. There is no significant disparity observed, indicating that full-day schooling provides a consistent benefit to students irrespective of their mother's education level.

For students with mothers who have incomplete high school education (Figure 6), the relatively stable trend across the board suggests that this level of maternal education does not

significantly affect ENEM scores. The parallel lines in the race heterogeneity panel indicate no substantial disparities among racial groups, reinforcing the program's equitable impact.

Figure 6: Propensity of Mothers with Incomplete High School Education



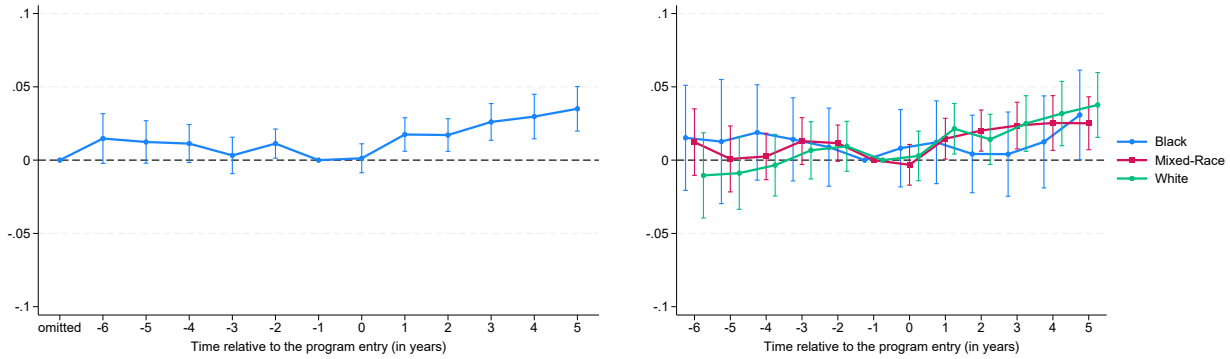
(a) All sample (b) race heterogeneity

Notes. Figure 6 examines the propensity of students whose mothers have incomplete high school education. Similarly, it consists of two panels: in fig6a We observe a stable trend in ENEM scores for students whose mothers have incomplete high school education. There are slight variations, but the overall slope remains fairly flat, indicating a neutral impact of this level of maternal education on scores. While in fig6b scores for all racial groups exhibit minimal differences, staying close to the initial trendline. The lines for black, mixed-race, and white students run nearly parallel, suggesting that maternal education level impacts are consistent across racial groups.

The lack of significant discrepancies between racial groups in these figures suggests that full-day schooling programs in Brazil can help mitigate some of the disadvantages associated with low maternal education levels, ensuring more uniform benefits across different demographic groups. This emphasizes the potential of well-designed educational programs to promote equity in educational outcomes.

The analysis of Figures 7 and 8 provides insights into the effects of having mothers with higher education levels. For Figure 7, which focuses on students with mothers who have completed high school, the overall impact on ENEM scores is neutral to slightly positive. The trends are relatively flat, with small increases post-implementation indicating that maternal high school education does not introduce significant disparities among racial groups. The parallel lines for black, mixed-race, and white students suggest that the program benefits all racial groups uniformly.

