Fertility and Childlessness in the US

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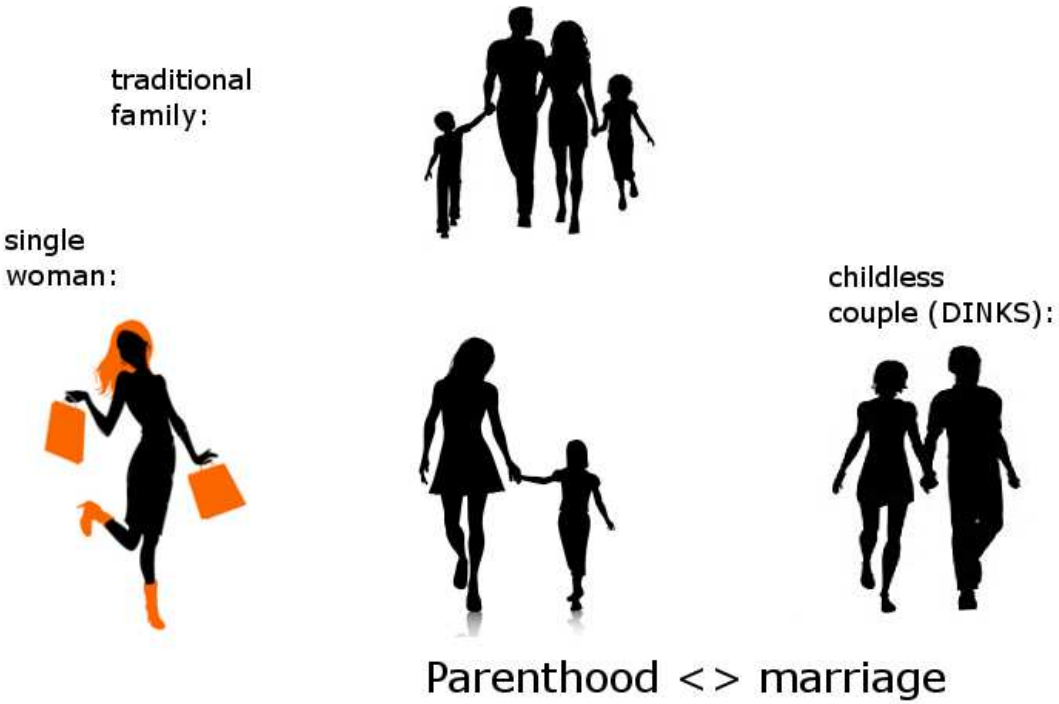
Various family types

New types of families.



Q: Childlessness is no longer necessarily a fate, it can also be a choice. By whom?

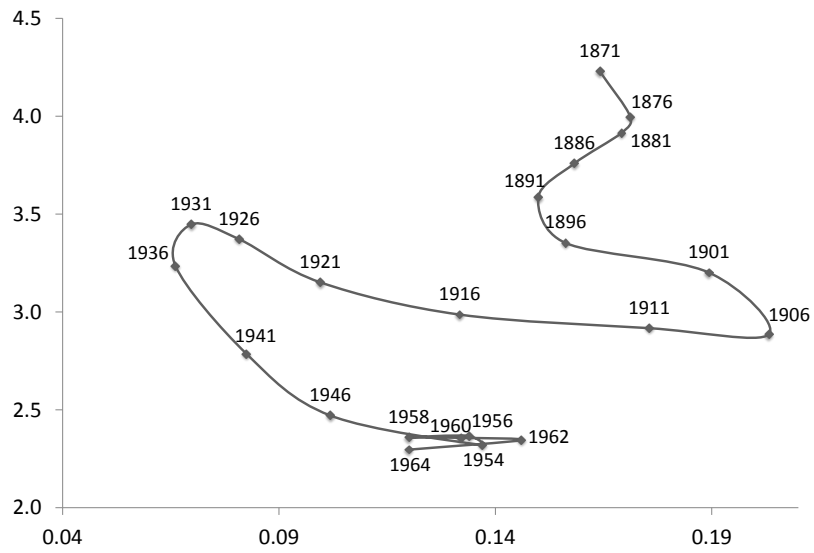
Childlessness

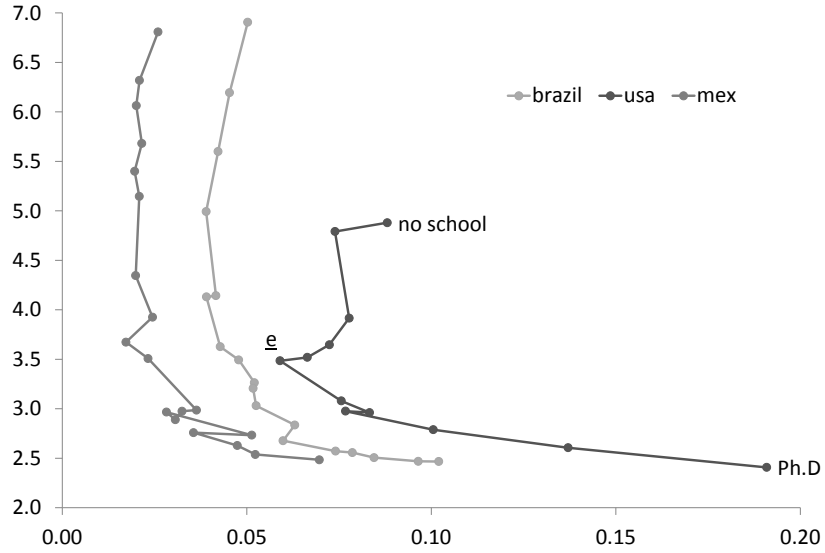
- voluntary: "child-free" (our estimation for US: 8.1%)
- involuntary
  - "natural sterility" (our estimation for US: 2.3%)
  - "social sterility" (our estimation for US: 2.5%)

Understanding the incentives can:

- predict population trends
- enhance welfare (fighting poverty driven childlessness)

Childlessness, more than a special case of fertility (=0)





Completed Fertility of Mothers vs. Childlessness

By Cohort in the USA (left panel), By Education levels in Brazil, Mexico and the USA (right panel)

Research Question

What is the share of childlessness that is voluntary ?

What is the share of childlessness that is poverty driven ?

How do economic changes affect the different family types? In particular, how can we reduce the involuntary part of childlessness?

$\rightarrow$ one needs a theory to measure the types of childlessness

Methodology

A theory to explain jointly marriage and parenthood decisions

Identification of the parameters using moments from Census

Show that co-existence of involuntary and voluntary causes of childlessness is key to explain facts (US, 1990)

Predictions: How better education did affect both types of childlessness and fertility over time.

Policy experiment: How inequality does affect both types of childlessness.

