

The effect of education on teenage fertility: causal evidence for Argentina

Cecilia Velázquez (CEDLAS)

Arnoldshain Seminar XIV

Cordoba & La Cumbre (Argentina)
October 2016

Outline

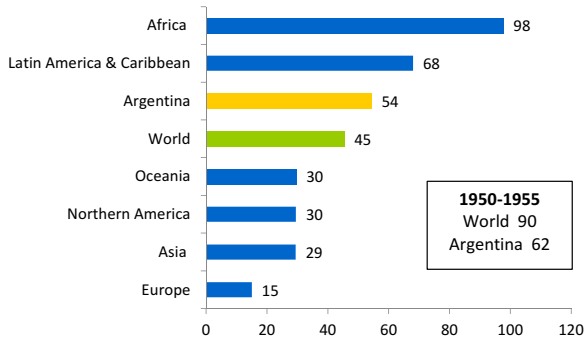
- Introduction
- Empirical strategy
- Results
- Final remarks

High rates ...

TEENAGE FERTILITY RATES

2010-2015

(number of live births per 1,000 women aged 15-19)



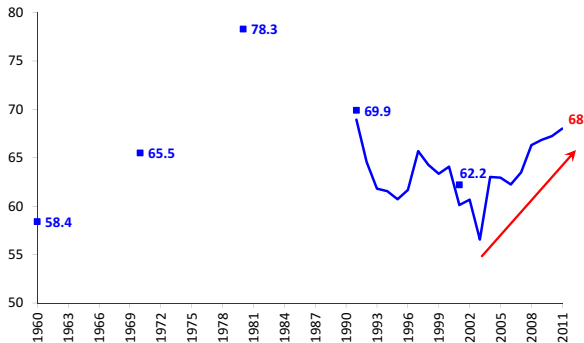
Source: United Nations, World Population Prospects: The 2012 Revision.

... and increasing

TEENAGE FERTILITY RATE

Argentina, 1960-2011

(number of live births per 1,000 women aged 15-19)



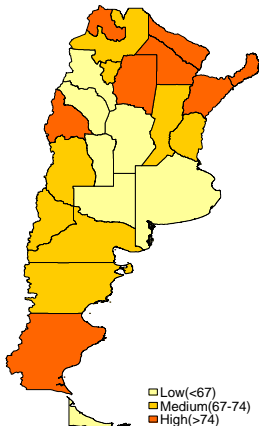
Source: Pantelides & Binstock (2007) and Office of Health Statistics DEIS.

High heterogeneity across provinces

TEENAGE FERTILITY RATES

by province, Argentina, 2011

(number of live births per 1,000 women aged 15-19)



104	Chaco
92	Formosa
83	Corrientes
81	Santa Cruz
79	Misiones
77	Santiago del Estero
75	San Juan
74	Jujuy
73	Salta
73	Tucuman
72	Entre Rios
72	Chubut
71	Rio Negro
70	Santa Fe
70	Mendoza
69	Neuquen
67	Catamarca
67	San Luis
65	Buenos Aires
64	La Rioja
60	La Pampa
59	Cordoba
55	Tierra del Fuego
34	CABA (Federal District)

Source: Office of Health Statistics DEIS.

Adverse consequences on child health

Argentina 2012

	Mother's age				Total
	10-14	15-19	20-34	35-49	
Premature (<37weeks gestation) ¹	12.7	9.3	7.9	10.3	8.5
Low birth weight (<2,500grams) ¹	11.4	8.1	6.6	8.6	7.1
Infant mortality rate (<1year) ²	15.6	9.7	6.6	7.0	7.2
Neonatal mortality rate (<28days) ²	9.9	6.6	4.5	5.0	4.9
Maternal mortality rate ³	3.3	3.0	3.0	6.6	3.5

Notes: (1) Per 100 live births. (2) Per 1,000 live births. (3) Per 10,000 live births.

Source: Vital Statistics 2012 (Office of Health Statistics DEIS).

- High risk for child health (DEIS categorization)
- Is it a result of age? Or lack of medical care/nutritional deficiencies?

Planned or unplanned?

- 45% of teenage pregnancies are unplanned → improve youth's information and access to contraception
- Remaining 55% → socioeconomic determinants of teen pregnancy

Note: women that “preferred to wait” or “did not want any / any more children” when they became pregnant.

