The Fertility, Marriage, and Gender Equality Quandary

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Motivation

- Three trends underpin the grand gender convergence in the last century:
  1. Falling fertility (Guinnane 2011)
  2. Declining marriage (Stevenson and Wolfers 2007)
  3. Converging gender (income) gaps (Goldin 2014)
- Existing research and policymakers often treat them in isolation

This Paper

- Document a three-way trade-off between (1) high fertility, (2) widespread dual parenthood, and (3) gender income equality
- Develop a unified model of marriage market equilibrium, extending Choo and Siow (2006), to explain the empirical facts
- Calibrate to the transition experience of Mexico
- Consider a dynamic extension with endogenous gender human capital gap

Key Findings

- Reducing women's child-rearing costs stands out as the unique policy that could mitigate the trade-off
- Quantitative results on Mexico from 1990 to 2015:
  - → Gender-neutral TFP explains half of declining fertility and marriage
  - → Gender-biased TFP and the gender education gap reversal account for the narrowing gender income and welfare gaps
- Gendered impacts of single parenthood result in dynamic propagation

Roadmap

- Empirical findings
- Model
- Quantitative analysis
- Dynamic extension
- Conclusion

Motivating Facts

Data Source

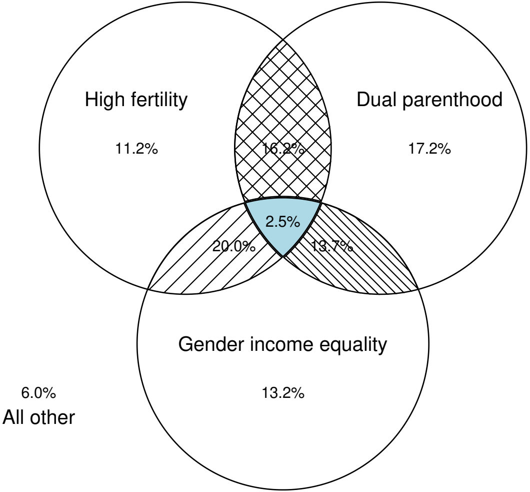
- OECD sample: 37 OECD countries from 1970 to 2014, 721 observations
  - → Total fertility rate (UN)
  - → Share of out-of-wedlock birth (OECD database)
  - → Gender gaps in median earnings (OECD database)
- World sample: 95 countries from 1990 to 2019, 1130 observations
  - → Total fertility rate (UN)
  - → Share of children living with both parents (Brenøe and Wasserman 2025)
  - → Female share of labor income (World Inequality Database)
- U.S. sample: 50 states and D.C. in 2023
  - → Live births per 1000 women aged 15-44 (CDC)
  - → Single-mother household share (ACS)
  - → Gender earnings gap (ACS)

Quantifying the Trade-Off

- Assign values to dummy variables
  - $\rightarrow$ High fertility
  - $\rightarrow$ Dual parenthood
  - $\rightarrow$ Gender income equality

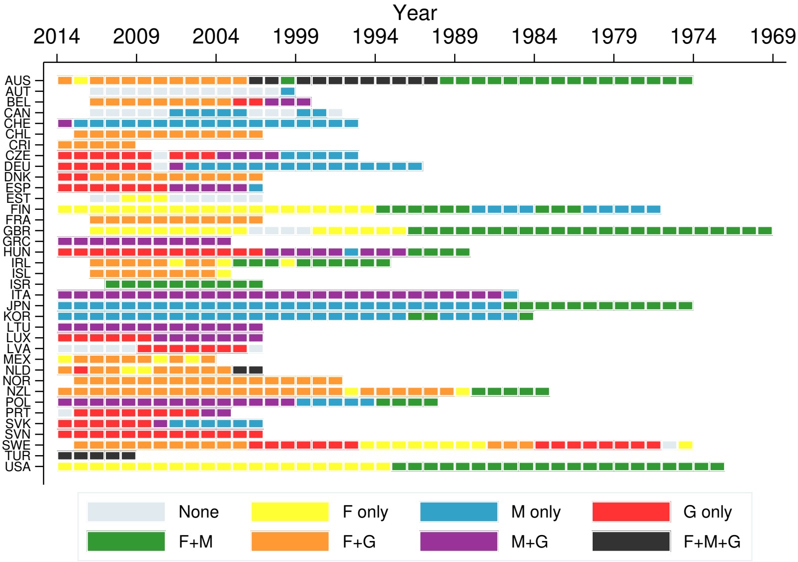
  according to sample medians
- Visualize the intersections using Venn diagrams
- In the spirit of the dartboard approach (Ellison and Glaeser 1997), the random benchmark of the intersection is $0.5 \times 0.5 \times 0.5 = 12.5\%$

OECD Sample



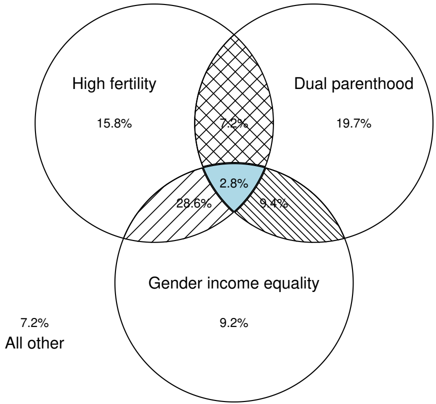
High fertility
11.2%
16.2%
Dual parenthood
17.2%
2.5%
20.0%
13.7%
Gender income equality
13.2%
6.0%
All other

