Grade repeaters: Pygmalion in the French educational system?

A study of teachers' bias against repeaters

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Grade Repetiton

What is repetition and what is its state of development in France?

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What is repetition and what is its state of development in France?

- Repeat a whole school year,
- 28% of 15 y.o. students have repeated a year (2012, Eurydice)
- 5^{th} highest rate of grade repetition among OECD countries,
- Particularity of French-speaking countries.
- Chronic ineffectiveness of repetition

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Research question

A priori observation of a paradoxical situation

Why does the French education system continue to make pupils repeat a year, while knowing thanks to researchers that this is mostly inefficient?

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Research question

A priori observation of a paradoxical situation

Why does the French education system continue to make pupils repeat a year, while knowing thanks to researchers that this is mostly inefficient?

Research question

Is there a teacher bias towards pupils who have already repeated a year? Does this hypothetical bias affect student progress? Does it add up to the negative effects of repeating a year?

Framework and methodology

- Data set of blind and non blind test scores for the 2008 - 2009 school year

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Framework and methodology

- Data set of blind and non blind test scores for the 2008 - 2009 school year
- Difference-in-difference strategy with fixed effects: difference between repeaters and non repeaters gaps between the blind and non blind test scores
- Extension of methodology developed by Lavy 2008 (Falch and Naper 2013, Robinson and Lubienski 2011, Breda and Ly 2015, Lavy and Sand 2018, Terrier 2020) on teachers' gender bias $\rightarrow$ Our contribution: applying it to repeaters

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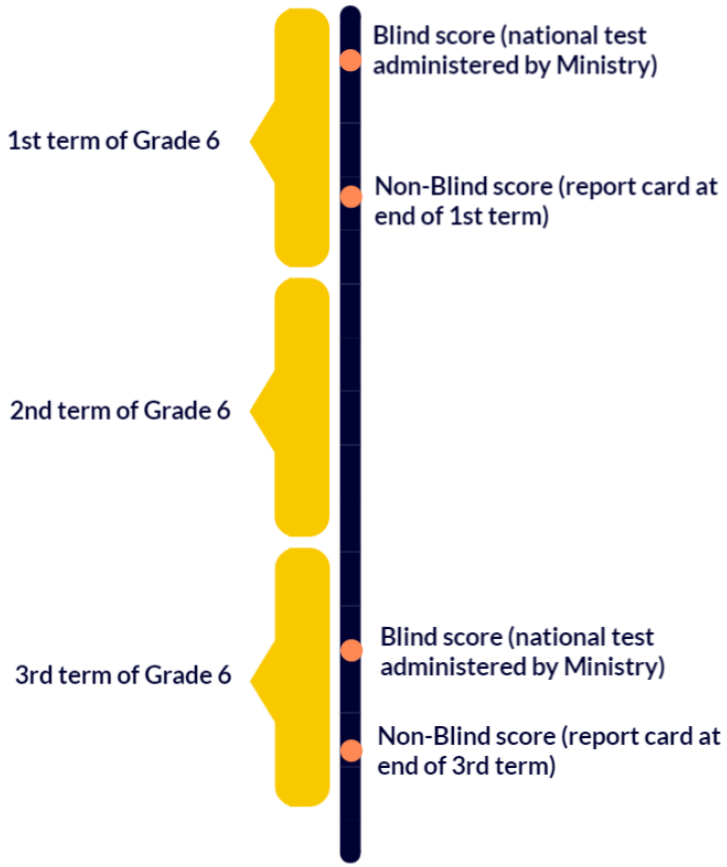
Data description

- 2008–2009 school year
- 35 middle schools, 191 classes and 4490 students
- Sample collected in the first year of middle school (grade 6)
- Contains French and Maths scores
- From Avvisati et al. 2014

Timeline of data collection



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Definition of the variables

- Repetition: coded on the basis of the pupils' age (date of birth) $\rightarrow$ cannot know when repeated or if began school later

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- Punishment dummy: disciplinary sanction or suspended in grade 6
- Reference teachers' questionnaires: sum of the results to measure a teacher's total questionnaire score for each student
- Socio-Economic characteristics: data on one parent, the self-declared "responsible legal 1". Based on social categories from INSEE, code as "white-collar" parents working as managers and executives, the two professions with higher salaries

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Descriptive statistics Table

- 28% of the students have repeated a class in the past
- Only one of the 191 classes does not have repeaters

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- Percentage of girls (41%) and boys (59%) among repeaters not completely balanced
- Similar shift in the average blind and non-blind scores between repeaters and non repeaters

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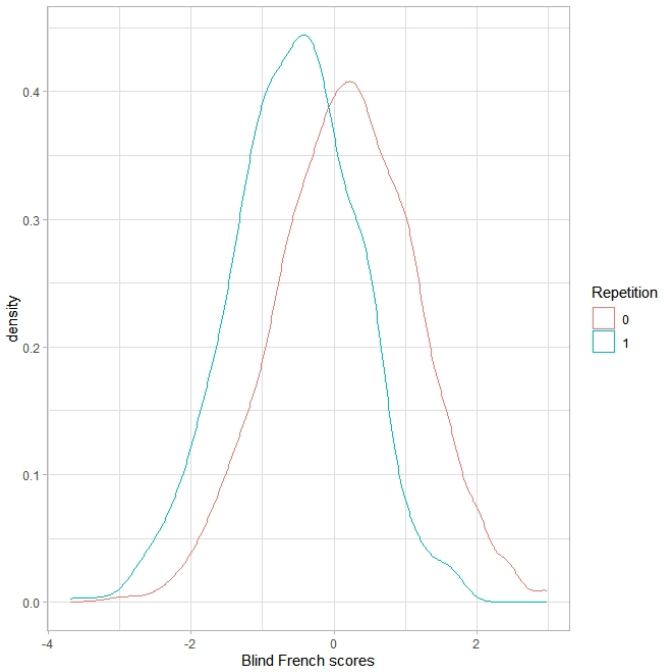
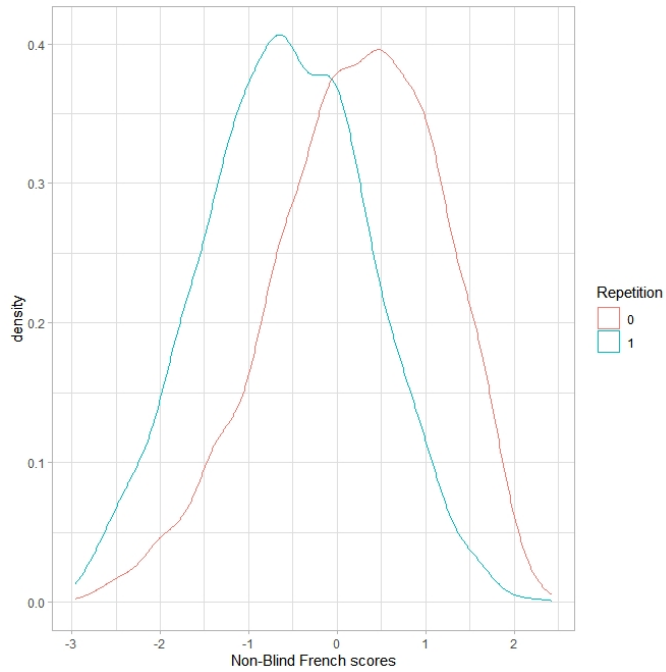
[1] "Catégorie socio-profesionnelle" i.e. Socio-professional category

