Determinants and consequences of fertility

Lorenzo Rocco

Department of Economics, Padova

February, 2017

Introduction

Why are economists interested in fertility?

- the Malthusian problem: with fixed land, chances are that population growth outweighs productivity growth (due to diminishing returns of labor). This an underlying threat which materialized in Europe before the industrial revolution and in Africa in the period 1950-70 (when rapid mortality decline - epidemiological transition - was not accompanied by an as much rapid fertility decline). But in the industrial era the Malthus trap did not snap shut in Europe, America, Asia and Latin America (however the threat is there, it has not disappeared).
  - Fast population growth rates have not implied falling per-capita incomes as
    - labor productivity grew much faster than population
    - behaviors changed $\Rightarrow$ reduced fertility

Introduction

- variations in fertility would alter the age composition of the population with consequences on saving rates (the young save more) and the sustainability of the pension system
- fertility influences women participation to the labor market, choices about children education, health care, nutrition

Osili & Long (2008)

The purpose of this paper is that of establishing a causal effect of education on fertility by exploiting an exogenous variation in the supply of primary education in Nigeria.

Economic theory provides several explanations for female education influences fertility.
Education:

- increases the opportunity cost of childbearing among educated women.
- improves child health and reduces rates of child mortality: women need to have fewer births to reach a given desired family size.
- improves knowledge and more effective use of contraceptive methods.
- increases female autonomy and bargaining power in fertility decisions.

Empirical issues

Simple negative associations between education and fertility, often found in literature, could not be causal

- a negative association may depend on omitted variables, such as individual ability or household and community resources, which affect both schooling and fertility decisions.
- schooling opportunities are not randomly placed in communities and, for instance, could be correlated with the presence of family planning services.
- if fertility choices lead to interruptions in schooling, then fertility may be an endogenous variable within the context of schooling decisions.

Empirical Issues

- To identify causal impacts we need an exogenous source of variation that hits schooling without having a direct impact on fertility besides the effect mediated by schooling itself $\Longrightarrow$ we need an instrument.
- Such an exogenous source of variation is represented by the UPE - Universal Public Education - program.

UPE

- introduced in September 1976
- large-scale, nationwide program designed to increase educational attainment
- funded by the federal government
- it provided tuition-free primary education
- increased the number of primary school classrooms and teacher-training institutions

During the UPE program, the number of primary school children in Nigeria increased from 4.4 million students in 1974 to 13.8 million by 1981

- in September 1981, the UPE program ended
- reduced funding for primary schools
- reintroduction of school fees

