



**Does supply matter?
Initial schooling conditions
and the effectiveness of
CCTs for grade progression
in Nicaragua**

John Maluccio (Middlebury College)

Alexis Murphy (IFPRI)

Ferdinando Regalia (IDB)

Center for Global Development (CGD)
and the
International Initiative for Impact Evaluation (3ie)

Outline of the presentation

- CCTs and the *Red de Protección Social (RPS)*
- Central research question: Do initial school supply conditions alter program effectiveness (impact heterogeneity)?
- Evaluation design and data
- Econometric strategy and results
 - RPS effect on enrollment & dropouts
 - RPS effect on grade attainment
 - How initial supply conditions grade attainment
 - RPS effect on supply side
- Conclusions

CCTs: key features

- Conditional cash transfers with monitoring
- Simultaneous interventions in 3 sectors: education, health, nutrition (synergies)
- Targeted (with focus on the poor)
- Transfers given to mothers
- Increases the use of already existing school and health facilities
- Supply side coordination and expansion

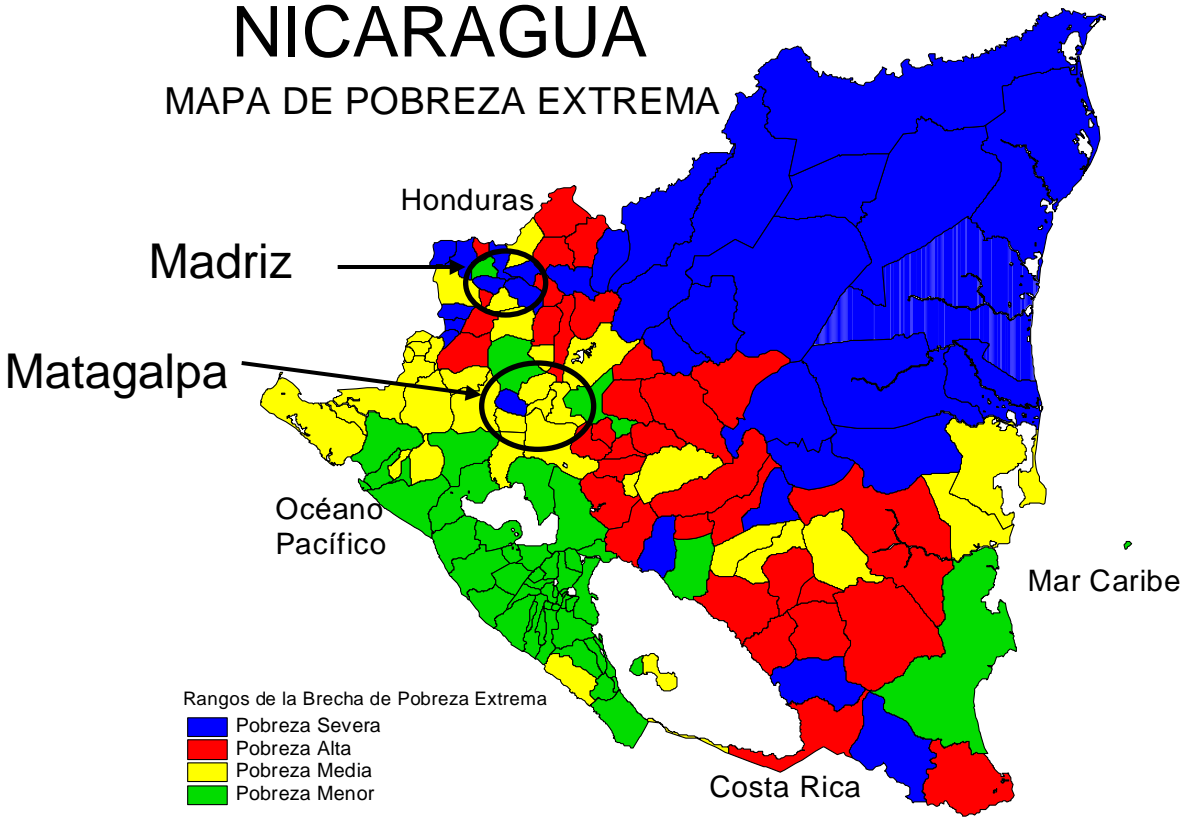
Nicaragua RPS



RPS Details

- Specific objectives
 - Supplement household income to increase food expenditures
 - Increase healthcare and nutrition of children under age 5
 - Increase primary school enrollment & attendance for grades 1-4
- Transfers conditional on enrollment, school attendance (85%), and attendance at preventive health visits and health education workshops
- Transfer size: 13-21% of households' expenditures in 2000-2, approximately 30% lower in 2003-5
- Effective Pilot