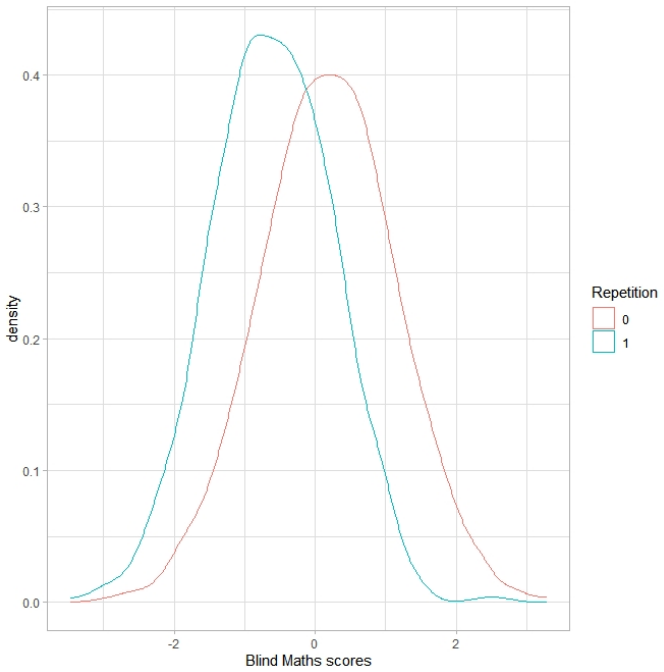
Distribution of 3rd term scores of repeaters and non-repeaters - French

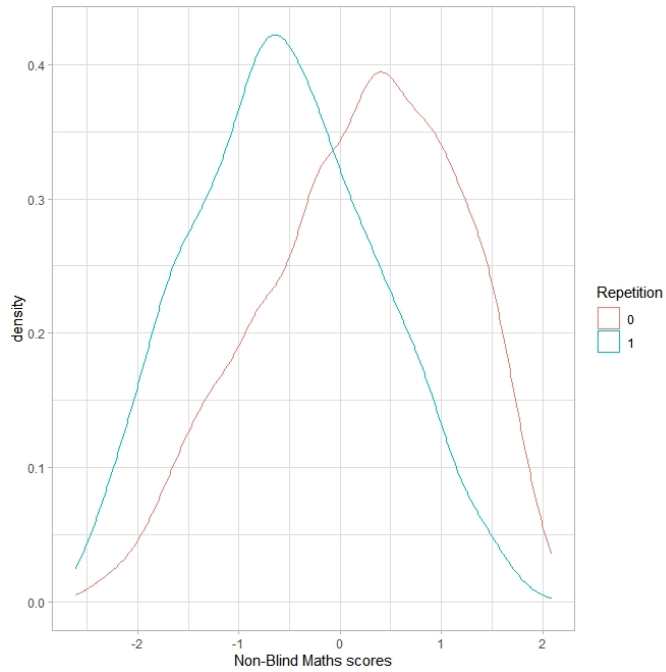




Notes: The distribution of densities of scores shows a clear shift between repeaters (in blue) and not repeaters (in red). The fact that the magnitude of the shift seems similar for blind and not blind scores confirm our main result that there is not a significant bias in teachers' evaluation.

Distribution of 3rd term scores of repeaters and non-repeaters - Maths





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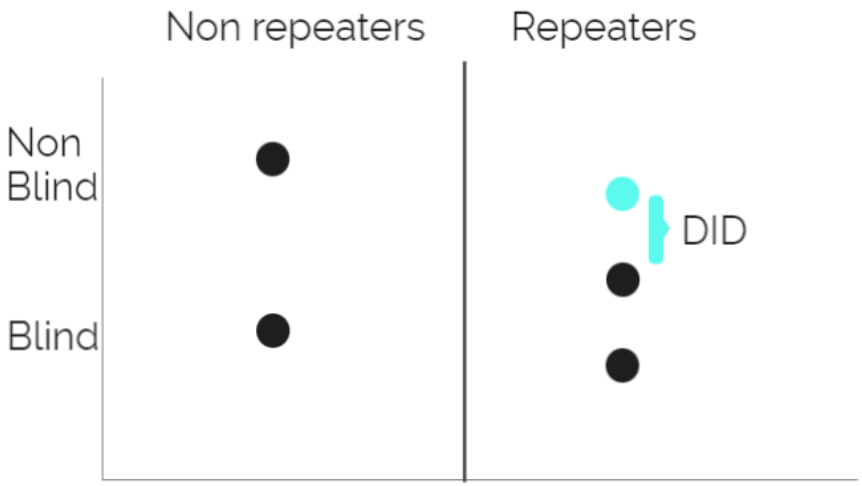
Difference-in-difference

Framework

Comparability of tests $\rightarrow$ parallel trend assumption.

Without teachers' bias, the difference between the non-blind score and the blind score should be the same for repeaters and non-repeaters.



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Identification strategy

DiD requires

(i) The difference between blind and non-blind tests is not correlated with other factors that have an impact on the scores $\rightarrow$ comparability

(ii) Repeating the year is not systematically affected by other variables that are in the error term

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ZCM for Blind: Comparability of Blind and Non-Blind scores

1. Do they measure the same skills? French Math
   - Competences
   - MCQ
   - Teachers' choice

→ Skills bias?

ZCM for Blind: Comparability of Blind and Non-Blind scores

2. Are they administered in the same way?
   - Environment
   - Stakes

$\rightarrow$ Incentive bias?