Figure 7: Propensity of Mothers with Complete High School Education



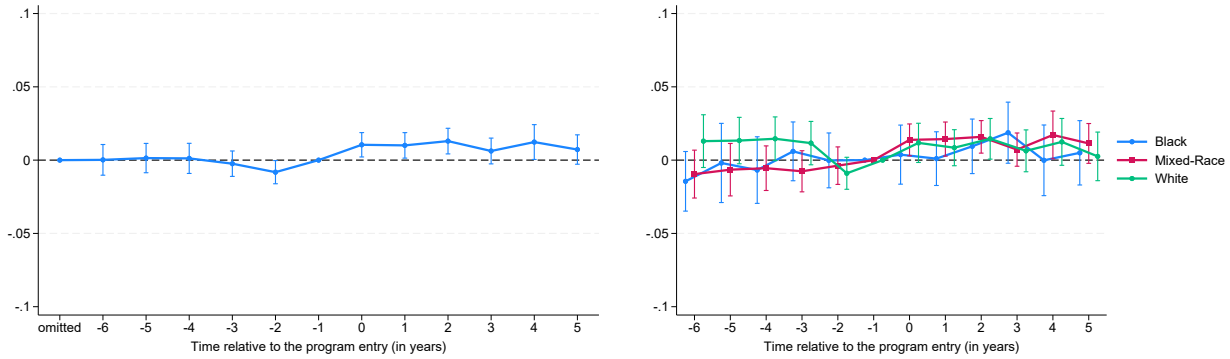
(a) All sample

(b) race heterogeneity

Notes. Figure 7 highlights the propensity of students whose mothers have completed high school education. figure 7a shows the overall trend across all racial groups. The trendline is relatively flat with minor fluctuations, indicating a neutral impact of complete high school education on ENEM scores. There is a slight upward trend post-implementation, suggesting a modest overall improvement in scores, though the changes are not pronounced. The figure 7b breaks down the trends by racial groups—black, mixed-race, and white. Before the program's implementation, the differences among racial groups are minimal, with scores fluctuating around zero. Post-implementation, all groups show slight increases in scores, with white and mixed-race students having marginally higher scores than black students. The lines for different racial groups run nearly parallel, indicating that the program's impact is fairly uniform across racial groups, with no significant disparities emerging.

Figure 8, which examines students with mothers who have completed higher education, shows a more pronounced positive impact on ENEM scores. There is a notable upward trend for all groups, indicating that maternal higher education significantly enhances student performance. However, slight discrepancies are observed, with white and mixed-race students showing marginally higher improvements compared to black students. These differences could be due to a variety of factors, including socio-economic advantages, better access to resources, and supportive learning environments that might be more prevalent among white and mixed-race families with higher educational backgrounds.

Figure 8: Propensity of Mothers with Complete Higher Education



(a) All sample

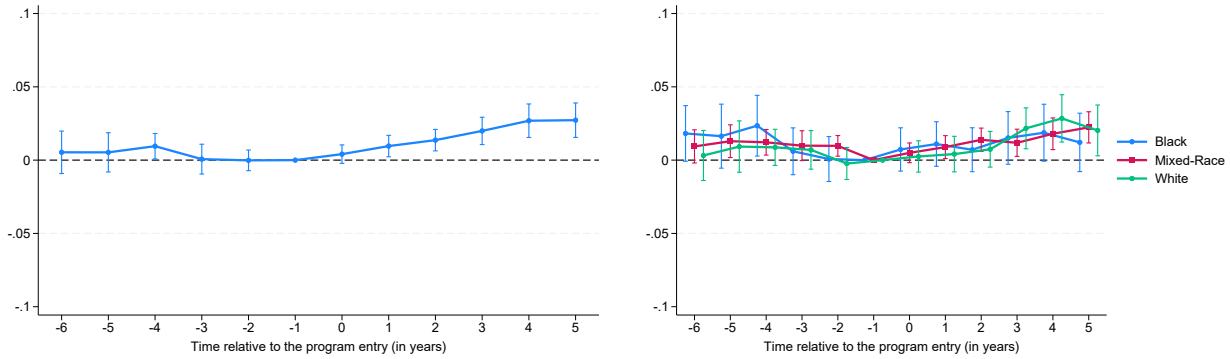
(b) race heterogeneity

Notes. Figure 8 examines the propensity of students whose mothers have completed higher education. figure 8a shows the overall trend for all racial groups combined. The trendline exhibits an upward slope post-implementation, indicating a positive impact of having mothers with higher education on ENEM scores. Significant improvements in scores suggest that maternal higher education plays an influential role in enhancing academic performance. The figure 8b divides the sample by racial groups. Pre-treatment, the scores fluctuate around zero, showing minimal differences among black , mixed-race , and white students. Post-implementation, all groups demonstrate positive trends with slight variations. White and mixed-race students exhibit marginally better improvements in scores compared to black students. Although the lines for each group run close to each other, indicating a generally uniform benefit from maternal higher education, there are modest differences that suggest white and mixed-race students may experience slightly higher gains.

