

Information, Market Incentives, and Student Performance: Evidence from a Regression Discontinuity Design in Brazil

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Introduction

- School quality is hard to observe.
 - School production function is generally unknown and effort by students, teachers, and principals is not observable.
- Test scores may be a less noisy signal of school quality. (not necessarily - Urquiola, Romaguera and Mizala (2006))
- How do students and schools react to signals of school quality?

Introduction

- The literature has mostly focused on:
 1. School choice debate:
 - Black (1999), Figlio and Lucas (2004), Hasting et al. (2008, 2012), Koning and Wiel (2010), and Urquiola and Mizala (2011).
 2. Reactions to accountability systems.
 - Carnoy and Loeb (2003); Hanushek and Raymond (2004), Jacob, (2005), Figlio and Rouse (2006), and Dee and Jacob (2009); Chiang (2009), and Bacolod et al. (2009).
 3. Impact on test scores - low evaluated schools:
 - Rockoff and Turner (2010) and Koning and Wiel (2012)
- Contribution: Pure informational effects

Mechanisms

- Test score disclosure can affect:
 - (i) School's effort (teachers, principals and inputs).
 - School ignores production function. Signal reveals school's weaknesses.
 - Might expect impacts on school's observed inputs.
 - Market incentives matter.
 - (ii) Student's (or parents') effort.
 - Information on school quality changes student choice to exert effort.
- Heterogenous effects. Negative signal induces more effort.(Pop-Eleches and Urquiola (2011))

In a Nutshell

- We take advantage of a discontinuity on the disclosure rules for the ENEM in Brazil.
- We find that disclosure of test scores in 2005:
 - (i) has no impact on school observable characteristics in 2007;
 - (ii) has an impact on test scores in 2007 (private schools only).
 - (iii) has heterogenous effects.
 - (a) Best schools: present no effects.
 - (b) Worst schools: present positive effects.
 - (iv) no evidence on students' effort (prep classes).

- The National Secondary Education Examination (ENEM) was created in 1998 to evaluate students who finish high school. It is organized by the National Institute for Educational Studies and Research (INEP) of the Ministry of Education (MEC) of Brazil.
- The ENEM score is used for admission by several public and private universities. It is also used in the selection of the beneficiaries for the Federal College Voucher Program (ProUni).

- ENEM is non-mandatory.
- Until 2008, it was a one-day exam comprised of 63 multiple-choice questions on a number of subjects and an essay.
- Beginning in 2009, it is a two-day exam consisting of 180 multiple-choice questions and an essay.
- ENEM is graded on a 0-100 scale. Before 2009, it did not use Item Response Theory.

- Starting in 2006, in each year INEP releases the schools' average scores in the previous year.
- Only schools with 10 or more ENEM takers have their average score released to the public.
- The school score is the average of all its students who finished high school in that year.
- The scores are available at INEP's website (<http://sistemasenem4.inep.gov.br/enemMediasEscola/>) and are publicized by all the major newspapers in Brazil.

ENEM-INEP website printscreen

Notas Médias do Enem dos alunos concluintes do Ensino Médio por escola.

Modalidade: Ensino Médio Regular

Município: São Paulo

Rede de Ensino: Privada

UF: SP

Localização: Urbana

Dep. Administrativa: Todas

Buscar nos seus resultados

Escola	Participantes Prova Objetiva	Média em Linguagens, Códigos	Média em Matemática	Média em Ciências Humanas	Média em Ciências da Natureza	Média nas Objetivas	Participantes Redação	Média Redação	Média Total (Redação + Objetivas)
ACTIVE COLEGIO	4	SC	SC	SC	SC	SC	4	SC	SC
ADVENTISTA CIDADE ADEMAR ESCOLA	9	SC	SC	SC	SC	SC	9	SC	SC
ADVENTISTA COLEGIO DE INTERLAGOS	18	561,62	595,90	563,26	582,40	575,79	18	538,89	557,34
ADVENTISTA DA LIBERDADE COLEGIO	27	557,66	545,56	561,15	580,46	561,21	27	634,26	597,73
ADVENTISTA DE CAMPO LIMPO COLEGIO	11	565,15	548,19	525,99	527,04	541,59	11	684,09	612,84
ADVENTISTA DE TUCURUVI COLEGIO	19	517,42	519,49	527,24	528,08	523,06	19	606,58	564,82
ALIADO COLEGIO UNIDADE JARDIM JAPAO	4	SC	SC	SC	SC	SC	4	SC	SC

ENEM–Estado de São Paulo website printscreen

Quarta-feira, 29 de Abril 2009, 0h48

As 1000 escolas mais bem colocadas no Enem 2008

Confira as escolas que se saíram melhor no exame nacional

estabelec.com.br



A+

Assine a Newsletter



4



2



Enviar



Recomendar



2 pessoas recomendaram isso. Seja o primeiro entre seus amigos.

Filtre por estado... administração... localização... ...ou busque por instituição

Todos Todos Todos

ESPECIAL
Tudo sobre o ENEM



Clique sobre as colunas para reordenar o quadro

(não use acentos)