ZCM for Repetition

- In the error term characteristics that are correlated with repetition **and** have an impact on scores
- Not simultaneous decision
- Control for some characteristics

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Difference-in-difference Equation

Estimation strategy

$$S_{itj} = \beta_0 + \beta_1 NB_{itj} + \beta_2 R_{itj} + \beta_3 (NB_{itj} \times R_{itj}) + \psi_j + u_{itj}$$

Parameter of interest

β_3 identifies the mean differences in score gaps for repeaters and not, conditional on the blind scores $\Rightarrow \beta_3 \neq 0$ & statistically significant = bias

- Class-level fixed effects
- Errors clustered at school level Why?
- Different regressions for French and Maths

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Difference-in-difference-in-difference (DDD)

Equation Identification

Why?

Difference out trends that may differently affect treatment and control groups in DD estimator (Wooldridge 2010). Study heterogeneous distribution of the bias against repeaters.

For example: coefficient of $NB_{itj} \times R_{itj} \times Girl$ captures the different in bias against repeaters *and* girls vs. bias against repeaters *and* boys.

- For baseline characteristics
- For achievement

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Effect of bias on progress Derivation

We follow Terrier 2020 in modelling the student's progress:

- Blind score as a noisy measure of the true student ability
- Bias is the difference between a student true ability and the Non-Blind grades received
- Progress is defined as the difference between the true abilities at the beginning and at the end of grade 6

→ Aggregation at class level Why?
→ Bootstrap errors Idea

Parameter of interest

The effect of the bias against repeaters on the relative progress among repeaters and non-repeaters

Effect of bias on progress Derivation Timeline

Assumptions

- There is a quasi-random assignment of students to teachers with different degrees of bias
  $\rightarrow$ Headmaster, 1^{st} year of middle school, Right- and left-hand side balancing tests (Pei, Pischke, and Schwandt 2019) Tables
- There are differences in average exposure to bias, i.e. there are more or less biased teachers. $\rightarrow$ Density plot

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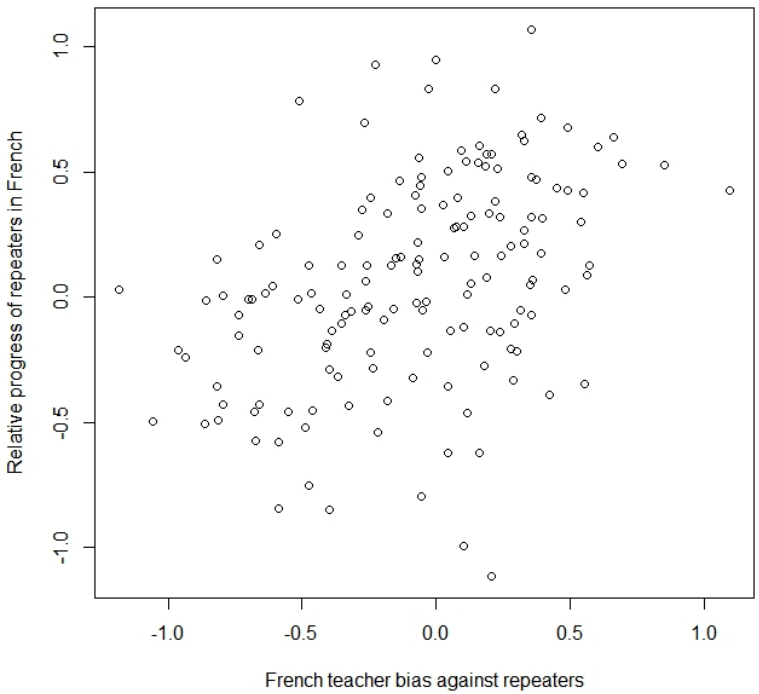
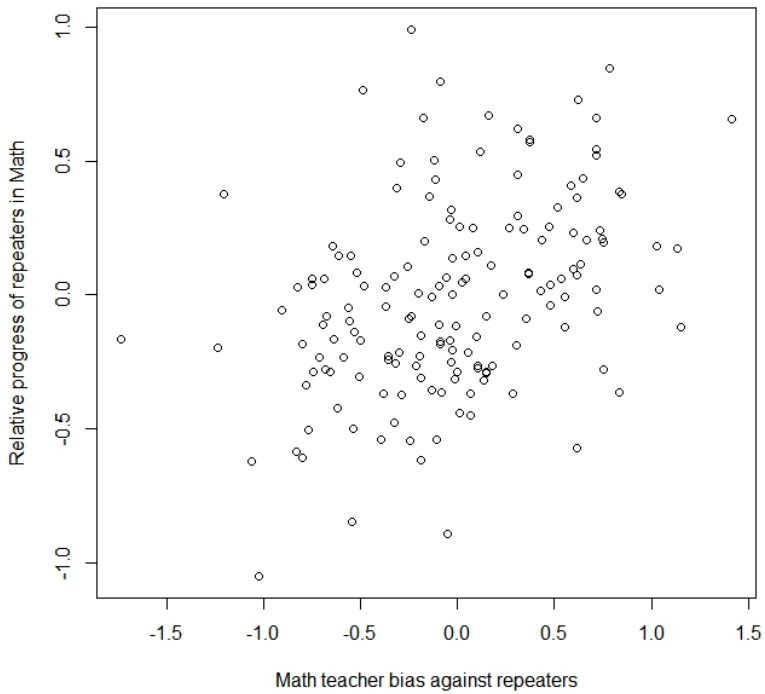
Variation in exposure to bias

Figure: Correlation between progress and bias for French (left) and Maths (right)





Average bias with DiD in third term

- French: estimate statistically significant at the 5% level without the inclusion of covariates $\rightarrow$ bias Table

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Average bias with DiD in third term

- French: estimate statistically significant at the 5% level without the inclusion of covariates $\rightarrow$ bias Table
- Maths: no apparent bias in Maths scores Table

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Heterogeneous effects for French scores - DDD results Table

- Gender: bias against female repeaters Table

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- Honors and good conduct grades: no statistically significant estimates Table

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Heterogeneous effects for Maths scores - DDD results

Table

- Again, no statistically significant estimates $\rightarrow$ no bias.

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Results

Main results

This suggests that there is a certain degree of bias against repeaters in French scores but only when coupled with other specific situations.

Quantile regression

How does the bias differ in different parts of the distribution of the dependent variable?