Nicaragua Poverty Map



Source: World Bank (2001)



Design of RPS evaluation

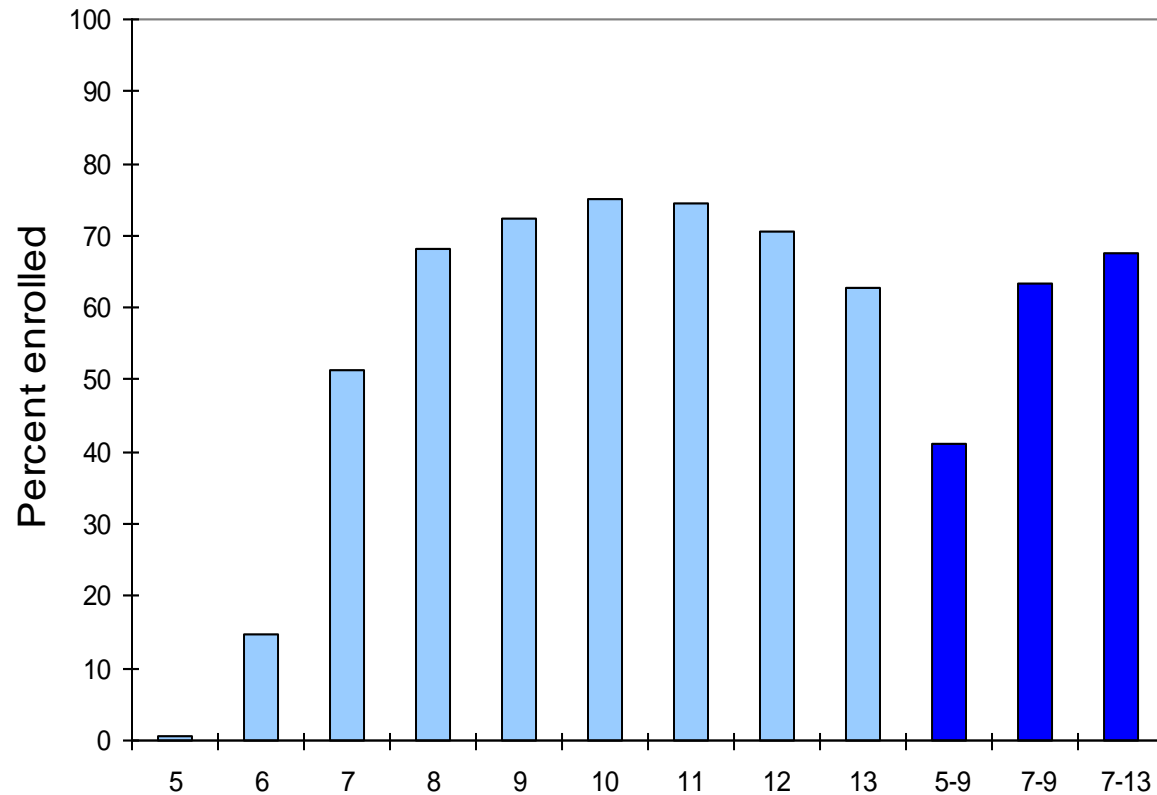


Comparison of intervention and control households at baseline 2000

Indicator	Intervention (n=706)	Control (n=653)	Difference (Intervention – Control)	Total (n=1359)
Household size	5.93 (2.95)	6.12 (2.78)	-0.19* [0.10]	6.02 (2.87)
Number of children < 5 years old	1.09 (1.10)	1.19 (1.06)	-0.10** [0.04]	1.13 (1.08)
Number of children < 3 years old	0.71 (0.85)	0.77 (0.82)	-0.06 [0.13]	0.74 (0.84)
Percent of female-headed households	13.2	15.3	-2.1 [0.26]	14.2
Age of household head	44.6 (16.1)	43.9 (15.3)	0.7 [0.57]	44.3 (15.7)
Years of education of household head	1.69 (2.17)	1.60 (2.22)	0.09 [0.41]	1.65 (2.20)