Main features of the model

1. agents are matched randomly, once in life
2. they decide to marry or not
3. they discover their natural fertility status
4. Cooperative decision on consumption and fertility

Women can have children, married or not $\neq$ Men should marry to have children

Exogenous potential income (education): w^i

$+$ heterogeneity in non labor income $a^i \perp w^i$

Preferences

Individuals:

$$u\left(c^i, n\right) = \ln c^i + \ln\left(n + \nu\right)$$

No gender differences in preferences
$\nu > 0$: Services from children are superior good

Couples:

$$\theta\ u(c^f, n) + (1 - \theta)\ u(c^m, n)$$

with

$$\theta \equiv \frac{1}{2}\,\underline{\theta} + (1 - \underline{\theta})\frac{w^f}{w^f + w^m}, \qquad \underline{\theta} \in (0, 1)$$

$\Rightarrow$ although $\exists$ marriage surplus, one spouse may refuse marriage

Sterility

Natural: χ and ζ: % of female and male who are naturally sterile

Social: Minimal consumption to be able to procreate: $c^{\min}$

$$n > 0 \Rightarrow c^f \geq c^{\min}$$

Why ? Mc Fall, (1979):

1. Malnutrition
2. Poor use more drugs
3. Poor have less access to medical services: if they want to abort, they may be sterile after a medical mistake + no access to IVF
4. Poor live in more polluted areas: $\searrow$ fecundity

Time constraints

Endowment per person: 1 if married; $1-\delta^f$, $1-\delta^m$ if not

First child costs $\phi(1+\eta)$ units of time
Additional children cost ϕ units of time

Singles: mothers support the time cost of children alone

Married's: $\alpha \in (\frac{1}{2}, 1)$ mother's share of child support (exogenous)

Upper bound on number of children one can have:

$$0 \leq n \leq \frac{1-\delta^f-\phi\eta}{\phi} \equiv \bar{n}_{\mathrm{M}}(\text{singles})$$

$$0 \leq n \leq \frac{1-\alpha\phi\eta}{\alpha\phi} \equiv n_{\mathrm{M}}(\text{couples})$$

Budget constraints

Single men:

$$b^m(c^m) = c^m - (1-\delta^m)w^m - a^m + \mu \leq 0.$$

μ: cost of running a household

Single women:

$$b^f(c^f, n) = c^f + \phi\left(1+\eta(n)\right) w^f n - (1-\delta^f)w^f - a^f + \mu \leq 0$$

Couples:

$$b(c^f, c^m, n) = c^f + c^m + \phi\left(1+\eta(n)\right)\left(\alpha w^f + (1-\alpha)w^m\right) n \\ - w^m - w^f - a^m - a^f + \mu \leq 0.$$

Value functions

$$
\begin{aligned}
V^{s,m} &= \max\{u(c^m, 0); b^m(c^m) \leq 0\} \text{ [single male]} \\
V^{s,f} &= \max\{u(c^f, n); b^f(c^f, n) \leq 0, \\
&\quad 0 \leq n \leq \bar{n}_{\mathrm{M}}, c^f < c^{\min} \Rightarrow n = 0.\} \text{ [single female]} \\
\tilde{V}^{s,f} &= \max\{u(c^f, 0); b^f(c^f, 0) \leq 0\} \text{ [single sterile female]}
\end{aligned}
$$

$$
\begin{aligned}
V^{\omega,i} &= u(c^i, n) \text{ where} \\
&\quad \{c^f, c^m, n\} = \arg\max\{U(c^f, c^m, n); b(c^f, c^m, n) \leq 0, \\
&\quad 0 \leq n \leq n_{\mathrm{M}}, c^f < c^{\min} \Rightarrow n = 0. \text{ [married]}
\end{aligned}
$$

$$
\begin{aligned}
\tilde{V}^{\omega,i} &= u(c^i, 0) \text{ where} \\
&\quad \{c^f, c^m\} = \arg\max\{U(c^f, c^m, 0); b(c^f, c^m, 0) \leq 0\} \\
&\quad \text{[sterile married]}
\end{aligned}
$$

Marriage if

$$(\chi + (1-\chi)\zeta)\tilde{V}^{\omega,f} + (1-\chi)(1-\zeta)V^{\omega,f} \geq \chi\tilde{V}^{s,f} + (1-\chi)V^{s,f}$$

$$(\chi + (1-\chi)\zeta)\tilde{V}^{\omega,m} + (1-\chi)(1-\zeta)V^{\omega,m} \geq V^{s,m}$$

Regimes given Marriage Decision

Depending on which constraint binds, people can be in six different situations:

[N] Natural sterility,

[S] social sterility when $n > 0 \Rightarrow c^f \geq c^{\min}$ binds and $n = 0$,

[M] maximum fertility when the time constraint, $n \leq \bar{n}_{\mathrm{M}}$ or $n \leq n_{\mathrm{M}}$, binds,

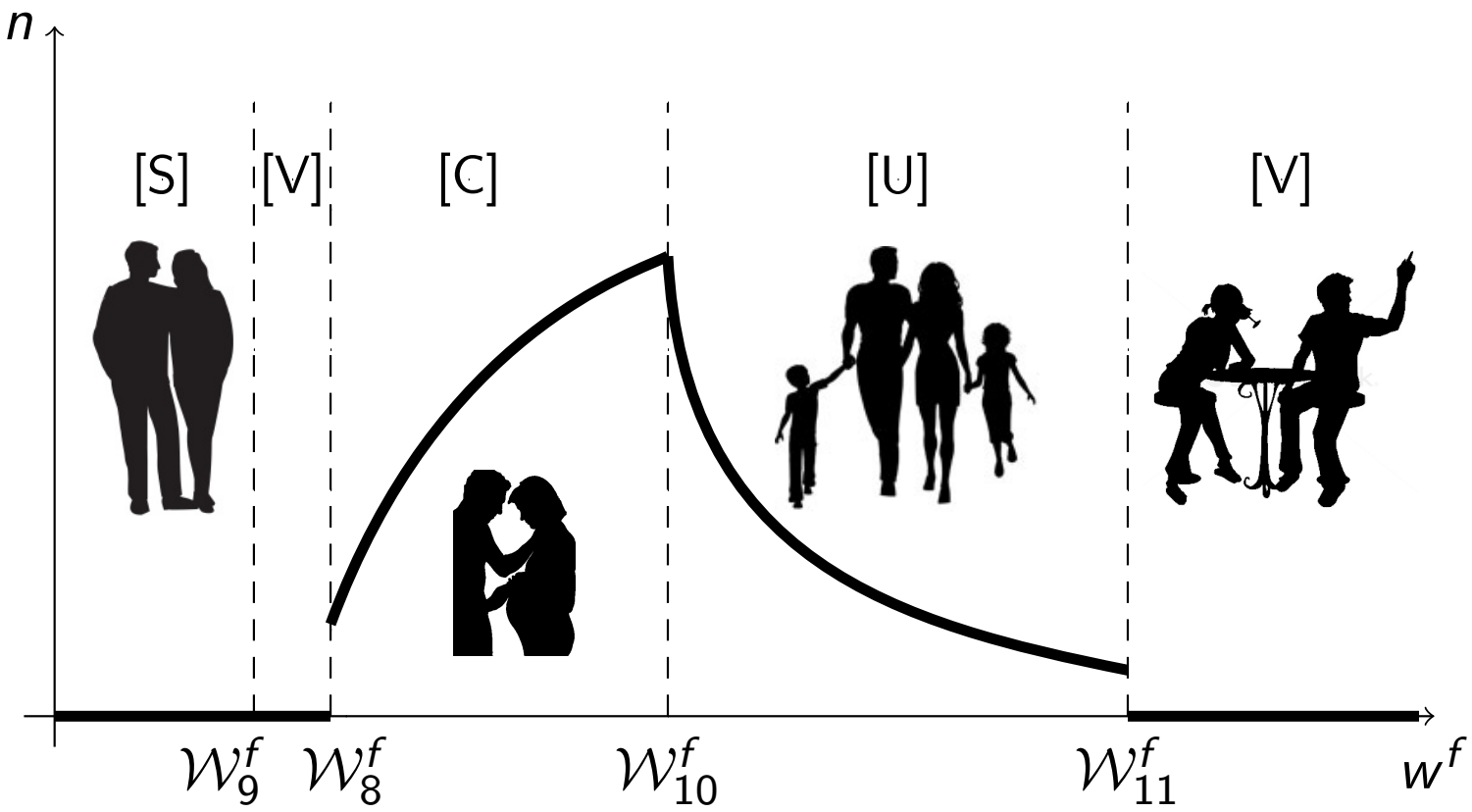
[C] constrained fertility when $n > 0 \Rightarrow c^f \geq c^{\min}$ binds and $n > 0$,

