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Roberta Costa, Tassia Cruz, André Sant'Anna

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Grade retention and academic outcomes: Evidence from Brazil

Roberta Costa[1]

orcid.org/0000-0001-8389-1897

Tassia Cruz[2]

orcid.org/0000-0003-1627-9467

André Sant'Anna[3]

orcid.org/0000-0002-5408-6765

Abstract

Despite the widespread use of grade retention in Latin American countries, the literature on the effects of this practice on academic outcomes remains inconclusive. This paper, using a comprehensive longitudinal (2012-2017) student-level dataset from Rio de Janeiro, the second-largest municipal basic education system in Brazil, aims to fill this gap. By employing a difference-in-differences approach with student's fixed effects, we find that grade retention has a positive impact on students' short-term learning results. These results remain consistent across various robustness checks. Our findings suggest that part of this effect may be attributable to students' fear of repeating a grade or the support given to those who are close to the threshold of repeating. Moreover, our results indicate that the classroom placement of retained students is not responsible for explaining our effects. This study contributes to the existing literature on grade retention by providing insights into how repeating a grade can lead to improved performance for the students who are held back.

Keywords: grade retention, grade repetition, primary education, academic outcomes.

[1] The author is grateful to the National Council for Scientific and Technological Development (CNPq) for the financial support received. E-mail: 42rmendes@gmail.com (corresponding author).
[2] Escola Brasileira de Administração Pública e de Empresas - FGV-Rio. E-mail: tassia.cruz@fgv.br.
[3] ‡BNDES and researcher at Center for Studies on Inequality and Development (CEDE-UFF). E-mail: andre albuquerque@id.uff.br.

Author contributions

Roberta Costa

Formal analysis

Writing – review & editing

Tassia Cruz

Methodology

Writing – review & editing

André Sant'Anna

Conceptualization

Writing – review & editing

Conflict of interest declaration

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

1. Introduction

Grade retention is commonly practiced in most Latin American countries, including Brazil. In 2018, while 6% of 15-year-old students from OECD countries reported having repeated a grade at least once in primary school, 13.9% of students in Latin America reported the same (OECD, 2020). Despite the additional costs and lack of consensus on its impact, it remains a popular practice among teachers.

This paper contributes to the debate about the effects of retention with a unique longitudinal dataset (2012-2017) covering the second-largest municipal education system in Brazil, Rio de Janeiro. We estimate the impact of being retained in the 3rd and 4th grades on 4th and 5th grades' performance. To achieve this, we use a difference-in-differences approach, which helps in controlling for unobservable characteristics by using student-fixed effects.

Our findings show that repeating the 3rd or 4th grade positively impacts students' academic achievement, with an effect size of 0.40 and 0.43 standard deviations. These results persist in several robustness checks. Our analysis suggests that the impact of grade retention on academic outcomes may be influenced by the fear of repeating a grade, as the threat of retention itself can affect students, or the additional support provided to students who are at risk of being held back. Upon further investigation, we found no evidence to support the idea that the way retained students are placed in classes during the repeated year contributes to the positive effects observed.

These findings contribute to the growing literature on retention effects. Studies from the 1980s and 1990s found adverse effects on retention, which established a consensus that grade repetition harms students' school performance (Holmes, 1989; Jimerson, 2001). Recent research has questioned these findings based on methodological limitations that prevented earlier research from accurately accounting for endogeneity, specifically the selection bias involved in retaining a student (Lorence, 2006; Allen *et al.*, 2009).

A growing body of literature has indeed found positive evidence of retention (Jacob and Lefgren, 2004; Schwerdt *et al.*, 2017; Nunes *et al.*, 2018; Figlio and Ozek, 2020). These studies show that retained students, especially those retained in early grades, perform better than promoted ones on short-term academic performance. However, there are two caveats. Firstly, the effects seem to fade out over time, typically lasting to three years after the repeated grade. Second, most of this research cannot disentangle the effects of retention from those of remedial interventions, such as summer schools and additional support.

Nonetheless, recent papers also find that retention has a null or negative effect on academic

outcomes (Valbuena *et al.*, 2021; Chen *et al.*, 2010; Roderick & Nagaoka, 2005). Repeating grades might also impact a student's psychological well-being and non-cognitive skills (Peixoto *et al.*, 2016). Even more, retention has been shown to have long-term negative effects, such as a low probability of high school completion (Jacob & Lefgren, 2009), a higher chance of dropping out (Manacorda, 2012; Eren *et al.*, 2017), and increased probability of engaging in criminal activity as an adult (Eren *et al.*, 2018).

The literature still does not have a clear answer on grade retention impacts, which is even more relevant when considering the case of Brazil. In the last two decades, Brazilian literature has focused on evaluating the effects of automatic grade promotion – which were popular in the 1990s and 2000s (Machado & Vasconcelos, 2020). The impact of non-retention policies on test scores is also mixed. There is evidence showing that automatic grade promotion may reduce (Menezes-Filho *et al.*, 2008; Carvalho and Firpo, 2014; Koppensteiner, 2014), have no effect (Ferrão *et al.*, 2002), or increase students' academic outcomes (Neves & Pazello, 2014). To our knowledge, only a few papers in Brazilian literature have examined retention with longitudinal data (Gomes-Neto and Hanushek, 1994; Luz, 2008; Riani *et al.*, 2012; Correa *et al.*, 2014). Although most of these papers find negative retention effects, all rely on designs that compare retained and promoted students solely on observable characteristics.