Average years of education of adults	2.21 (1.87)	2.23 (1.85)	-0.02 [0.58]	2.22 (1.86)
Percentage of children between 7 and 13 years of age who matriculated	68.1	68.5	-0.04 [0.66]	68.2
Time it takes to walk to school (minutes)	26.6 (34.1)	21.8 (24.2)	4.8 [0.13]	24.3 (29.8)
Number of rooms in the home	1.50 (0.78)	1.53 (0.84)	-0.03 [0.69]	1.51 (0.81)
Number of durable goods ^a	0.23 (0.47)	0.23 (0.47)	0.00 [0.86]	0.23 (0.47)
Size of land owned (hectares)	1.41 (1.47)	1.49 (1.88)	-0.08 [0.69]	1.45 (1.68)
Percent working as agricultural producer	83.1	82.8	0.3 [0.88]	83.0
Percent working in coffee	9.9	8.6	1.3 [0.40]	9.3
Percent using credit	15.3	16.4	-1.1 [0.58]	15.8



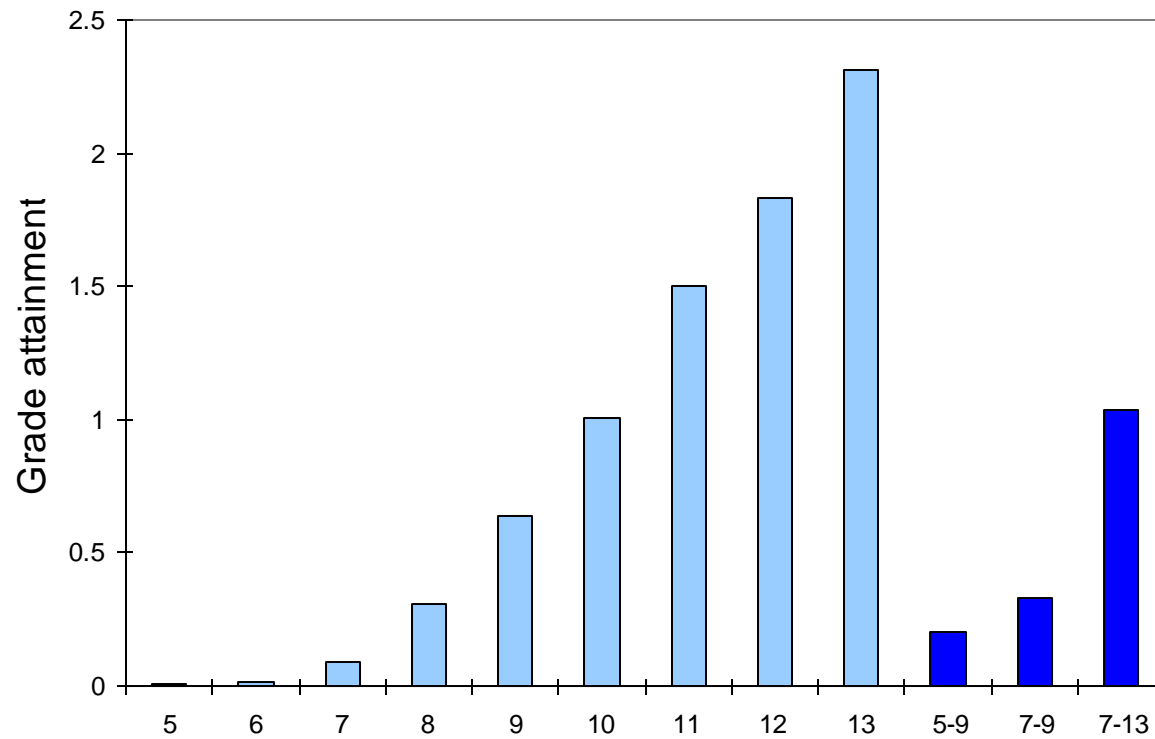
School enrollment at baseline, 2000



Notes: RPS Census – all 7-13 year olds (Table 1)