[V] voluntary childlessness when the constraint $n \geq 0$ binds, and, finally,

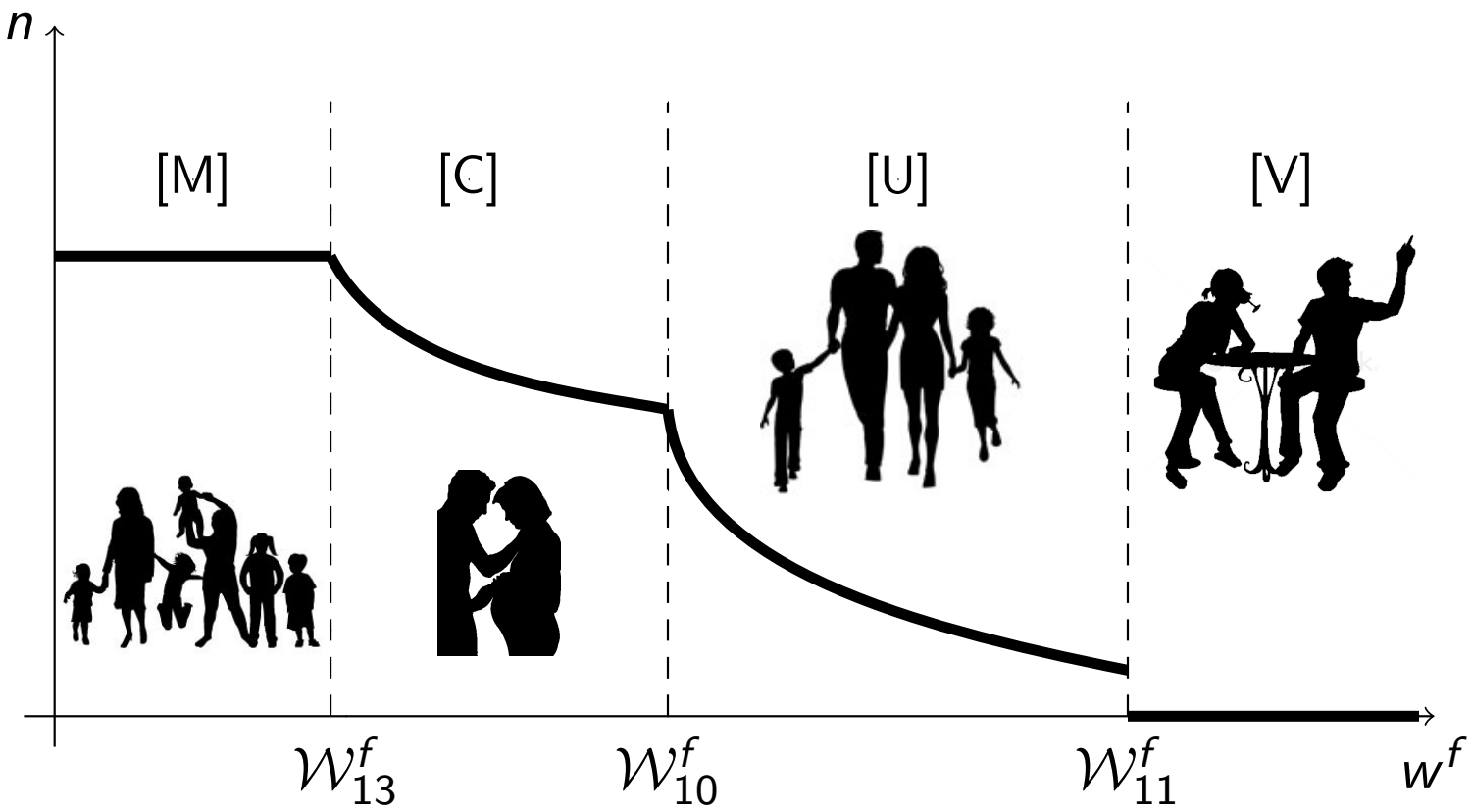
[U] unconstrained fertility.

Conditionally on being married or not, $\exists$ thresholds for wages and non-labor income separating different regimes.

Fertility conditionally on being married when $a^f \in [A_0, A_1[$



Fertility conditionally on being married when $a^f \in [A_1, A_2[$



Moments used for identification

Data: US Census, 45-70 year old married and never married women in 1990. Completed fertility

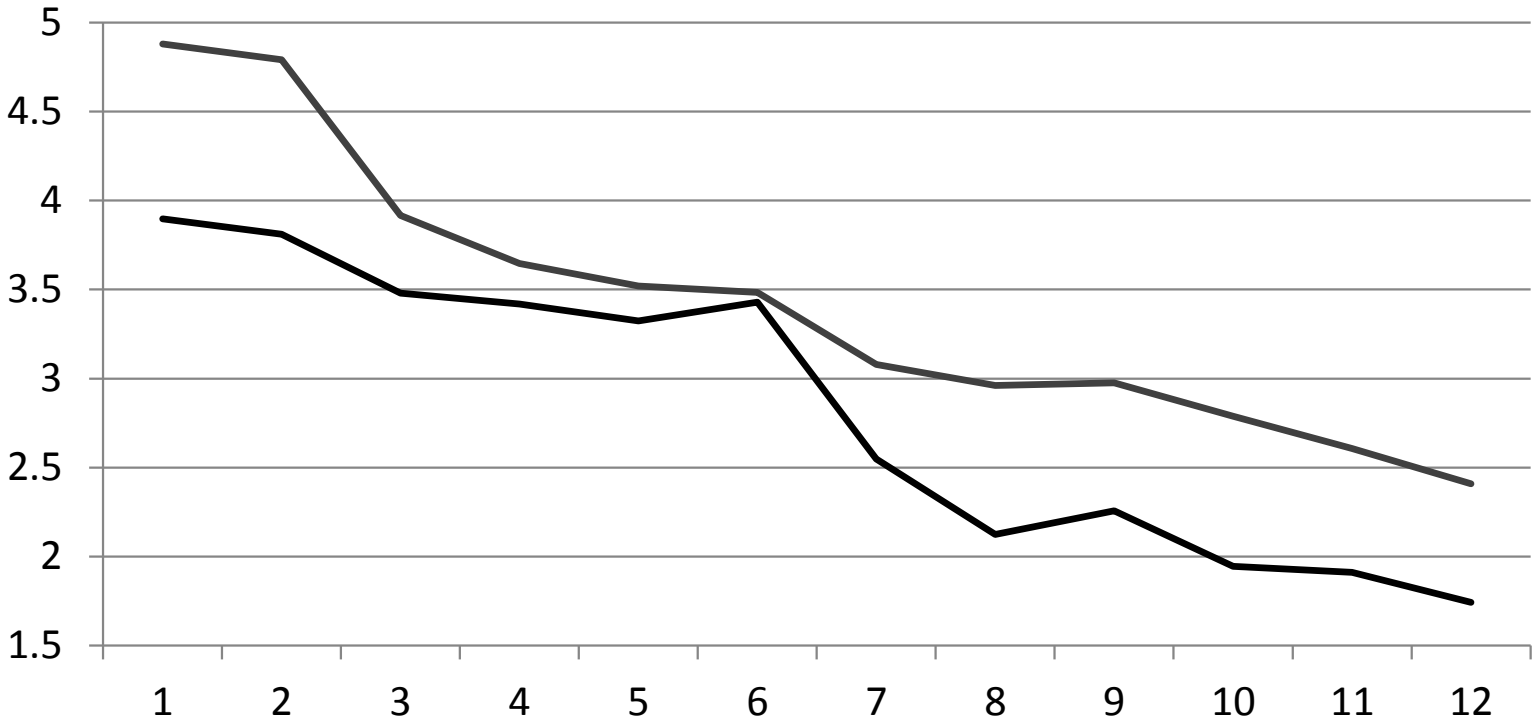
Drop Separated, Widowed and Divorced ($\approx$ 30%), concentrate on Married and Single