Instituição de ensino	UF	município	admin.	localização	nota*
COL DE SAO BENTO	RJ	Rio de Janeiro	Privada	Urbana	80,58
COLEGIO BERNHOLLI	MG	Belo Horizonte	Privada	Urbana	77,38
COL DE APLICACAO DA UFV - COLINI	MG	Viçosa	Federal	Urbana	76,66
COL STO ANTONIO	MG	Belo Horizonte	Privada	Urbana	76,43
COLEGIO HELYOS	BA	Feira de Santana	Privada	Urbana	76,34
COLEGIO WR	GO	Goiânia	Privada	Urbana	76,26
COLEGIO SANTO INACIO	RJ	Rio de Janeiro	Privada	Urbana	76,09
JUAREZ DE SIQUEIRA BRITTO WANDEILEY ENG COLI	SP	São José Dos Campos	Privada	Urbana	76,02
VERTICE COLEGIO UNID II	SP	São Paulo	Privada	Urbana	75,97
COLEGIO SANTO AGOSTINHO	RJ	Rio de Janeiro	Privada	Urbana	75,97
COLEGIO SANTO INACIO	RJ	Rio de Janeiro	Privada	Urbana	75,92
BANDEIRANTES COLEGIO EFM	SP	São Paulo	Privada	Urbana	75,86
COLEGUJUN - ENSINO FUNDAMENTAL E MEDIO	MG	Belo Horizonte	Privada	Urbana	75,71
COLEGIO DE APLICACAO DO CE DA UFPE	PE	Recife	Federal	Urbana	75,68
INST DOH BARRETO	PI	Teresina	Privada	Urbana	75,5
ESCOLA PREPARATORIA DE CADETES DO AR	MG	Barbacena	Federal	Urbana	75,3
COL DE APLIC. DA UNIV. FED. DO RIO DE JANEIRO	RJ	Rio de Janeiro	Federal	Urbana	75,25
ETAPA COLEGIO	SP	Valinhos	Privada	Urbana	75,23
INST DE APLIC FERNANDO R DA SILVEIRA CAP/UEUJ	RJ	Rio de Janeiro	Estadual	Urbana	75,11

* Entenda a nota

O Exame Nacional de Ensino Médio (Enem) é realizado por alunos que já concluíram o Ensino Médio ou por aqueles que irão concluí-lo ao final do ano de realização do Exame. A nota que serve de base para este ranking é formada pela média das provas objetiva e de redação, corrigidas pelo nível de participação adesão ao exame, que é voluntário. A média varia entre 0 e 100.

Identification Strategy

- Sharp Regression Discontinuity Design:

$$Y_{ij} = \alpha + \phi(\text{Forcing Variable}_j - 10) + \beta d_j + d_j \phi(\text{Forcing Variable}_j - 10) + \epsilon_{ij}$$

- (ii) $\phi(\cdot)$ is a continuous polynomial function.
 - (iii) *Forcing Variable*_{*j*} is number of ENEM takers in school *j* in 2005.
 - (iv) d_j is the treatment dummy, i.e., an indicator variable that assumes the value 1 if the number of ENEM takers in school *j* was equal to or greater than 10 in 2005.
 - (v) ϵ_{ij} is a error term with school clustered variance–covariance matrix.
- Also consider non–parametric RDD (Local Linear Regressions).

Caveats

- Gaming the system: treated schools may induce only the best students to take the exam.
 - Students responsible for enrollment, though. Also, participation of students in private schools is close to 90%.
- Composition: best students may enroll on treated schools.
- School selection: Only good schools among treated survive.
 - Only 45 (6%) schools disappear from sample. No significant difference between treated and non-treated
- Career concerns: treated and non-treated schools may assign different probabilities to future disclosure of average test scores.
 - Downward bias

Databases

- Databases: 2005 and 2007 ENEM microdata and 2007 School Census.
- ENEM databases have information on test scores, number of test takers, and socio-demographic characteristics of students such as age, race, family income, and parental schooling.
- The Census has information on schools' characteristics: number of students; number of teachers; teachers' schooling; principals' schooling; existence of science and computer labs and libraries; internet access.
- We analyze schools in the São Paulo Metropolitan Area.

Discontinuity in the Forcing Variable

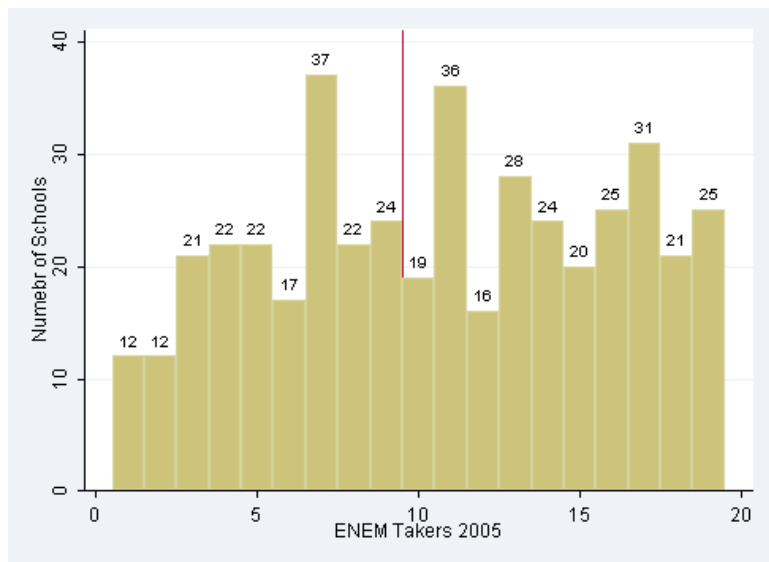


Table : Summary Statistics - 2005

Variable	Public		Private	
	Mean	Std. Dev.	Mean	Std. Dev.
ENEM score	34.06	12.29	55.74	16.41
Correct Age/Grade	0.75	0.43	0.95	0.22
Age	18.43	2.19	17.42	0.99
White	0.50	0.50	0.78	0.41
Father - College Degree	0.05	0.21	0.48	0.50
Family Income < 10 m.s.	0.98	0.15	0.54	0.50
# ENEM Takers	121,050		28,159	

