

# Assessing the Impact of a School Subsidy Program in Mexico: Using a Social Experiment to Validate a Dynamic Behavioral Model of Child Schooling and Fertility

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# Motivation

- All eligible treatment group households were offered **the same** school attendance subsidy schedule.

TABLE 1—MONTHLY TRANSFERS FOR SCHOOL ATTENDANCE  
UNDER THE PROGRESA PROGRAM

School level	Grade	Monthly payment in pesos	
		Females	Males
Primary	3	70	70
	4	80	80
	5	105	105
	6	135	135
Secondary	1	210	200
	2	235	210
	3	255	225

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- It is not possible to determine the size and structure of the subsidy.
- It is not possible to assess the many alternative policy tools available to achieve the same goals.

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- How to compare the efficacy of the PROGRESA program with that of alternative policies that were not implemented as part of the experiment?
- Structural estimation of a dynamic behavioral model of parental decision-making about childrens schooling and family fertility.
- Out-of-sample validation first compares the actual post-program school attendance rates of the children in treated households to the rates predicted by the model based on simulating the introduction of the subsidy schedule.
- Explore the usefulness of social experiments as a tool for model validation.

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- subsidizing attendance at the lower grade levels, as under the existing program, is essentially an income transfer
- 3 to 5 and increases the amount of the subsidy to grades 6 to 9 by about 50 percent leaves the overall cost of the program unchanged and produces an increase in average completed schooling by about an additional 0.1 years

# Model

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- Married couples are assumed to make sequential decisions over a finite horizon about the **time allocation** of all of their **children age 6 through 15**, including their **school attendance** and **labor market participation**, and about the **timing and spacing of births**.
- Childrens **wages** are assumed to depend on **distance to the nearest largest city**, which provides an important source of identification.

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- The model also allows for a psychic cost of attending school that may be higher when a child is behind in school for his age. The existence of this psychic cost implies that forward-looking parents may forego having a child work when faced with a high child wage offer that is transitory.

# Model

$$(1) \quad U(t) = U(C(t), p(t), \mathbf{n}(t), \mathbf{s}_b(t), \mathbf{s}_g(t), \mathbf{S}_b(t), \\ \mathbf{S}_g(t), \mathbf{l}_b(t), \mathbf{l}_g(t), z_s; \boldsymbol{\varepsilon}(t), \boldsymbol{\mu}).$$

$$(2) \quad C(t) = y_p(t) + \sum y_o(t, \tau_n)h(t, \tau_n).$$

$$(3) \quad \log y_p(t) = y_p(a_p(t), z_c, \boldsymbol{\varepsilon}_{y_p}(t); \boldsymbol{\mu}_{y_p}),$$

$$\log y_o(t, \tau_n) = y_o(t - \tau_n, \mathbf{I}(b(\tau_n) = 1),$$

$$z_c, \boldsymbol{\varepsilon}_{y_o}(t); \boldsymbol{\mu}_{y_o}).$$

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$$(4) \quad \pi_c(t, \tau_n) = \pi(t - \tau_n, S(t, \tau_n) | s(t, \tau_n) \\ = 1, \mu_c).$$

TABLE 6—ONE-PERIOD TRANSITION RATES BY SEX:  
AGE ( $a$ ) 13 TO 15

	Boys		
	Home ( $a$ )	Work ( $a$ )	School ( $a$ )
Home ( $a - 1$ )	44.4	40.7	14.8
Work ( $a - 1$ )	25.0	62.5	12.5
School ( $a - 1$ )	8.3	5.5	86.2

$$V^k(\Omega(t), t) = U^k(t, \Omega(t)) + \delta E(V(\Omega(t + 1)),$$



# Results

TABLE 9—ACTUAL AND PREDICTED CHOICE DISTRIBUTION BY CHILD AGE AND SEX  
(Pooled 1997 and 1998)

