Evaluation of the Impact of a Remedial Mathematic Program in Mexico City

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Motivation

Developing countries, worried on why their young population don't accumulate as much Human Capital as their peers in developed countries, have implemented different programs seeking to increase Education based on different diagnostics:

Diagnostic	Program
Imperfections in the capital market forces poor people to start working	Cash transfers programs: e.g. Oportunidades/Progresa
The poors are myopic, don't see the benefits of education	Inform the high returns to education e.g. Dominican Republic
There is a lack of supply: Goverment don't invest as much as it should in education	Money e.g. infrastructure improvements, more teachers, text books…

Motivation

While those policies have succeeded in increasing schooling, we still wonder: Where are the benefits of Education?

-**Quantity vs Quality debate.** Hanusheck (2008) shows that what really matters to see high returns to education are the cognitive abilities of individuals. Leading to two main ideas:

1. Schooling is different than Education. Evidence suggest that: "…*students often seem not to learn anything in the additional days that they spend in the school…*"

Banerjee et al.(2007)

2. Policies must focus on what influence what happens inside the classrooms: So Structural reforms that changes the incentives for teachers, students, and parents.

Remedial Programs

- **Motivated by the believe that**:
  - the big size of the classrooms
  - the old pedagogical techniques of the teachers

  Make low performance students failed/dropout because of feeling lost in class…

- **There have arise "remedial programs"** in different countries in order to provide of high quality additional courses to this target population.

- **This study** analyzes a program:
  - Targeted on nine graders students with high probabilities of failing, from marginal under-performance schools in Mexico City
  - That provides of an undergraduate student as a teacher with a good math background
  - In small groups, so that students received the enough attention and confidence to solve all their doubts.

Remedial Programs (analyzed by the literature)

Banerjee, Cole, Duflo and Linden (2005) :

- **The program:** takes woman to teach 3rd and 4th graders students in India in small groups (15-20)
- **Methodology:**
  - Randomized evaluation
  - Two different cities of urban India
  - 2 scholar years 2001-2002 and 2002-2003
  - Run on a large-scale
- **Output of interest:** learning levels at pre and post-test
- **Results:** it increased average test scores of all in treatment schools by 0.14 standard deviations in the first year, and 0.28 in the second

Lavy and Schlosser (2005) :

- **The program:** classroom teachers gave additional instruction to under-performing 10th-12th graders students in small groups (up to 5) in Israel
- **Methodology:**
  - Quasi-experimental evaluation
  - Comparison group: schools enrolled later
  - Participants were chosen by teachers based on the likelihood of passing matriculation exams.
  - 2000-2001 the treatment year, with 4,100 students attended
- **Output of interest:** matriculation status of 12 graders
- **Results:** raising school mean matriculation rate by 3.3 percentage points

Remedial Programs (this study)

- **The program:** gives additional math courses to marginalized under-performing 9th graders students in small groups (up to 15) in Mexico City, taught by undergraduate students from some of the most prestigious Mexican Universities.

- **Relevance:**
  - The largest population ever in low secondary school in Mexico, INEGI (2010)
  - High failing/dropout rates at the end of low high school in Mexico (most of the time by failing math, SEP (2009))

- **Output of interest:** math scores of 9 graders
- **Empirical strategy:** Differences in Differences
- **Comparison groups:**
  - **Control1:** Non-treated students at treated schools
  - **Control2:** Students from non-treated schools

- **Participants were chosen by teachers based on:** the likelihood of approving the year

The Program

- **Operated by:** DGFA of SEP at Mexico City and the Laboratorio de Iniciativas para el Desarrollo (LID) a local NGO throw their program Universitarios por la Educación
- **When?** second semester of the 2009-2010 academic year
  (from April to June 2010 = after their third partial test)
- **Where?** 33 schools of 11 different delegations
- **To Who?** ninth grade underperformer students
  (with high probability of failing math)
- **What?** 2 sessions a week of 2hours each held by 2 advisors (an undergraduate of 3 different prestigious Universities doing their social service) for up to 15 students

The Data

We have a Panel constructed with scores of the 5 partial exams of all ninth graders students (before and after the treatment) and some school characteristics such as:

SCHOOLS

Type of secondary	
General	29
Technical	18
Shift	
Morning school	15
Afternoon school	25
Both	7
Geographical location	
Alvaro Obregón	20
Venustiano Carranza	6
Cuauhtemoc	5
Benito Juárez	4
Coyoacán	4
Iztapalapa	2
Tlahuac	2
Tlalpan	2
Gustavo A. Madero	1
Magdalena Contreras	1

ADVISORS

	Female	Male	Total
Number of advisors	23	20	43
UNAM	8	5	13
ITAM	11	13	24
UP	4	2	6
Group size			
Initial size	13.1	13.7	13.4
Final size	12.0	13.0	12.4
Sessions	11.2	7.7	9.9
Total hours	27.6	31.2	29.2

Descriptive Analysis

Table 2. Average Scores of 9th Graders in Math Summary Statistics

	Whithin Treated Schools			Between Schools			
	Treatment	Control	Simple Differences (1-2)	All in treated schools	All non-treated in all the schools	Simple Differences (1-5)	All the schools of the sample
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Pre-treatment							
Period 1	6.2961	6.8634	-0.5599***	6.7971	6.9233	-0.6191***	6.9037
	[1.2733]	[1.4243]	[0.0573]	[1.4195]	[1.5325]	[0.0582]	[1.5045]
Period 2	6.2612	6.9454	-0.6572***	6.8663	6.9315	-0.6474***	6.9107
	[1.1904]	[1.7060]	[0.0685]	[1.6712]	[1.7553]	[0.0680]	[1.7333]
Period 3	6.2221	6.6625	-0.4133***	6.5875	6.8069	-0.5558***	6.7606
	[1.2134]	[1.5279]	[0.0820]	[2.0294]	[2.0317]	[0.0786]	[2.0338]
Average Pre-treatment	6.2597	6.8237	-0.5435**	6.7583	6.9076	-0.6074***	6.8677
	[1.0474]	[1.4574]	[0.0582]	[1.4273]	[1.5499]	[0.0589]	[1.5061]
Post-treatment							
Period 4	6.5109	6.6789	-0.1344	6.6297	6.7508	-0.2035**	6.728
	[1.2703]	[1.4579]	[0.0940]	[2.3218]	[2.3217]	[0.0899]	[2.3221]
Period 5	6.7184	6.7293	0.0235	6.6976	6.8966	-0.1389	6.8631
	[1.5595]	[2.4010]	[0.1025]	[2.5296]	[2.5164]	[0.0976]	[2.5217]
Average Post-treatment	6.6146	6.7041	-0.0555	6.6938	6.8232	-0.1712*	6.8172
	[1.2085]	[2.4010]	[0.0943]	[2.2945]	[2.3039]	[0.0894]	[2.3113]
Observations	689	5258	-	5947	16278	-	22225

Notes: This table gives the mean scores for the five partial test (and the average for those made before and after the intervention) for treatment and comparison students. Columns (1)-(3) show the average scores for the treated, the comparison, and the difference between those groups of students within the treated schools respectively. Column (4)-(6) show the average scores for all the students in the treated schools, for all non-treated in all the schools in the sample and the simple differences between the last and the treated, respectively. Column (7) shows the mean scores for all the students of all the schools in the sample. Standard errors in brackets.