Potential income - 12 education categories - 1127080 obs

Nb	Category	N. obs.	Nb	Category	N. obs.
1	No school	12122	7	Grade 12	479703
2	Grade 1-4	14050	8	1 year of college	178274
3	Grade 5-8	84243	9	2 years of college	53428
4	Grade 9	38121	10	Bachelor degree	99046
5	Grade 10	57213	11	Master degree	56855
6	Grade 11	49413	12	Doctoral degree	4612

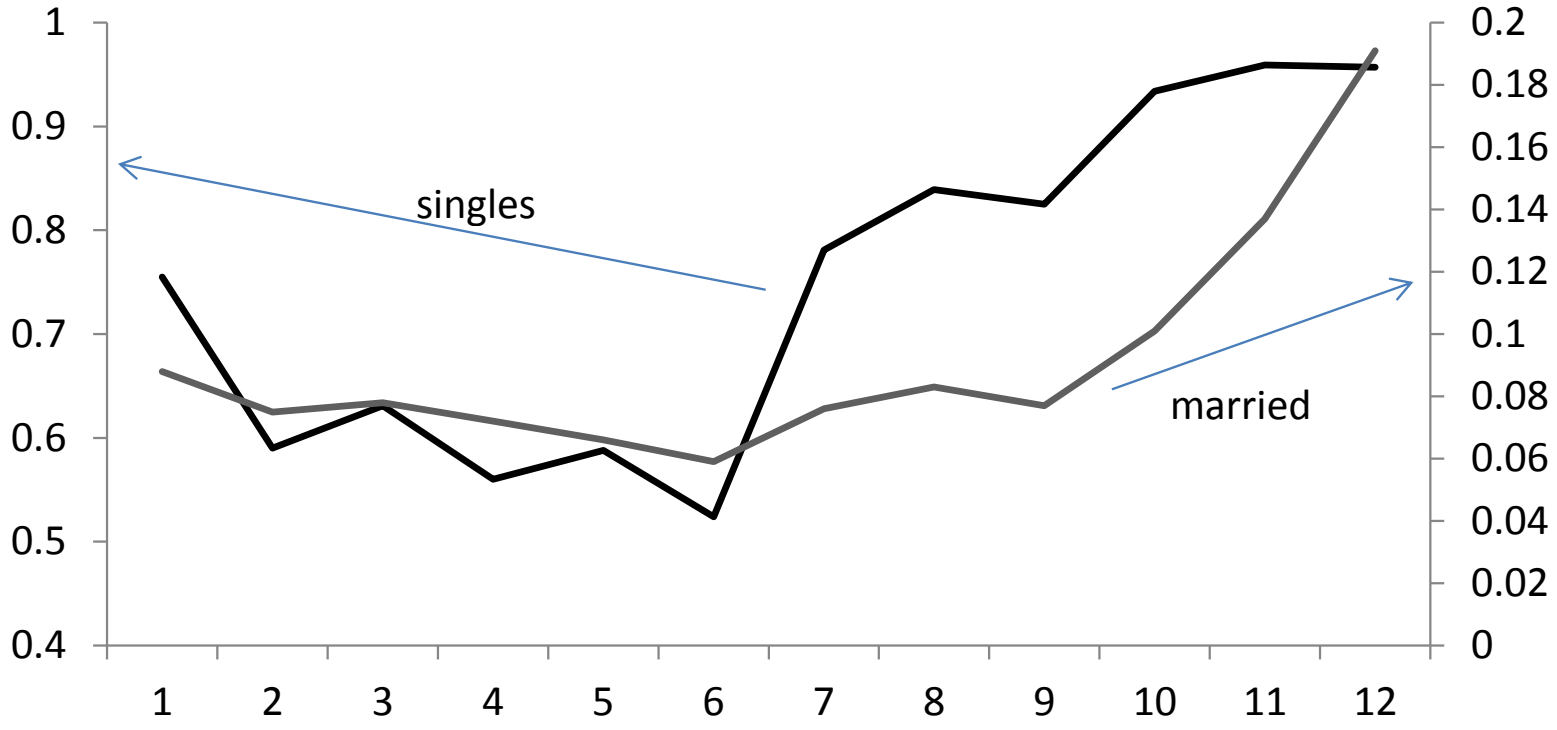
Facts used for identification

Fact 1: fertility Fertility of mothers decreases with education, for both married and single women.



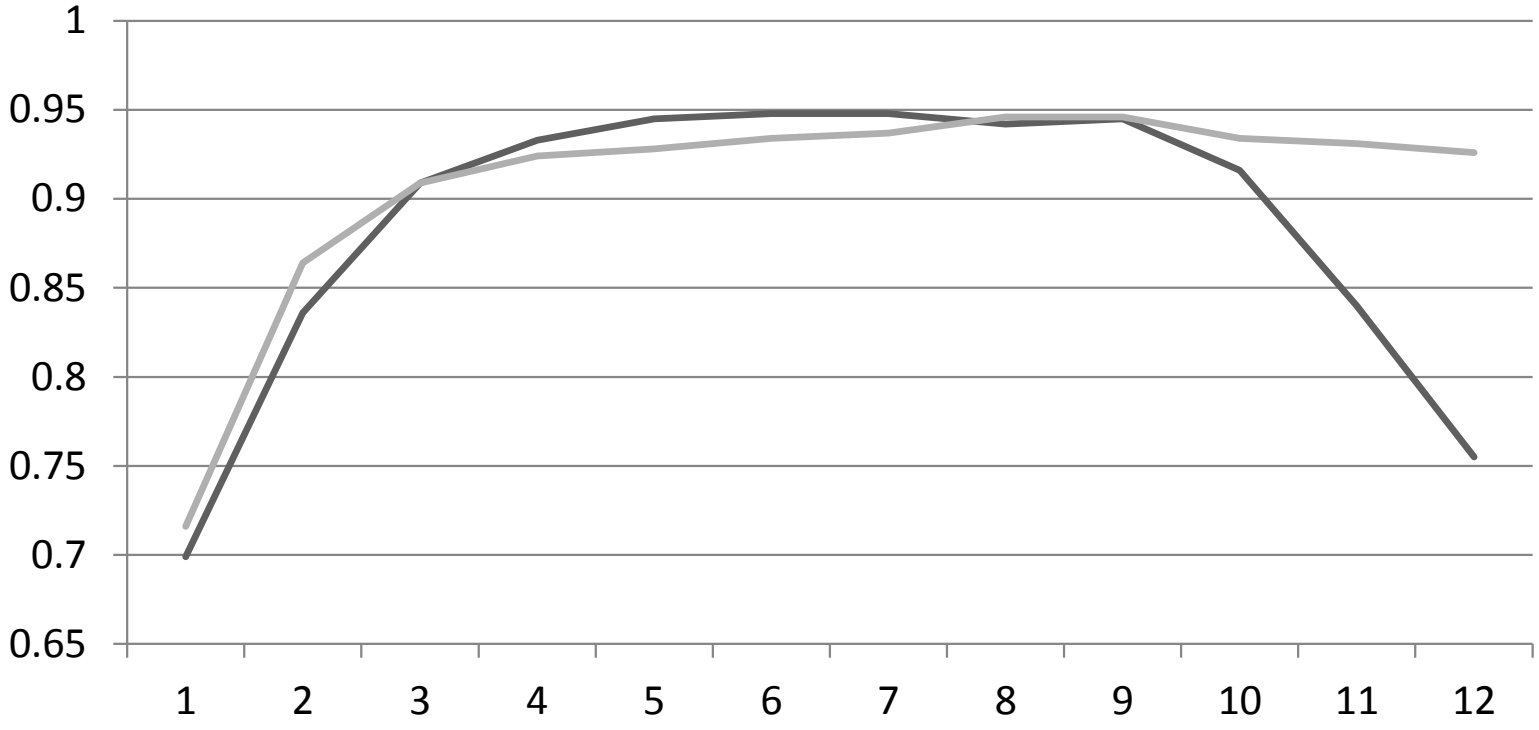
Facts used for identification

Fact 2: childlessness Childlessness exhibits an U-Shaped relationship with education for both singles and married



Facts used for identification

Fact 3: marriage There is a hump-shaped relationship between marriage rates and education levels for women. Marriage rates (weakly) increase with education for men.