This paper is structured as follows: Section 2 explains Rio de Janeiro's retention policy. Section 3 discusses the dataset and variables. Section 4 presents the empirical strategy. Section 5 shows the main results, while section 6 provides robustness checks. Sections 7 and 8 further examine the drivers behind our results and potential mechanisms. Finally, in Section 9, we conclude.

2. Institutional context

Rio de Janeiro has the second-largest municipal education system in Brazil, with around 400 thousand students in 2019[4]. Starting from the 3rd grade, students are evaluated based on their proficiency level and attendance rate. The public system classifies students into four proficiency levels: Inadequate, Regular, Good, and Very Good. Every two months, teachers assess students' performance and assign them one of these proficiency levels based on various factors such as classroom quizzes, overall development, and behavior. Students who receive

[4] Retrieved from https://www.gov.br/inep/pt-br/acesso-a-informacao/dados-abertos/sinopses-estatisticas/educacao-basica.

an Inadequate proficiency level in the last two months of the school year are required to attend remedial classes and take an exam. Those who score lower than five on this exam are held back and must repeat the grade.

Every two months, the Municipal Education Department (MED) evaluates all students in the system. Although the assessment is developed and administered by the department, which makes it an external evaluation, teachers play important roles: they apply the exam in the classroom, and they grade the writing exam. The score from this exam composes the students' proficiency level (Rio de Janeiro, 2011). Although the exam is not a standardized test, all students in the same year and grade take the same exam.

The legislation that governs Rio's educational system does not recommend any specific intervention for retained students, but it does include instructions for preventing grade repetition. According to this legislation, schools must provide extra activities throughout the school year for all students who obtain an Inadequate grade in the bimonthly assessments (or a score below five in any subject). Additionally, during the school recess in July, these students must attend extra classes and be reevaluated in the first week of August (Rio de Janeiro, 2011).

3. Data

Our dataset is a longitudinal panel of students sourced from administrative records, encompassing all students enrolled in primary education from 2012 to 2017. The dataset lacks information on the four proficiency levels mentioned in section 2 or school attendance.[5] However, it does include the academic scores from the evaluations conducted bimonthly by the MED.

We estimate the impact of being retained in the 3rd grade on the 4th grade performance and of repeating the 4th grade on the 5th grade performance. We identify if a student is retained by checking if they are in the same grade for two consecutive years. Table 1 shows the school paths of our treatment and control groups, along with the sample of students. We have 30,825 students in the 3rd grade analysis and 29,013 students in the 4th grade analysis.

Table 1: School path and sample

Panel A: 3rd grade retention

[5] Therefore, we are not able to use an RDD approach.

		Treatment: Repeated the 3rd grade in 2015...			Control
		(A)	(B)	(C)	(D)
		... and maintained a regular school path after	... and repeated the 4th grade in 2017	... and repeated the 3rd grade in 2016	Did not repeat the 3rd grade in 2015
Grade each year	2012	1	1	1	1
	2013	2	2	2	2
	2014	3	3	3	3
	2015	3	3	3	4
	2016	4	4	3	5
	2017	5	4	4	6
Sample	N	2,736	590	932	26,567
		4,258			
Panel B: 4th grade retention					
		Treatment: Repeated the 4th grade in 2015...			Control
		(A)	(B)	(C)	(D)
		... and maintained a regular school path after	... and repeated the 5th grade in 2017	... and repeated the 4th grade in 2016	Did not repeat the 4th grade in 2015
Grade each year	2012	2	2	2	2
	2013	3	3	3	3
	2014	4	4	4	4
	2015	4	4	4	5
	2016	5	5	4	6
	2017	6	5	5	7
Sample	N	1,730	140	220	26,923
		2,090			

Source: Bimonthly evaluation data - Rio de Janeiro, MED, 2012 - 2017.

The treatment group is composed of students who had to retake the 3rd or 4th grade in 2015, and it encompasses three groups: a) those who were retained and maintained a regular school path after that; b) those who repeated the 3rd or the 4th grade in 2015 and also repeated the next grade in 2017; and, c) those who repeated the 3rd or 4th grade in 2015 and 2016. The

control group consists of students who follow a regular school path. For the 4th grade analysis, we will only consider the 2nd, 3rd, and 4th grades as the pre-treatment period, to be able to track students until the 5th grade in all three treatment groups. This means a student may have repeated the 1st grade, even in the control group. Although this is not ideal, the 1st grade retention rate is 3%, much lower than other grades.[6]

While organizing the data, we made two adjustments. Our complete database initially contained 892,146 students. First, we excluded students with potentially incorrect information, such as different grades in the same year. This exclusion resulted in a loss of 1,893 students, which is less than 0.2% of the dataset. Additionally, we excluded students who were not present in the dataset for the entire period, as we needed to track their progress throughout their school years. By doing so, we lost 727,691 students, which accounts for 81% of the dataset.

Different possibilities could explain this data loss. First, we might be losing students due to administrative inaccuracies. Each student has a unique code in the system, which should not change as they progress along the school years or if they change schools. However, we know from direct communication with the MED that such mistakes happen. Second, students might be leaving the municipal education system for three reasons: i) families could be migrating to another municipality, ii) parents could be transferring their children to private schools, and iii) students could be evading the education system altogether. It is unlikely that any of these three reasons are related to retention. Migration and transfers to private schools, presumably, are more associated with socioeconomic fluctuations and changes in the job market of parents. Primary schooling is mandatory in Brazil, so the evasion rate at this stage is low: between 2014 and 2015, the evasion rate was 2.1 for the 3rd grade and 2.0 for the 4th.[7]

Still, in Table 2, we examine our sample in comparison to all students who were on the complete dataset in 2014 and 2015. Our sample presents a lower retention rate and higher academic scores for both the control and treatment groups, suggesting our comparison groups are similar. However, this also means we must be careful when discussing the results since they might not apply to the municipal system in Rio de Janeiro.