- Interpretation following the framework of Koenker 2005
- Great deal of variation for the distribution of the bias in French: the estimates have a lower magnitude and are not statistically significant in the tails of the distribution Results
- Even larger degree of heterogeneity in Maths, positive bias for high-achieving repeaters Results
- Non-significant with Bonferroni correction for multiple comparison problem

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Effect of bias on progress Table

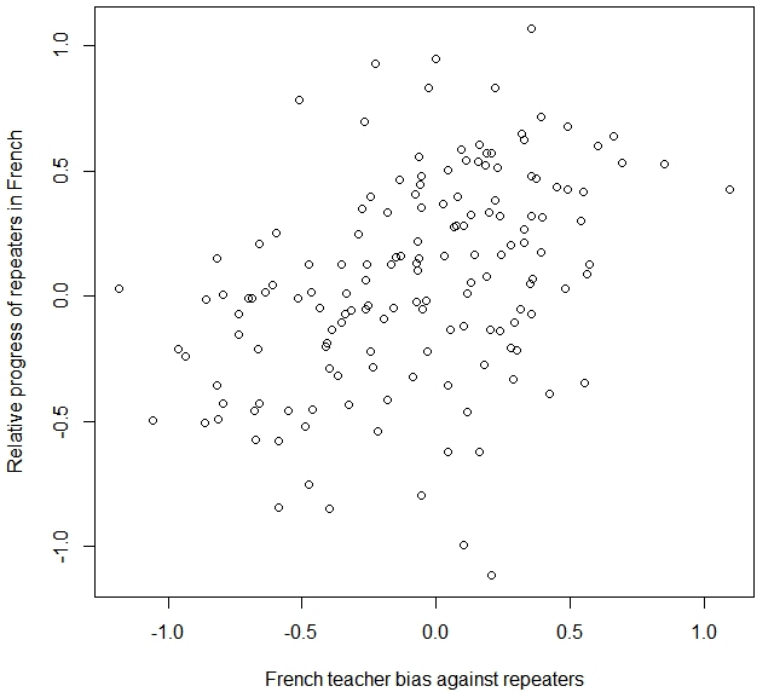
- Being assigned to a French teacher who is 1 SD more biased against repeaters would decrease repeaters' relative progress by 0.314 SD
- Being assigned to a Maths teacher who is 1 SD more biased against repeaters is associated with a decrease of 0.238 SD in repeaters' relative progress in Maths

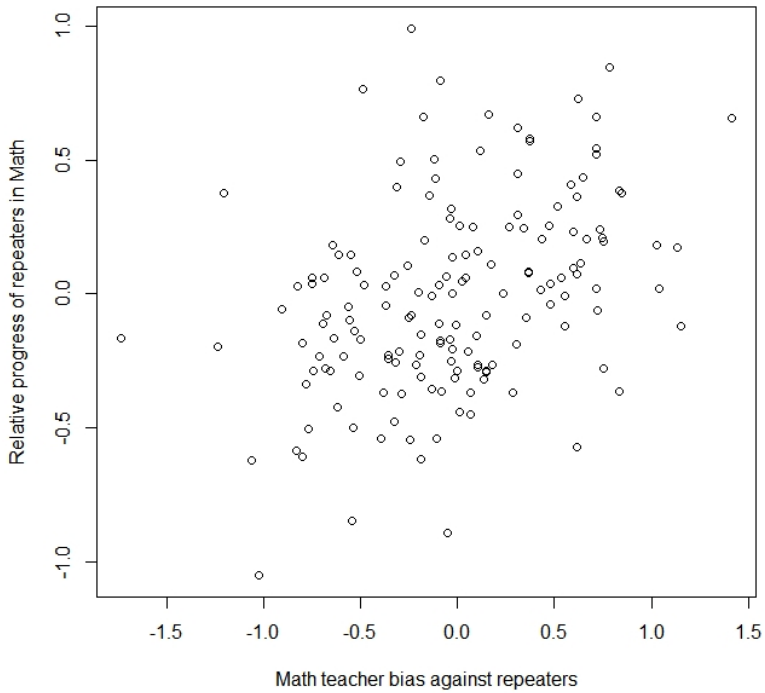
Main results

Estimates of teachers' biases have a negative and significant effect on repeaters' relative progress, both in French and Maths

Interpretation Derivation

How is it possible to have a non-significant average bias and still find a significant effect of teacher's bias on students' progress?





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Spillovers Table

- Regression adding the spillovers effect of having biased teachers in Maths on the progress in French (and conversely)
- No spillovers
- Coefficient of effect of bias on progress robust to inclusion

Limitations of our analysis

- Definition of repeaters: cannot know when repeated (already 6^{th} grade?)
- The estimated teacher bias captures also these differences in teachers' evaluation methods $\rightarrow$ not constant
- We are not able to disentangle the effect of teacher bias in giving grades from the teacher's biased behaviour in class
- Repeaters tend to do more half-days of absences $\rightarrow$ more missing values

Robustness checks

- 1st Term Replication: bias against repeaters in French is taste-based rather than statistical Table
- Number of observations: 28%
- Quasi-random assignment of students Right hand side balancing test Left hand side balancing test
- Balanced checks of attrition

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External validity

"Zone d'Education Prioritaire"

- 1 French pupil out of 5
- Fewer students per class (Jeljoul, Lopes, and Degabriel 2001)
- Younger teachers (Prost 2012)
- Role of the composition of the teaching staff in their beliefs and therefore their behaviour (Boraita 2015; Marcoux and Crahay 2008)

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Our sample:

- Two thirds are in ZEPs
- Schools in the data are "volunteers"
- Representative sample of the population of deprived schools

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Conclusion

Main findings of our article

Our results point towards a bias only in French marks, not Maths, against repeaters with other shortcomings, such as disciplinary sanctions. Relative bias against repeaters has a negative effect on their relative progress.

Our contribution: extending the diff-in-diff bias method for gender on repetition bias, finding new evidence of negative effect of repetition $\rightarrow$ policy implications

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Empirical evaluations of grade repetition

Literature review

Harmful consequences on pupils' trajectory (Alexander, Entwisle, and Kabbani 2001)

Repeaters make less progress than pupils who have been promoted (Seibel 1984)

Positive effects in the sort term, i.e. 2 first years, but negative in the long term (Dong 2010)

Beneficial effect of repetition disappears as soon as new skills have to be learned (Goos 2013)

Public authorities, teachers and parents have a positive image of grade repetition (Crahay 2007)

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Teachers' questionnaires

- How pleasant is she/he/they in class?
- Did he/she/they work diligently?
- Did he/she/they progress over the year?
- Was dialogue with the child's parents satisfactory?
- Did his/her/their parents provide her/him/them with support with school work?

Zero Conditional Mean assumption

Comparability between tests

- Measuring the same skills?
  - Written questions or oral presentations versus MCQs
- Administered in the same way?
  - Taken on paper in 2008 (not the case anymore)
  - Same school and classroom
- Different incentives?

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Descriptive Statistics

Table 1: Descriptive statistics for repeaters and non-repeaters.