▶ More Statistics

Table : 2005 ENEM Performance

	10 students window		7 students window		5 students window	
	Private	Public	Private	Public	Private	Public
	b/se	b/se	b/se	b/se	b/se	b/se
<i>Treatment</i>	-0.100 (0.173)	-0.099 (0.192)	-0.134 (0.190)	-0.683* (0.381)	-0.254 (0.238)	0.290 (0.404)
<i>Forc. Variable</i>	0.000 (0.080)	-0.017 (0.114)	0.026 (0.097)	0.258 (0.262)	0.092 (0.165)	-0.669 (0.413)
<i>Forc. Var. × Treat.</i>	0.116 (0.092)	0.045 (0.119)	0.094 (0.120)	-0.246 (0.269)	0.152 (0.208)	0.667 (0.430)
<i>Forc. Variable²</i>	-0.002 (0.009)	-0.002 (0.013)	0.001 (0.012)	0.041 (0.034)	0.016 (0.028)	-0.137* (0.076)
<i>Forc. Var.² × Treat.</i>	-0.008 (0.010)	0.000 (0.013)	-0.013 (0.017)	-0.041 (0.035)	-0.061 (0.042)	0.142* (0.080)
N	3,233	1,267	2,486	1,031	1,893	628

Quadratic polynomial

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Characteristics: Pre-Treatment

Table : 2005 Composition Effects

	Male		Age		White	
	Private	Public	Private	Public	Private	Public
	b/se	b/se	b/se	b/se	b/se	b/se
<i>Treatment</i>	0.006	-0.215*	-0.215	1.878*	0.109	0.104
	(0.088)	(0.124)	(0.204)	(1.085)	(0.085)	(0.214)
N	2,250	1,139	2,249	1,141	2,239	1,138

	Father - College		Correct Age/Grade		Fam. Inc. > 10 m.s.	
	Private	Public	Private	Public	Private	Public
	b/se	b/se	b/se	b/se	b/se	b/se
<i>Treatment</i>	-0.193	-0.036	0.054	-0.268	0.171*	0.025
	(0.129)	(0.047)	(0.046)	(0.199)	(0.104)	(0.035)
N	2,156	1,039	2,249	1,141	2,195	1,102

Quadratic polynomial

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Descriptive Statistics - 2007

Table : Summary Statistics - entire 2007 sample

Variable	Public Schools		Private Schools	
	Mean	Std. Dev.	Mean	Std. Dev.
ENEM score	46.25	15.3	69.7	14.99
Male	0.39	0.49	0.45	0.5
White	0.49	0.5	0.78	0.41
Age	18.51	2.29	17.26	0.97
Correct Age/Grade	0.75	0.43	0.96	0.2
Father - College Degree	0.06	0.24	0.55	0.5
Family Income < 10m.s.	0.97	0.16	0.5	0.5
Proportion of ENEM takers	0.61	0.20	0.91	0.06
Number of ENEM Takers	101,833		22,315	
Number of Schools	1,416		702	

Descriptive Statistics: 10 students window

Table : Summary Statistics - 10 students window

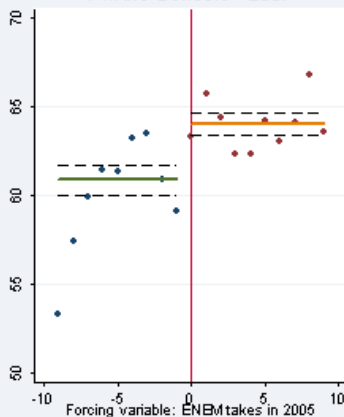
Variable	Private				Public			
	Treatment		Control		Treatment		Control	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
ENEM score	63.98	15.69	60.84	15.91	40.47	12.87	40.45	13.33
Male	0.46	0.5	0.45	0.5	0.37	0.48	0.33	0.47
White	0.76	0.43	0.75	0.43	0.41	0.49	0.35	0.48
Age	17.43	0.91	17.54	1.23	19.62	2.88	20.7	2.98
Correct Age/Grade	0.95	0.22	0.91	0.28	0.57	0.5	0.39	0.49
Father - College Degree	0.42	0.49	0.37	0.48	0.03	0.16	0.02	0.14
Family Inc. < 10m.s.	0.64	0.48	0.68	0.47	0.99	0.08	0.99	0.11
% ENEM takers	0.84	0.18	0.76	0.21	0.51	0.23	0.48	0.2
# ENEM Takers	2,210		1,409		2,322		518	
# Schools	160		148		97		29	

Average Scores: 10 students window

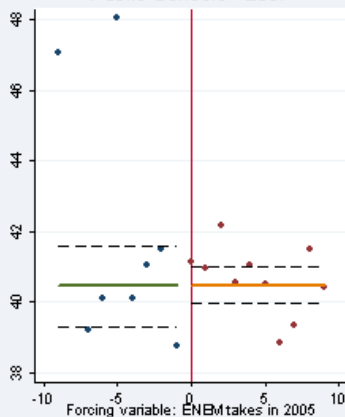
RDD estimates treatment - SPMA

2007 ENEM performance - 10 students window

Private Schools - 2007



Public Schools - 2007



Results in 2007

Table : 2007 ENEM Performance

	10 students window		7 students window		5 students window	
	Private	Public	Private	Public	Private	Public
	b/se	b/se	b/se	b/se	b/se	b/se
<i>Treatment</i>	0.168**	0.106	0.265***	0.034	0.392**	0.253
	(0.073)	(0.133)	(0.082)	(0.129)	(0.175)	(0.193)
<i>Forc. Variable</i>	-0.002	-0.021	-0.017	0.012	-0.051	-0.095
	(0.013)	(0.028)	(0.016)	(0.024)	(0.041)	(0.061)
<i>Forc. Var. × Treat.</i>	0.002	0.014	-0.007	-0.035	-0.003	0.087
	(0.015)	(0.029)	(0.021)	(0.027)	(0.057)	(0.065)
N	3,503	1,928	2,680	1,402	2,067	895