Source: Survey on Sexual and Reproductive Health (INDEC, 2013).

Motivation

- High levels
- Increasing since 2003
- Focus on Northeast
- High risk for child health
- 45% of teenage pregnancies are unplanned → information and access to contraception
- Remaining 55% → socioeconomic determinants

Objective

- Estimate the effect of education on teenage fertility
- Hypothesis: education reduces probability of birth in teens
- Channels:
 - **'Incapacitation' or 'incarceration' effect:** limits time/opportunities to engage in risky behavior
 - **Human capital effect:** education \uparrow future earnings
 - Substitution effect (-) : \uparrow opportunity cost
 - Income effect (+) : families can “afford” more children (weaker if parents prefer to invest more in each child)
 - Knowledge about contraception or reproductive health

Negative relationship

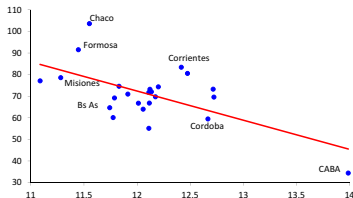
Argentina, 2011

TEENAGE FERTILITY RATES

(number of live births per 1,000 women aged 15-19)

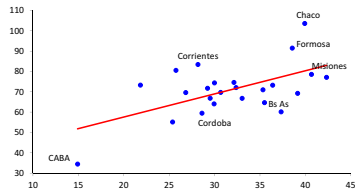
YEARS OF SCHOOLING

(mean, women aged 25-40)



INCOMPLETE SECONDARY

(%, women aged 25-40)



Source: DEIS & Household Survey EPH (SEDLAC, CEDLAS & World Bank).

Teenage Fertility & Education

Ideally:

$$TP_{i,t} = \beta S_{i,t} + \gamma X_{i,t} + \varepsilon_{i,t}$$

- $TP_{i,t}$ Pregnancy of teenager i , in year t
- $S_{i,t}$ Education of teenager i , in year t
 - Enrollment
 - Years of schooling

But:

- No microdata
- Not observe pregnancies
- $TP_{i,t} \rightarrow TF_{j,t+1}$ Fertility rate of region j , in year $t+1$
- $\hat{\beta}$ causal effect?

Causal effect?

2 kinds of endogeneity:

- Reverse causality: reproductive decisions and human capital investment are joint decisions
- Selection bias: disadvantageous family background and preferences for risky behaviors, imply both a higher probability of becoming pregnant and higher probability of educational failures

$\widehat{\beta}_{OLS}$ correlation, NO causal interpretation

Objective:

Identify causal effect of education attainment on fertility decisions

Literature

- RCT: Kenya (Duflo et al, 2006), Malawi (Baird et al, 2010), Dominican Republic (Novella & Ripani, 2015)
- Natural experiments:
 - CCT programs: Colombia (Cortes et al, 2010)
 - \neq age-school-entry policies: US ([McCrary & Roger, 2011](#))
 - Educational reforms which extended:
 - Length of the School Day: Chile (Berthelon & Kruger, 2010)
 - Years of Obligatory Schooling: US & Norway (Black et al, 2008); Great Britain & Northern Ireland (Silles, 2011); Germany (Cygan-Rehm & Maeder, 2013); 22 LAC countries ([Alzua et al, 2016](#))

Identification strategy

- Natural experiment, educational reform which extended obligatory schooling: **Law of Federal Education (LFE)** 1993 (Law 24195)
- Reform required investing in education budget
- Since 1991, primary and secondary public education became a provincial responsibility
- However, Provinces required federal government financial aid
- Timing and degree of LFE's implementation was driven by political reasons

1993 education reform law

- Change in the structure of the educational curricula
- Increase the number of years of obligatory schooling

Before LFE		Age	After LFE	
Level	Year		Level	Year
Pre-primary	1º	3	Pre-primary	1º
	2º	4		2º
	3º	5		3º
Primary	1º	6	EGB 1	1º
	2º	7		2º
	3º	8		3º
	4º	9	EGB 2	4º
	5º	10		5º
	6º	11		6º
	7º	12	EGB 3	7º
Secondary	1º	13		8º
	2º	14		9º
	3º	15	Polimodal	1º
	4º	16		2º
	5º	17		3º

Source: Ministry of Education.