	Not-late (1)		Late (2)		Difference (3) = (2)-(1)	
	Mean	Std. Dev.	Mean	Std. Dev.	Diff. in Means	Std. Error
Students' characteristics						
Girls (%)	0.51	0.50	0.41	0.49	-0.11	0.02
First child	0.54	0.50	0.54	0.50	-0.01	0.02
Academic results						
Non-Blind French (1st Term)	12.59	3.28	9.86	3.08	-2.73	0.11
Non-Blind French (3rd Term)	11.82	3.50	8.94	3.39	-2.89	0.12
Non-Blind Math (1st Term)	13.32	3.69	10.33	3.69	-2.99	0.13
Non-Blind Math (3rd Term)	11.96	4.08	8.86	3.86	-3.10	0.14
Blind French (1st Term)	0.23	0.95	-0.60	0.87	-0.83	0.03
Blind French (3rd Term)	0.17	0.97	-0.56	0.87	-0.73	0.04
Blind Math (1st Term)	0.22	0.96	-0.61	0.87	-0.83	0.03
Blind Math (3rd Term)	0.18	0.97	-0.61	0.86	-0.79	0.04
N	3314		1283			
Behaviour (3rd Term)						
Disciplinary warning (%)	0.08	0.27	0.15	0.36	0.07	0.01
Grade 6 retention (%)	0.03	0.17	0.01	0.10	-0.02	0.00
Honours ("Mention")	0.42	0.49	0.22	0.41	-0.21	0.02
Half-day absences in 3rd term	2.81	5.39	7.08	11.51	4.27	0.40
N	3005		1167			
Socio-economic characteristics						
At least one parent employed	0.89	0.32	0.74	0.44	-0.14	0.01
High SES (%)	0.22	0.42	0.09	0.29	-0.13	0.01
2 parents in the household	0.76	0.43	0.64	0.48	-0.12	0.02
Need-based scholarship	0.29	0.46	0.41	0.49	0.12	0.02
N	3314		1283			
Teacher's questionnaire (%)						
Behaviour in class	0.64	0.48	0.46	0.50	-0.18	0.02
Diligence in class work	0.65	0.48	0.32	0.47	-0.33	0.02
Progress over the year	0.69	0.46	0.35	0.48	-0.34	0.02
Dialogue with parents	0.85	0.36	0.65	0.48	-0.19	0.02
Parents' support to homework	0.28	0.45	0.08	0.27	-0.20	0.01
N	2516		808			

Blind scores are standardized to a normal $N(0,1)$. High SES (Socio-Economic Status) for the parents professions takes value 1 if the parents belong to the French administrative category "manager" or "executive". Teacher questionnaire were administered to the reference teacher at the end of grade 6. Honours obtained indicates a judgement on the general attitude. In this table, there is the percentage of students who obtained either the lower level (encouragements), the second level (compliments) *or* the highest honours (félicitations).

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Base model

$$S_{itj} = \beta_0 + \beta_1 NB_{itj} + \beta_2 R_{itj} + \beta_3 (NB_{itj} \times R_{itj}) + \psi_j + u_{itj}$$

where j is the class, i is the student and t is the period.

- S_{itj} is the blind or non-blind grade a pupil receives.
- NB_{itj} is a dummy equal to 1 when the score is NB.$\rightarrow \beta_1$ identifies the "grade inflation" for non-repeating students in the teacher grading
- R_{itj} is a dummy equal to 1 when the student has repeated a year in the past. $\rightarrow \beta_2$ identifies the repeaters achievement gap.
- ψ_j are class fixed effects.
- u_{itj} is the error term.

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DDD estimator

$$
\begin{aligned}
S_{itj} =& \beta_0 + \beta_1 NB_{itj} + \beta_2 R_{itj} + \beta_3 (NB_{itj} \times R_{itj}) + \beta_4 X_{ij} \\
&+ \beta_5 (X_{ij} \times NB_{itj}) + \beta_6 (X_{ij} \times R_{itj}) \\
&+ \beta_7 (X_{ij} \times NB_{itj} \times R_{itj}) + \psi_j + u_{itj}
\end{aligned}
$$

$$
\begin{aligned}
\hat{\beta}_7 =& [(\bar{S}_{R,F,NB} - \bar{S}_{R,F,B}) - (\bar{S}_{NR,F,NB} - \bar{S}_{NR,F,B})] \\
&- [(\bar{S}_{R,M,NB} - \bar{S}_{R,M,B}) - (\bar{S}_{R,M,B} - \bar{S}_{NR,M,B}))]
\end{aligned}
$$

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Modelling student progress

$$B_{itj} = \theta_{it} + \epsilon_{itj}$$

$$Bias_{it} = NB_{it} - \theta_{it}$$

$$\theta_{i2} - \theta_{i1} = \beta Bias_{i1} + \eta R_i + \mu T_i + \gamma \theta_{i1} + \omega_i$$

$$B_{i2j} - B_{i1j} = \beta(NB_{i1} - B_{i1}) + \eta R_i + \mu T_i + \gamma B_{i1} + \epsilon_{i2j} + (\beta - 1 - \gamma)\epsilon_{i1j}$$

Class level aggregation:

$$[(B_{2R} - B_{1R}) - (B_{2NR} - B_{1NR})]_j = \eta + \beta[(NB_{R1} - B_{R1}) - (NB_{NR1} - B_{NR1})]_j + (B_{1R} - B_{1NR}) + (\omega_R - \omega_{NR})_j$$

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Clusterization for diff-in-diff

We cluster errors at the school level because:

- we expect unobserved components for children within a school to be correlated.
- The experimental design by Avvisati et al. 2014 involves sampling a selection of middle schools in the district. Administrative data was collected for all 6th grade classes in the sampled schools.

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Why aggregation at class level?

Each observation is a class.

- Avoid (class-invariant) teacher's effect (value-added, Lavy and Megalokonomou 2019)
- Avoid reverse causality at individual level
- Attenuate measurement error

First Term Replication

	Dependent variable:	
	Scores in French	Scores in Math
Repetition	0.235***	−0.118***
	(0.038)	(0.046)
Non-Blind	−0.003	0.005
	(0.045)	(0.049)
Repetition × Non-Blind	0.018	0.027
	(0.051)	(0.044)
Observations	8,061	8,095

Notes: Constant omitted. Fixed effects for class included. Errors clustered at school level. *p<0.1; **p<0.05; ***p<0.01

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Quasi-random assignment of students

Right hand side balancing test for Maths.

