Policy implications of endogenous fertility

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Demographic Economics

Economic incentives →
Fertility
Mortality
Migration
→
Economic Performance
Growth and Inequality

Population changes slowly over time ...
            but has large effects in the long-run

Here focus on net fertility

Map

Facts and explanations of the decline in fertility

Four arguments in favor of fertility as reacting to economic incentives
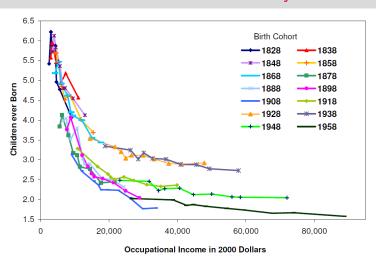
A simple model of endogenous fertility

Implications for NTA Accounts Research

Policy consequences for inequality, fiscal policy, education

Facts about Fertility

Fact 1: In all species, when resources are more abundant, reproduction increases. This is true for plants, animals, and humans before the industrial revolution.

Fact 2: Before the industrial revolution, the rich had more surviving children than the poor.

Fact 3: The transition from stagnation to economic growth is accompanied by a demographic transition from high to low fertility.

Fact 4: Now, both within and across countries, rich and educated mothers have less children than poor and unskilled ones.

The decline in fertility

from Jones and Tertilt (2007)

Reasons for the decline in fertility (1)

Demographers would stress:

Contraception: Better contraception technology. But how large is the gap between desired and effective fertility ?

Mortality: Lower child mortality may imply lower birth, to get the same number of surviving children (child-replacement hypothesis)

Culture: Change in cultural norms (drops in fertility across Europe often followed linguistic and religious contours)

Reasons for the decline in fertility (2)

Economists would stress:

Mortality: Same mechanism as demographers

Old-age support: Children as a way to save resources for the future
and to obtain some support when old. Declines with
pension systems.

Ban on child labor: Reduces the return from children

Parents' income: Opportunity cost of child-rearing time is high for
high income/education mothers

Return to education: Industrial revolution accompanied by a rise in
the skill premium (Galor).

Quality - Quantity Tradeoff Model

Most economic models are based on the QQ model

In the budget constraint:
Total cost of children = number × spending on quality
(education+health)

When number of children (quantity) becomes too costly, or if
quality becomes more profitable
parents may want to invest more in the quality of a small number
of children. Becker.

Also across species in natural world (elephant vs invertebrates).

Differential fertility

QQ account for fertility over time in the demographic transition, but also for fertility rates in the cross-section of a given country.

Since for EDUCATED WOMEN the opportunity cost of child-rearing time is high, they prefer to invest in the "quality" of a small number of children.

For LESS EDUCATED WOMEN, the opportunity cost of raising children is low, while providing education is expensive relative to their income. They would therefore prefer to have many children, but invest little in the education of each child.

1. Surveys

Do people really choose their number of children ?? four arguments

1. Surveys (Pritchett 1994)

Ninety percent of the differences across countries in total fertility rates are accounted for solely by differences in women's reported desired fertility.

2. Common sense

Having one more child is a huge investment

Similar in cost to buying a small house (Cigno)

Cumulative hours of child care that the wife devotes:
1 kid family: 9.274
2 kids family: 12.946
3 kids family: 18.389

+ Husbands time

3. Historical data

Look at forerunners in fertility decline

Fertility started to decline in some European cities as early as in the 18th century

Because some incentives changed ? return to education ?

Historical data - Rouen (Bardet)

	notables	merchants	craftsmen	workmen
Fertility per women				
1670-99	6.23	6.53	7.19	7.21
1700-29	4.87	5.51	6.29	6.06
1730-59	4.84	4.81	5.48	5.67
1760-92	3.77	3.28	4.84	4.84

Similar trends in Geneva (1670-1820)

4. Fathers vs mothers

Many studies find that fertility increases with father's wage but decreases with mother's wage

We will see below that the theoretical effect of Mother's wage can be different from the one of the Father's wage

If those studies are right, strong evidence in favor of the economic approach

against the idea that wage reflect "culture" or "norms" only which would not imply different effects

Basics

A simple model linking together fertility, inequality and growth

Time is discrete and runs from 0 to ∞.

People live for two periods, childhood, and adulthood.

Unitary representation of the household.

Two types of agents, unskilled (group $i = A$) and skilled (group $i = B$).

The size of each group is denoted N_t^i.