Nigeria

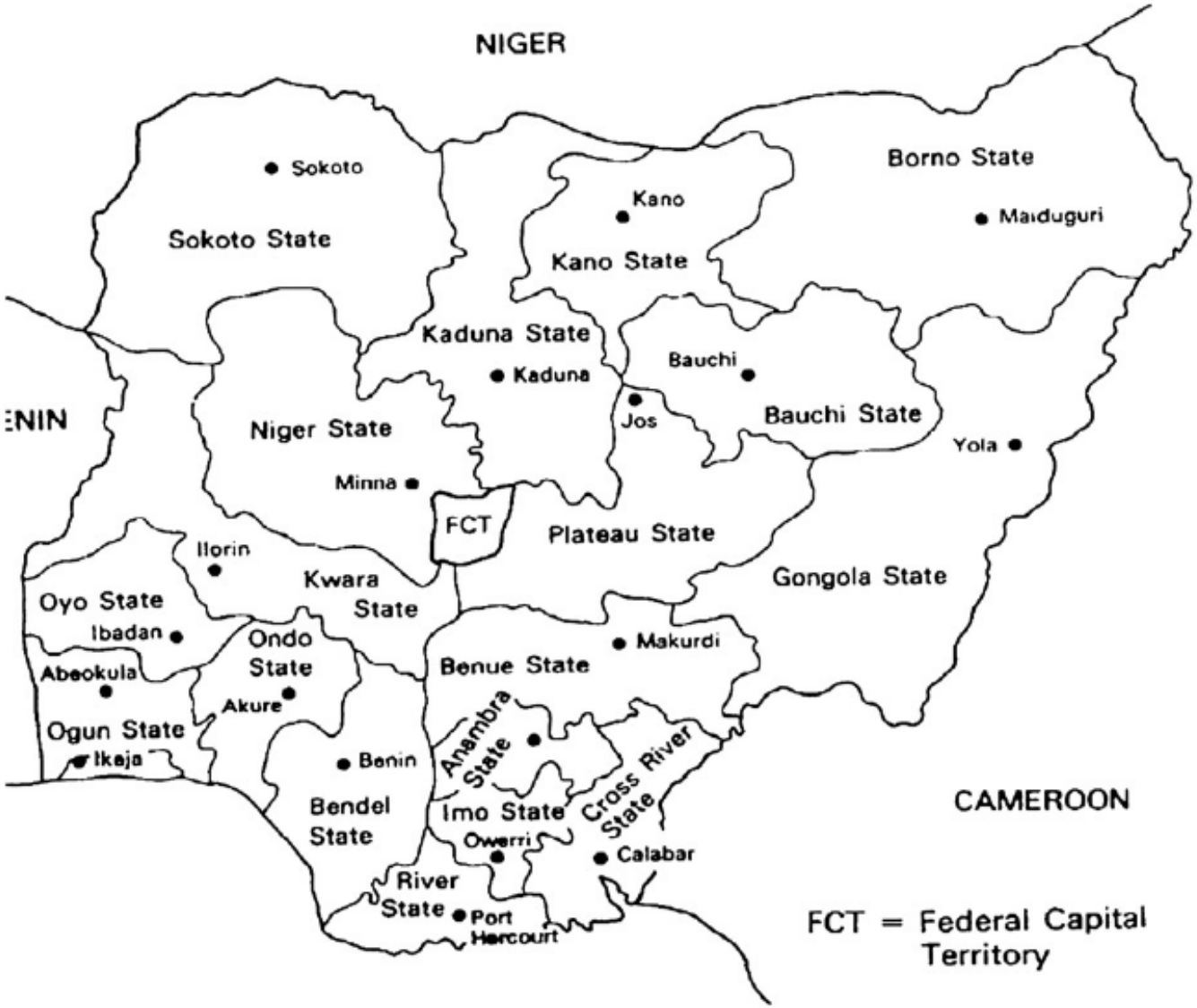

Fig. 1. The 19 states of Nigeria in 1976. Source: Bray (1981).

UPE

- To capture the intensity of the program by state, the analysis focuses on the amount of federal capital funds disbursed for classroom construction in 1976.
- As shown in Table 1, the states that received the highest levels of federal capital funds for classroom construction per capita were located *outside* the former Western region of Nigeria with the exception of Lagos.
  - These were the states that had relatively low primary school enrollment rates and levels of educational inputs prior to the UPE program.
  - We use the term "high-intensity" to refer to these states, which experienced a significant expansion in educational inputs.

Data

Table 1
Federal capital funds allocated for primary school construction in 1976 (in naira)

State	Region	Funds allocated	Using 1953 census population estimates for towns		Using 1976 state population projections based on 1963 census	
			Population	Funds/capita	Population	Funds/capita
Low-intensity areas						
Oyo	Western	1,744,305	1,243,090	1.40	7,330,400	0.24
Ogun	Western	321,524	166,274	1.93	2,182,600	0.15
Ondo	Western	717,838	219,741	3.27	3,841,400	0.19
Lagos (Capital Region)	Western	13,890,626	267,407	51.95	2,244,500	6.19
High-intensity areas						
Anambra	Eastern	8,342,532	213,561	39.06	5,061,500	1.64
Borno	Northern	2,601,302	77,730	33.47	3,415,500	0.76
Kaduna	Northern	11,116,441	145,440	76.43	5,168,500	2.15
Rivers	Eastern	5,821,876	71,634	81.27	2,420,400	2.41
Imo	Eastern	8,271,194	93,633	88.34	3,666,300	2.26
Kano	Northern	12,131,038	130,173	93.19	8,126,800	1.49
Sokoto	Northern	8,369,744	87,845	95.28	6,387,300	1.31
Kwara	Northern	9,538,412	94,264	101.19	2,412,800	3.95
Bauchi	Northern	2,973,215	29,075	102.26	3,421,500	0.87
Gongola	Northern	5,005,510	47,643	105.06	4,894,700	1.02
Bendel	Midwestern	10,062,666	76,092	132.24	3,462,300	2.91
Niger	Northern	2,025,000	12,810	158.08	1,681,000	1.20
Plateau	Northern	6,287,450	38,527	163.20	2,852,100	2.20
Benue	Northern	3,175,804	16,713	190.02	3,463,300	0.92
Cross-river	Eastern	10,256,206	46,705	219.60	4,218,300	2.43

Data

- 1999 Nigerian Demographic Health Survey (NDHS). This dataset is a nationally representative survey of women, with detailed information on fertility, family planning and education (less detailed as regards income).
- it contains rich information on socioeconomic and demographic variables for nearly ten thousand Nigerian women.
- potential problem: no data on where and when individual had studied $\Longrightarrow$migration
- however, recent studies on migration patterns in Nigeria in the 1990s suggest that the vast majority of Nigerians did not move or only move within state.
    - National Population Commission (1998), "If migration is defined as moves across state boundaries— most Nigerians can be classified as non-migrants. The only state with a sizable share of migrants is Lagos State, with 87% of its population migrated from other states." (p. 285).

Empirical strategy

First, the effects of the reform are assessed:

- DiD: difference in differences
  - treated cohort vs untreated - earlier - cohort
  - high-intensity regions vs low-intensity regions

Next, the causal effect of education on fertility is estimated:

- IV: the amount of federal capital funds for classroom construction is used as instrument

In general a DiD design exploits the discontinuity introduced by a given policy on an underlying trend of the treated regions, which would have been otherwise common between the treated and non treated (= control) regions in the absence of treatment.
The general DiD specification is

$$Y = \beta_0 + \beta_1 T + \beta_2 P + \beta_3 TP + \beta_4 X + \varepsilon$$

where
T is for time: a dummy which takes 0 before the treatment/policy and 1 after the treatment
P is the policy variable which takes 1 in treated regions and 0 in non-treated regions