	Dependent variable:					
	Repeaters bias in Maths					
	(1)	(2)	(3)	(4)	(5)	(6)
Achievement gap in Maths	−0.043	−0.046	−0.048	−0.045	−0.044	−0.049
	(0.034)	(0.035)	(0.036)	(0.036)	(0.036)	(0.036)
High SES gap		0.048	0.047	0.062	0.058	0.065
		(0.106)	(0.107)	(0.108)	(0.109)	(0.108)
2 parents in household gap			0.033	0.041	0.037	−0.009
			(0.078)	(0.078)	(0.079)	(0.081)
Need-based scholarship gap				0.065	0.064	0.079
				(0.073)	(0.074)	(0.073)
First child gap					−0.027	−0.023
					(0.072)	(0.072)
At least 1 parent employed gap						0.202**
						(0.098)
Constant	−0.006	−0.003	−0.002	−0.003	−0.004	0.009
	(0.031)	(0.032)	(0.032)	(0.032)	(0.032)	(0.033)
Observations	178	178	178	178	178	178
R^2	0.009	0.010	0.011	0.015	0.016	0.040
F Statistic	1.549	0.871	0.638	0.676	0.566	1.192

Notes: Fixed effects for schools included in all regressions. Errors clustered at school level. The degrees of freedom of the F-Statistics are respectively: df = 1; 176 for the 1st regression, df = 2; 175 for the second one, df = 3; 174 for the third one, df = 4; 173 for the fourth one, df = 5; 172 for the fifth one, df = 6; 171 for the sixth one. *p<0.1; **p<0.05; ***p<0.01

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Quasi-random assignment of students

Right hand side balancing test for French.

	Dependent variable:					
	Repeaters bias in French					
	(1)	(2)	(3)	(4)	(5)	(6)
Achievement gap in French	−0.098**	−0.097**	−0.098**	−0.098**	−0.102**	−0.112***
	(0.042)	(0.041)	(0.041)	(0.041)	(0.041)	(0.042)
High SES gap		−0.018**	−0.022**	−0.022**	−0.023**	−0.025***
		(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
2 parents in household gap			0.008	0.008	0.002	−0.004
			(0.006)	(0.006)	(0.007)	(0.009)
Need-based scholarship gap				−0.0002	−0.003	−0.004
				(0.008)	(0.008)	(0.008)
First child gap					0.012*	0.009
					(0.006)	(0.007)
At least 1 parent employed gap						0.010
						(0.009)
Observations	178	178	178	178	178	178
R^2	0.306	0.325	0.336	0.336	0.374	0.359
F Statistic	1.864***	1.970***	1.993***	1.926***	2.198***	1.993***

Notes: Fixed effects for schools included in all regressions. Errors clustered at school level. The degrees of freedom of the F-Statistics are respectively: df = 1; 176 for the 1st regression, df = 2; 175 for the second one, df = 3; 174 for the third one, df = 4; 173 for the fourth one, df = 5; 172 for the fifth one, df = 6; 171 for the sixth one. *p<0.1; **p<0.05; ***p<0.01

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Quasi-random assignment of students

Left hand side balancing test for Maths.

	Dependent variable:				
	High SES	2 parents	Scholarship	First Child	Employed
	(1)	(2)	(3)	(4)	(5)
Repeaters bias in Maths	0.228	2.063	0.934	0.979	3.656**
	(1.237)	(1.849)	(1.140)	(1.674)	(1.781)
Achievement gap in Maths	0.578	1.605***	0.268	1.134	2.079***
	(0.359)	(0.595)	(0.362)	(0.812)	(0.750)
Constant	−3.054***	−11.359***	−2.309***	−8.966***	−14.393***
	(0.276)	(0.431)	(0.207)	(0.560)	(0.467)
Note:					*p<0.1; **p<0.05; ***p<0.01

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Quasi-random assignment of students

Left hand side balancing test for French.

	Dependent variable:				
	High SES	2 parents	Scholarship	First Child	Employed
	(1)	(2)	(3)	(4)	(5)
Repeaters bias in French	−1.583	1.064	0.350	2.580*	1.913
	(1.057)	(1.590)	(1.300)	(1.457)	(1.685)
Achievement gap in French	−0.149	0.176	0.355	0.696	1.406
	(0.401)	(0.917)	(0.623)	(0.883)	(1.102)
Constant	−3.714***	−11.929***	−2.078***	−8.732***	−14.058***
	(0.384)	(0.814)	(0.549)	(0.710)	(0.969)
Note:					*p<0.1; **p<0.05; ***p<0.01

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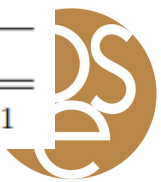
Quantile regression - Maths

Table 5: Quantile regression for Maths scores

	Dependent variable:					
	Maths Scores					
	(1)	(2)	(3)	(4)	(5)	DID
	5th perc.	25th perc.	50th perc.	75th perc.	95th perc.	
Repetition × Non-Blind	0.106	−0.046	−0.040	−0.014	0.236**	0.008
	(0.101)	(0.074)	(0.059)	(0.069)	(0.103)	(0.049)
Repetition	−0.553***	−0.685***	−0.832***	−0.810***	−0.872***	0.035
	(0.081)	(0.052)	(0.043)	(0.046)	(0.082)	(0.130)
Non-Blind	−0.110*	0.030	0.087***	0.075**	−0.090**	0.001
	(0.064)	(0.035)	(0.029)	(0.033)	(0.041)	(0.024)
Constant	−1.438***	−0.517***	0.203***	0.827***	1.700***	−0.767***
	(0.056)	(0.014)	(0.020)	(0.025)	(0.037)	(0.128)
Observations	7,597	7,597	7,597	7,597	7,597	7,597
Note:						*p<0.1; **p<0.05; ***p<0.01



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Quantile regression - French

Table 4: Quantile regression for French scores

	Dependent variable:					
	French Scores					
	(1)	(2)	(3)	(4)	(5)	DID
	5th perc.	25th perc.	50th perc.	75th perc.	95th perc.	
Repetition × Non-Blind	−0.075	−0.177**	−0.104	−0.056	0.116	−0.118**
	(0.109)	(0.069)	(0.083)	(0.067)	(0.123)	(0.049)
Repetition	−0.520***	−0.634***	−0.707***	−0.837***	−0.814***	−0.010
	(0.069)	(0.039)	(0.071)	(0.052)	(0.104)	(0.131)
Non-Blind	−0.014	0.113***	0.082*	0.110***	−0.006	0.036
	(0.059)	(0.037)	(0.046)	(0.038)	(0.073)	(0.024)
Constant	−1.495***	−0.540***	0.167***	0.815***	1.629***	−0.686***
	(0.032)	(0.021)	(0.038)	(0.031)	(0.071)	(0.128)
Observations	7,566	7,566	7,566	7,566	7,566	7,566
Note:						*p<0.1; **p<0.05; ***p<0.01