Data

Panel dataset:

- Yearly, 1995-2006
- Birth-cohort & province of residence
 - 23 provinces (exc. Rio Negro): 15 provinces for the entire period + 8 provinces since 1998 (according to Household Survey sample)
 - Birth-cohorts 1977 to 1994, included when they are 12-18 years old (births 13-19)
- Unbalanced panel: 390 groups; 1,764 obs

Data (birth-cohort & province level)

Indicator		Period		Source	Notes
Live births	By age, 13-19	1995-2006	Yearly	Office of Health Statistics DEIS	
Female population	By age, 13-19	1995-2006	Yearly	National Statistics Institute INDEC	Forecasts based on 2001 Census. Results by five-year age group are then disaggregated into single years of age using Sprague's multipliers (Siegel & Swanson, 2004)
Teenage fertility	By age, 13-19	1995 -2006	Yearly	Own elaboration based on DEIS and INDEC	$\frac{\text{Live births}}{\text{Female population}} \times 1.000$
Years of schooling	By age, 12-18	1995-2006	1995-2002 yearly 2003-2006 1st half	Household Survey, SEDLAC (CEDLAS and The World Bank)	Average years of schooling
School enrollment		1995-2006	1995-2002 yearly 2003-2006 1st half		$\frac{\text{Students enrolled}}{\text{Population}} \times 100$

Data (province level)

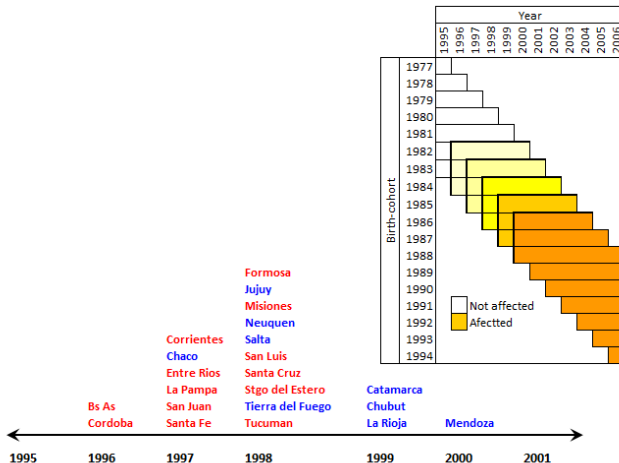
Indicator		Period		Source	Notes
Gross Regional Product		1995-2006	Yearly	Statistics offices at provincial level	In million Pesos, at 1993 constant prices
Unemployment		1995-2006	1995-2002 yearly 2003-2006 1st half	Household Survey, SEDLAC (CEDLAS and The World Bank)	Unemployment rate (> 15 years old)
Public expenditure	Education Health	1995-2006	Yearly	Ministry of Economy MECON	In million Pesos, at 1993 constant prices (implicit price deflator for GDP)
<i>Plan Nacer</i>	Women and children	2004-2006	Yearly	<i>Plan Nacer</i> (Ministry of Health)	$\frac{\text{Beneficiaries}}{\text{Population}} \times 100$

Instruments

Implementation of the reform, 2 complementary indicators:

- **LFE Dummy**: =1 for the birth-cohort who were 14 when their province implemented the reform (according to Crosta, 2007) and younger birth-cohorts
- **Polimodal**: share of students in Polimodal for each province (Ministry of Education)

Birth-cohorts affected by the reform



Source: Crosta (2007).

Instrumental Variables

Instrumental Variables: Two Stage Least Squares

$$S_{c,j,t} = \phi LFEDummy_{c,j,t} + \psi Polimodal_{j,t} + \alpha X_{j,t} + \eta_{c,j} + \lambda_t + v_{c,j,t} \quad (1)$$

$$TF_{c,j,t+1} = \hat{\beta} S_{c,j,t} + \gamma X_{j,t} + \mu_{c,j} + \delta_t + \varepsilon_{c,j,t} \quad (2)$$

Reduced Form

$$TF_{c,j,t+1} = \xi LFEDummy_{c,j,t} + \tau Polimodal_{j,t} + \pi X_{j,t} + \rho_{c,j} + \sigma_t + \varpi_{c,j,t} \quad (3)$$

($X_{j,t}$ GRP, unemployment, public expenditure education & health, *Plan Nacer*)
(birth-cohort/province fixed effects & year dummies)

Reform effects on Teenage fertility (reduced form)

	(1)	(2)	(3)	(4)	(5)	(6)
LFE Dummy	-7.518 *** (2.446)		-7.632 *** (2.43)	-7.333 *** (2.368)		-7.415 *** (2.346)
Polimodal		0.060 (0.038)	0.061 (0.039)		0.057 (0.038)	0.058 (0.038)
Covariates ^{††}	No	No	No	Yes	Yes	Yes
R2	0.925	0.924	0.925	0.926	0.926	0.926
Obs	1764	1764	1764	1764	1764	1764

Robust standard errors clustered at the birth-cohort/province level in parentheses.