Table 2: Comparison between our sample and the complete dataset

[6] Retrieved from https://www.gov.br/inep/pt-br/acesso-a-informacao/dados-abertos/indicadores-educacionais/taxas-de-rendimento-escolar.

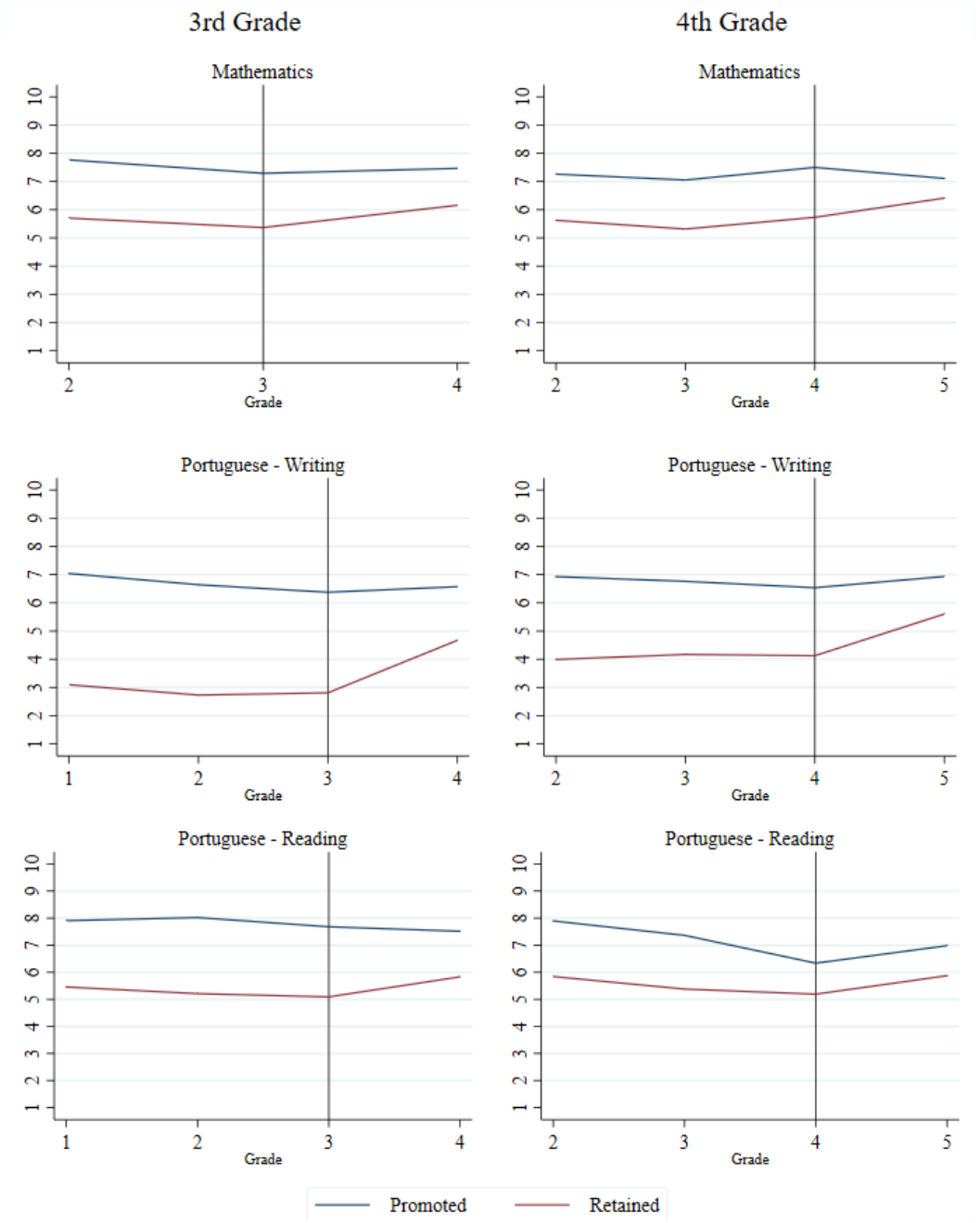
[7] Retrieved from https://www.gov.br/inep/pt-br/acesso-a-informacao/dados-abertos/indicadores-educacionais/taxas-de-transicao.

Panel A: Retention rate						
	3rd grade retention			4th grade retention		
	Our sample	Complete dataset	Diff	Our sample	Complete dataset	Dif
Retention rate	13.8	17.5	-3.7***	7.2	8.7	-1.5***
N	30,825	51,182	82,007	29,695	48,491	78,186
Panel B: Average score						
3rd grade retention						
	2014			2015		
	Our sample	Complete dataset	Diff	Our sample	Complete dataset	Diff
Retained	3.2	3.1	0.1**	5.3	5.0	0.4***
Promoted	7.1	6.8	0.3***	7.2	6.8	0.4***
4th grade retention						
	2014			2015		
	Our sample	Complete dataset	Diff	Our sample	Complete dataset	Diff
Retained	4.0	3.9	0.1*	5.9	5.7	0.2***
Promoted	6.8	6.5	0.2***	7.0	6.7	0.3***

Source: Bimonthly evaluation data - Rio de Janeiro, MED, 2012 - 2017. *p < 0.05, **p < 0.01, ***p < 0.001.
The retention rate was calculated as the ratio between the number of students who repeated the 3rd or 4th grades in 2015 and the number of students enrolled in these grades in 2014. For the complete dataset, we only considered students who were present in 2014 and 2015. The scores are the average of the original bi-monthly score (non-standardized) by each year-grade.