Identification of the Parameters

Fix some parameters a priori

For the others: We minimize

$$[d - s(p)]\,[W]\,[d - s(p)]'$$

- d: vector of 72 moments from Census
- p: vector of 11 parameters
- $s(p)$: vector of simulated moments
- W: weighting matrix.

Some parameters are fixed a priori

Wages

Potential labor income depending on education

$$w_e = \gamma \exp\{\rho e\},$$

$\gamma = 0.869$, $\rho = 0.092$ (estimated on census data)

Sterility

$\chi + (1 - \chi)\zeta = 0.024$ (childlessness rate of Hutterites)

$\chi = \zeta = 0.0121$

How the simulated moments are computed

For each woman we draw

- a non labor income from a log-normal distribution (mean and variance are parameters to be identified)
- a potential husband, with random education level and non-labor income

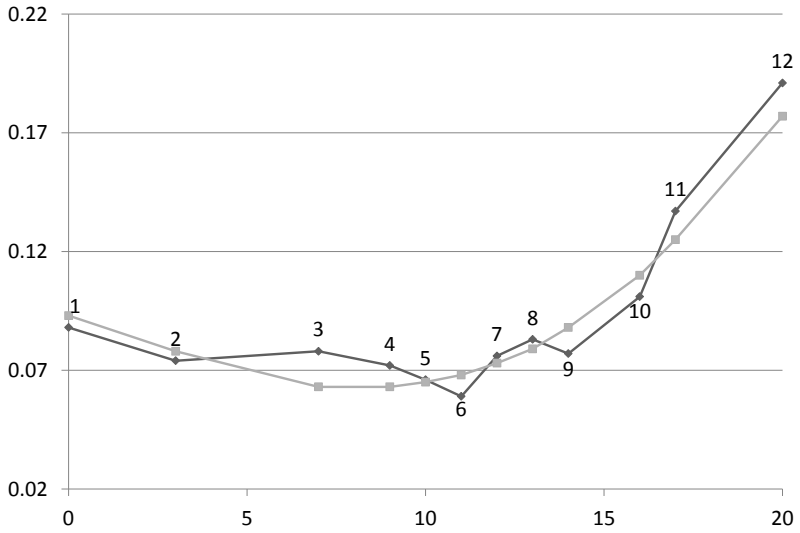
We compute whether each potential couple will marry, and what will be the optimal fertility of the woman

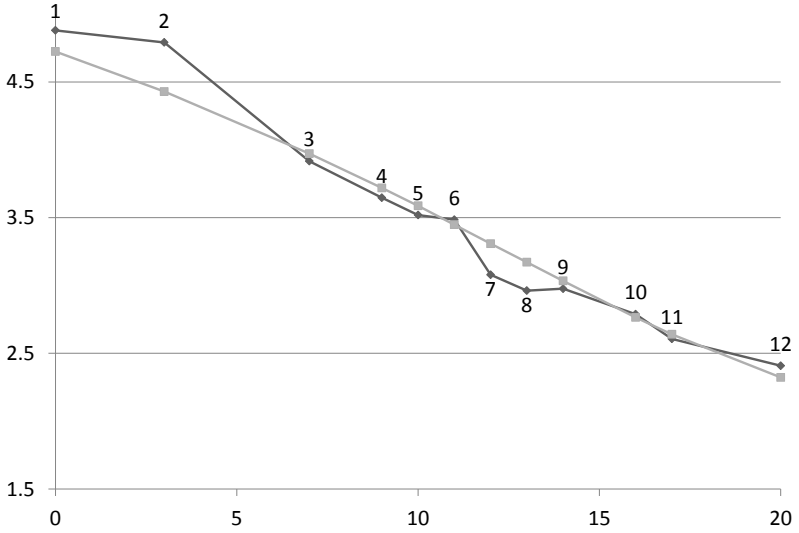
Simulated moments obtained by aggregating all individual choices

Identified parameters

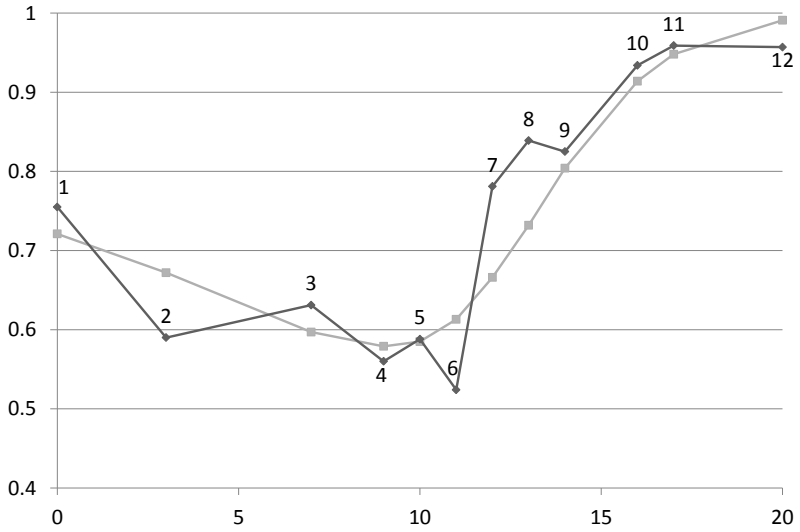
Description		Value	S.E.
Variance of the log-normal distribution	σ_a	0.247	0.012
Average ratio of non-labor income to labor income	$\bar{m}_a$	1.001	0.012
Preference parameter	ν	9.362	0.146
Minimum consumption level to be able to procreate	$c^{\min}$	0.399	0.009
Good cost to be supported by a household	μ	0.272	0.013
Bargaining parameter	$\underline{\theta}$	0.864	0.014
Fraction of childrearing to be supported by women	α	0.524	0.005
Time cost of having children	ϕ	0.206	0.003
Fixed cost of children	η	0.114	0.006
Time cost of being single (men)	δ^m	0.256	0.015
Time cost of being single (women)	δ^f	0.077	0.013

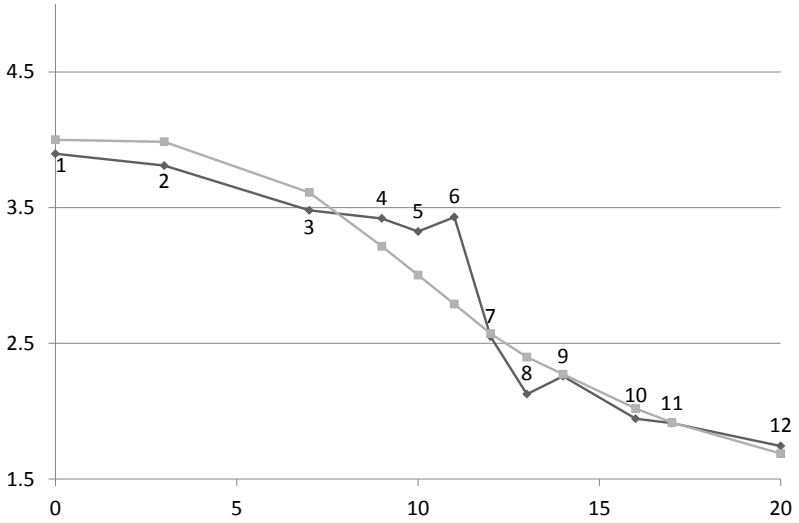
Childlessness and Completed Fertility of Mothers, Married Women