Note that

$$E(Y|T=1,P=1) - E(Y|T=0,P=1) = \beta_1 + \beta_3$$

$$E(Y|T=1,P=0) - E(Y|T=0,P=0) = \beta_1$$

$$DiD = \beta_3$$

- The (continuous) variable funds per capita (P) is made dichotomous: 1 high intensity 0 low intensity (see Table 1 - Lagos excluded)
- The before/after variable is the birth cohort (T):
  - primary school lasts for six years in Nigeria. Pupils should start school at age 6. Given the timing of the program, UPE should have primarily affected individuals born between 1970 and 1975
  - due to high prevalence of underage and overage enrollments in first grade in Nigeria, the control group is composed of women who were aged 15 to 20 when the UPE was initiated (born between 1956 and 1961)

DiD model

First, let's check whether the program/policy is effective. Outcome: educational attainment (years of education)

$$S_{ijk} = a_0 + a_1 X_{ijk} + a_2(HighIntensity_k * UPECohort_j) + \\ + a_3 HighIntensity_k + a_4 UPECohort_j + e_{ijk}$$

Next, let's look at early fertility. Outcome: number of children before age 25

$$N_{ijk} = a_0 + a_1 X_{ijk} + a_2(HighIntensity_k * UPECohort_j) + \\ + a_3 HighIntensity_k + a_4 UPECohort_j + e_{ijk}$$

DiD model

The baseline models include

- dummy variables for religion (Muslim, Catholic, Protestant, Other Christian, Traditional Religion with "Other" being the left out group)
- ethnicity (Hausa, Yoruba, and Igbo with "Other" being the left out group)
- the female share of total primary school enrollment in 1970 in the state; this variable is also interacted with a dummy variable for being born in 1970–75
- the proportion of civil servants in the state who were female the year the individual was aged 6
- state fixed effects

Results

Table 3
The impact of the UPE program — DD analysis

A. Program intensity measured with a dummy variable for high-intensity (non-Western) states

Dependent var	Years of schooling			Number of kids before age 25		
	Baseline	Add 1970 state FE	Add year FE	Baseline	Add 1970 state FE	Add year FE
	(1)	(2)	(3)	(4)	(5)	(6)
Born 1970–75 *	1.632*	1.573*	1.537*	−1.110***	−1.142***	−1.086***
High-intensity state	(1.77)	(1.76)	(2.22)	(4.35)	(4.49)	(5.03)
Born 1970–75	−0.297	−1.188		3.676***	3.774***	
Dummy variable	(014)	(0.61)		(4.35)	(4.38)	
High-intensity	−0.605			0.766***		
State dummy variable	(0.64)			(3.28)		
R-squared	0.383	0.393	0.404	0.102	0.110	0.130
Observations	2646	2646	2642	2646	2646	2646

Notes: t-statistics are shown in parentheses. The t-statistics reported are based on standard errors that are clustered at the year*state level.

Problems with a direct regression of fertility on years of education (OLS)

- Unmeasured individual, household, and community-level resources may affect both education and fertility decisions. For example, an increase in the level of economic development may lead to higher educational attainment and lower fertility.
- Education may serve as a proxy for unobservable factors, such as ability, cognitive skills, motivation, and parental background, and these factors may be important determinants of a woman's fertility choices

The instrumental variables approach allows to identify the causal effect of education

- Valid instruments are variables that affect the level of educational attainment but have no direct impact on fertility.
- federal disbursed funds per capita for primary school construction in the state where an individual was educated are assumed to have no direct effect on fertility, other than through their effect on educational attainment (Is it obvious?).

The IV specification is

$$N_{ijk}=\gamma_0 + \gamma_1 X_{ijk} + \gamma_2 S_{ijk} + \varepsilon_{ijk}$$

$$S_{ijk} = f(UPEinputs_k) + \nu_{ijk}$$

$f(UPEinputs_k)$ =year of birth dummies*state capital allocation for classroom construction

Results

Table 8
The impact of education on fertility — instrumental variable estimates

A. OLS estimates

	Baseline	Add 1970 state Fixed effects	Add year of birth Fixed effects
	(1)	(2)	(3)
Years of education	−0.111***	−0.113***	−0.109***
	(14.08)	(14.35)	(14.35)
R-squared	0.163	0.172	0.187
Observations	2646	2646	2646

B. Instrumental variables estimates instruments used: year of birth dummies∗state capital allocation for classroom construction

	Baseline	Add 1970 state Fixed effects	Add year of birth Fixed effects
	(1)	(2)	(3)
Years of education	−0.444***	−0.475***	−0.263**
	(3.70)	(3.99)	(2.28)
Overidentification test (*P*-values)	0.086	0.032	0.281
R-squared	0.428	0.393	0.628
Observations	2646	2646	2646

Notes: t-statistics are shown in parentheses. The t-statistics reported are based on standard errors that are clustered at the year*state level.