Preferences

Parents choose consumption c_t^i, fertility n_t^i (quantity) and education e_t^i (quality)

$$\max \ln[c_t^i] + \gamma \ln[n_t^i \pi(e_t^i)]. \qquad (1)$$

Probability for a child to become skilled:

$$\pi^i(e) = \tau^i \, (\theta + e)^\eta, \quad \eta \in (0, 1).$$

return rate of education spending related to η

Budget constraint

$$c_t^i = \left[w_t^i(1 - \phi n_t^i) - n_t^i e_t^i \right]. \qquad (2)$$

Maximum fertility: $1/\phi$

Firms and markets

Output:

$$Y_t = \omega^A L_t^A + \omega^B L_t^B.$$

The equilibrium condition on both labor markets

$$N_t^i(1 - \phi n_t^i) = L_t^i$$

Implies that wages are equal to marginal productivity:

$$w_t^i = \omega^i.$$

Equilibrium

Definition (Benchmark Inter-temporal Equilibrium)

Given initial population sizes N_0^A and N_0^B, an equilibrium is a sequence of individual quantities $(\hat{c}_t^i, \hat{e}_t^i, \hat{n}_t^i)_{i=A,B.t\geq 0}$ and group sizes $(\hat{N}_t^i)_{i=A,B.t\geq 0}$ such that

- Consumption, education and fertility maximize households' utility (1) subject to the budget constraint (9);
- Group sizes evolve according to:

$$\begin{bmatrix} \hat{N}_{t+1}^A \\ \hat{N}_{t+1}^B \end{bmatrix} = \begin{bmatrix} \hat{n}_t^A(1-\pi^A(\hat{e}_t^A)) & \hat{n}_t^B(1-\pi^B(\hat{e}_t^B)) \\ \hat{n}_t^A \pi^A(\hat{e}_t^A) & \hat{n}_t^B \pi^B(\hat{e}_t^B) \end{bmatrix} \begin{bmatrix} \hat{N}_t^A \\ \hat{N}_t^B \end{bmatrix}$$
(3)

- Labor market clears, i.e.

$$\hat{N}_t^i(1-\phi\hat{n}_t^i) = L_t^i \qquad \forall i.$$
(4)

Solution to the household problem

If $w_t^i > \theta/(\eta\phi)$ [interior regime],

$$\hat{e}_t^i = \frac{\eta\phi w_t^i - \theta}{1 - \eta}, \qquad \text{and:} \tag{5}$$

$$\hat{n}_t^i = \frac{(1-\eta)\gamma w_t^i}{(\phi w_t^i - \theta)(1+\gamma)}. \tag{6}$$

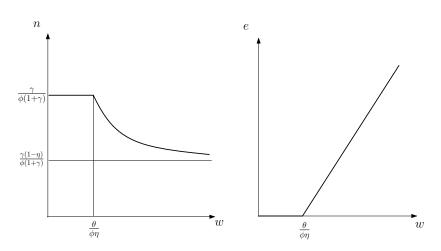otherwise,

$$\hat{e}_t^i = 0, \qquad \text{and:} \tag{7}$$

$$\hat{n}_t^i = \frac{\gamma}{\phi(1+\gamma)} \tag{8}$$

Fertility as a Function of Parents' Human Capital

Dynamics

Population ratio:

$$z_t = \frac{N_t^A}{N_t^B}.$$

The dynamic system (3) can be reduced to:

$$z_{t+1} = \frac{n^A(1 - \pi^A)z_t + n^B(1 - \pi^B)}{n^A\pi^A z_t + n^B\pi^B} \equiv f(z_t).$$
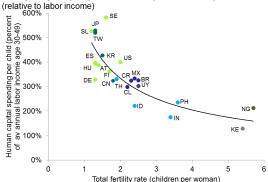
Proposition (Dynamics of the Composition of Population)

The dynamics of z_t given by $z_{t+1} = f(z_t)$ admit a single positive steady state which is globally stable.

Better Measurement of the Quantity - Quality Tradeoff

Budget constraint implies:

$$n_t^i = (w_t^i - c_t^i)/(\phi w_t^i + e_t^i)$$

Fertility and pubic plus private human-capital investment per child
(relative to labor income)

Ronald Lee and Andrew Mason, 9/19/2011   26

Mothers, Fathers, and Time Use

Budget constraint with two sources of income, female - male

$$c_t^i = \left[w_t^{F,i}(1 - \alpha\phi n_t^i) + w_t^{M,i}(1 - (1-\alpha)\phi n_t^i) - n_t^i e_t^i \right]. \quad (9)$$

α is the share of childrearing supported by the female (exogenous here)

For $\alpha = 1$ (traditional family), fertility is decreasing in $w_t^{F,i}$ (opportunity cost) but increasing in $w_t^{M,i}$ (income effect)

$\partial n_t^i / \partial w^{F,i}$ (resp. $\partial n_t^i / \partial w^{M,i}$) decreases (resp. increases) with α

NTA: Having a good measure of α is key !!