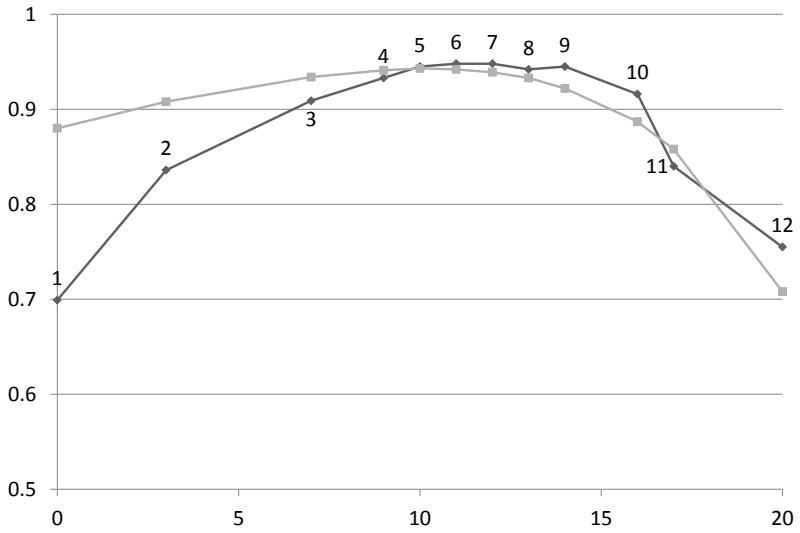


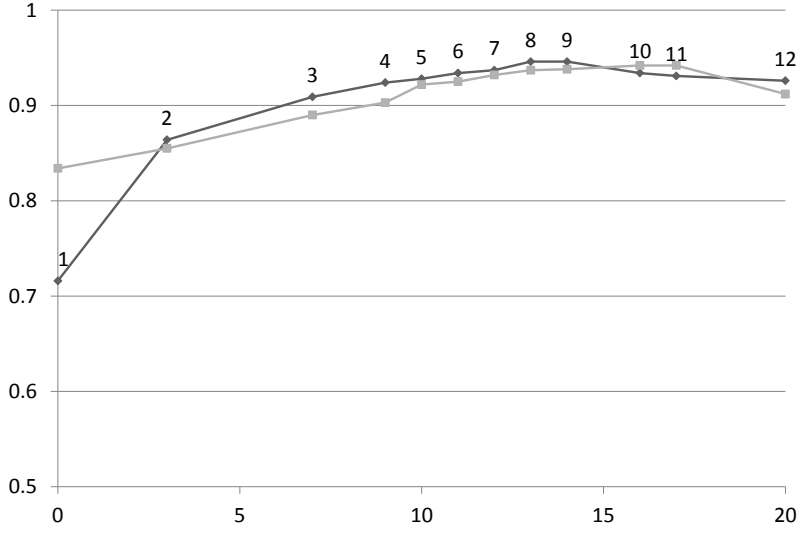
Childlessness and Completed Fertility of Mothers, Single Women



