Do Highly Educated Women Choose Smaller Families

Moshe Hazan and Hosny Zoabi

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- In a cross-section of countries
- Over time within countries and regions
- At the individual level for cohorts of American women born between 1826 and 1960.
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We find that this is no longer true in the U.S.

Between 2001 and 2009, the relationship between TFR and female education is U-shaped.

Not surprisingly, labor supply is increasing in female education.

But standard models (Gronau 1977, Galor and Weil 1996) predict negative correlation between fertility and labor supply.
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We address two questions:

1. What can account for the U-shaped fertility pattern
2. What can account for the positive correlation between fertility and labor supply for highly educated women
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We advance an explanation that relies on the *marketization hypothesis* (Freeman and Schettkat 2005)

Some of the inputs into raising children can be purchased in the market. Highly educated women find it optimal to buy more baby-sitter and housekeeping services to help them run their homes more efficiently.

This enables them to have more children and work more hours in the labor market.
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Introduction

- There are large differences between the U.S. and Western Europe in fertility and women’s time allocated to labor supply and home production.

  - In the U.S. TFR is about one-half larger than in Europe
  - In the U.S. hours worked by women per week in the market are about 7-8 more than in Europe
  - In the U.S. hours worked by women per week in home production (including childcare) are about 7-8 less than in Europe
  - In the U.S. hours spent in childcare per week by women are about 1-2 hours more than in Europe
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There are also large differences between the U.S. and Western Europe in income inequality.

- The Gini coefficient after tax and transfers in the mid 2000s for working age population was 0.37 in the U.S. while it was 0.31 for all European OECD members.

- The 90-10 ratio in the U.S. is 5.91 while for all European OECD members the ratio is 3.84.
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Differences in income inequality can account for the differences in fertility and time allocation of women across these regions.

- Compute aggregate fertility and time allocation in the economy.
- Analyze the effect of a mean preserving spread of the human capital (income) of households on aggregate variables.

Results are consistent with the evidence:
- Fertility unambiguously increases.
- Labor supply and time in childcare can increase.
- Time spent in home production can decrease.
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The data:

- We pooled data from the American Community Survey for the years 2001–2009.
- We restrict our sample to white, non-Hispanic women who live in households under the 1970 definition.
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Evidence: Age-Specific-Fertility-Rates

Age Specific Fertility Rates 2001-2009

Age groups

- 15-19
- 20-24
- 25-29
- 30-34
- 35-39
- 40-44
- 45-49

- high School Dropout
- high School Diploma
- Some College
- College
- Advanced Degree
Evidence: Total Fertility Rates

![Graph showing Total Fertility Rate 2001-2009]

- 2.24 (high school dropout)
- 2.11 (high school diploma)
- 1.79 (some college)
- 1.93 (college)
- 1.98 (advanced degree)

Female Education:
- High School Dropout
- High School Diploma
- Some College
- College
- Advanced Degree

Total Fertility Rate (TFR)
Evidence: usual hours worked: women age 25-50 and mothers to newborns
Evidence: usual hours worked of spouses by women’s education and fathers to newborns

![Graph showing usual hours worked per week by educated group of wives and fathers to newborns. The graph includes data for high school dropouts, high school diploma, some college, college, and advanced degree levels of female education.](Image)
Evidence: Fraction of currently married by women’s education
Evidence: usual hours worked: mothers to newborns by marital status

![Graph showing usual hours worked per week 2001-2009: Women aged 15-50 to Newborns by Education and Marital Status.](image)
Is the U-shaped association between fertility and women’s education robust?

- We can make use of the micro structure of the data and estimate probability models.

- A caveat: we have only a flow measure of fertility in the data.
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Evidence

\[ b_{ist} = e'_{ist} \cdot \pi + \delta_1 F\text{I}_{ist} + \delta_2 (F\text{I}_{ist})^2 + \epsilon_{ist} \]

- \( b_{ist} \in \{0, 1\} \) 1 if woman \( i \) living in state \( s \) in year \( t \) gave birth during the reference period, 0 otherwise
- \( e_{ist} \) educational dummies corresponding to the five groups mentioned above
- \( F\text{I}_{ist} \) is total family income
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The correlation between giving a birth in the past 12 months and women’s education – Linear Prob. Models

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Model - Basic Assumptions

- **Static model (one period)**
  - continuum of individuals that differ in their human capital, $h_i$
  - Each Individual forms a household, works, chooses consumption, her number of children and their level of education.
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Model - Preferences, Budget Constraint and HC Production Function

- **utility function:**

  \[ u_i = \ln(c_i) + \ln(n_i h'_i) \]

- **budget constraint:**

  \[ h_i = p_{ci} c_i + p_{ni} n_i + n_i p_{ei} e_i \]

- **human capital production function:**

  \[ h'_i = (e_i + \eta)^{\theta}, \quad \theta \in (0, 1) \]
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- The average level of human capital among teachers is $\bar{h}$

- Thus, all parents face the same market price for education, $p_{ei} = p_e = \bar{h}$
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Model - Raising Children

- **production function:**

\[ n = (t_M^n)^\phi (t_B^n)^{1-\phi}, \quad \phi \in (0, 1) \]

- \( t_M^n \) is time of the mother
- \( t_B^n \) is the time bought in the market, e.g., a babysitter.
- Assumption: price of one unit of time bought in the market is some level of human capital denoted by \( h \).