First stage

Appendix Table 3
The impact of UPE by year of birth (2003 sample)

Dependent var.	Years of schooling	Number of kids before age 30
	(1)	(2)
Born 1962 or 1963 * Classroom Construction funds per capita	0.0061*	−0.001
	(1.82)	(−0.53)
Born 1964 or 1965 * Classroom Construction funds per capita	0.0105**	−0.0053***
	(2.09)	(−3.99)

Appendix Table 3 (*continued*)

Dependent var.	Years of schooling	Number of kids before age 30
	(1)	(2)
Born 1966 or 1967 * Classroom Construction funds per capita	0.0058*	0.00163
	(1.73)	(0.91)
Born 1968 or 1969 * Classroom Construction funds per capita	0.0042	−0.0035*
	(1.14)	(−1.68)
Born 1970 or 1971 * Classroom Construction funds per capita	0.0129***	−0.0036**
	(2.70)	(−2.16)
Born 1972 or 1973 * Classroom Construction funds per capita	0.0068*	−0.0035**
	(1.94)	(−2.34)
Born 1974 or 1975 * Classroom Construction funds per capita	0.0038	−0.004***
	(1.17)	(−2.67)
R-squared	0.3696	0.1713
Observations	5168	5168

Conclusions

- At the mean, for each additional 100 naira per capita spent on primary school classroom construction in 1976, we estimate a 2-year increase in educational attainment
- IV estimates are generally higher than OLS estimates and suggest that an additional year of schooling reduces the number of children born before age 25 by 0.26.
- UPE may also have positively affected the outcomes of the children of the affected women. For example, health and schooling indicators for children are known to improve with the level of female education (Schultz, 1998).
  - not to speak of the direct effect on human capital accumulation and of the reduced population growth $\Rightarrow$ economic growth
  - Returns to universal primary education programs may be substantial over the long term

Lavy and Zablotsky (2011)

- Perhaps the most common motivation why education reduces fertility is that the opportunity cost of time to educated females is higher, because they can obtain better jobs and higher incomes.
- This paper challenges this view: Israel Arab women increased their education and reduced their fertility without increasing their (low) participation to the labor market.
- Other mechanisms are then suggested, the most intriguing of these being the fact that more educated women married more educated men who understand the trade off between children quantity and quality (better nutrition, health and education).

Lavy and Zablotsky (NBER 2011, JPubE 2015)

- As usual the correlation between education and fertility is likely to be spurious (omitted variables, reversed causation). An exogenous shock is used in this paper, i.e. the end of restriction to mobility imposed to Israel Arabs in 1963.
- Restrictions to mobility represented a barrier to attaining education. They affected people in school-age between 1948 and 1963 who resided in localities without a school.

Background

- After Israel independence (1948) and the immediate independence war against the neighboring Arab countries (first Arab-Israel war), restrictions to Israel Arabs mobility were imposed.
- The resignation of Prime Minister David Ben-Gurion on June 16, 1963, and the appointment of Levi Eshkol as his successor led immediately to a dramatic and unexpected change. In a speech to the Knesset in October 1963, Eshkol announced that the Arab population would no longer need travel permits and that Arabs could once again move freely around the country
- Characteristics of the education system: until the mid-1970s, Israeli children attended primary school (grades 1–8) between the ages of 6 and 13 and secondary school (grades 9–12) at age 14–18.

Outline of the paper

- estimating the effect of mobility restriction removals on education and fertility
  - via DiD
  - via IV
- discussion of the mechanisms:
  - effect of the reform on women and spouse (labor) outcomes
  - effect of education on values/views/perceptions/preferences about fertility

Reform effects are observed using census data in 1983 and in 1995 (data on years of education and number of children).

- before/after:
  - cohorts 1955-1960 and 1950-1955 are affected by the 1963 reform (aged 4-14 in 1964).
  - cohorts 1945-1950 and 1940-1945 too old to be affected (aged 14-24 in 1964)
- treated/untreated localities: locality of residence (before 1964) without/with a school

Remarks

- The reform is more likely to affect girls than boys
  - because girls participate less to the labor market so they would bear only the costs and not the benefits of education
  - because passing through the check points is more risky for girls
  - because there existed residential schools only for boys, very costly (households allocated limited resources to boys to avoid the effects of mobility restrictions)
- In a DiD setting, internal migration is an issue. In the census data there is no precise information on the birth place. However migration is a minor issue in the Israel Arab context (75% reside in the same place as they born).
- Remark: members of a given cohort are affected only if they lived in a locality without a school before 1964.

$$S_{ilj} = \alpha + \alpha_j + \mu_l + \delta A_j Y_i + \varepsilon_{ilj}$$

where

- S_{ilj} years of schooling of individual i living in locality j and belonging to cohort l (precisely of being aged l in 1964)
- α_j are locality fixed effects
- μ_l are cohort fixed effects
- A_j is a dummy which takes 1 for localities without a school before 1964
- Y_i is a dummy which takes 1 if individual i belongs to the "young" cohort

Note: this model is slightly more general than that discussed in Osili & Long (2008): "more detailed" before/after and regional fixed effects

$$F_{ilj} = \alpha + \alpha_j + \mu_l + \delta A_j Y_i + \varepsilon_{ilj}$$

where F_{ilj} is the number of children of individual i living in locality j and belonging to cohort l (precisely of being aged l in 1964)

Results

How reading Table 5 below:

- first three columns is DiD estimates of the effect of reform on years of education with different sets of controls included
- second three columns is DiD estimates of the effect of the reform on fertility (reduced form)
- last two columns are OLS estimates of the effect of education on fertility and 2SLS estimates of the effect of education on fertility instrumenting by $A_j Y_i$
- Panel A: treated cohort more exposed (the youngest) vs control cohort (the youngest not exposed)
- Panel B: treated cohort less exposed vs control cohort (the youngest not exposed)
- Panel C: test of common trend

Results

Table 5: Estimated Effect of Female Education on Fertility: First Stage, Reduced Form, OLS and 2SLS Estimates

	Years of schooling			Fertility			Fertility	
	First stage			Reduced form			OLS	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. Experiment of interest:Cohorts aged 4-9 and 14-19 in 1964								
1983 census	0.751	0.694	0.738	-0.555	-0.533	-0.539	-0.240	-0.730
(N=4,226)	(0.279)	(0.262)	(0.257)	(0.155)	(0.147)	(0.147)	(0.009)	(0.303)
1995 census	1.078	0.921	1.018	-0.727	-0.651	-0.609	-0.119	-0.598
(N=3,798)	(0.297)	(0.283)	(0.276)	(0.195)	(0.190)	(0.188)	(0.010)	(0.238)
B. Experiment of interest:Cohorts aged 9-14 and 14-19 in 1964								
1983 census	0.490	0.545	0.514	-0.279	-0.346	-0.342	-0.134	-0.665
(N=3,553)	(0.313)	(0.289)	(0.283)	(0.192)	(0.183)	(0.181)	(0.011)	(0.480)
1995 census	0.605	0.533	0.575	-0.543	-0.507	-0.465	-0.088	-0.808
(N=3,190)	(0.321)	(0.300)	(0.293)	(0.227)	(0.220)	(0.218)	(0.013)	(0.536)
C. Control experiment:Cohorts aged 14-19 and 19-24 in 1964								
1983 census	0.026	0.028	0.039	-0.193	-0.189	-0.251	-	-
(N=2,860)	(0.344)	(0.305)	(0.291)	(0.263)	(0.250)	(0.246)		
1995 census	-0.384	-0.367	-0.334	-0.092	-0.101	-0.124	-	-
(N=2,351)	(0.374)	(0.342)	(0.335)	(0.285)	(0.273)	(0.271)		
Control variables								
Individual level religion dummy	No	Yes	Yes	No	Yes	Yes	Yes	Yes
Locality fixed effects	No	No	Yes	No	No	Yes	No	Yes

Notes: Standard errors are presented in parentheses. The religion dummy indicates Muslim or Christian. In the 1983 census data, columns (2), (3), (5), (6), (7) and (8) include cohort dummies.

Test of common trend

- The DiD design assumes that in the absence of treatment, the underlying trend in education and fertility in localities with a school and localities without a school is common (across cohorts): otherwise we would find out an effect of the treatment even if the effect is absent.
- Suppose for instance that in localities without schools households or local communities take actions to improve their children schooling and fill the gap with the others
  - hence educational attainment would increase faster than in localities with schools.
  - In the absence of treatment the difference in years of schooling between the young and the old cohort in the first type of localities is larger than the difference in years of schooling in the second type so that the DiD would be positive.
- However, if such a trend existed, we should observe a positive DiD if we compared two old cohorts, not affected by the 1963 reform. This is what Panel C of Table 5 does.

Remark: given a general IV model

$$Y = \alpha_0 + \alpha_1 X + \varepsilon$$

with $E(X\varepsilon) \neq 0$ (X endogenous) and an instrument Z such that $E(ZX) \neq 0$ and $E(Z\varepsilon) = 0$ we name

- first stage $X = \beta_0 + \beta_1 Z + \mu$
- second stage $Y = \alpha_0 + \alpha_1 \hat{X} + \varepsilon$
- reduced form $Y = \gamma_0 + \gamma_1 Z + \theta$

Important result: $\alpha_1 = \gamma_1/\beta_1$

If the instrument is binary (in our case $A_j Y_i$ is binary) we have

$$\gamma_1 = E(Y|Z=1) - E(Y|Z=0)$$

$$\beta_1 = E(X|Z=1) - E(X|Z=0)$$

and

$$\alpha_1 = \frac{E(Y|Z=1) - E(Y|Z=0)}{E(X|Z=1) - E(X|Z=0)}$$

is the Wald estimator of the causal effect of X on Y (take the effect of Z on Y and divide by the effect of Z on X)

Is the instrument really excludable?

- removal of mobility restrictions could have open up a larger labor market with additional labor opportunities to women and men
  - (but evidence that the proportion of both genders working outside the locality of residence did not change)
- removal of mobility restrictions could have made possible to reach health facilities and family planning centers
  - (but evidence that such services were available also in localities without schools)
- removal of mobility restrictions could have an effect on the marriage market i.e. better opportunities to find a suitable spouse (still an open question)

Mechanisms

Additional women education influences fertility throughout many potential mechanisms.

1. own variables (labor force participation, divorce rate, age at marriage)
2. spouse's variables (via assortative mating/matching - people tend to match with persons similar to them)
3. women and spouse values/views/perceptions/preferences about family planning, contraception...

Authors find that there is no effect of education on own variables (especially on LFP) $\Rightarrow$ therefore fertility reduction cannot be motivated by an increased opportunity cost.