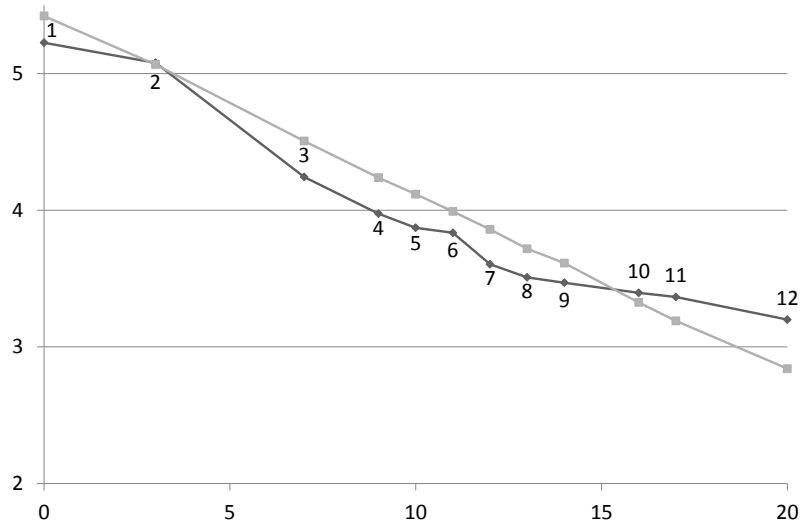


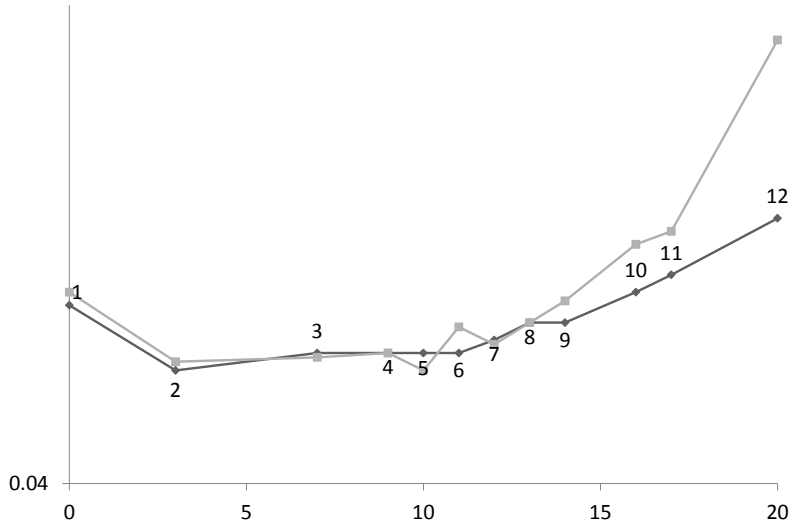
Marriage Rates of Women and Men





Overidentification check



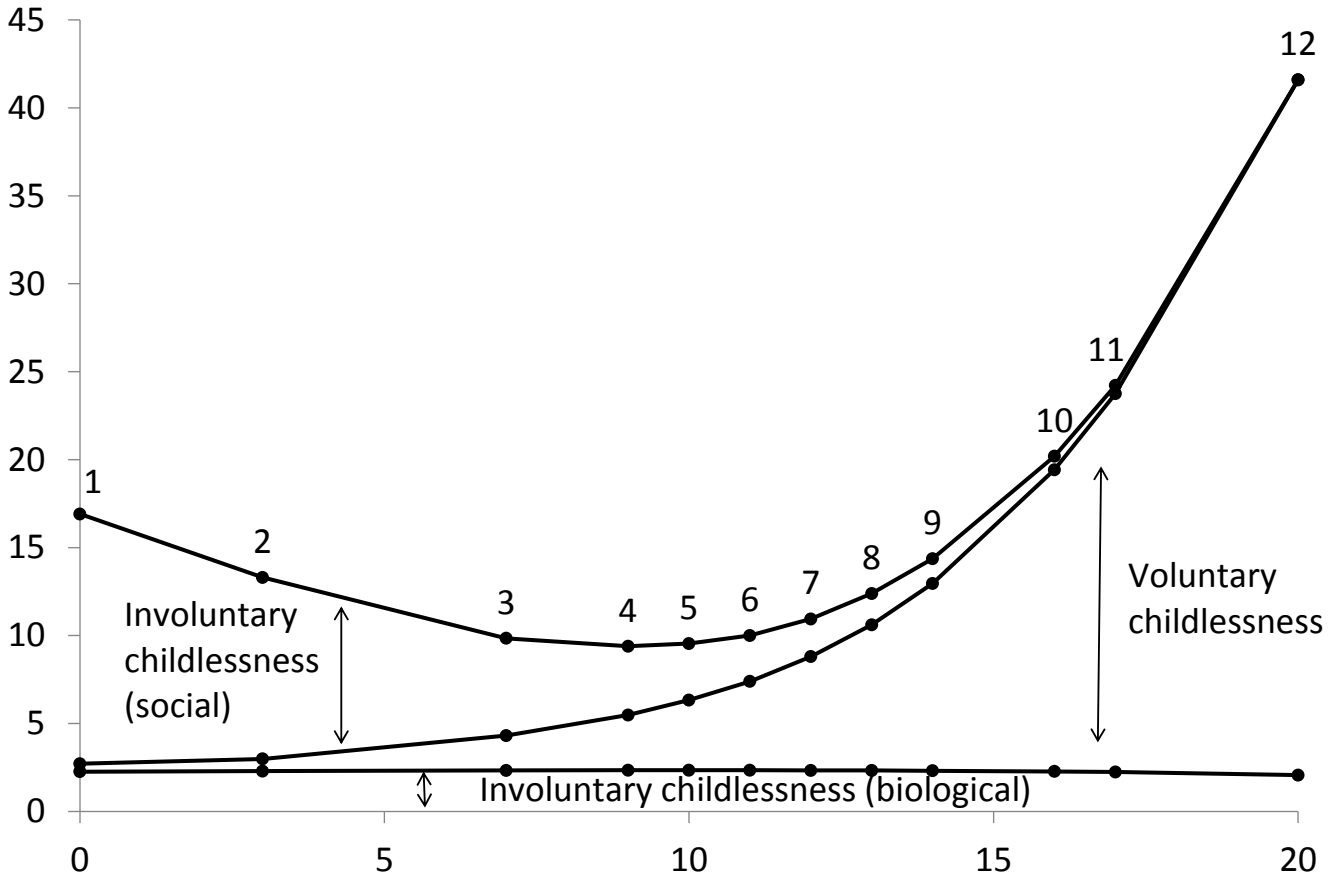


Completed Fertility of Married Fathers (left), Childlessness rates of Married Men (right), by Years of Schooling. Data (black), Simulation (grey), Education Categories (labels)

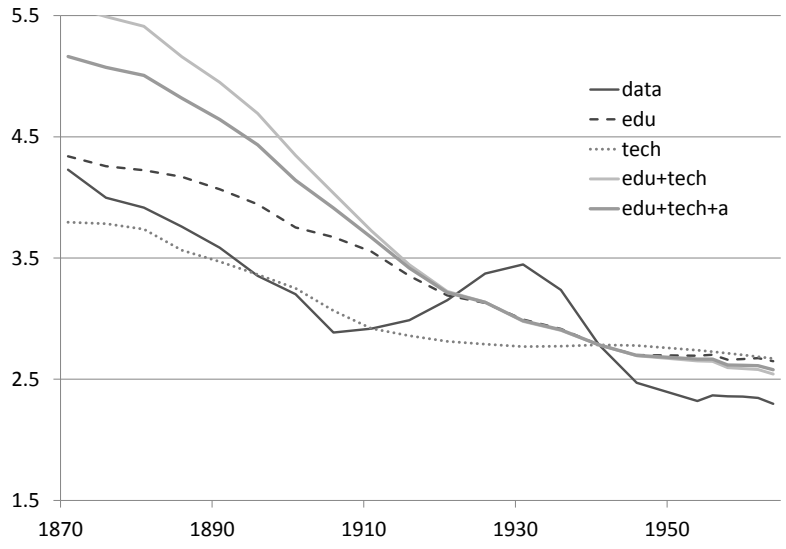
% of women in each regime by education category

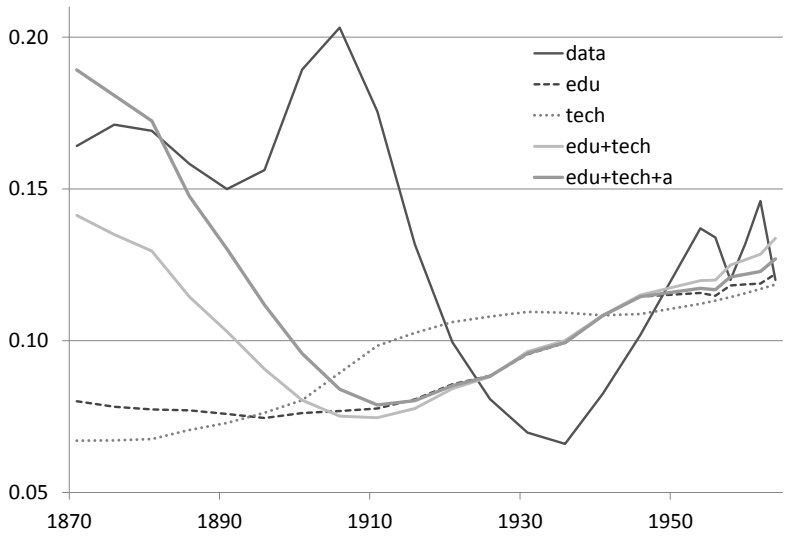
	1	2	3	4	5	6	7	8	9	10	11	12	tot
[N]	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.2	2.1	2.3
[S]	14.2	10.3	5.5	3.9	3.2	2.6	2.1	1.8	1.4	0.8	0.5	0.0	2.5
[M]	11.6	9.2	5.5	3.8	3.0	2.3	1.7	1.2	0.9	0.4	0.3	0.0	2.0
[C]	29.6	22.8	9.4	4.0	2.5	1.3	0.5	0.1	0.0	0.0	0.0	0.0	1.8
[V]	0.5	0.7	2.0	3.1	4.0	5.1	6.5	8.3	10.7	17.2	21.5	39.5	8.1
[U]	41.9	54.6	75.3	82.9	85.0	86.5	86.8	86.3	84.7	79.4	75.5	58.4	83.3