\[ TC^n(n, h, h^i) = p_{ni} n = \varphi h^{1-\phi} h_i^\phi n; \quad \varphi = (\frac{\phi}{1-\phi})^{1-\phi} + (\frac{1-\phi}{\phi})^\phi \]
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Model - Consumption

- production function:

\[ c = m^{1-\alpha} \left[ (t_M^c)^\sigma + (t_H^c)^\sigma \right]^{\alpha/\sigma}, \quad \sigma \in (0, 1) \]

- \( m \) is the market good
- \( t_M^c \) is time of the mother
- \( t_H^c \) is the time bought in the market, e.g., a housekeeper.
- Assumption: price of one unit of time of a housekeeper is \( \hat{h} \).

\[ \Rightarrow \quad TC^c(c, \hat{h}, h^i) = p_c c = \frac{h_i^\alpha}{\omega \left(1 + \left(\frac{h_i}{\hat{h}}\right)^{\frac{\sigma}{1-\sigma}}\right)^{1+\alpha\left(\frac{1}{\sigma}-1\right)} c} \]
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- Assumption: price of one unit of time of a housekeeper is \( \hat{h} \).

\[ \Rightarrow \]

\[ TC^c(c, \hat{h}, h^i) = p_c c = \frac{h_i^\alpha}{\omega \left( 1 + \left( \frac{h_i}{h} \right)^{\frac{\sigma}{1-\sigma}} \right)^{1+\alpha\left(\frac{1}{\sigma}-1\right)} c} \]
Education:

\[ e_i = \frac{\theta \varphi h_1^{1-\phi} h_i^\phi - \eta h}{\bar{h}(1 - \theta)} \]

Proposition 1: The educational choice, \( e^* \), is strictly increasing in \( h_i \).
Model - Equilibrium

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Proposition 2: The fertility choice, \( n^* \) is U-shaped as a function of \( h_i \).
Mother’s time spent in child raising:

\[ t^n_M = \left( \frac{\phi h}{1 - \phi h_i} \right)^{1-\phi} \frac{h_i(1 - \theta)}{2(\varphi h^{1-\phi} h_i^\phi - \eta \bar{h})} \]

Proposition 3: Mother’s time spent on raising children, \( t^n_M \), is strictly decreasing with income, \( h_i \).
Mother’s time spent in child raising:

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Model - Equilibrium

Mother’s time spent in home production:

\[
t^c_M = \frac{\alpha}{2 \left(1 + \left(\frac{h_i}{\hat{h}}\right)^{\frac{\sigma}{1-\sigma}}\right)}
\]

Proposition 4: Mother’s time spent on raising children, \(t^c_M\), is strictly decreasing with income, \(h_i\)
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Model - Equilibrium

Mother’s labor supply:

\[ l^* \equiv 1 - t^n_M - t^c_M \]

Proposition 5: The labor supply is strictly increasing with mother’s income, \( h \);
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Proposition 5: The labor supply is strictly increasing with mother’s income, \( h \).
Babysitter services purchased in the market:

\[ t_B^n = \left( \frac{1 - \phi h_i}{h} \right) \phi \frac{h_i(1 - \theta)}{2(\phi h^{1-\phi} h_i^\phi - \eta h)} \]

Proposition 6: Purchase of babysitter services is:

- Strictly increasing with income, \( h_i \) if \( \theta \leq \frac{1}{1+\phi} \) (sufficient cond.).
- Strictly increasing when \( n \) increases.
Babysitter services purchased in the market:

\[ t_B^n = \left( \frac{1 - \phi h_i}{\phi} \right)^\phi \frac{h_i(1 - \theta)}{2(\varphi h_i^{-\phi}h_i^{\phi} - \eta \bar{h})} \]

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\[
\hat{h}^{\frac{1}{1-\sigma}} \left( 1 + \left( \frac{h_i}{\hat{h}} \right)^{\frac{\sigma}{1-\sigma}} \right)^{1+\alpha\left(\frac{1}{\sigma}-1\right)} \frac{\omega}{\hat{h}} h_i^{\alpha-1} \left( 1 + \left( \frac{h_i}{\hat{h}} \right)^{\frac{\sigma}{1-\sigma}} \right) \alpha\left(\frac{1}{\sigma}-1\right)
\]

Proposition 7: Housekeeping services purchased in the market are strictly increasing with income, \( h_i \)
Housekeeping services purchased in the market:

\[
\left( \frac{\alpha}{1-\alpha} \right)^{1-\alpha} h_i^{\alpha+\frac{\sigma}{1-\sigma}} \frac{\omega}{\hat{h}^{1-\sigma}} \left( 1 + \left( \frac{h_i}{\hat{h}} \right)^{\frac{\sigma}{1-\sigma}} \right)^{1+\alpha \left( \frac{1}{\sigma} - 1 \right)}
\]

Proposition 7: Housekeeping services purchased in the market are strictly increasing with income, $h_i$
Highly educated women:

1. Provide each of their children with more education

2. Have larger families than women with intermediate level of education

3. Allocate less time to child raising and to home production

4. Work more in the labor market

5. This is possible because they buy more babysitter and housekeeping services
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Application – the U.S. and Europe

Use the model to explain differences in fertility and time allocation of women.

- Compute aggregate fertility, time spent raising children, time spent in home production and labor supply

- Analyze the effect of a mean preserving spread of the income distribution

- At this stage, only a numerical example
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Assumptions

- $h_i$ is informally distributed

- The costs (average human capital) of babysitters, housekeepers and teachers are assumed to be in a certain percentile
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Aggregate variables as a function of inequality