The slight discrepancies between racial groups in both figures underscore the importance of maternal education in shaping educational outcomes. While full-day schooling programs contribute to improving scores across the board, the level of maternal education plays a critical role in determining the extent of these improvements. These findings highlight the need for targeted interventions and support systems to ensure that all students, regardless of racial background, can fully benefit from educational advancements.

The analysis of Figure 9 reveals insights into how parental income, specifically parents earning around two minimum wages, influences ENEM scores across different racial groups in integral schools. In figure 9b, while all groups show improvements post-implementation, white and mixed-race students exhibit slightly better performance gains compared to black students. This suggests a marginally more beneficial impact of the program on students from white and mixed-race backgrounds whose parents earn around two minimum wages.

Figure 9: racial gap integral - prop de pais com2 salarios min



(a) All sample

(b) race heterogeneity

Notes.

Overall, the full-day schooling program appears to positively impact ENEM scores for all students, including those whose parents earn around two minimum wages. The program's impact is generally equitable, though slight advantages are observed for white and mixed-race students. These findings highlight the importance of considering both income and racial factors when assessing educational outcomes and suggest that, while the program is beneficial, additional support may be necessary to ensure that black students derive equal benefits from educational interventions.

6 Conclusion

Our analysis provides compelling evidence on the effectiveness of full-day schooling programs in reducing educational inequalities in Brazil. Utilizing a robust difference-in-differences strategy and event-study approach, we find that the program significantly improves ENEM scores across all racial and gender groups. While all students benefit, the extent of improvement varies, with some disparities persisting. Black and mixed-race students, particularly men, exhibit substantial gains in certain subjects, indicating progress in closing the racial gap. However, white students generally show more consistent improvements, suggesting that additional targeted interventions may be required to ensure equitable gains across all demographic groups.

The findings highlight the crucial role of maternal education and parental income in shaping educational outcomes. Students whose parents have higher education levels or earn around two minimum wages generally perform better, benefiting more from full-day schooling. These results underscore the need for comprehensive policies that address not only the direct educational interventions but also the broader socio-economic factors influencing student performance.

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A Appendix

Table 1: Estimated Effects of the Extended School Day Program on College Admission Test (ENEM) Scores by race

	Math			Sciences			Humanities			Language and Codes			Essay		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Treatement	0.0876	0.166***	0.291***	0.194***	0.183***	0.193***	0.122	0.0965***	0.184***	0.0799	0.115***	0.203***	0.266***	0.191***	0.266***
	(0.0721)	(0.0382)	(0.0477)	(0.0690)	(0.0358)	(0.0492)	(0.0769)	(0.0300)	(0.0449)	(0.0904)	(0.0344)	(0.0458)	(0.0552)	(0.0323)	(0.0449)
Constant	0.851***	1.098***	1.326***	0.428***	0.599***	0.849***	0.402***	0.512***	0.695***	0.595***	0.605***	0.887***	0.698***	0.740***	0.877***
	(0.0636)	(0.0374)	(0.0488)	(0.0589)	(0.0380)	(0.0502)	(0.0560)	(0.0391)	(0.0451)	(0.0607)	(0.0372)	(0.0474)	(0.0537)	(0.0353)	(0.0479)
Observations	15,852	59,312	32,695	16,114	60,113	33,143	16,353	61,088	33,509	16,091	60,287	33,061	17,514	65,762	35,959
R-squared	0.242	0.239	0.320	0.211	0.205	0.279	0.202	0.184	0.251	0.201	0.182	0.241	0.218	0.182	0.218
School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Demographics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Black	Yes			Yes			Yes			Yes			Yes		
Mixed-race		Yes			Yes			Yes			Yes			Yes	
White			Yes			Yes			Yes			Yes			Yes

Notes.This table presents the results from estimating equation 1. Standard errors are clustered at the school level. (*$p \leq 0.01$, **$p \leq 0.05$, *$p \leq 0.1$).