Instead what matters is education influence on spouse's characteristics and on values/views/perceptions/preferences.

Assortative mating

- Note: 1963 reform had no direct effect on males.
- Therefore if we observed that more educated women married more educated men, this would not be due to a generalized increase in education. Rather more educated women deliberately choose / are chosen by more educated men.

Mechanisms

Table 8: OLS and 2SLS Estimates of the Effect of Education on Woman's Labor-Force Participation, Marriage, Age upon Marriage, Divorce, and Spouse's Outcomes

	Cohorts aged 4-9 and 14 -19 in 1964				Cohorts aged 9-14 and 14 -19 in 1964			
	1983 census		1995 census		1983 census		1995 census	
	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: own outcomes								
Labor-force participation	0.032	-0.139	0.039	-0.040	0.030	-0.035	0.036	-0.007
	(0.001)	(0.070)	(0.001)	(0.034)	(0.001)	(0.063)	(0.002)	(0.051)
Marriage	-0.007	0.055	0.003	-0.011	0.005	-0.068	0.004	-0.061
	(0.002)	(0.042)	(0.001)	(0.024)	(0.001)	(0.063)	(0.001)	(0.051)
Age upon marriage	0.115	-0.107	0.216	0.506	0.150	-0.091	0.157	-0.490
	(0.014)	(0.230)	(0.023)	(0.472)	(0.016)	(0.331)	(0.028)	(1.084)
Divorce	-0.000	0.004	-0.001	-0.009	-0.000	0.002	-0.001	-0.028
	(0.000)	(0.006)	(0.000)	(0.008)	(0.000)	(0.011)	(0.000)	(0.020)
Panel B: spouse outcomes								
Years of schooling	0.498	0.579	0.545	0.537	0.502	0.464	0.466	0.538
	(0.014)	(0.223)	(0.015)	(0.283)	(0.015)	(0.285)	(0.017)	(0.449)
Labor-force participation	0.007	0.006	0.019	-0.018	0.007	-0.019	0.017	-0.007
	(0.001)	(0.017)	(0.002)	(0.033)	(0.001)	(0.026)	(0.002)	(0.056)
Ln (monthly earnings)	0.027	0.067	0.034	-0.034	0.033	0.092	0.030	0.001
	(0.003)	(0.042)	(0.003)	(0.058)	(0.003)	(0.076)	(0.003)	(0.102)

Notes: Standard errors are presented in parentheses.

Mechanisms

Effect of education on values/perceptions/preferences.
(simple OLS regressions based on a fertility survey conducted in 1974/75 among a representative sample of some 3,000 currently married Arab women under age 55 in Israel)

- The following table includes the effect of mother's and father's education on mother's reported values/perceptions/preferences.

Table A4 : Education and Fertility Preferences, Contraceptives Details, Quality of children, Child Mortality, Religiousity, Family Decision Making, and Health knowledge, Using Data from 1974-75 Fertility Survey

	Conrol 1		Conrol 2		Conrol 3	
	Mother's Education	Father's Education	Mother's Education	Father's Education	Mother's Education	Father's Education
	(1)	(2)	(3)	(4)	(5)	(6)
Woman's fertility preferences						
Considered desired number of children	0.027	0.022	0.025	0.020	0.021	0.017
	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
Number of children desired	-0.063	-0.018	-0.051	-0.011	-0.046	-0.012
	(0.016)	(0.016)	(0.017)	(0.017)	(0.017)	(0.017)
Important to have at least one son	-0.004	0.003	-0.003	0.003	-0.003	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Important to have at least one daughter	-0.003	0.005	-0.002	0.003	-0.002	0.002
	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)
Contraceptives details						
Consulted wth doctor about birth control	0.027	0.006	0.028	0.005	0.021	-0.001
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Consulted with anyone about birth control	0.029	0.006	0.029	0.005	0.024	0.000
	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Ever done anything to prevent pregnancy	0.030	0.007	0.030	0.007	0.025	0.002
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Used any method to prevent pregnancy	0.031	0.006	0.031	0.007	0.026	0.002
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Respondent knows how prevent pregnancy	0.025	0.000	0.024	-0.003	0.022	-0.004
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Attidude about Quantity versus quality of children						
Limiting number of children influences chan	0.010	0.001	0.010	-0.003	0.011	-0.001
of their advance	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Should 14 years old boy continue studying	-0.001	0.003	-0.000	0.003	-0.000	0.003
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Should 14 years old girl continue studying	0.005	0.007	0.004	0.006	0.004	0.005
	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)