School attainment at baseline, end-1999



Notes: RPS Census – all 7-13 year olds (Table 1)



Schooling conditions at baseline (2000)

	Intervention areas	Control areas	Difference
Time to school (min)	29	24	5
Distance to school (m)	1037	893	143.6
Percent Autonomous	29	31.3	-2.4
Total enrollment (2000)	75.7	66.1	9.6
Number of Teachers	2.3	1.9	0.37
Student-teacher ratio	35.1	36.7	1.6
Highest grade available	4.4	4.6	0.2
School texts per student	1.7	1.7	0.0

Notes: Time & distance measured at child-level, all others at school level (I=107 schools, C=83 schools) (Table 2)



RPS evaluation data

Survey

Census 2000 (May)	Baseline 2000 (Aug)	Follow-up 2001 (Oct)	Follow-up 2002 (Oct)	RPS Admin monitoring (2003-4)	Follow-up 2004 (Oct)
10981 HH Census School Survey	1581 HH Sample	1490/1581 HH Sample	1434/1581 HH Sample	~9000 HH Beneficiary School Survey	1346/1581 HH Sample



Pre-program

Post-program



RPS evaluation data

Survey	Census 2000 (May)	Baseline 2000 (Aug)	Follow-up 2001 (Oct)	Follow-up 2002 (Oct)	RPS Admin monitoring (2003-4)	Follow-up 2004 (Oct)
	10981 HH Census School Survey	1581 HH Sample	1490/1581 HH Sample	1434/1581 HH Sample	~9000 HH Beneficiary School Survey	1346/1581 HH Sample
Outcome variable	Grade ('99) School char. ('99)	Enroll ('00) Grade ('99)	Enroll ('01) Grade ('00)	Enroll ('02) Grade ('01)	Grade ('02) School char. ('02)	Enroll ('04) Grade ('03)



Pre-program

Post-program



RPS evaluation data

Survey	Census 2000 (May)	Baseline 2000 (Aug)	Follow-up 2001 (Oct)	Follow-up 2002 (Oct)	RPS Admin monitoring (2003-4)	Follow-up 2004 (Oct)
	10981 HH Census School Survey	1581 HH Sample	1490/1581 HH Sample	1434/1581 HH Sample	~9000 HH Beneficiary School Survey	1346/1581 HH Sample
Outcome variable	Grade ('99) School char. ('99)	Enroll ('00) Grade ('99)	Enroll ('01) Grade ('00)	Enroll ('02) Grade ('01)	Grade ('02) School char. ('02)	Enroll ('04) Grade ('03)
	No program	No program	Original Experiment	Original Experiment	Original Experiment	Original Intervention areas: supply only Original Control areas: all program



Pre-program

Post-program



RPS impact on enrollment and dropout

- Reduced form single difference estimation

$$E_{ihct} = \beta_0 + P_{c0} \beta_1 + \varepsilon_{ihc} \mid \text{enrolled (or not) in 2000}$$

- E_{ihct} = Enrollment status in year t, individual i, household h, locality c (linear prob model)
 - $P_{c0} = 1$ if locality c received the program in Phase I
 - ε_{ihct} = idiosyncratic error term
 - β_1 = single difference estimator of the average program effect
- Intent-to-treat effect: we are not conditioning on household participation in the program.

RPS impact on enrollment conditional on enrollment in 2000

	Not enrolled in 2000	
Age on Jan. 1 st , 2000	Enrolled in 2001	Enrolled in 2002
5-9	0.299 (0.036)	0.201 (0.035)
7-9	0.410 (0.057)	0.299 (0.056)
7-13	0.412 (0.046)	0.340 (0.047)

Notes: RPS Baselines – all 7-13 year olds who had not completed 4th grade in 2000

RPS impact on enrollment conditional on enrollment in 2000 (cont'd)

	Not enrolled in 2000		Enrolled in 2000	
Age on Jan. 1 st 2001	Enrolled in 2001	Enrolled in 2002	Drop out 2001	Drop out 2002
5-9	0.299 (0.036)	0.201 (0.035)	- 0.048 (0.015)	- 0.014 (0.034)
7-9	0.410 (0.057)	0.299 (0.056)	- 0.044 (0.015)	- 0.047 (0.015)
7-13	0.412 (0.046)	0.340 (0.047)	- 0.058 (0.15)	- 0.061 (0.013)