Linear polynomial

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Results in 2007

Table : 2007 ENEM Performance

	10 students window		7 students window		5 students window	
	Private	Public	Private	Public	Private	Public
	b/se	b/se	b/se	b/se	b/se	b/se
<i>Treatment</i>	0.486** (0.217)	-0.024 (0.254)	0.594** (0.258)	0.339 (0.242)	0.733** (0.338)	0.048 (0.286)
<i>Forc. Variable</i>	-0.151* (0.088)	0.096 (0.111)	-0.221* (0.128)	-0.228* (0.120)	-0.400* (0.221)	0.101 (0.154)
<i>Forc. Var. × Treat.</i>	0.101 (0.105)	-0.152 (0.115)	0.160 (0.160)	0.259* (0.131)	0.477* (0.268)	-0.088 (0.174)
<i>Forc. Variable²</i>	-0.017* (0.009)	0.012 (0.011)	-0.026* (0.015)	-0.029** (0.013)	-0.058* (0.034)	0.040* (0.020)
<i>Forc. Var.² × Treat.</i>	0.022** (0.011)	-0.007 (0.011)	0.032 (0.022)	0.021 (0.015)	0.027 (0.049)	-0.045 (0.027)
N	3,503	1,928	2,680	1,402	2,067	895

Quadratic polynomial

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Composition

Table : Composition Effects

	# enrollment - 3rd Grade		% of ENEM takers			
	Private	Public	Private	Public		
<i>Treatment</i>	3.765	8.940	-0.037	0.438***		
	(7.057)	(20.437)	(0.088)	(0.108)		
N	3,452	1,947	2,525	1,822		

	Male		Age		White	
	Private	Public	Private	Public	Private	Public
<i>Treatment</i>	0.022	-0.010	-0.592	-1.165	-0.002	0.080
	(0.065)	(0.054)	(0.399)	(1.661)	(0.058)	(0.061)
N	3,404	2,538	3,386	2,512	3,376	2,510

	Father - College		Correct Age/Grade		Mon. Fam. Inc. < 10 m.s.	
	Private	Public	Private	Public	Private	Public
<i>Treatment</i>	0.071	-0.014	0.080	0.135	-0.110	0.010
	(0.084)	(0.022)	(0.072)	(0.256)	(0.101)	(0.012)
N	3,258	2,225	3,386	2,512	3,334	2,448

Quadratic polynomial

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table : Inputs

	Comput. Lab		Science. Lab		Library	
	Private	Public	Private	Public	Private	Public
<i>Treatment</i>	-0.048	-0.138	0.058	-0.442	-0.290	-0.129
	(0.224)	(0.097)	(0.207)	(0.359)	(0.202)	(0.300)
N	3,619	2,850	3,619	2,850	3,619	2,850

	Number of Comput.		Teacher/Stud. Ratio		% of Teacher - College	
	Private	Public	Private	Public	Private	Public
<i>Treatment</i>	15.980*	-5.661	0.003	0.006	0.013	0.054
	(9.150)	(4.319)	(0.094)	(0.035)	(0.022)	(0.038)
N	3,525	2,321	3,467	2,171	3,467	2,171

Quadratic polynomial

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Robustness: Jumps at Non-Discontinuity Points

Table : Robustness - jumps

	10 students window		7 students window		5 students window	
<i>20 Students Cutoff</i>						
	Private	Public	Private	Public	Private	Public
<i>Treatment</i>	-2.160 (2.807)	1.039 (1.598)	0.184 (3.476)	-0.407 (2.070)	0.743 (4.900)	-0.516 (2.426)
N	4,508	4,992	3,226	3,581	2,287	2,562
<i>15 Students Cutoff</i>						
	Private	Public	Private	Public	Private	Public
<i>Treatment</i>	1.598 (3.080)	-0.981 (1.725)	3.943 (3.568)	0.191 (2.070)	4.110 (4.619)	0.111 (2.350)
N	4,419	3,614	3,150	2,606	2,210	2,152
<i>7 Students Cutoff</i>						
	-	-	Private	Public	Private	Public
<i>Treatment</i>	-	-	-0.463 (4.140)	-4.196 (2.735)	0.144 (4.625)	1.524 (3.408)
N	-	-	2,275	1,144	1,821	767

Quadratic polynomial

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Robustness: w/o schools with 9 and 10 takers

Table : 2007 ENEM Performance - w/o schools with 9 and 10 takers

	Linear		Quadratic		Cubic	
	Private	Public	Private	Public	Private	Public
	b/se	b/se	b/se	b/se	b/se	b/se
<i>Treatment</i>	0.058	0.095	0.468**	-0.632	1.525***	4.828
	(0.087)	(0.159)	(0.185)	(0.418)	(0.439)	(3.077)
N	3,157	1,802	3,157	1,802	3,157	1,802

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Heterogeneity

Table : Heterogenous Effect - Private Schools

	Mean		Median		1st and 3rd Quartiles	
	Above b/se	Below b/se	Above b/se	Below b/se	1st Quart. b/se	3rd Quart. b/se
<i>Treatment</i>	-0.092 (0.606)	0.507** (0.226)	-0.092 (0.606)	0.507** (0.226)	0.313 (1.074)	0.531*** (0.189)
<i>Forc. Variable</i>	0.159 (0.276)	-0.155* (0.094)	0.159 (0.276)	-0.155* (0.094)	-0.155 (0.660)	-0.182** (0.087)
<i>Forc. Var. × Treat.</i>	-0.163 (0.293)	0.075 (0.109)	-0.163 (0.293)	0.075 (0.109)	0.110 (0.664)	0.072 (0.104)
<i>Forc. Variable²</i>	0.016 (0.028)	-0.017* (0.010)	0.016 (0.028)	-0.017* (0.010)	-0.034 (0.082)	-0.019* (0.009)
<i>Forc. Var.² × Treat.</i>	-0.015 (0.030)	0.024** (0.011)	-0.015 (0.030)	0.024** (0.011)	0.045 (0.083)	0.030*** (0.011)
N	642	2,861	642	2,861	169	1,943

Quadratic polynomial

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Student Effort

Table : Effects on Students' Effort Proxy Measures - Prep Course Enrollment

Specification	Coefficient	Private		Public		
		Stand. Error	# of obs.	Coefficient	Stand. Error	# of obs.
Local Linear	-0.019	0.050	3,061	0.031	0.043	1,483
Quadratic	0.041	0.051	3,061	-0.013	0.047	1,483

Conclusions

- Results suggest that test score disclosure improves average students' performance for private schools.
- Market incentives matter.
- We could not identify any change on the composition of students or on the school inputs.
- We find heterogenous effects between schools.
- We conjecture that schools and teachers' unobservable effort levels were affected by disclosure.