Our dependent variable is the math, writing, and reading score of the evaluation administered bimonthly by the MED. Since the exam changes yearly, they might not be comparable with each other over the years. To deal with this issue, we standardized the scores, using the average and standard deviation, according to the month, grade, and year in which the exam took place. From there, we use the average standardized score for each pair of year-grade in the estimations.

Figure 1: Scores over the grades by treatment status.



Source: Bimonthly evaluation data—Rio de Janeiro, MED, 2012 - 2017. The scores are the average of the original bimonthly score (non-standardized) by each grade. The data contains the repeated year and includes a balanced sample of the main results.

Figure 1 shows how the scores behave over the grades for retained and promoted students. As expected, retained students have a lower score than promoted ones. We can see that all retained students had an increase in their scores after repeating the 3rd or the 4th grade. The difference-in-differences method assumes that student's scores would have followed the same

trajectory over time in the absence of retention. Except for reading, the two groups of students have similar trends before the retained grade, so Figure 1 is mostly supportive of this assumption.

4. Methods

There are two strategies used for studying the effects of repeating a grade: i) same-year, comparing students' scores on the same year but in different grades; and ii) same-grade, comparing students' scores across different years but on the same grade (Lorence, 2006). We employ a same-grade comparison.

The literature debates which strategy is the best, with arguments in favor and against each approach. For instance, same-year comparisons do not consider the different rates of learning across grades (Schwerdt *et al.*, 2017) and may be biased in favor of promoted students since these have been exposed to an additional and more advanced year of schooling (Lorence, 2006).

Same-grade comparisons, on the other hand, are biased in favor of retained students since they are older than those who were promoted and have been exposed to an additional year of schooling (Schwerdt *et al.*, 2017). Schwerdt and West (2013) argue that same-grade estimates will be biased if retained students have prior retentions. These valid points notwithstanding, if the goal of retention is ensuring students have properly acquired the necessary knowledge and skills to progress in their school years by providing them with another year worth of instruction, then same-grade comparison is a more appropriate tool for evaluating retention (Lorence, 2006; Winters & Greene, 2012). Regardless, prior retentions are not an issue in our study and our results persist when we control for students' age and exclude the repeated school year from the estimations. Our results also do not change when we perform a same-year comparison and a robustness check in which we match students' school path after the retention, circumventing this issue entirely.

We use a difference-in-differences approach to evaluate the impact of being retained in the 3rd and in the 4th grade. We have three different specifications, as shown below. In all estimations, we have the same number of students over the years, so our data is balanced. All specifications have subject and municipal administration fixed effects. In the years covered in this paper, there have been three different municipal administrations: 2012 was the last year of the first run of Eduardo Paes as mayor, from 2013 to 2016 we had his second term and 2017 was the first year of Marcelo Crivella's administration. We include a dummy for each of

these administrations to account for possible changes in education policies.

We do not include a year trend in the equations because that would mean comparing promoted and retained students in the same year but in different grades. As discussed above, this would result in a same-year comparison and we are aiming for a same-grade comparison.

For the 3rd grade retention investigation, we estimate our results for two different groups: i) with the 1st grade and excluding math; ii) without the 1st grade and including math. We do this because, although the math exam is applied in all years and grades, the students in the 1st grade in 2012 do not have that information on the dataset. The results between these estimations do not vary significantly. For this reason, we opted to show only the results for the estimations without the 1st grade and including math.

The estimated equations are the following:

$$Y_{itsu} = \beta_0 + \beta_1 Tr_i + \beta_2 D_t + \beta_3 \left(Tr_i * D_t\right) + \delta_{itsu} + \eta + \gamma_{it} + \epsilon_{itsu} \quad (1)$$

i = Student

t = Grade

su = Subjects (math, writing and reading)

Y_{itsu} = 4th or 5th grade standardized score

Tr_i = Treatment (3rd or 4th grade retention)

D_t = Period ummy (= 1 if post)

(Tri ∗ Dt) = Treatment#Post

δ_{itsu} = Subject fixed effects

η = Municipal administration fixed effects

γ_{it} = School fixed effects

ϵ_{itsu} = Error term

The period dummy (Dt) is equal to 1 for the grade following the repeated school year. For instance, (Dt) is equal to 1 for the 4th grade in the 3rd grade analysis, meaning we consider the repeated school year (3rd grade in 2015) to be in the pre-treatment period. Given that exposing students to the educational program for a second time is part of the reasoning behind retention, we believe it is more suitable to consider the repeated year as part of the pre-treatment.

$$Y_{itsu} = \beta_0 + \beta_1 Tr_i + \beta_3 \left(Tr_i * D_t\right) + \delta_{itsu} + \eta + \gamma_{it} + \omega_t + \epsilon_{itsu} \quad (2)$$

ω_t = Grade fixed effects

$$Y_{itsu} = \beta_0 + \beta_1 Tr_i + \beta_2 D_t + \beta_3 \left(Tr_i * D_t\right) + \delta_{itsu} + \eta + \rho_i + \epsilon_{itsu} \quad (3)$$

ρ_i = Student fixed effects

For the students who repeated the 3rd or the 4th grade in 2015 and went on to repeat the 4th and the 5th grade in 2017 (column (B) on Table 1), the dependent variable only contains the 4th and the 5th grade standardized score from 2016.