Table 2: Estimated Effects of the Extended School Day Program on College Admission Test (ENEM) Scores for Women by race

	Math			Sciences			Humanities			Language and Codes			Essay		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Treatement	0.0876	0.166***	0.291***	0.194***	0.183***	0.193***	0.122	0.0965***	0.184***	0.0799	0.115***	0.203***	0.266***	0.191***	0.266***
	(0.0721)	(0.0382)	(0.0477)	(0.0690)	(0.0358)	(0.0492)	(0.0769)	(0.0300)	(0.0449)	(0.0904)	(0.0344)	(0.0458)	(0.0552)	(0.0323)	(0.0449)
Constant	0.851***	1.098***	1.326***	0.428***	0.599***	0.849***	0.402***	0.512***	0.695***	0.595***	0.605***	0.887***	0.698***	0.740***	0.877***
	(0.0636)	(0.0374)	(0.0488)	(0.0589)	(0.0380)	(0.0502)	(0.0560)	(0.0391)	(0.0451)	(0.0607)	(0.0372)	(0.0474)	(0.0537)	(0.0353)	(0.0479)
Observations	15,852	59,312	32,695	16,114	60,113	33,143	16,353	61,088	33,509	16,091	60,287	33,061	17,514	65,762	35,959
R-squared	0.242	0.239	0.320	0.211	0.205	0.279	0.202	0.184	0.251	0.201	0.182	0.241	0.218	0.182	0.218
School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Demographics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Black	Yes			Yes			Yes			Yes			Yes		
Mixed-race		Yes			Yes			Yes			Yes			Yes	
White			Yes			Yes			Yes			Yes			Yes

Notes.This table presents the results from estimating equation 1. Standard errors are clustered at the school level. (*$p \leq 0.01$, **$p \leq 0.05$, *$p \leq 0.1$).

Table 3: Estimated Effects of the Extended School Day Program on College Admission Test (ENEM) Scores for Men by race

	Math			Sciences			Humanities			Language and Codes			Essay		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Treatement	0.0677	0.150***	0.197***	0.174***	0.180***	0.194***	0.128*	0.193***	0.148***	0.119*	0.186***	0.189***	0.196***	0.241***	0.263***
	(0.0462)	(0.0298)	(0.0332)	(0.0501)	(0.0294)	(0.0344)	(0.0738)	(0.0319)	(0.0332)	(0.0636)	(0.0330)	(0.0360)	(0.0624)	(0.0308)	(0.0361)
Constant	0.264***	0.301***	0.504***	0.169***	0.265***	0.446***	0.273***	0.316***	0.454***	0.592***	0.571***	0.759***	0.909***	0.926***	0.949***
	(0.0368)	(0.0209)	(0.0257)	(0.0458)	(0.0214)	(0.0264)	(0.0485)	(0.0238)	(0.0277)	(0.0436)	(0.0230)	(0.0307)	(0.0477)	(0.0266)	(0.0296)
Observations	18,911	94,620	48,904	19,162	95,836	49,577	19,403	97,180	50,066	19,152	95,964	49,393	20,891	105,306	54,092
R-squared	0.210	0.196	0.287	0.183	0.175	0.255	0.187	0.165	0.237	0.205	0.181	0.245	0.216	0.181	0.212
School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Demographics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Black	Yes			Yes			Yes			Yes			Yes		
Mixed-race		Yes			Yes			Yes			Yes			Yes	
White			Yes			Yes			Yes			Yes			Yes

Notes.This table presents the results from estimating equation 1. Standard errors are clustered at the school level. (*$p \leq 0.01$, **$p \leq 0.05$, *$p \leq 0.1$).