Robustness - Pretreatment - 2005

Table : Summary Statistics: Window 10 students - 2005

Variable	Less than 10 exam takers				At least 10 exam takers			
	Public		Private		Public		Private	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
ENEM score	30.67	10.91	46.27	14.87	30.03	9.67	49.46	15.33
Correct Age/Grade	0.42	0.50	0.88	0.33	0.50	0.50	0.93	0.26
Age	20.52	3.03	17.76	1.57	19.98	2.93	17.49	1.22
White	0.44	0.50	0.75	0.44	0.41	0.49	0.78	0.41
Father - College Degree	0.02	0.15	0.29	0.45	0.02	0.13	0.40	0.49
Family Income < 10 m.s.	0.99	0.09	0.77	0.42	0.98	0.12	0.66	0.47
# ENEM Takers	208		1,102		1,567		2,331	

Robustness - Pretreatment - 2005

Table : Summary Statistics: Window 7 students - 2005

Variable	Less than 10 exam takers				At least 10 exam takers			
	Public		Private		Public		Private	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
ENEM score	30.80	10.92	46.49	14.81	30.05	9.79	49.07	15.56
Correct Age/Grade	0.42	0.50	0.89	0.31	0.54	0.50	0.93	0.26
Age	20.53	3.04	17.71	1.48	19.66	2.80	17.49	1.24
White	0.43	0.50	0.75	0.43	0.39	0.49	0.79	0.40
Father - College Degree	0.02	0.16	0.29	0.46	0.01	0.12	0.41	0.49
Family Income < 10 m.s.	0.99	0.09	0.76	0.42	0.98	0.12	0.65	0.48
# ENEM Takers	200		1,053		849		1,614	

Robustness - Pretreatment - 2005

Table : Summary Statistics: Window 5 students - 2005

Variable	Less than 10 exam takers				At least 10 exam takers			
	Public		Private		Public		Private	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
ENEM score	30.25	10.80	46.92	14.74	29.87	9.82	48.34	15.43
Correct Age/Grade	0.43	0.50	0.91	0.29	0.53	0.50	0.92	0.27
Age	20.52	3.07	17.59	1.22	19.69	2.77	17.52	1.33
White	0.42	0.50	0.75	0.43	0.40	0.49	0.77	0.42
Father - College Degree	0.03	0.17	0.30	0.46	0.02	0.13	0.37	0.48
Family Income < 10 m.s.	0.99	0.10	0.75	0.43	0.98	0.13	0.71	0.45
# ENEM Takers		165		880		522		1,147

◀ Back

Table : 2005 ENEM Performance

	10 students window		7 students window		5 students window	
	Private	Public	Private	Public	Private	Public
	b/se	b/se	b/se	b/se	b/se	b/se
<i>Treatment</i>	0.014 (0.109)	-0.089 (0.128)	-0.050 (0.081)	-0.202* (0.121)	-0.038 (0.142)	-0.542* (0.317)
<i>Forc. Variable</i>	0.019 (0.020)	0.002 (0.035)	0.016 (0.018)	-0.093*** (0.016)	0.001 (0.035)	0.078 (0.094)
<i>Forc. Var. × Treat.</i>	-0.001 (0.024)	0.005 (0.036)	0.030 (0.022)	0.107*** (0.020)	0.057 (0.049)	-0.061 (0.099)
N	3,233	1,267	2,486	1,031	1,893	628

Linear polynomial

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Inputs: Pre-Treatment

Table : 2005 School Inputs

	Comput. Lab		Science. Lab		Library	
	Private	Public	Private	Public	Private	Public
	b/se	b/se	b/se	b/se	b/se	b/se
<i>Treatment</i>	-0.005	0.129	-0.134*	-0.158	-0.036	0.244
	(0.059)	(0.388)	(0.080)	(0.289)	(0.106)	(0.370)
N	3,233	1,525	3,233	1,525	3,233	1,525

Quadratic polynomial

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

◀ Back

Descriptive Statistics: 7 students window

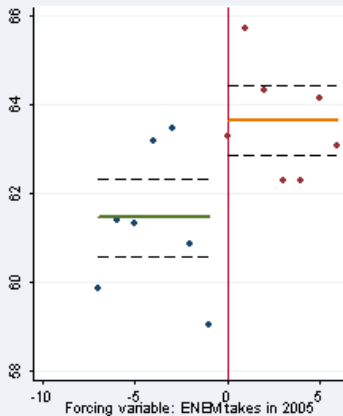
Table : Summary Statistics - 7 students window

Variable	Private				Public			
	Treatment		Control		Treatment		Control	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
ENEM score	63.62	15.64	61.44	15.74	40.62	12.62	39.95	12.95
Male	0.45	0.5	0.45	0.5	0.36	0.48	0.33	0.47
White	0.75	0.43	0.75	0.43	0.42	0.49	0.35	0.48
Age	17.42	0.91	17.43	0.92	19.44	2.81	20.87	2.96
Correct Age/Grade	0.94	0.23	0.93	0.25	0.6	0.49	0.37	0.48
Father - College Degree	0.42	0.49	0.38	0.49	0.02	0.14	0.02	0.14
Family Income < 10m.s.	0.65	0.48	0.67	0.47	0.99	0.07	0.99	0.09
% ENEM takers - 3rd graders	0.82	0.19	0.77	0.22	0.55	0.23	0.49	0.21
# ENEM Takers	1,462		1,209		1,330		481	
Number of Schools	140		109		97		29	