Table A4: Continued

	Conrol 1		Conrol 2		Conrol 3	
	Mother's Education	Father's Education	Mother's Education	Father's Education	Mother's Education	Father's Education
	(1)	(2)	(3)	(4)	(5)	(6)
Incidence of child mortality						
Ever experienced child mortality	-0.011	-0.006	-0.010	-0.006	-0.009	-0.005
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Number of children deaths	-0.013	-0.012	-0.015	-0.009	-0.014	-0.007
	(0.005)	(0.007)	(0.005)	(0.006)	(0.005)	(0.006)
Number of miscarriages and abortions	0.007	-0.017	0.008	-0.011	0.009	-0.009
	(0.009)	(0.010)	(0.009)	(0.010)	(0.009)	(0.010)
Religiousity						
Degree of religiosity in current home	-0.009	-0.006	-0.010	-0.003	-0.009	-0.003
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Observe religious laws/rituals	-0.006	-0.007	-0.008	-0.004	-0.011	-0.006
	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Woman role in family decision making						
Respondent decides on daily expenses	0.004	-0.000	0.005	-0.002	0.005	-0.003
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Respondent decides on large expenses	0.017	-0.002	0.016	-0.006	0.014	-0.006
	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Respondent decides on childen's education	0.011	0.003	0.014	0.002	0.012	0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Respondent decides on shopping for childre	0.007	0.003	0.010	0.004	0.009	0.003
	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)
Health knowledge/ modernity						
Sickness is due to physical/medical reasons	0.030	0.005	0.028	0.004	0.023	-0.001
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Wears traditional (religious) clothes	-0.035	-0.014	-0.037	-0.013	-0.031	-0.011
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)

Notes: Standard errors are presented in parenthesis. The table presents estimates from three different specifcations, each different set of controls, defined as follows:

Control 1: religion and wife's age.

Control 2: Control 1 + husband's age, age of marriage of husband/wife, husband and wife current working status indicators, husband and wife ever worked indicators.

Control 3: Control 2 + number of rooms, electricity, running water and toilet in woman's home, and an index of standard of living.

Conclusions

- Among Israel Arab women an exogenous increase in education sharply reduces fertility.
- However, the mechanism is not that of an increased opportunity cost of child bearing for more educated women, but rather their empowerment, i.e. better options on the marriage market for better educated women and changes in preferences about fertility, contraception and family planning.
- Policy implication: also in countries where women participate little to the labor market, investing in education (as a fertility reducing policy) is worthwhile.

La Ferrara et al. (2012)

Soap Operas and Fertility: Evidence from Brasil (AEJ:AE).

- This paper analysis the relationship between the family model portrayed by the soap operas (that of families with few children) and fertility in Brazil between 1979 and 1991.
- In a context of limited education attainment and poor education quality, television is likely to play a major role, substituting for formal education.
- This paper exploits the progressive introduction of Rede Globo, the main novelas producer, in different areas of the country between 1980 and 1991.
- Results show that fertility declined because of the TV.

Background

- TV licenses granted by the government (both military and democratic) for clientelistic reasons, as a way to reward loyal deputies (and their constituencies) in occasion of key Parliamentary passages.
- Strong trend of fertility decline: total fertility reduced by half between 1970 and 1990
  - sterilization, use of birth control pills, education (but abortion illegal)
- Television reiterates the disclosure of a very specific model of family—small, beautiful, white, healthy, urban, middle and upper-middle class consumerist family.
  - Note: the small family may result from the constraints imposed by the plot. In Brazilian novelas the drama typically revolves around four or five families. In order to keep the number of characters manageable, no family can be very large.

Data and empirical strategy

- Using the 1991 Brazilian Census, authors build a retrospective history of a woman's fertility for the previous 12 years.
- Thus there are 13 observations (years) for each woman in childbearing age (15-49).
- Rede Globo provided the locations, the catching area, and the dates of setup of its antennas.

Emprical strategy

- The model is a simple LPM

$$y_{ijt} = X_{ijt}\beta + \gamma G_{jt} + \mu_j + \lambda_t + \varepsilon_{ijt}$$

- where
  - y_{ijt} is equal to 1 if a woman i living in area j gives birth to a child in year t
  - G_{jt} is a dummy equal to 1 if area j received the signal of Rede Globo at least one year prior to year t (to account for the length of pregnancy)
  - X_{ijt} is a set of time-varying controls at the individual and at the area level (age, education, wealth index based on durables, number of children marital status, catholic, urban/rural area, number of doctors and nurses in the area)
  - μ_j are area fixed effects
  - λ_t are year fixed effects

Identification.

- Identifying assumption is that, conditional on area and time fixed effects and on the time-varying controls X_{ijt}, the year of Globo entry is not correlated with the error term (in other words, are there time-varying area-shocks that correlate with both Globo entry and fertility?).
- There are two potential sources of endogeneity in the timing of Globo entry into different locations.
  - the Ministry of Telecommunications may have used selective criteria in awarding licenses. But the Ministry's choices were mostly linked to patronage rather than local fertility
  - Globo may have chosen to enter wealthier locations first, as the latter would yield higher profits from advertising. Thus, at each time, treated areas would have been different than untreated areas. To address this concern, authors control for education, wealth, and for an "index of potential consumption" used by Globo to assess the attractiveness of new markets.

Outcome: whether woman *i* gave birth at time *t*

Panel B.