Notes: RPS Baselines – all 7-13 year olds who had not completed 4th grade in 2000



RPS impact on grade attainment

- Reduced form estimation with controls

$$\Delta E_{ihc} = \beta_0 + X_{i0} \beta_1 + X_{h0} \beta_2 + P_{c0} \beta_3 + \Delta \varepsilon_{ihc}$$

- ΔE_{ihc} = Grade progression (number of grades progressed between base line survey and a later period for child i, in household h and locality c)
- X_{i0} = vector of individual characteristics at baseline year zero
- X_{h0} = vector of household characteristics at baseline year zero
- $P_{c0} = 1$ if locality c received the program in Phase I
- $\Delta \varepsilon_{ihc}$ = idiosyncratic error
- β_3 = DD estimator of the average program effect

RPS impact on grade attainment (cont'd)

- Child level RPS evaluation survey panel data set (grade progression from 2000 to 2001 and 2002)
 - **Intent-to-treat effect**: we are not conditioning on household participation in the program.
 - β_3 = DD estimator of the average program effect
- Administrative panel data between 2000 and 2003 (grade progression from 1999 to 2002)
 - **Treatment-on-the-treated effect**: if selection process for participation did not vary.

RPS impact on grade attainment (cont'd)

- Child level RPS evaluation survey panel data set (grade progression from 2000 to 2004)
 - β_3 = four year intent-to-treat program effect of having RPS Phase I for three years and then the supply-side for one year, relative to having no program for three years, and the RPS Phase II for one year
 - Conservative four year impact of the program.

Average RPS impact on grade attainment

Age (Jan1st, 2001)	1999-2000 ITT 1 year	1999-01 ITT 2 year	1999-02 TT 3-year	1999-03 ITT 4-year hybrid
5-9	0.107 (0.028)	0.379 (0.050)	0.529 (0.026)	0.607 (0.087)
7-9	0.115 (0.040)	0.426 (0.064)	0.676 (0.035)	0.596 (0.105)
7-13	0.129 (0.031)	0.371 (0.051)		0.532 (0.082)

Notes: RPS Census & Baselines – all 7-13 year olds who had not completed 4th grade in 2000 (Table 5)



Average RPS impact on grade attainment conditional on 2000 enrollment

Age (Jan 1 st 2001)	1999-2000 ITT 1 year	1999-01 ITT 2 year	1999-02 TT 3-year	1999-03 Hybrid 4-year
5-9	0.024 (0.014)	0.295 (0.044)	0.503 (0.259)	0.591 (0.090)
7-9	0.052 (0.029)	0.486 (0.081)	0.764 (0.045)	0.848 (0.154)
10-13	0.181 (0.067)	0.447 (0.079)		0.955 (0.240)
7-13	0.075 (0.031)	0.484 (0.074)		0.897 (0.141)

Not
Enrolled
2000

Average RPS impact on grade attainment conditional on 2000 enrollment (cont'd)

**Not
Enrolled
2000**

Age in 2000	1999-2000 ITT 1 year	1999-01 ITT 2 year	1999-02 TT 3-year	1999-03 Hybrid 4-year
5-9	0.024 (0.014)	0.295 (0.044)	0.503 (0.259)	0.591 (0.090)
7-9	0.052 (0.029)	0.486 (0.081)	0.764 (0.045)	0.848 (0.154)
10-13	0.181 (0.067)	0.447 (0.079)		0.955 (0.240)
7-13	0.075 (0.031)	0.484 (0.074)		0.897 (0.141)
5-9	0.162 (0.045)	0.409 (0.065)	0.642 (0.041)	0.509 (0.101)
7-9	0.147 (0.048)	0.396 (0.069)	0.649 (0.043)	0.478 (0.107)
10-13	0.140 (0.043)	0.256 (0.059)		0.313 (0.101)
7-13	0.140 (0.035)	0.324 (0.050)		0.397 (0.079)

**Enrolled
2000**



Messages so far....