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Skills in Blind and Non-Blind - Maths

Blind	Non-Blind
Geometry	
Two-dimensional figures	
Alignment, perpendicular, parallel, and symmetry	Symmetry of a straight line
Cube shape and parallelepiped rectangle	Parallelepiped rectangle
Data understanding	
Proportionality	
Tables, diagrams, and graphics	Carthesian axis, diagrams/graphics
Size and measurement	
Measurement units (length, mass, volums, and duration)	
	Angles
	Area and Volumes
Calculus	
Integer numbers	
Decimals	
Fractions	
4 operations	

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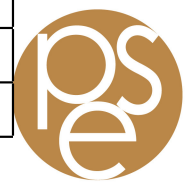
Skills in Blind and Non-Blind - French

Blind	Non-Blind
Grammar	
Verb conjugation	
	Spelling
	Classes of words (noun, pronoun...)
Word formation	
Time-space indication	
Word understanding	
Understanding of words in context, unusual words	Vocabulary
	Reading
Classification of informations	
Writing	
Add punctuation to a text	Use of punctuation
Produce a coherent text	Essay writing (1 page max)
Transform a text	



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Estimation of the Repetition Bias in French Scores

Table 2: Estimation of the Repetition Bias in French Scores

	Third-term marks in French				
	(1)	(2)	(3)	(4)	(5)
Repetition	−0.010	−0.172	0.003	0.230*	0.047
	(0.131)	(0.131)	(0.131)	(0.122)	(0.131)
Non-Blind	0.036	−0.006	0.003	−0.129***	−0.142**
	(0.024)	(0.034)	(0.031)	(0.046)	(0.058)
Repetition × Non-Blind	−0.118**	−0.063	−0.034	−0.133*	0.013
	(0.049)	(0.065)	(0.064)	(0.076)	(0.103)
Heterogeneous effects for gender:					
Girl		0.344***			0.211***
		(0.034)			(0.038)
Girl × Non-Blind		0.082*			0.019
		(0.047)			(0.048)
Girl × Repetition		0.034			0.030
		(0.071)			(0.078)
Girl × Non-Blind × Repetition		−0.099			−0.044
		(0.096)			(0.097)
Heterogeneous effects for punishments:					
Punishment			−0.580***		−0.260***
			(0.048)		(0.048)
Punishment × Non-Blind			−0.359***		−0.162**
			(0.077)		(0.073)
Punishment × Repetition			0.340***		0.261***
			(0.087)		(0.084)
Punishment × Non-Blind × Repetition			−0.201		−0.303***
			(0.129)		(0.122)
Heterogeneous effects for teacher questionnaire scores:					
TQS = 1				0.031	0.021
				(0.062)	(0.071)
TQS = 2				0.281***	0.224***
				(0.067)	(0.080)
TQS = 3				0.575***	0.482***
				(0.061)	(0.072)
TQS = 4				0.736***	0.549***
				(0.053)	(0.063)
TQS = 5				1.086***	0.883***
				(0.054)	(0.066)
TQS = 1 × Non-Blind × Repetition				0.087	0.157
				(0.129)	(0.140)
TQS = 2 × Non-Blind × Repetition				0.157	0.176
				(0.143)	(0.155)
TQS = 3 × Non-Blind × Repetition				0.192	0.157
				(0.158)	(0.175)
TQS = 4 × Non-Blind × Repetition				0.276**	0.131
				(0.139)	(0.152)
TQS = 5 × Non-Blind × Repetition				0.485**	0.284
				(0.197)	(0.227)
Constant	0.686***	0.515***	0.737***	0.721***	0.663***
	(0.128)	(0.127)	(0.125)	(0.116)	(0.116)
Observations	7,566	7,566	6,219	7,566	6,219

Notes: ***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

Interaction variables between TQS and Repetition (TQS × Repetition) were not included in the table as they all yielded mostly statistically insignificant results, and those between TQS and Non-Blind (TQS × Non-Blind), despite some yielding statistically significant results, as they weren't directly relevant to the research question.

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Estimation of the Repetition Bias in Maths Scores

Table 3: Estimation of the Repetition Bias in Maths Scores

	Third-term marks in Maths				
	(1)	(2)	(3)	(4)	(5)
Repetition	0.035	0.061	−0.008	0.152	0.158
	(0.130)	(0.133)	(0.130)	(0.122)	(0.134)
Non-Blind	0.001	−0.140***	0.093***	0.060	0.012
	(0.024)	(0.034)	(0.033)	(0.044)	(0.063)
Repetition × Non-Blind	0.008	0.063	0.113	−0.044	0.100
	(0.049)	(0.066)	(0.074)	(0.075)	(0.119)
Heterogeneous effects for gender:					
Girl		−0.074**			−0.251***
		(0.035)			(0.039)
Girl × Non-Blind		0.274***			0.186***
		(0.047)			(0.054)
Girl × Repetition		0.017			0.048
		(0.073)			(0.080)
Girl × Non-Blind × Repetition		−0.075			−0.069
		(0.097)			(0.108)
Heterogeneous effects for punishments:					
Punishment			−0.514***		−0.272***
			(0.049)		(0.049)
Punishment × Non-Blind			−0.323***		−0.233***
			(0.064)		(0.065)
Punishment × Repetition			0.292***		0.225***
			(0.086)		(0.086)
Punishment × Non-Blind × Repetition			−0.008		−0.006
			(0.116)		(0.117)
Heterogeneous effects for teacher questionnaire scores:					
TQS = 1				0.097	0.017
				(0.062)	(0.075)
TQS = 2				0.312***	0.199**
				(0.067)	(0.082)
TQS = 3				0.632***	0.532***
				(0.060)	(0.074)
TQS = 4				0.822***	0.680***
				(0.053)	(0.066)
TQS = 5				1.226***	1.061***
				(0.054)	(0.060)
TQS = 1 × Non-Blind × Repetition				0.124	0.026
				(0.129)	(0.153)
TQS = 2 × Non-Blind × Repetition				0.085	0.064
				(0.143)	(0.169)
TQS = 3 × Non-Blind × Repetition				0.111	0.133
				(0.158)	(0.192)
TQS = 4 × Non-Blind × Repetition				0.234*	0.170
				(0.139)	(0.167)
TQS = 5 × Non-Blind × Repetition				0.265	0.259
				(0.200)	(0.267)
Constant	0.767***	0.806***	0.778***	0.699***	0.869***
	(0.128)	(0.128)	(0.123)	(0.116)	(0.119)
Observations	7,579	7,597	4,970	7,597	4,970

Notes: ***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

Interaction variables between TQS and Repetition (TQS × Repetition) were not included in the table as they all yielded mostly statistically insignificant results, and those between TQS and Non-Blind (TQS × Non-Blind),

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DDD framework

Equation

DDD can be used when the trend assumption does not seem to be valid (Wing, Simon, and Bello-Gomez 2018) → white-collar worker and homework

Pro

Allows repeaters and non-repeaters to have different unobserved characteristics, as long as these differences do not vary across the additional dimension.