5. Main results

Table 3 shows the main results: repeating the 3rd or the 4th grade has a positive and significant impact on students' academic achievement in the short run. For 3rd grade retention, the results with student fixed effects translate to an effect size of 0.43σ. That value is slightly lower for 4th grade retention, 0.40.[8] The results are robust to the different fixed effects, which is the case throughout most of our additional analysis. For this reason, going forward, we only show the results with student fixed effects, which is our preferred specification.

Table 3: Main results - Estimated effects of grade retention on academic achievement

	3rd grade retention				**4th grade retention**		
	4th grade standardized score				5th grade standardized score		
	(1)	(2)	(3)		(4)	(5)	(6)
Treatment#Post	0.398***	0.426***	0.333***		0.336***	0.320***	0.299***
	(0.018)	(0.018)	(0.014)		(0.019)	(0.019)	(0.015)

[8] The standard deviation for the 4th grade standardized score is 0.776 and 0.750 for the 5th grade standardized score.

Subject FE	Yes	Yes	Yes	Yes	Yes	Yes
Administration FE	Yes	Yes	Yes	Yes	Yes	Yes
School FE	Yes	Yes	No	Yes	Yes	No
Grade FE	No	Yes	No	No	Yes	No
Student FE	No	No	Yes	No	No	Yes
Observations	292,963	292,963	292,963	354,750	354,750	354,750
R-squared	0.292	0.297	0.648	0.171	0.175	0.554
Students	30,825	30,825	30,825	29,013	29,013	29,013
Clusters: Class	5,978	5,978	5,978	7,474	7,474	7,474

Source: Bimonthly evaluation data - Rio de Janeiro, MED, 2012 - 2017. Robust standard errors allowing for clustering at the class level in parentheses. *p < 0.05, **p < 0.01, ***p < 0.001. Estimations include math, writing and reading and do not include the 1st grade in the pre-treatment period.

Since we have three distinct classifications in our treatment group, we estimate the effects for each one of them to see if there are heterogeneous effects. As we can see from Table 4, the effects of being retained are still positive for students who maintained a regular school path after the retention (column (A) on Table 1) and for those who repeated the 3rd or the 4th grade twice in a row (column (C) on Table 1). This is not the case for students who went on to repeat the 4th or the 5th grade in 2017 (column (B) on Table 1). This result suggests that being retained consecutively in different grades might have a negative impact on academic achievement. Then again, our treatment group in this case has on average lower scores in the 4th and the 5th grades in 2016 since they had to repeat these grades in 2017.

Table 4: Heterogeneity in the treatment group

	3rd grade retention			**4th grade retention**		
	4th grade standardized score			5th grade standardized score		
	Regular school path	Repeated the 4th grade in 2017	Repeated the 3rd grade in 2016	Regular school path	Repeated the 5th grade in 2017	Repeated the 4th grade in 2016
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment#Post	0.454***	-0.230***	0.473***	0.343***	-0.239***	0.477***

	(0.015)	(0.022)	(0.022)	(0.014)	(0.043)	(0.037)
Observations	271,908	246,162	253,065	348,698	324,869	326,725
R-squared	0.622	0.633	0.634	0.546	0.536	0.537
Students	29,303	27,157	27,499	28,653	27,063	27,143
Clusters: Class	5,816	5,543	5,695	7,409	7,259	7,312

Source: Bimonthly evaluation data - Rio de Janeiro, MED, 2012 - 2017. Robust standard errors allowing for clustering at the class level in parentheses. *p < 0.05, **p < 0.01, ***p < 0.001. Estimations include math, writing and reading and do not include the 1st grade in the pre-treatment period. All estimations include subject, administration, and student fixed effects.

For students who maintained a regular school path after the retention (column (A) on Table 1), it is possible to identify the effects of 3rd grade retention on the 4th and 5th grade performance (and on the 5th and 6th grade scores from the 4th grade retention). The results are on Table 5. Retention continues to have a positive effect. A 3rd grade retention has a smaller impact on the 5th grade than on the 4th grade score in both specifications, which might suggest the effects of retention dissipate over time. These results are not as robust for the 4th grade retention analysis. While we see the same phenomenon for the estimation with student fixed effects, the opposite occurs with school fixed effects.

Table 5: Retention effects by grade

	3rd grade retention			**4th grade retention**	
	Standardized score			**Standardized score**	
	(1)	(2)		(3)	(4)
4th grade	0.475***	0.477***		-	-
	(0.018)	(0.014)		-	-
5th grade	0.407***	0.407***		0.328***	0.326***
	(0.020)	(0.015)		(0.019)	(0.014)
6th grade	-	-		0.351***	0.157***
	-	-		(0.021)	(0.018)
Subject FE	Yes	Yes		Yes	Yes

Administration FE	Yes	Yes	Yes	Yes
School FE	Yes	No	Yes	No
Grade FE	Yes	Yes	Yes	Yes
Student FE	No	Yes	No	Yes
Observations	359,211	359,211	434,657	434,657
R-squared	0.184	0.599	0.158	0.517
Students	29,253	29,253	28,653	28,653
Clusters: Class	7,593	7,593	9,429	9,429

Source: Bimonthly evaluation data - Rio de Janeiro, MED, 2012 - 2017. Robust standard errors allowing for clustering at the class level in parentheses. *p < 0.05, **p < 0.01, ***p < 0.001. Estimations include math, writing, and reading and do not include the 1st grade in the pre-treatment period. Only contains students who maintained a regular school path after the retention (column (A) in Table 1).