* significant at 10%; ** significant at 5%; *** significant at 1%

First Differences

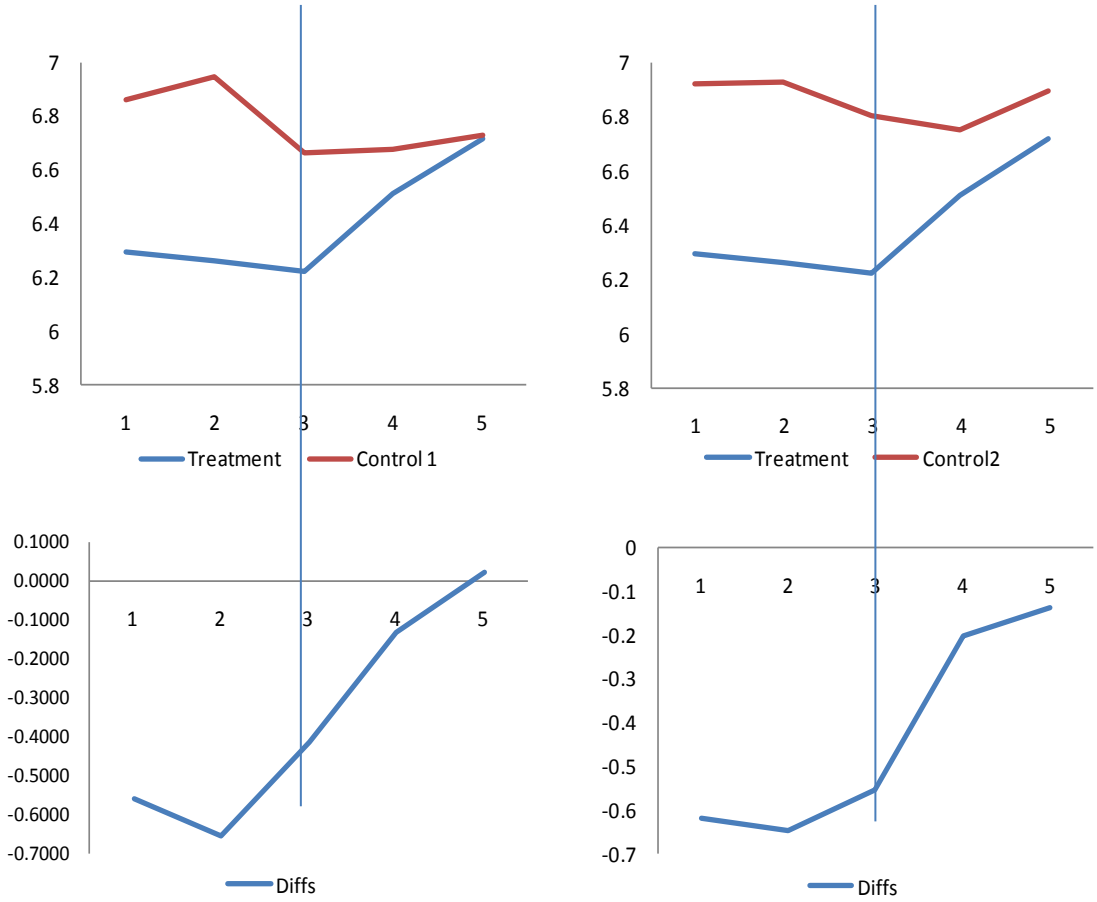

Figure 1.
In the left side it is shown the Average Scores for treated & non-treated students within treated schools, and Differences between them. In the right side, the Average Scores for treated & non-treated students among schools in the sample, and Differences between them

Empirical Strategy

Main Equation:

$$Score_{it} = \sum_{t=1}^{5} \emptyset_t Partial_{it} + \sum_{t=1}^{5} \beta_t Treatment_i * Period_t + e_{it}$$

Assumption: Both treated and non-treated have the same trend on performance at math tests in the absence of the program

But it seem that the gap between groups starts to decrease in 3rd period

i.e. there are reasons to doubt that the elimination of the differences at the end of the year are associated with the program!!

Table 3
Treatment effects on the Average Math Scores

	(1)	(2)
Period 1	6.9233***	6.8634***
	[0.0139]	[0.0279]
Period 2	6.9315***	6.9454***
	[0.0139]	[0.0279]
Period 3	6.8069***	6.6625***
	[0.0139]	[0.0279]
Period 4	6.7508***	6.6789***
	[0.0139]	[0.0279]
Period 5	6.8966***	6.7293***
	[0.0139]	[0.0279]
Treatment * Period 1	-0.6284***	-0.5685***
	[0.0788]	[0.0817]
Treatment * Period 2	-0.6643***	-0.6782***
	[0.0788]	[0.0817]
Treatment * Period 3	-0.5820***	-0.4377***
	[0.0788]	[0.0817]
Treatment * Period 4	-0.2341***	-0.1621**
	[0.0788]	[0.0817]
Treatment * Period 5	-0.1798**	-0.0125
	[0.0788]	[0.0817]
Observations	110005	29410
R-squared	0.92	0.92