Age	Actual			Predicted			$\chi^2$
	School	Work	Home	School	Work	Home	
<b>Boys</b>							
6	0.933	—	0.066	0.923	—	0.077	0.58
7	0.981	—	0.019	0.980	—	0.020	0.02
8	0.987	—	0.013	0.980	—	0.020	0.99
9	0.994	—	0.006	0.979	—	0.021	3.49
10	0.982	—	0.018	0.974	—	0.026	0.86
11	0.977	—	0.023	0.964	—	0.036	1.45
12	0.885	0.021	0.094	0.846	0.039	0.115	3.99
13	0.780	0.084	0.136	0.736	0.078	0.186	4.51
14	0.677	0.157	0.166	0.619	0.191	0.190	3.41
15	0.490	0.276	0.235	0.520	0.251	0.229	0.88
<b>Girls</b>							
6	0.965	—	0.035	0.942	—	0.058	3.84
7	0.976	—	0.024	0.968	—	0.032	0.77
8	0.989	—	0.011	0.976	—	0.024	1.96
9	0.991	—	0.009	0.975	—	0.025	3.26
10	0.979	—	0.021	0.970	—	0.030	0.93
11	0.969	—	0.031	0.948	—	0.052	2.97
12	0.896	0.007	0.097	0.854	0.020	0.126	4.61
13	0.726	0.028	0.245	0.676	0.025	0.299	2.85
14	0.582	0.089	0.329	0.566	0.092	0.342	0.22
15	0.419	0.123	0.458	0.402	0.157	0.442	1.68

Note:  $\chi^2$  (0.05, 1) = 3.84,  $\chi^2$  (0.05, 2) = 5.99.

# Results

TABLE 10—ACTUAL AND PREDICTED SCHOOL ATTENDANCE RATES BY NUMBER OF YEARS  
LAGGING BEHIND IN SCHOOL: AGE 12–15

Age	Boys			Girls		
	Actual	Predicted	$\chi^2$	Actual	Predicted	$\chi^2$
Not behind	88.3	82.1	8.50	83.8	78.2	6.02
Behind one year	79.8	76.4	1.56	75.4	74.5	0.09
Behind two years	65.8	62.5	0.91	52.9	51.0	0.20
Behind three years or more	49.1	51.7	0.62	44.7	42.7	0.39

Note.  $\chi^2$  (0.05, 1) = 3.84.

# Results

TABLE 19—THE EFFECTIVENESS AND COST OF ALTERNATIVE PROGRAMS

	Baseline <sup>a</sup>	Compulsory school attendance through age 15	Original subsidy	2× subsidy	0.5× subsidy	Restricted subsidy <sup>b</sup>	1.43× restricted subsidy
Mean completed schooling							
Girls	6.29	8.37	6.83	7.30	6.56	6.67	6.97
Boys	6.42	8.29	6.96	7.44	6.68	6.79	7.07
Percent completed grade 6 or more							
Girls	75.8	95.1	82.3	86.9	79.3	77.4	82.0
Boys	78.8	93.7	83.3	86.7	81.1	79.6	82.8
Percent completed grade 9 or more							
Girls	19.8	55.5	25.9	31.6	23.1	26.2	29.3
Boys	22.8	54.7	28.0	34.6	25.5	29.2	31.8
Cost per family	0	—	26,096	59,935	11,989	15,755	25,193
Mean number of children	4.24	4.21	4.28	4.32	4.27	4.25	4.27
	Bonus for completing 9th grade <sup>a</sup>	Junior secondary school in each village	Unconditional income transfer 5,000 pesos/yr	No child labor through age 15	Original subsidy and 25% wage increase		
Mean completed schooling							
Girls	6.50	6.39	6.41	6.30	6.75		
Boys	6.58	6.55	6.53	6.52	6.79		
Percent completed grade 6 or more							
Girls	74.9	76.0	77.6	76.1	81.5		
Boys	76.9	79.0	80.0	79.9	81.8		
Percent completed grade 9 or more							
Girls	28.8	21.2	20.8	19.7	25.2		
Boys	32.7	24.1	23.7	23.5	26.5		
Cost per family	36,976	—	237,000	—	25,250		
Mean number of children	4.20	4.24	4.24	4.25	4.29		

<sup>a</sup> Predicted: control and treatment families.

## Videos of Structural Models:

<https://hceconomics.uchicago.edu/news/3-questions-petra-todd>