All regressions include year and birth-cohort/province fixed effects.

***p<0.01, **p<0.05, *p<0.1.

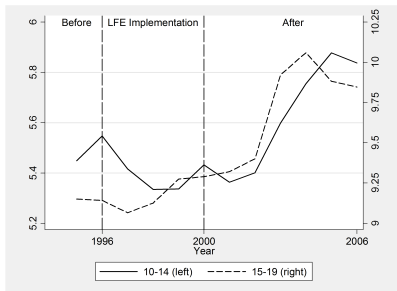
(††) Economic activity, unemployment, public expenditure on education and health, and Plan Nacer beneficiaries.

Source: own calculations.

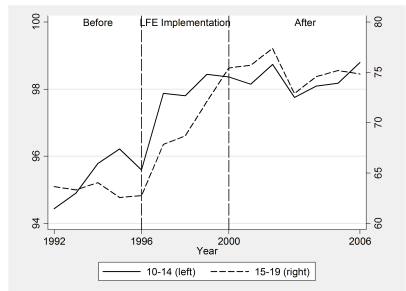
- LFE Dummy reduces TF, ranging from 7.3 to 7.6 births per 1,000 girls aged 13-19
- Polimodal (% students) not statistically significant

Preliminary evidence

**YEARS OF SCHOOLING
MEAN**



**GROSS ENROLLMENT
RATES (%)**



Source: Household Survey EPH (SEDLAC, CEDLAS & World Bank).

Reform effects on Years of Schooling (First stage)

	(1)	(2)	(3)	(4)
<u>PANEL A - Identified</u>				
LFE Dummy	0.27 *** (0.048)	0.24 *** (0.064)	0.27 *** (0.048)	0.25 *** (0.062)
Partial-R2	0.0136	0.0080	0.0138	0.0083
F-statistic	31.38 ***	14.78 ***	32.65 ***	16.01 ***
<u>PANEL B - Over-identified</u>				
LFE Dummy	0.27 *** (0.048)	0.25 *** (0.063)	0.27 *** (0.047)	0.25 *** (0.062)
Polimodal	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)
Partial-R2	0.0149	0.0095	0.0157	0.0100
F-statistic	16.59 ***	8.24 ***	17.40 ***	8.84 ***
Covariates††	No	No	Yes	Yes
Obs	1718	1718	1718	1718

Robust standard errors clustered at the birth-cohort/province level in parentheses.

All regressions include year and birth-cohort/province fixed effects.

***p<0.01, **p<0.05, *p<0.1.

In (1) and (3) dependent variable is average years of schooling; in (2) and (4) is average years of schooling of females.

(††) Economic activity, unemployment, public expenditure on education and health, and Plan Nacer beneficiaries.

Source: own calculations.

- LFE Dummy increases Years of Schooling, from 0.24 to 0.27
- Polimodal (% students) not statistically significant
- F-statistic > 10 (exc. 2 & 4 Panel B), but always statistically significant
- But, partial-R2 very low

Reform effects on Enrollment (First stage)

	(1)	(2)	(3)	(4)
<u>PANEL A - Identified</u>				
LFE Dummy	2.6 *** (0.88)	2.9 *** (0.925)	2.7 *** (0.875)	3.0 *** (0.9)
Partial-R2	0.0042	0.0036	0.0044	0.0038
F-statistic	8.65 ***	9.76 ***	9.33 ***	11.07 ***

<u>PANEL B - Over-identified</u>				
LFE Dummy	2.6 *** (0.876)	2.9 *** (0.924)	2.7 *** (0.871)	3.0 *** (0.897)
Polimodal	-0.012 (0.013)	-0.015 (0.015)	-0.011 (0.013)	-0.013 (0.014)
Partial-R2	0.0052	0.0047	0.0053	0.0047
F-statistic	5.31 ***	6.10 ***	5.56 ***	6.69 ***
Covariates††	No	No	Yes	Yes
Obs	1718	1718	1718	1718

Robust standard errors clustered at the birth-cohort/province level in parentheses.