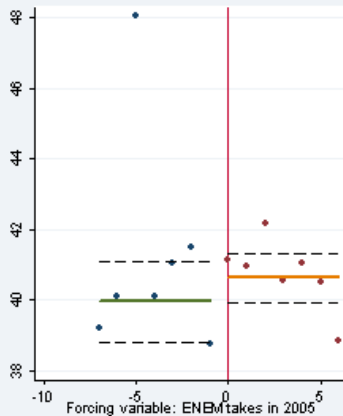
Average Scores: Seven students window

RDD estimates treatment - SPMA
2007 ENEM performance - 7 students window

Private Schools - 2007



Public Schools - 2007



Descriptive Statistics: Five students window

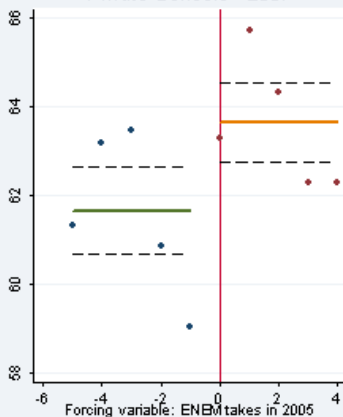
Table : Summary statistics - 5 students window

Variable	Private				Public			
	Treatment		Control		Treatment		Control	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
ENEM score	63.70	15.42	61.64	15.73	41.08	12.57	40.13	12.84
Male	0.46	0.5	0.46	0.5	0.38	0.49	0.35	0.48
White	0.74	0.44	0.75	0.44	0.42	0.49	0.33	0.47
Age	17.42	0.94	17.41	0.83	19.56	2.88	21.2	2.98
Correct Age/Grade	0.94	0.23	0.93	0.25	0.58	0.49	0.33	0.47
Father - College Degree	0.39	0.49	0.38	0.49	0.02	0.14	0.01	0.12
Family Income < 10m.s.	0.69	0.46	0.68	0.47	0.99	0.06	0.99	0.09
% ENEM takers - 3rd graders	0.84	0.18	0.78	0.21	0.54	0.21	0.50	0.25
# ENEM Takers		1,154		978		882		268
Number of Schools		106		84		39		16

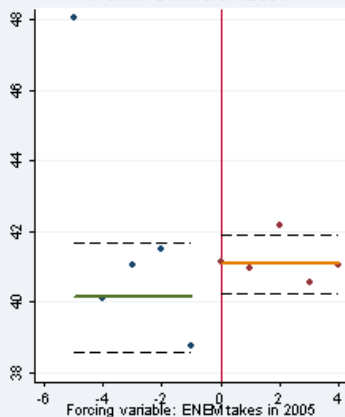
Average Scores: Five students window

RDD estimates treatment - SPMA
2007 ENEM performance - 5 students window

Private Schools - 2007



Public Schools - 2007

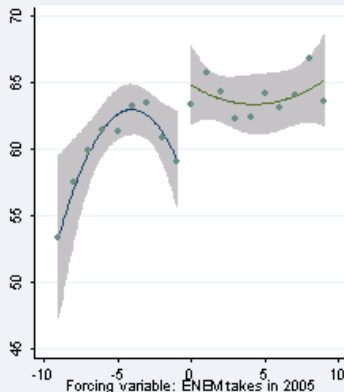


Scatter and Quadratic Fit Plots - 10 student win.

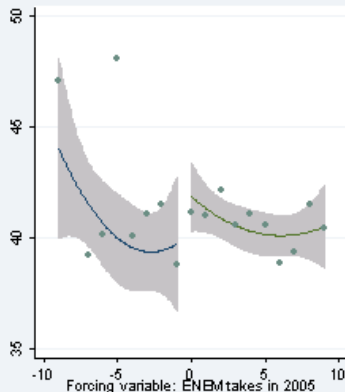
RDD estimates treatment - SPMA

2007 ENEM performance - 10 students window

Private Schools



Public Schools

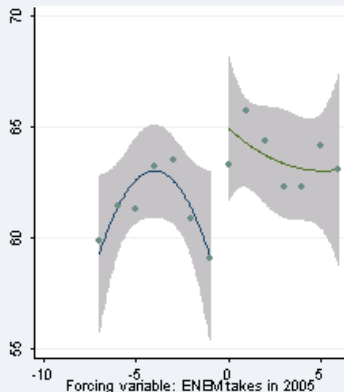


Quadratic fit / 95% IC

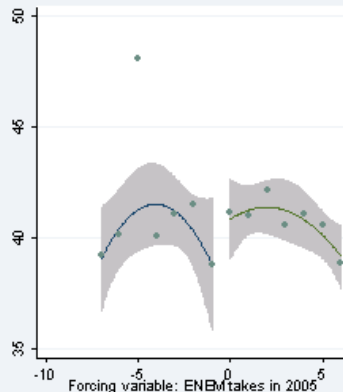
Scatter and Quadratic Fit Plots - 7 student win.

RDD estimates treatment - SPMA
2007 ENEM performance - 7 students window

Private Schools



Public Schools

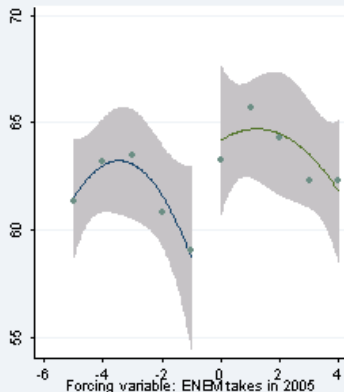


Quadratic fit / 95% IC

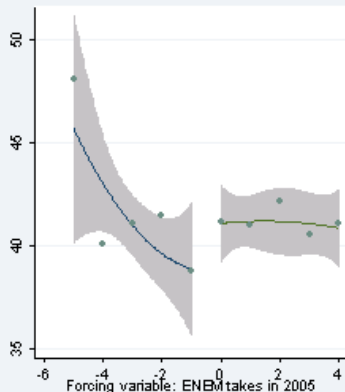
Scatter and Quadratic Fit Plots - 5 student win.