6. Robustness checks

We now move to some basic robustness tests. Since grade repetition itself is not an exogenous event, as it depends on performance, we replicate the main results excluding the repeated grade. Purposely, we remove the 3rd grade entirely from the estimation on 3rd grade retention and do the same for the 4th grade analysis. As shown in Table 6, the results do not change.

Table 6: Removing the repeated year

	3rd grade retention		**4th grade retention**
	4th grade standardized score		5th grade standardized score
	(1)		(2)
Treatment#Post	0.453***		0.236***
	(0.013)		(0.015)
Observations	184,935		260,781

R-squared	0.678	0.555
Students	30,825	29,013
Clusters: Class	3,702	5,702

Source: Bimonthly evaluation data - Rio de Janeiro, MED, 2012 - 2017. Robust standard errors allowing for clustering at the class level in parentheses. *p < 0.05, **p < 0.01, ***p < 0.001. Estimations include math, writing and reading and do not include the 1st grade in the pre-treatment period. All estimations include subject, administration, and student fixed effects.

As discussed, we use a same-grade approach, implying we compare students' scores across different years, specifically on the post-treatment period. For illustration, looking at Table 1, it is possible to see that, for estimating the effects of being retained in the 3rd grade, we compare the 4th grade performance across different years. While the control is enrolled in that grade in 2015, part of the treatment group is enrolled in 2016 and another part is in 2017. This could mean our results are affected by particularities and events inherent to those years, such as the hiring of a new teacher or budget fluctuations.

One way to deal with this issue is to employ a same-year comparison strategy. We use the same comparison groups on Table 1, but our pre- and post-treatment periods are no longer based on grade. Instead, they are defined according to school years. The years between 2012 and 2014 are the pre-treatment and 2015, 2016 and 2017 are the post-treatment. This means, for example, that we are assessing the impacts of 3rd grade retention by comparing the 3rd grade score in 2015 of retained students with the 4th grade score of promoted students in 2015. The results, shown on columns 1 and 4 on Table 7, continue to be positive and significant.

Table 7: Dealing with comparing students' scores across different years

	3rd grade retention			**4th grade retention**		
	2015 - 2017 standardized score	4th grade standardized score		2015 - 2017 standardized score	5th grade standardized score	
	Same-year comparison	School path matched after the retention		Same-year comparison	School path matched after the retention	
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment#Post	0.713***	0.417***	0.847***	0.407***	0.336***	0.638***

	(0.010)	(0.044)	(0.197)	(0.012)	(0.015)	(0.043)
Treatment groups						
Regular school path	Yes	Yes	No	Yes	Yes	No
Repeated the 4th or 5th grade in 2017	Yes	Yes	No	Yes	Yes	No
Repeated the 3rd or 4th grade in 2016	Yes	No	Yes	Yes	No	Yes
Observations	462,315	38,376	13,008	521,898	350,337	10,128
R-squared	0.599	0.374	0.286	0.506	0.584	0.584
Students	30,825	3,220	870	28,013	28,724	736
Clusters: Class	9,467	4,503	2,474	11,118	7,379	2,486

Source: Bimonthly evaluation data - Rio de Janeiro, MED, 2012 - 2017. Robust standard errors allowing for clustering at the class level in parentheses. *p < 0.05, **p < 0.01, ***p < 0.001. Estimations include math, writing and reading. All estimations include subject, administration, and student fixed effects. On columns 1 and 2 the grade fixed effects are replaced with year fixed effects.

Another possibility to test our results regarding comparing students' scores across different years, is to reproduce our main findings comparing students whose school path is matched after grade repetition. The treatment group is the same as in Table 1, but our control changes. We exemplify this with the 3rd grade retention. For students who maintained a regular school path after the retention (column (A) on Table 1) and for those who went on to repeat the 4th grade in 2017 (column (B) on Table 1), the control group is composed by students who were in the 1st grade in 2013 so that in 2016 they were on the 4th grade. The results from this are in columns 2 and 5 in Table 7. For students who repeated the 3rd grade twice in a row (column (C) on Table 1), the control group is students who began their education career in 2014 and were enrolled in the 4th grade in 2017. The results from this are in columns 3 and 6 in Table 7.

This way we can circumvent which approach to use (same-grade or same-year comparison), since the treatment and control group are on the same year and on the same grade on the

post-treatment. All results remain positive and significant, as in section 5, suggesting our results are not subject to time-variant effects.

We perform other robustness and heterogeneity checks that are not shown due to space constraints (available upon request), but we give a brief overview of them here. Since we saw in Figure 1 that the scores for reading do not show a clear trend before the students are retained and since teachers grade the writing exam, we run an estimation considering only math, and the results remain the same.

We also look into how socioeconomic characteristics and background might explain how students benefit from retention, namely age, race, gender, and mother's level of education. Retention is more prevalent among boys, black and brown students, and children with less educated mothers, results consistent with the literature (Oliveira & Soares, 2012; Valbuena *et al.*, 2021). We estimate the retention effects including interactions with being treated and the post-treatment period for each of these characteristics. Retention continues to have a positive effect even when controlling for socioeconomic background.