Notes: This table reports the estimates of the treatment effect according with equation (1), taking as comparison groups: non-treated students excluding (Column (1)) and including (Column (2)) those in non-treated schools. Standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Controlling by initial conditions (1)

1. First: we control by the **score in the first period test** as a proxy of their initial mathematics abilities and the reputation created at teachers' head:

$$Score_{it} = \sum_{t=2}^{5} \emptyset_t Period_t + \sum_{t=2}^{5} \beta_t Treatment_i * Period_t + \sum_{t=2}^{5} \gamma_t Score_{i1} * Period_t + e_{it}$$

Results (1)

Table 4
Treatment effects on the Average Math Scores controlling by Period 1 Scores

	(1)	(2)
Partial 2	2.0257***	2.1078***
	[0.0595]	[0.1255]
Period 3	1.9882***	2.3898***
	[0.0595]	[0.1255]
Period 4	1.8087***	2.2527***
	[0.0595]	[0.1255]
Period 5	2.3168***	2.5048***
	[0.0595]	[0.1255]
Treatment * Period 2	-0.2190***	-0.2775***
	[0.0727]	[0.0791]
Treatment * Period 3	-0.1447**	-0.0838
	[0.0727]	[0.0791]
Treatment * Period 4	0.2145***	0.2046***
	[0.0727]	[0.0791]
Treatment * Period 5	0.2359***	0.3374***
	[0.0727]	[0.0791]
Observations	88004	23528
R-squared	0.93	0.93

Notes: This table reports the estimates of treatment effect controlling by scores in period 1 like in equation (2), taking as comparison groups: non-treated students excluding (Column (1)) and including (Column (2)) those in non-treated schools. Standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

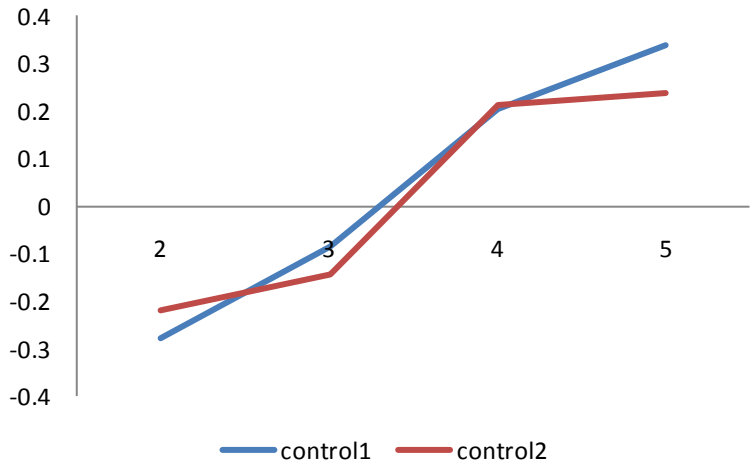

Figure 2.
The figure 2 plots the estimated treatment effects controlling by grades in period1 (equation 2) for both comparison groups of non-treated students excluding (control1) and including (control2) those in non-treated schools.

Controlling by initial conditions (2)

2. Second: we control by **differences between scores achieved in test 2 and 1** as a proxy of the consistency of the grades of both groups:

$$Score_{it} = \sum_{t=3}^{5} \emptyset_t Period_t + \sum_{t=3}^{5} \beta_t Treatment_i * Period_t + \sum_{t=3}^{5} \gamma_t Score_{i1} * Period_t + \sum_{t=3}^{5} \pi_t (Score_{i2} - Score_{i1}) * Period_t + e_{it}$$

3. Third: we include both variables and their **interactions**:

$$Score_{it} = \sum_{t=3}^{5} \emptyset_t Period_t + \sum_{t=3}^{5} \beta_t Treatment_i * Period_t + \sum_{t=3}^{5} \gamma_t Score_{i1} * Period_t + \sum_{t=3}^{5} \pi_t (Score_{i2} - Score_{i1}) * Period_t + \sum_{t=3}^{5} \partial_t (Score_{i2} - Score_{i1}) * Score_{i1} * Partial_t + e_{it}$$

Results (2)

Table 5
Treatment effects on the Average Math Scores controlling by different measures of the initial performance of students