Public and Private Spending

Long literature on public vs private funding of education ($+$ health...)

Private

$$c_t^i = \left[w_t^i(1 - \phi n_t^i) - n_t^i e_t^i \right]$$

Public

$$c_t^i = (1 - \tau_t) \left[w_t^i(1 - \phi n_t^i) \right]$$

$+$ Possible mix of the two

$+$ Consider two types of spending: good/time

NTA: Important to provide data helping to analyze the implications of those models

Does it matter if fertility is endogenous ?

Yes, it would then react to incentives.

Policy implications.

Inequality

Inequality is usually found bad for growth

Many channels are invoked: political economy, sociopolitical unrest, borrowing constraints...
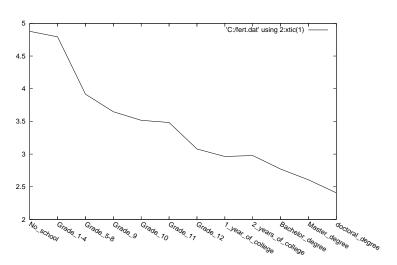
One neglected channel: differential fertility

We show it is an important one

If inequality increases, rich are richer, have fewer highly educated children
poor are poorer, still have many uneducated children
average human capital decreases in the future

Differential fertility: Fertility Rates by Education

Completed Fertility of Married Mothers, US 1990

Initial effect of inequality

	Endogenous Fertility				Exogenous Fertility			
σ^2	g_0	N_0	I_0	D_0	g_0	N_0	I_0	D_0
0.10	2.00%	0.00%	0.056	0.09	2.00%	0%	0.056	0
0.75	1.26%	0.66%	0.404	1.95	1.87%	0%	0.400	0
1.00	0.80%	1.08%	0.520	2.76	1.78%	0%	0.513	0
1.50	0.01%	1.71%	0.707	2.77	1.53%	0%	0.700	0

I_0: initial Gini on earnings. D_0: initial fertility differential

from De la Croix and Doepke, AER 2003

Education policy

Literature with exo fertility says public schooling is bad for growth

With endo fertility:

Fertility differentials between rich and poor are bad for growth

They are related to private investment in quality

It may disappear with (free) public schooling

That can be good for growth.

PISA for Brazil and S. Korea

Country	social status	% in priv. schools	fertility
Brazil	16–35	2.35%	3.67
	36–53	10.59%	3.36
	54–70	23.00%	3.07
	71–90	49.60%	2.86
S. Korea	16–35	47.23%	2.46
	36–53	50.00%	2.25
	54–70	49.69%	2.18
	71–90	45.83%	2.20

A more egalitarian education system (or society) lowers fertility differentials between rich and poor

Additional effect of public education

Differential fertility $\rightarrow$ centrifugal force: higher reproduction by low-skilled people increase the relative number of the poor. Public education offsets this centrifugal force.

Same argument could be applied in deeply divided countries (because of different ethnic groups, religions,...)

Conclusion about Public Education

1. Public schooling distorts the fertility and education choice of parents: parents increase fertility once education is provided for free.

This leads to lower growth in the long-run.

2. When there is inequality, the comparison of growth rates can switch in favor of public education, because of differential fertility.

3. With private education, differential-fertility can result in a diverging income distribution. This divergence can be prevented by a public education.

Fertility as a strategic variable

Suppose a deeply divided society, e.g. by ethnic groups.

Political power is often strongly increasing in the size of the group.

This provides incentives to have a high fertility norm, for the next generation to regain power.

Example of Easter Island - population race between clans - environmental collapse.

Current examples: Palestinians - Orthodox Jewish.
Extensions: Education race - Cast system in India.

Other policies: Taxation policy

1. Taxing wages may reduce the opportunity cost of children →
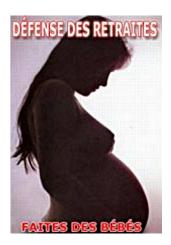increasing fertility

Problematic as far as environmental policy is concerned

(De la Croix and Gosseries, The Natalist Bias of Pollution Control)

2. Giving lump sum transfers: increases fertility if children are a
normal good (likely)

Population policy

Population policy is effective, but may backfire on quality of children

[Sweet Achievement]