All regressions include year and birth-cohort/province fixed effects.

***p<0.01, **p<0.05, *p<0.1.

In (1) and (3) dependent variable is enrollment rate; in (2) and (4) is female enrollment rate.

(††) Economic activity, unemployment, public expenditure on education and health, and Plan Nacer beneficiaries.

Source: own calculations.

- LFE Dummy increases Enrollment rate, from 2.6 to 3 p.p.
- Polimodal (% students) not statistically significant
- $F < 10$ (exc. 4 Panel A), but always statistically significant
- But, partial-R2 very low

Years of Schooling effects on Teenage Fertility

	(1)	(2)	(3)	(4)
<u>PANEL A - Identified</u>				
Schooling (years)	-27.72 *** (8.804)	-30.76 *** (11.397)	-26.89 *** (8.557)	-29.56 *** (10.98)
<u>PANEL B - Over-identified</u>				
Schooling (years)	-31.97 *** (9.083)	-35.53 *** (12.196)	-30.82 *** (8.684)	-33.63 *** (11.421)
Sargan-Hansen (p value)	0.252	0.447	0.356	0.511
Covariates††	No	No	Yes	Yes
Obs	1718	1718	1718	1718

Robust standard errors clustered at the birth-cohort/province level in parentheses.

All regressions include year and birth-cohort/province fixed effects.

***p<0.01, **p<0.05, *p<0.1.

In (1) and (3) the instrumented explanatory variable is average years of schooling; in (2) and (4) is average years of schooling of females.

(††) Economic activity, unemployment, public expenditure on education and health, and Plan Nacer beneficiaries.

Source: own calculations.

- One additional year of education reduced the number of births per 1,000 women aged 13-19 by 26.9 to 35.5
- Sargan-Hansen Test: H0 cannot be rejected

Enrollment effects on Teenage Fertility

	(1)	(2)	(3)	(4)
PANEL A - Identified				
Enrollment rate	-2.904 ** (1.181)	-2.600 *** (1.001)	-2.743 ** (1.094)	-2.450 *** (0.921)
PANEL B - Over-identified				
Enrollment rate	-3.318 *** (1.18)	-2.934 *** (1.006)	-3.125 *** (1.1)	-2.780 *** (0.936)
Sargan-Hansen (p value)	0.591	0.664	0.554	0.599
Covariates††	No	No	Yes	Yes
Obs	1718	1718	1718	1718

Robust standard errors clustered at the birth-cohort/province level in parentheses.

All regressions include year and birth-cohort/province fixed effects.

***p<0.01, **p<0.05, *p<0.1.

In (1) and (3) the instrumented explanatory variable is enrollment rate; in (2) and (4) is female enrollment rate.

(††) Economic activity, unemployment, public expenditure on education and health, and Plan Nacer beneficiaries.

Source: own calculations.

- An increase of one p.p. in the enrollment rate reduces the number of births per 1,000 women aged 13-19 by 2.4 to 3.3
- Sargan-Hansen Test: H0 cannot be rejected

Final remarks

Reform Effects on Education

- LFE Dummy positive impact on :
 - 0.24 to 0.27 additional Years of Schooling
 - 2.6 to 3 p.p. Enrollment rate
- Polimodal (% students) not statistically significant

Education effects on Teenage Fertility

- Education negative impact on teenage fertility decisions:
 - One additional year of education reduced the number of births per 1,000 women aged 13-19 by 26.9 to 35.5
 - An increase of one p.p. in the enrollment rate reduces the number of births per 1,000 women aged 13-19 by 2.4 to 3.3

Discussion

- Implementation of the reform, 2 complementary indicators:
 - LFE Dummy → extensive margin
 - Polimodal (% students) → intensive margin
- 2 education outcomes:
 - Enrollment rate → 'incapacitation' effect
 - Years of Schooling → human capital effect
- Estimated effects very high
- But, local average treatment effect (LATE), only valid for *compliers*
- External validity, only assuming homogeneous effects

Thank you!