	(1)	(2)	(3)	(4)
Partial 3	0.9910***	0.9919***	0.6072***	0.6119***
	[0.1280]	[0.1282]	[0.0596]	[0.0597]
Partial 4	0.8015***	0.8104***	0.4565***	0.4632***
	[0.1280]	[0.1282]	[0.0596]	[0.0597]
Partial 5	0.9447***	0.9522***	0.9508***	0.9629***
	[0.1280]	[0.1282]	[0.0596]	[0.0597]
Treatment * Partial 3	0.1004	0.1001	0.0047	0.0038
	[0.0770]	[0.0771]	[0.0696]	[0.0695]
Treatment * Partial 4	0.3956***	0.3925***	0.3607***	0.3595***
	[0.0770]	[0.0771]	[0.0696]	[0.0695]
Treatment * Partial 5	0.5428***	0.5402***	0.3836***	0.3814***
	[0.0770]	[0.0771]	[0.0696]	[0.0695]
Controls by Partial 1 grade	Yes	Yes	Yes	Yes
Controls by changes in grades between grades in period 1 & 2	Yes	Yes	Yes	Yes
Controls by the interaction of the changes (1&2) & grade in Partial 1	No	Yes	No	Yes
Observations	17646	17646	66003	66003
R-squared	0.93	0.93	0.94	0.94

Notes: This table reports the estimates of the treated effect according with equation (3) and (4) controlling by different measures of the initial performance of students, taking as comparison groups the non-treated students excluding (Columns 1&2) and including (Columns 3&4) those in non-treated schools. Standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Results (2)

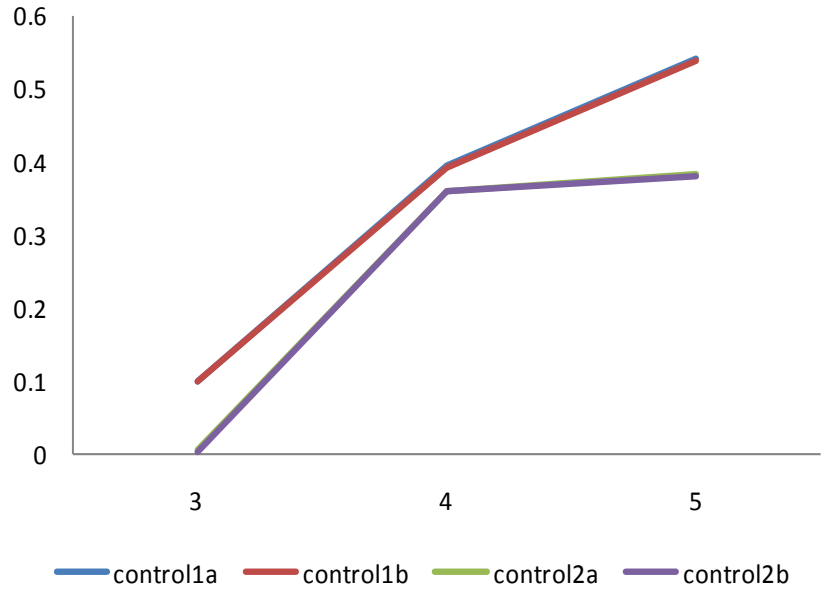

Figure 3.

The figure 3 plots the estimated treatment effects by equation 3 and by equation 4 (identified by (a) and (b) respectively), for both comparison groups of non-treated students excluding (control1) and including (control2) those in non-treated schools, which are fairly equal.

Conclusions

The results suggest that students participating in the **program observed a higher increase in their school grades** after having received the extra courses of **almost 0.4 points (over 10)**, and that the difference in grades between the two groups decreases over time.

Which is consistent with the history given by the simple differences which shows that by the end of the school year, when the free extra courses had been offered for around ten weeks, participating students' grades were not significantly lower from non-participating students' grades: **eliminating the gap that in the beginning of the year was in average of around 0.5 points (over 10).**

This provides evidence that this kind of intervention could be an **useful instrument on reducing the inequalities on student achievement** inside the classrooms, and on reducing dropouts of lagged students.

Final Remarks

- Triple Differences Estimation
- Exploiting operational information
- Looking for the effects by gender

- For future works:
  - Math classes Impact on other subjects
  - Long run effects

Thank you!!