Con

Additional assumptions (Atanasov and Black 2016):
1. Without repetition, scores for girls would have been parallel in blind vs. non blind tests.
2. Without repetition, scores for girls vs. boys would have been parallel in non blind tests.

DDD identification

$$\begin{aligned}\beta_7 =& E(Y_1|NB=1,X=1,R=1) - E(Y_0|NB=1,X=1,R=0) - \\ & [E(Y_0|NB=0,X=1,R=1) - E(Y_0|NB=0,X=1,R=0)] - \\ & [E(Y_1|NB=1,X=0,R=1) - E(Y_0|NB=1,X=0,R=0) - \\ & [E(Y_0|NB=0,X=0,R=1) - E(Y_0|NB=0,X=0,R=0)]]\end{aligned}$$

1. Without repetition, scores for girls would have been parallel in blind vs. non blind tests.

$$\begin{aligned}& E(Y_0|NB=1,X=1,R=1) - E(Y_0|NB=1,X=1,R=0) = \\ & E(Y_0|NB=0,X=1,R=1) - E(Y_0|NB=0,X=1,R=0)\end{aligned}$$

2. Without repetition, scores for girls vs. boys would have been parallel in non blind tests.

$$\begin{aligned}& [E(Y_0|NB=1,X=1,R=1) - E(Y_0|NB=1,X=1,R=0) - \\ & [E(Y_0|NB=1,X=0,R=1) - E(Y_0|NB=1,X=0,R=0)]]\end{aligned}$$

Bootstrap errors

	Samples		Parameters	
World of origin	$Y = Y_1 \ldots Y_n$	β_Y	Y^*	β_Y^*
Bootstrap world	Y^b	β_Y^b	Y_b^*	β_Y

$$V(\beta) = \frac{1}{B}\sum_{b=1}^{B}(\beta_Y^b - \beta_Y)^2$$

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Heterogeneity in repeaters bias along Gender axis

Results for French

	Dependent variable
	Scores
Repetition	0.206***
	(0.059)
Non-Blind	0.076
	(0.060)
Non-Blind × Repetition	−0.161**
	(0.071)
Boy	−0.344***
	(0.030)
Boy × Non-Blind	−0.082**
	(0.039)
Boy × Repetition	−0.034
	(0.081)
Boy × Non-Blind × Repetition	0.099
	(0.085)
Constant	0.859***
	(0.035)
Observations	7,566

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Heterogeneity in repeaters bias for mono- and bi-parental

Results for French

	Dependent variable:	
	French scores	
	(1)	(2)
Repetition × Non-Blind	−0.075	−0.136**
	(0.092)	(0.058)
Repetition	−0.615***	−0.714***
	(0.070)	(0.043)
Non-Blind	−0.010	0.050*
	(0.053)	(0.027)
Biparental	0.699***	
	(0.128)	
Biparental × Non-Blind	0.060	
	(0.059)	
Repetition × Biparental	−0.099	
	(0.082)	
Repetition × Biparental × Non-Blind	−0.060	
	(0.109)	
Monoparental		−0.132***
		(0.044)
Non-Blind × Monoparental		−0.060
		(0.059)
Repetition × Monoparental		0.099
		(0.082)
Repetition × Monoparental × Non-Blind		0.060
		(0.109)
Observations	7,566	7,566
Note:	*p<0.1; **p<0.05; ***p<0.01	

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Heterogeneity in repeaters bias for honors and good conduct grades

Results for French

	Dependent variable:	
	Scores	
	(1)	(2)
Repetition × Non-Blind	−0.077	−0.073
	(0.075)	(0.048)
Repetition	−0.429***	−0.086**
	(0.086)	(0.042)
Non-Blind	−0.112	−0.124*
	(0.108)	(0.070)
Good Conduct	0.638***	
	(0.063)	
Non-Blind × Good Conduct	0.250**	
	(0.097)	
Repetition × Good Conduct	−0.295***	
	(0.097)	
Repetition × Non-Blind × Good Conduct	0.120	
	(0.083)	
Honors		0.885***
		(0.042)
Non-Blind × Honors		0.328***
		(0.048)
Repetition × Honors		−0.300***
		(0.086)
Repetition × Non-Blind × Honors		0.134
		(0.095)
Constant	0.047	0.183***
	(0.057)	(0.037)

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Heterogeneity in repeaters bias for socio-economic background

Results for French

	Dependent variable:	
	French scores	
	(1)	(2)
Repetition × Non-Blind	−0.122**	−0.142***
	(0.050)	(0.052)
Repetition	−0.643***	−0.002
	(0.036)	(0.039)
Non-Blind	0.059	0.039
	(0.058)	(0.058)
White-collar	0.941***	
	(0.056)	
White-collar × Non-Blind	−0.096*	
	(0.056)	
White-collar × Repetition	−0.135	
	(0.128)	
White-collar × Repetition × Non-Blind	−0.109	
	(0.138)	
Unemployed		−0.165**
		(0.065)
Non-Blind × Unemployed		−0.027
		(0.066)
Repetition × Unemployed		0.075
		(0.098)
Repetition × Non-Blind × Unemployed		0.111
		(0.084)
Note:		*p<0.1; **p<0.05; ***p<0.01

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Effect of bias on progress and spillovers

	Dependent variable:			
	Repeaters' progress in French		Repeaters' progress in Maths	
	(1)	(2)	(3)	(4)
Repeaters' bias in Maths		−0.015	0.238***	0.236***
		(0.058)	(0.049)	(0.050)
Repeaters' bias in French	0.314***	0.300***		0.042
	(0.079)	(0.081)		(0.063)
Achievement gap in French	−0.175**	−0.180**		
	(0.071)	(0.073)		
Achievement gap in Maths			−0.127**	−0.130**
			(0.051)	(0.052)
Constant	−0.047	−0.054	−0.098**	−0.100**
	(0.066)	(0.068)	(0.047)	(0.048)
Observations	154	152	158	156

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