RDD estimates treatment - SPMA
2007 ENEM performance - 5 students window

Private Schools



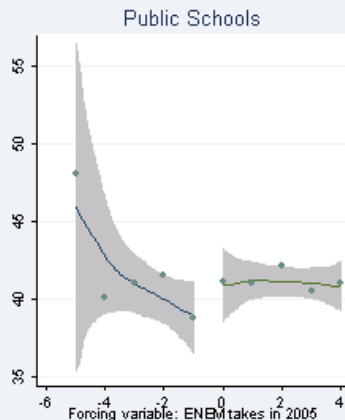
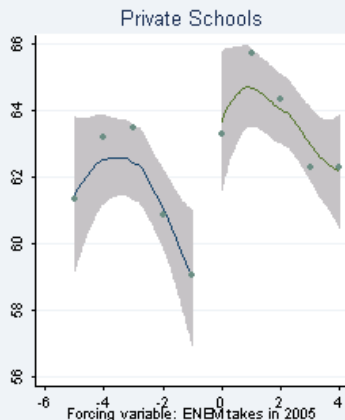
Public Schools



Quadratic fit / 95% IC

Scatter and Local Linear Fit

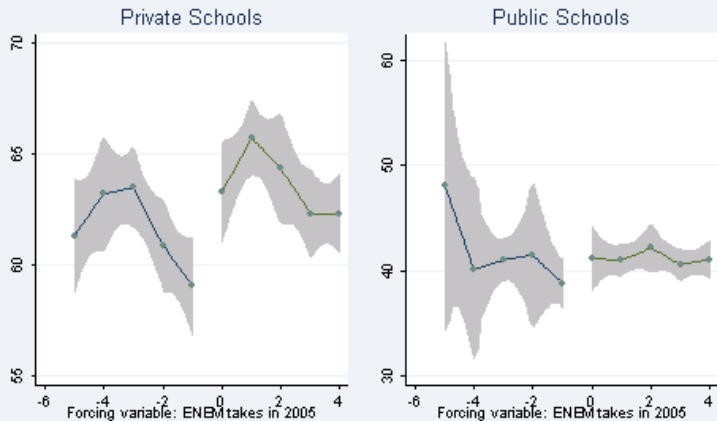
RDD estimates treatment - SPMA
2007 ENEM performance



Notes: 95% IC; Local Linear Regression; epanechnikov kernel function. Bandwidth 1

Scatter and Local Linear Fit

RDD estimates treatment - SPMA
2007 ENEM performance

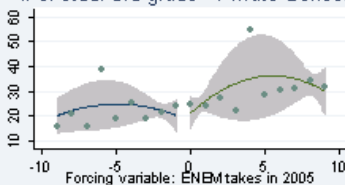


Notes: 95% IC; Local Linear Regression; rectangle kernel function. Bandwidth 1

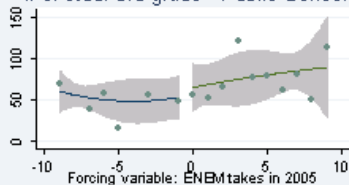
Composition

RDD composition estimates - SPMA

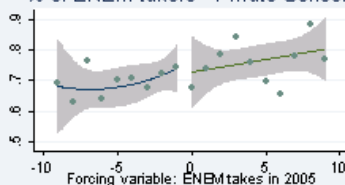
of stud. 3rd grade - Private Schools



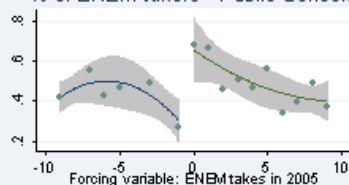
of stud. 3rd grade - Public Schools



% of ENEM takers - Private Schools



% of ENEM takers - Public Schools

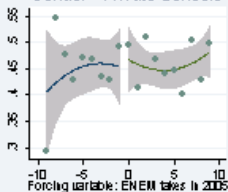


Notes: Quadratic fit / 95% IC

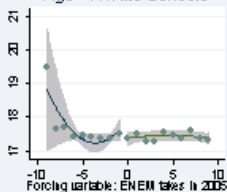
Composition

RDD composition estimates - SPMA

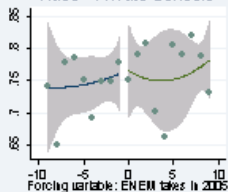
Gender - Private Schools



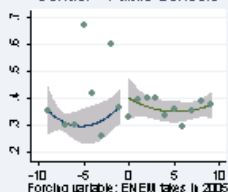
Age - Private Schools



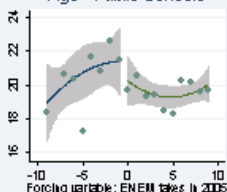
Race - Private Schools



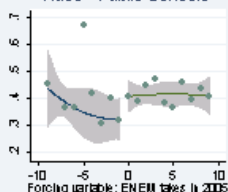
Gender - Public Schools



Age - Public Schools



Race - Public Schools

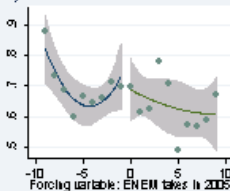
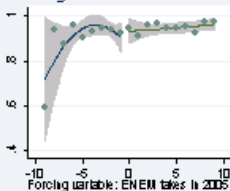
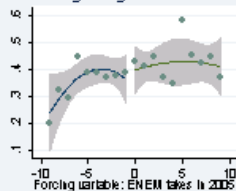