Globo coverage	−0.0075	−0.0042	−0.0047	−0.0074	−0.0037	−0.0047
	(0.0012)***	(0.0010)***	(0.0012)***	(0.0013)***	(0.0011)***	(0.0012)***
Age	0.023	0.023	0.0231	0.0234	0.0235	0.0236
	(0.0005)***	(0.0005)***	(0.0006)***	(0.0005)***	(0.0005)***	(0.0005)***
Age squared[a]	−0.4208	−0.4208	−0.4213	−0.4305	−0.4305	−0.431
	(0.0105)***	(0.0105)***	(0.0107)***	(0.0105)***	(0.0105)***	(0.0106)***
Stock of children	0.0029	0.0027	0.0017	0.0008	0.0006	−0.0003
	(0.0007)***	(0.0007)***	(0.0006)***	(0.0007)	(0.0007)	(0.0006)
Stock of children squared[a]	−0.06	−0.0597	−0.0222	0.0497	0.0505	0.089
	(0.0368)	(0.0361)*	(0.0341)	(0.0383)	(0.0374)	(0.0352)**
Education of head	−0.0002	−0.0002	−0.0002			
	(0.0001)	(0.0001)	(0.0001)			
Education of woman				−0.0029	−0.003	−0.003
				(0.0001)***	(0.0001)***	(0.0001)***
Wealth	−0.0208	−0.0204	−0.0205	−0.017	−0.0161	−0.0162
	(0.0003)***	(0.0003)***	(0.0003)***	(0.0003)***	(0.0004)***	(0.0004)***
Married	0.0567	0.0575	0.0581	0.0571	0.0581	0.0588
	(0.0010)***	(0.0011)***	(0.0012)***	(0.0011)***	(0.0012)***	(0.0013)***
Catholic	−0.0025	−0.0034	−0.0033	−0.0029	−0.0038	−0.0037
	(0.0006)***	(0.0006)***	(0.0006)***	(0.0006)***	(0.0006)***	(0.0006)***
Rural	−0.0043	−0.0054	−0.0048	−0.0045	−0.0055	−0.0048
	(0.0012)***	(0.0011)***	(0.0011)***	(0.0013)***	(0.0011)***	(0.0012)***
Doctors and nurses	−0.074	−0.0733	−0.0515	0.0507	0.0546	0.0816
	(0.0710)	(0.0713)	(0.0748)	(0.0677)	(0.0681)	(0.0723)
Index of potential consumption	0.0112	0.0016	−0.3646	0.0164	0.0151	−0.3608
	(0.0069)	(0.0087)	(0.0628)***	(0.0060)***	(0.0108)	(0.0670)***
Constant	−0.193	−0.194	−0.1877	−0.1818	−0.1829	−0.176
	(0.0069)***	(0.0069)***	(0.0074)***	(0.0064)***	(0.0064)***	(0.0068)***
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Area fixed effects	No	State	AMC	No	State	AMC
Number of areas		27	3,485		27	3,485
Observations	2,102,136	2,102,136	2,102,136	2,102,136	2,102,136	2,102,136
R^2	0.046	0.046	0.050	0.047	0.048	0.051

Notes: Table reports OLS coefficients. Standard errors in parentheses are corrected for clustering at the AMC level. AMC stands for Minimally Comparable Area and is a geographic aggregate slightly broader than a municipality.

[a]Coefficient and standard error multiplied by 1,000.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

TABLE 3—HETEROGENEOUS EFFECTS, EDUCATION, AND WEALTH

Dependent variable = 1 *if gives birth in year t (BIRTH)*	[1]	[2]	[3]
Globo coverage	−0.0101	−0.013	−0.0043
	(0.0014)***	(0.0015)***	(0.0013)***
Globo coverage × education of head	0.0013		
	(0.0002)***		
Globo coverage × education of woman		0.0018	
		(0.0002)***	
Globo coverage × wealth			0.0018
			(0.0005)***
Education of head	−0.0012		−0.0002
	(0.0001)***		(0.0001)
Education of woman		−0.0044	
		(0.0001)***	
Wealth	−0.0204	−0.0161	−0.0218
	(0.0003)***	(0.0004)***	(0.0005)***
Controls[a]	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
AMC fixed effects	Yes	Yes	Yes
Observations	2,102,136	2,102,136	2,102,136
R^2	0.05	0.05	0.05

Notes: Table reports OLS coefficients. Standard errors in parentheses are corrected for clustering at the AMC level. AMC stands for Minimally Comparable Area and is a geographic aggregate slightly broader than a municipio.

[a]Controls not listed include those in column 6 of Table 2.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

TABLE 4—AGE EFFECTS

Dependent variable = 1 *if gives birth in year t (BIRTH)* Age range:	15–24 [1]	25–34 [2]	35–44 [3]
Globo coverage	−0.0023	−0.0078	−0.0059
	(0.0015)	(0.0024)***	(0.0020)***
Years exposed 10–19			
Years exposed 20–29			
Years exposed 30–39			
Years exposed 40–49			
Controls[a]	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
AMC fixed effects	Yes	Yes	Yes
Observations	823,218	653,533	454,836
R^2	0.068	0.038	0.051

Results

- Exposition to Rede Globo reduces significantly fertility
- more so among the less educated and the poor
- less so at younger age and more at later age (childbearing stop rather than delayed first birth)

Conclusions

- Fertility responds to many factors. Education is just one in many.
- This paper has shown that the model of the ideal family portrayed by the TV changed significantly women preference regarding fertility.
- An interesting point to remark is that Rede Globo did not act according to an explicit demographic policy enacted by the government. Rather small families were necessary to the smooth progress of novelas story-plot.