Causes of childlessness



Historical experiment



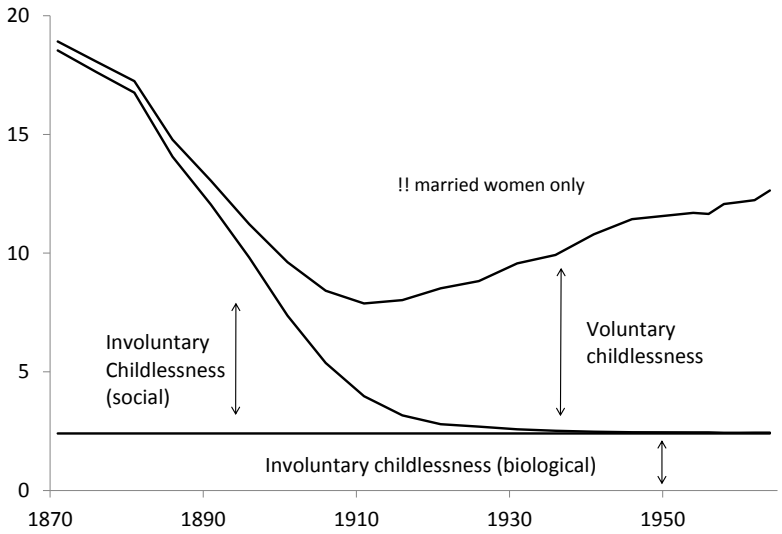


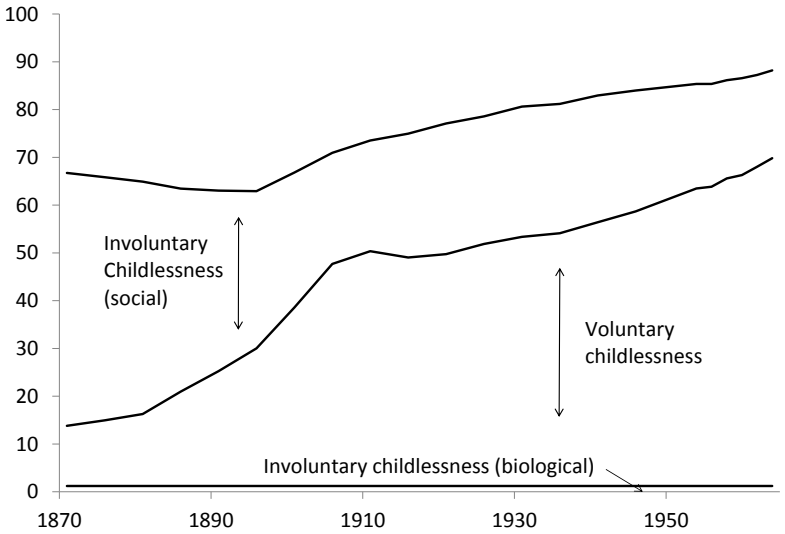
Fertility and childlessness rate of married women

General trend in captured.
Non linear interaction between education and TFP.
Two events are not captured: baby boom, super high childlesness in 1900

Historical experiment

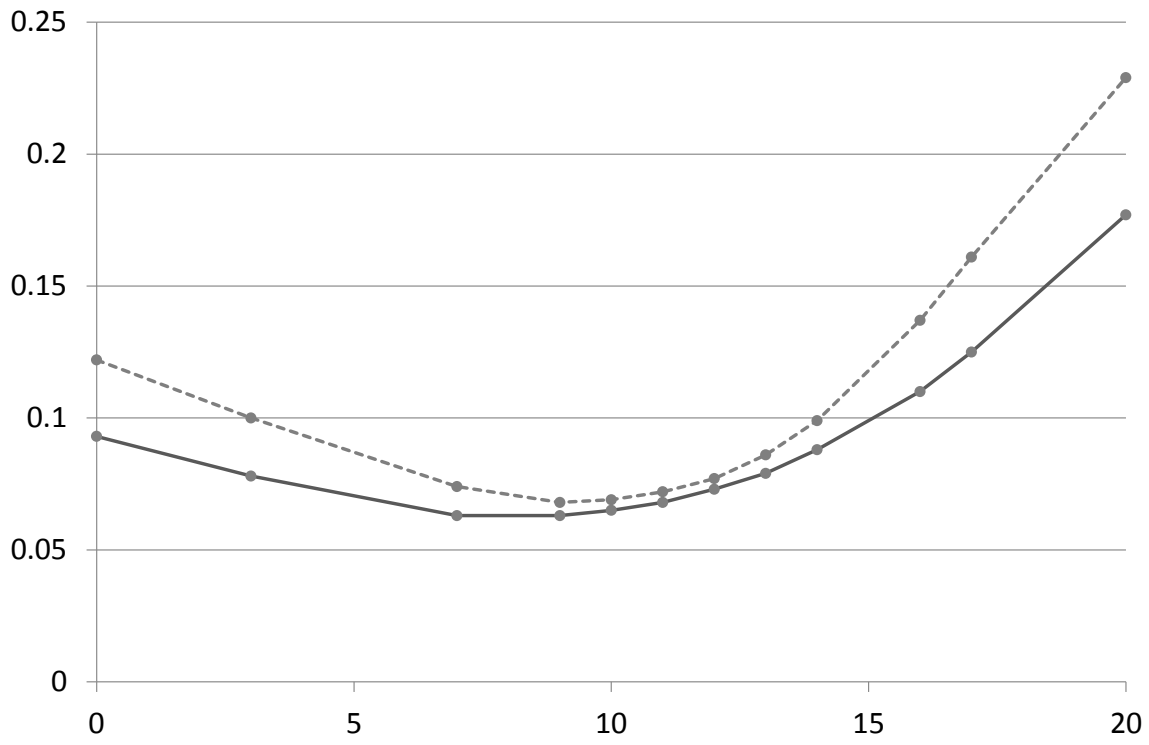
Simulated Childlessness by Cohort, Married (left) and Singles (right)





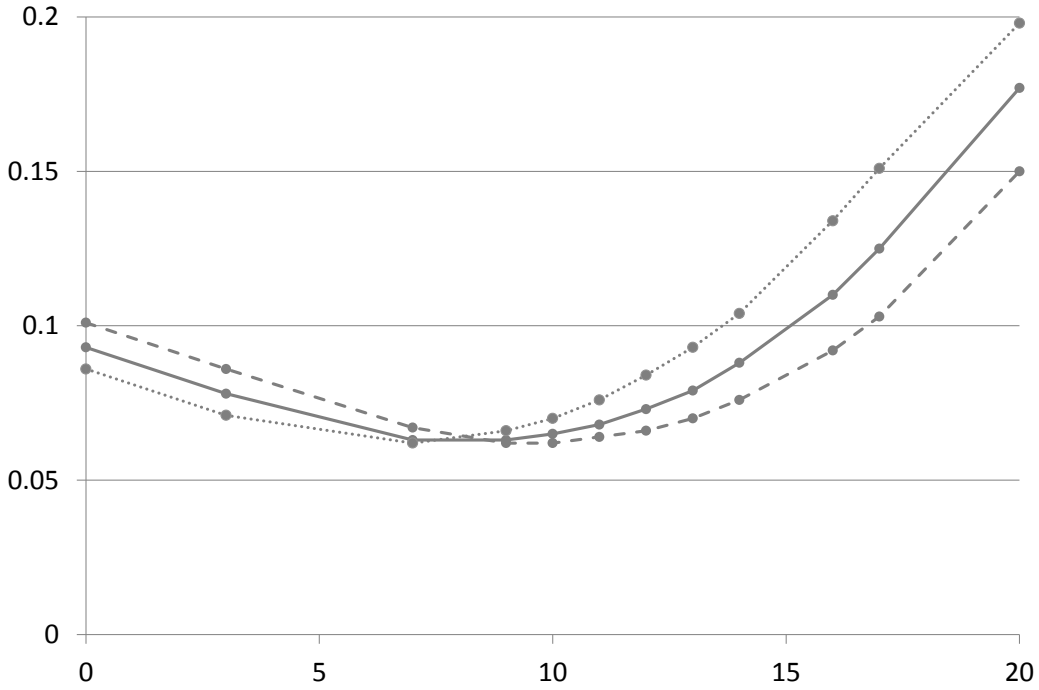
Social sterility has disappeared for married, but not for singles

Childlessness Rate for Different Levels of Inequality (Mincer Coefficient)



Grey Line is the Benchmark $\rho = 0.092$ and Dotted Line is the Historical Maximal $\rho = 0.126$.

Childlessness Rate & gender wage gap γ



$\gamma = 0.755$ (dashed), $\gamma = 0.869$ (solid), and $\gamma = 1$ (dotted)

Usual opportunity cost effect on fertility

Drop in Involuntary Childlessness and rise in Voluntary Childlessness

Conclusion

Distinguish decision to have children from choice of their number

New "regimes" of fertility, relevant in the data:
- 4.8% of American women are involuntarily childless in 1990
- 8.1% are voluntarily childless

Co-existence of regimes explains U-shaped relationship between childlessness and education (for both married and single women)

Marriage interacts with childlessness:
- for low skilled woman $\Rightarrow$ marriage gives more resources to be able to have children $\Rightarrow$ reduces involuntary childlessness.
- for high skilled women, marriage reduces opportunity cost of having children $\Rightarrow$ reduces voluntary childlessness.

Reducing inequality helps fighting social sterility