Notes: Quadratic fit / 95% IC

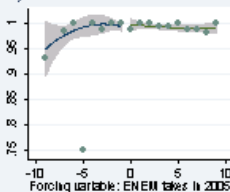
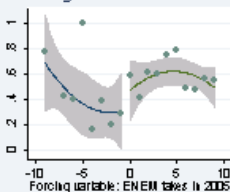
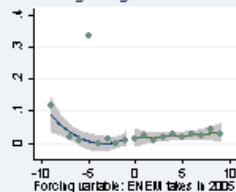
Composition

RDD composition estimates - RMSP

Father College Degree - Private School Correct Age / Grade - Private School Family Income > 10m.s. - Private School



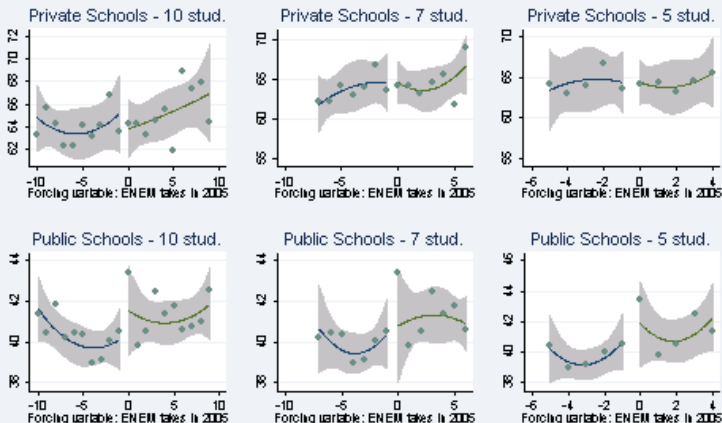
Father College Degree - Public School Correct Age / Grade - Public School Family Income > 10m.s. - Public School



Notes: Quadratic fit / 95% IC

Robustness: Jumps at Non-Discontinuity Points

RDD estimates treatment - SPMA
2007 ENEM performance - Cutoff: 20 stud.

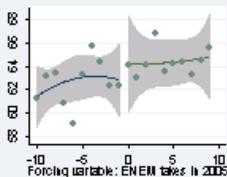


Quadratic fit / 95% IC

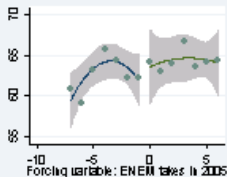
Robustness: Jumps at Non-Discontinuity Points

RDD estimates treatment - SPMA
2007 ENEM performance - Cutoff: 15 stud.

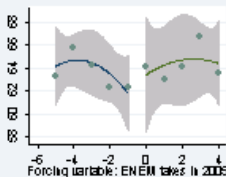
Private Schools - 10 stud.



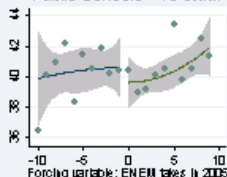
Private Schools - 7 stud.



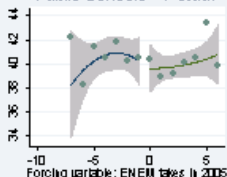
Private Schools - 5 stud.



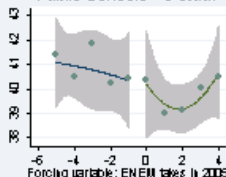
Public Schools - 10 stud.



Public Schools - 7 stud.



Public Schools - 5 stud.

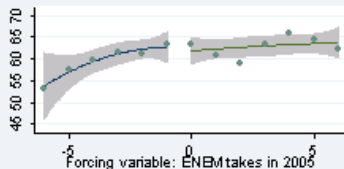


Quadratic fit / 95% IC

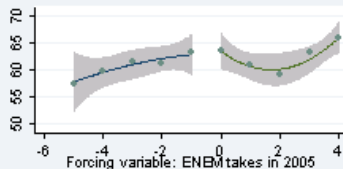
Robustness: Jumps at Non-Discontinuity Points

RDD estimates treatment - SPMA
2007 ENEM performance - Cutoff: 7 stud.

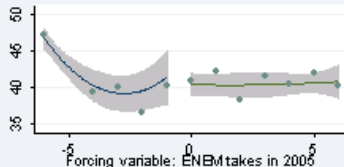
Private Schools - 7 stud.



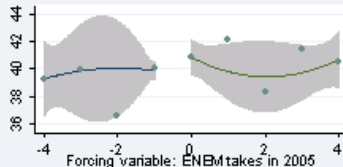
Private Schools - 5 stud.



Public Schools - 7 stud.



Public Schools - 5 stud.

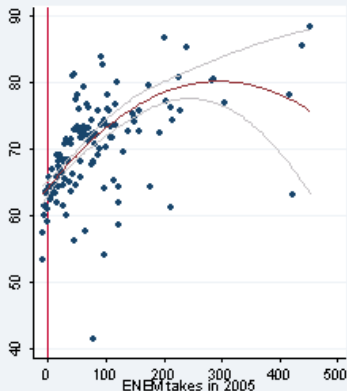


Quadratic fit / 95% IC

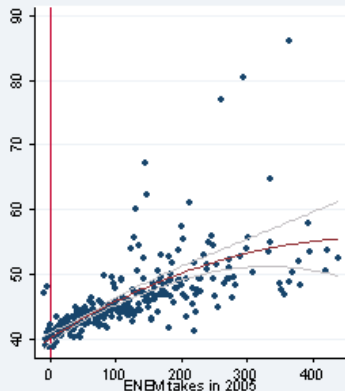
2007 ENEM scores vs. Forcing Variable

RDD estimates treatment - SPMA
2007 ENEM performance

Private Schools



Public Schools



Quadratic fit / 95% IC