7. Understanding our results

Following these analyses, we have to wonder what explains these results. What is the drive behind the improvement in the performance of retained students? First, we thought it would be useful to contrast the treatment group with a more comparable control.

We built this control group with students who scored lower than four on at least one or all three subjects in the 3rd or the 4th grade in 2014, considering the average of the original non-standardized bimonthly score, and were still promoted to the next grade in 2015. Due to their low performance, these students would have been more likely to repeat a grade in 2015. The results, all positive and significant, are in columns 1 and 3 in Table 8. Retained students perform better in their academic future than promoted lower-performing students.

Following a similar logic, we compare two groups of promoted students in columns 2 and 4 of Table 8: promoted lower-performing students, who scored lower than four, and promoted higher-performing students, who scored higher than four. We again use the average of the original non-standardized bimonthly score and students must score lower or higher than four in at least one or all three subjects on the 3rd or the 4th grade in 2014 and be promoted in 2015.[9]

[9] We replicated all estimates on Table 8 with students who scored lower than five and the results remain the same (not shown, available upon request).

Since the highest score a student can receive is ten, students who scored above four face an upper bound. Namely, it is not possible for a student with a score of eight on the 3rd grade to reach a score of eleven on the 4th grade, so they have a smaller room for improvement than those students who scored below four. To deal with this we use different control groups with four upper bounds in the scores: seven, eight, nine and ten. On Table 8, columns 2 and 4, we show the findings using the control group with students who scored higher than four and lower than seven.

Table 8: Estimation with a more comparable control (columns 1 and 3) and a comparison between promoted students (columns 2 and 4)

	3rd grade retention			**4th grade retention**	
	4th grade standardized score			5th grade standardized score	
	(1)	(2)		(3)	(4)
Treatment#Post	0.213***	0.357***		0.263***	0.248***
	(0.017)	(0.038)		(0.018)	(0.064)
Treatment	Retained students	Promoted lower-performing students		Retained students	Promoted lower-performing students
Control	Promoted lower-performing students	Promoted higher-performing students		Promoted lower-performing students	Promoted higher-performing students
Observations	84,560	23,481		64,680	54,732
R-squared	0.363	0.403		0.310	0.322
Students	7,668	2,609		4,821	4,561
Clusters: Class	5,608	3,668		6,352	6,156

Source: Bimonthly evaluation data - Rio de Janeiro, MED, 2012 - 2017. Robust standard errors allowing for clustering at the class level in parentheses. *p < 0.05, **p < 0.01, ***p < 0.001. Estimations include math, writing and reading and do not include the 1st grade in the pre-treatment period. All estimations include subject, administration, and student fixed effects.

As we can see, the results are also positive and significant, which happens no matter which upper bound is used. Lower-performing students who were promoted have a higher academic

performance when compared to higher-performing students who were also promoted.

Considering both analyses on Table 8 gives an interesting insight into our results. *Promoted lower-performing students*, who were probably almost retained, have a higher academic performance when compared to *promoted higher-performing students*. As discussed in section 2, lower-performing students receive remedial classes throughout the year to prevent retention. These extra school activities could be responsible for this finding. This can also be interpreted as lower-performing students responding to the threat of retention, which compels them to perform better in the following years. This leads us to believe that the threat of retention itself has an effect on students, which has been registered in the literature (Carvalho and Firpo, 2014).

However, these cannot account for the entirety of the effect because we also find evidence that *retained students* perform better than *promoted lower-performing students*. Retention itself has an effect, beyond what is generated by its threat or the extra school activities. It is also of note that the threat of retention only exists because retention itself exists, which makes the threat of retention part of the intervention.

8. Mechanisms

We next consider whether the students are being motivated by the retention itself or if their higher performance is a result of schools intervening during the repeated grade. Considering our dataset, there is only one possible research avenue to investigate this matter. We examine the distribution of students across classes to assess the placement of retained students. If retained students are placed in high-performing classes, this could reveal that schools are indeed taking measures to assist these students.

For this analysis, we go back to the raw dataset with 892,146 students. Again, we exclude students who had a different grade in the same year, losing 1,893 students (less than 0.2% of the dataset). In this case, we also exclude students with a different class or school in the same grade or year. This is not necessarily an input mistake, since students can change class or school during the year, but we prefer to take a cautious approach. We lose 168.489 students, 19% of the dataset.

For the 3rd grade retention analysis, we start from all students who are in the 3rd grade in 2014 and in the 3rd or 4th grade in 2015. That leaves us with 86,248 students. For the 4th grade, our sample are students in the 4th grade in 2014 and in the 4th or 5th grade in 2015, which amounts to 77,891 students. We exclude schools with only one class in 2014 and 2015,

and students who change schools (this is probably a choice made by the parents, so the school does not have control over this). In the end, we have 73,946 students for the 3rd grade retention analysis and 67,706 for the 4th grade.

We then calculate the ratio between the average class performance in which the student is placed and the average class performance of the other classes in the same grade for each year, 2014 and 2015. We use the average of the original non-standardized bimonthly score and only consider classes within the same school.

