Quantification of Gender Preferences and Counterfactual Simulation of Sex-Selective Technology

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Research Questions and Motivation

Research Questions:

- Are there still gender preferences regarding fertility in the US?
- How would widespread adoption of SST impact fertility and demographics?

Why Study Gender Preferences and SST?

- Gender preferences significantly impact fertility decisions worldwide.
- With advancements in sex-selective technology (SST), these preferences may lead to demographic shifts.

Feature and Contribution:

- Disentangled preference for a certain gender from the preference for gender variety.
- First study to demonstrate how fertility patterns respond to varying costs of sex selection.

Background of SST

Model Overview

Model Framework:

- A static discrete choice model with a probit structure to estimate:
  - Gender preferences and Fertility decisions.

Key Parameters:

- Utility of having boys or girls.
- Cost of having children in different birth order.
- Household type-specific discount rate.

Data and Estimation:

- Data: American Community Survey (ACS) from 2008–2019.
- Estimation: Maximum likelihood method.

Key Findings

Gender Preferences:

- Slight preference for boys; a strong preference for gender variety.
- Non-white, immigrant, and low-educated households prefer boys.
- White, native, and highly educated households prefer girls.

Impact of SST on Fertility:

- The sex ratio would still be balanced.
- Average fertility rate $\uparrow$ 1%.
- Shift in birth-order distribution.

Empirical Verification

***Roe v. Wade* and Sex Balancing:**

- The probability of the first two children being the same sex $\downarrow$ immediately following *Roe*.
- The fertility surplus of having a third child among same-gender first two children households $\downarrow$ right after *Roe*.

Table 1 Table 2

Discussion

Conclusion:

- Preference for gender variety drives fertility decisions with sex-selective technology.
- Sex-selective technology has limited aggregate demographic impact.

Policy Implications:

- Welfare gains from enabling desired family compositions.

Potential Risks:

- Potential SES-based imbalances in sex ratios.

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Background and History of Sex-Selective Technology

Three Major Sex-Selective Technologies:

- Sex-selective abortion
  - Using ultrasound or amniocentesis to detect the fetus's sex.
  - Considering aborting the fetus with undesired sex.
- Sperm sorting
  - MicroSort and Ericsson method (91% for X sort and 80% for Y sort).
  - Followed by in vitro fertilization (IVF) or intrauterine insemination (IUI).
- Preimplantation genetic diagnosis (PGD)
  - Selecting embryos with the desired sex.
  - Implanted via IVF.

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Model

$$U_i(x_i, y_i, d_{1i}, d_{2i}) = 1\{\gamma^{d_{1i}}\{p_b\mu^{x_i}b + (1 - p_b)\mu^{y_i}g\} - (C\beta^{d_{2i}}) + \epsilon > 0\} \tag{1}$$

Parameters:

- b: utility of having a boy.
- g: utility of having a girl.
- C: cost of having the second child.
- μ: patient or discount rate for the same sex. $\mu \in [0, 1]$
- γ: discount rate for the next child if first time reaches mixed gender. $\gamma \in [0, 1]$
- β: relative cost of having the next child when the number of existing children is greater than or equal to two.
- ϵ: unobserved heterogeneity or preference shock. $\epsilon \sim N(0, 1)$

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Maximum Likelihood Estimation

$$
\begin{aligned}
L(\theta_i) &= \prod_{i=1}^{n} \{\Phi(\theta_i)^{U_{1i}}(1-\Phi(\theta_i))^{(1-U_{1i})}\}\{\Phi(\theta_i)^{U_{2i}}(1-\Phi(\theta_i))^{(1-U_{2i})}\}\{\Phi(\theta_i)^{U_{3i}}(1-\Phi(\theta_i))^{(1-U_{3i})}\} \\
l(\theta_i) &= ln(L(\theta_i)) = \sum_{j=1}^{3}\sum_{i=1}^{n} U_{ij} ln\Phi(\theta_i) + (1-U_{ij}) ln(1-\Phi(\theta_i))
\end{aligned}
\tag{2}
$$

Notes:

- Φ: cumulative distribution function of the standard normal distribution.
- θ: parameter set.
- j: birth parities.
- C: normalized to 1.
- P_b: assumed to be $\frac{1}{2}$.

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Roe V. Wade and Sex Balancing

Table 1

The probability of the second child being a girl with a first-born girl

	Second child a girl		
	Pre	Pre/Post	Post
	(1)	(2)	(3)
First child a girl	0.0040	-0.0293***	-0.0317***
	(0.0028)	(0.0031)	(0.0049)
Controls	Yes	Yes	Yes
Constant	0.467	0.453	0.470
Observations	130,344	106,433	42,202

Note : Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1). Data are from the IPUMS US census from 1970 and 1980. The dependent variable is the sex of the second child, coded as 1 for girl and 0 for boy. The main explanatory variable is the sex of the first child, 1 for girl and 0 for boy. Controls include maternal educational attainment, mother's age and age at first birth, with race and Hispanic indicators. I limit the sample to those households with the first child born after 1965. In column (1), the second child was born before 1973. In column (2), the first child was born before 1973, and the second child was born in or after 1973. In column (3), the first child was born in or after 1973.

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Roe V. Wade and Sex Balancing

Table 2

Whether the first two children have the same gender and the probability of having the third child

	Having a third child?		
	Pre	Pre/Post	Post
	(1)	(2)	(3)
Same gender first two children	0.0842***	0.0426***	0.0150***
	(0.0027)	(0.0022)	(0.0023)
Controls	Yes	Yes	Yes
Constant	0.290	0.185	-0.090
Observations	130,344	106,433	42,202

Note: Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1). Data are from the IPUMS US census from 1970 and 1980. The dependent variable equals 1 if households have a third child. The main explanatory variable equals 1 if the first two children have the same gender. Controls include maternal educational attainment, mother's age and age at first birth, with race and Hispanic indicators. I limit the sample to those households with the first child born after 1965. In column (1), the second child was born before 1973. In column (2), the first child was born before 1973, and the second child was born in or after 1973. In column (3), the first child was born in or after 1973.

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