- Low initial outcomes = potential for impact
- Large increase in grades attained...
 - ~0.5 grades by 2004, 25% of average
- ...half due to those already enrolled
- Large increase in enrollment
 - Bringing kids who would not have attended, or would have started late, into school
 - Keeping kids in school longer (lower dropouts)
 - Also, lower repetition rates
- And now, **supply**...

RPS impact on grade attainment, incorporating initial supply

- Reduced form estimation with controls

$$\Delta E_{ihc} = \beta_0 + X_{i0} \beta_1 + X_{h0} \beta_2 + P_{c0} \beta_3 + K_{c0} \beta_4 + K_{c0} P_{c0} \beta_5 + \Delta \varepsilon_{ihc}$$

- ΔE_{ihc} = grade progression
- X_{i0} = vector of individual characteristics at baseline year zero
- X_{h0} = vector of household characteristics at baseline year zero
- $P_{c0} = 1$ if locality c received the program in Phase I
- K_{c0} = vector of schooling characteristics at baseline year zero
- $\Delta \varepsilon_{ihct}$ = error term
- β_3 = DD estimator of the average program effect
- β_5 = estimator of differential effect of the program given initial supply characteristics.

Grade attainment between 1999 and 2002

Grade Progression 2000-2003 (TT 3-year)	5-9 year olds	7-9 year olds
Avg Prog Effect (DD) β_3	0.648 (0.05)	0.726 (0.08)
Autonomy β_5	0.190 (0.05)	0.293 (0.08)
Time to school < 30 minutes β_5	-0.126 (0.05)	-0.070 (0.07)
Availability of 5 th grade or more β_5	-0.141 (0.05)	-0.176 (0.07)
Student/teacher < 35 β_5	0.057 (0.05)	0.082 (0.07)
Text/Student > 1.5 β_5	-0.041 (0.05)	-0.032 (0.07)

?

?

Notes: RPS Census and Admin data (Table 7)



RPS effect on school supply characteristics

- RPS school panel data (2000, 2003)
- Reduced form estimation

$$\Delta S_j = \beta_0 + P_c \delta_2 + \beta_1 SL_{2000} + SL_{2000} P_c \delta_3 + \Delta \varepsilon_j$$

- ΔS_j = Change in j school characteristic (e.g., number of teachers) 2003 - 2000
- $P_c = 1$ if original intervention locality
- $SL_{2000} = 1$ if low level of S in 2000
- $\Delta \varepsilon_j$ = idiosyncratic error
- δ_2 = DD estimator of the average program effect on school characteristics
- δ_3 = estimator of differential effect of the program on school characteristics given “low” initial supply characteristics



RPS effect on school supply characteristics

	High grade	Logarithm Number of Classes	Number of Teachers	Logarithm Number of Teachers	Student- teacher ratio
DD (δ_2)	0.355 (0.186)	0.143 (0.069)	0.294 (0.151)	0.131 (0.066)	1.098 (2.237)

RPS effect on school supply characteristics (cont'd)

	High grade	Logarithm Number of Classes	Logarithm Number of Teachers	Number of teachers	Student- teacher ratio
δ_2 (DD)	0.355 (0.186)	0.143 (0.069)	0.131 (0.066)	0.294 (0.151)	1.098 (2.237)
δ_3 (DDD-low initial supply versus high)	1.072 (0.229)	0.301 (0.080)	0.230 (0.095)	0.230 (0.095)	-7.071 (2.778)

Notes: Estimates based on 132 schools from *RPS* schools data. Low initial values are: High grade: 3rd grade or lower; Number of classes: 3 or fewer; Number of teachers; 2 or fewer; Student-teacher ratio: 35 or lower. (Table 8)

Conclusions

- Substantial program effects on enrollment, dropout, repetitions, and grade progression
- Gains made for children both
 - in school prior to program
 - not in school prior to program
- All this despite many schools with poor initial conditions
- RPS led to large increase in demand, what was the supply response?
 - Autonomous schools more effective, i.e., had higher impact

Conclusions (cont'd)

- Poor initial conditions were not a severe constraint on program effectiveness, apparently b/c supply adjusted
- RPS, via purposive action and demand incentives, led to increased supply



Thanks





Inter-American Development Bank / www.iadb.org