We have three panels on Table 9. On Panel A, we compare the group of retained and promoted students from our main analysis. Although the difference is small, there is an indication that schools assign retained students in a class with lower performance in 2015. Notwithstanding, this also appears to happen with promoted students. The evidence is not strong enough to suggest schools are intervening, at least pertaining to student placement across classes. In fact, we could say schools seem to be putting retained students at a disadvantage before they repeat a year. In 2014, promoted students are placed on higher performance classes while retained ones are on classes with scores lower than average.

On Panel B and C we focus on retained students and further explore class designations because classes with a lower designation have higher scores.[10] On panel B, switching class means schools placed the student in a different class in 2015 than the one they were in 2014, i.e. going from class 1305 to class 1306. On Panel C, switching to a class with lower designation means schools assigned the student to a class with a smaller designation number than the one they were in 2014, i.e. going from class 1304 to class 1301.

Table 9: Student distribution across classes

Panel A									
	3rd grade retention					4th grade retention			
	N	2014	2015	Difference		N	2014	2015	Difference
Retained	2,309	0.93	0.92	0.01***		1,081	0.97	0.97	-0.01*
Promoted	15,209	1.07	1.04	0.03***		16,638	1.03	1.02	0.02***
Panel B (retained students)									

[10] For instance, in 2014 classes with the designation 1301 had an average score of 6.4, while classes with the designation 1306 had an average score of 6.4. We see this trend for the 3rd and 4th grade both in 2014 and 2015 for the average score and each of the three subjects.

	3rd grade retention				4th grade retention			
	N	2014	2015	Difference	N	2014	2015	Difference
Switched classes	1,435	0.93	0.90	0.03***	566	0.96	0.97	0.0
Did not switched classes	874	0.94	0.95	-0.01*	568	0.97	0.98	-0.01*
Panel C (retained students who switched class)								
	3rd grade retention				4th grade retention			
	N	2014	2015	Difference	N	2014	2015	Difference
Class with lower designation	470	0.88	0.96	-0.08***	301	0.93	0.99	-0.06***
Class with higher designation	965	0.96	0.88	0.08***	265	1.01	0.95	0.06***

Source: Bimonthly evaluation data - Rio de Janeiro, MED, 2012 - 2017. *p < 0.05, **p < 0.01, ***p < 0.001.

The differences between 2014 and 2015 continue to be small on Panel B. Still, for both the 3rd and 4th grade retention, students who did not switch classes end up in a higher performance class, compared to the one they were in 2014. For those who did switch classes, in the 3rd grade analysis they go to a class with a lower score in 2015; in the 4th grade, these students are in a class as good as the one they were in 2014. Again, it does not seem like schools are intervening when deciding if retained students should switch classes or remain in the same one. The scores on Panel C behave as expected. Students assigned to a lower designation class in 2015, move to a class with higher performance; those placed in a class with higher designation in 2015, turn out to be in a class with lower scores.

We proceed to test if *switching classes* or *switching to a class with a lower designation* are possible channels for the positive effects of grade retention. To implement this, we use the retained and promoted groups on Table 1, but we have to make additional modifications on that sample, the same ones described earlier in this section. As Table 10 shows, neither one of the interactions is significant, suggesting student placement across classes is not responsible for the positive effects of retention.

Table 10: Testing the student distribution across classes in the effects of retention

	3rd grade retention		**4th grade retention**	
	4th grade standardized score		5th grade standardized score	
	(1)	(2)	(3)	(4)

Treatment#Post	0.345***	0.320***	0.287***	0.299***
	(0.021)	(0.031)	(0.022)	(0.036)
Interactions with Treatment#Post				
Switched classes	0.005	-	0.023	-
	(0.027)	-	(0.030)	-
Class with lower designation	-	0.050	-	0.003
	-	(0.040)	-	(0.047)
Observations	203,231	74,526	268,040	56,754
R-squared	0.651	0.633	0.559	0.566
Students	21,450	21,450	21,977	21,977
Clusters: Class	4,972	4,359	6,379	4,859

Source: Bimonthly evaluation data - Rio de Janeiro, MED, 2012 - 2017. Robust standard errors allowing for clustering at the class level in parentheses. *p < 0.05, **p < 0.01, ***p < 0.001. Estimations include math, writing and reading and do not include the 1st grade in the pre-treatment period. All estimations include subject, administration, and student fixed effects.

9. Concluding remarks

In this paper, we estimate the impact of being retained in the 3rd grade on the 4th grade performance and of repeating the 4th grade on the 5th grade performance using a difference-in-differences approach. Our dataset is a panel of primary education students enrolled in the municipal education system of Rio de Janeiro between 2012 and 2017. Our results show that repeating the 3rd or 4th grade has a positive and significant impact on students' academic achievement. These results remain consistent across several robustness checks.

We find evidence suggesting part of the effect of retention on academic outcomes might be driven by the fear of repeating a grade because the threat of retention itself affects students. However, it cannot account for the entirety of the effect. Retention itself has an effect, beyond what is generated by its threat. It is also of note that the threat of retention only exists because retention itself exists, which makes the threat of retention part of the intervention. Another indication of this is that we find no indication that the placement of retained students across

classes in the repeated year is responsible for the positive effects we find in this paper. Our results seem to indicate retention works as a positive incentive for students to improve their academic performance in the short-term.

It is important to note that retention has been associated with negative outcomes in the long-term and affects students' psychological well-being. Requiring a student to repeat a grade is not the only way to ensure they are prepared for more advanced material and it might not be the most cost-effective strategy. The debate about retention and its effectiveness must consider all its possible effects on students and its high costs for the school system, especially considering its prevalence among vulnerable students.

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