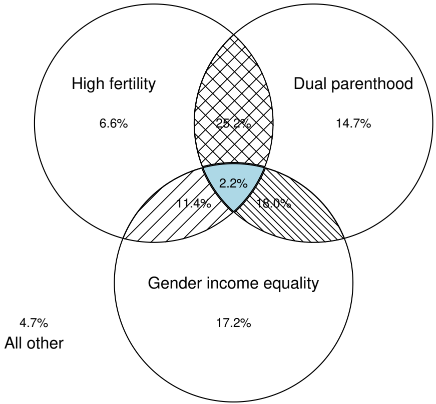
OECD Sample



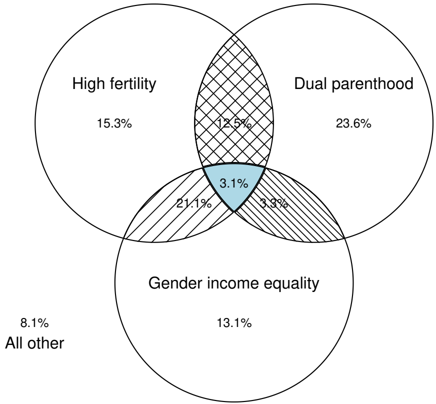
Year
2014
2009
2004
1999
1994
1989
1984
1979
1974
1969
AUS
AUT
BEL
CAN
CHE
CHL
CRI
CZE
DEU
DNK
ESP
EST
FIN
FRA
GBR
GRC
HUN
IRL
ISL
ISR
ITA
JPN
KOR
LTU
LUX
LVA
MEX
NLD
NOR
NZL
POL
PRT
SVK
SVN
SWE
TUR
USA
None
F only
M only
G only
F+M
F+G
M+G
F+M+G

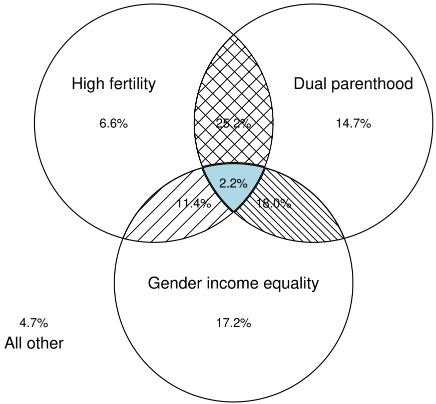
OECD Sample - High & Low Income



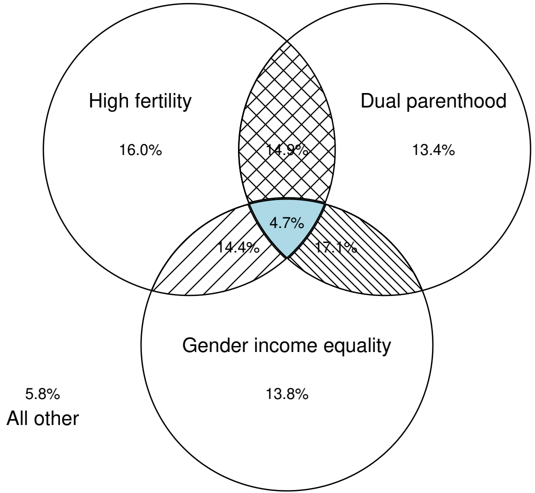


OECD Sample - High & Low Schooling

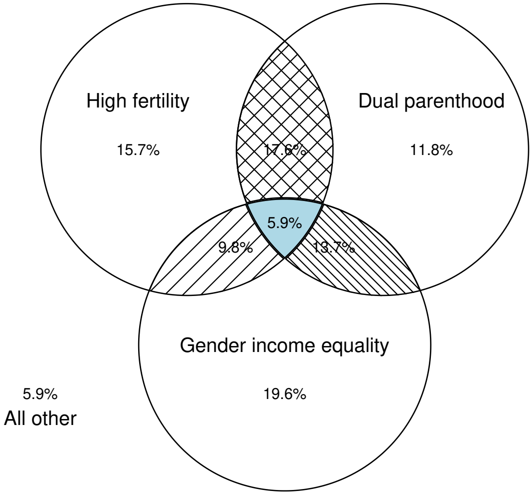




World Sample

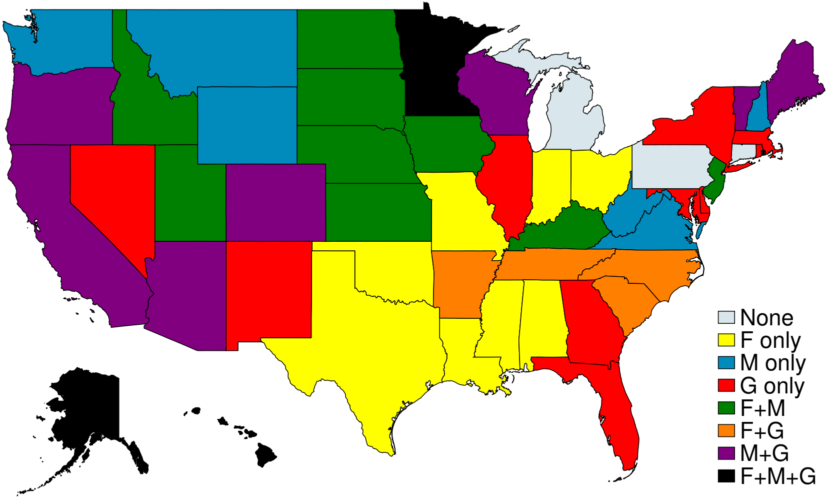


U.S. Sample



High fertility
15.7%
17.6%
Dual parenthood
11.8%
5.9%
9.8%
13.7%
Gender income equality
19.6%
5.9%
All other

U.S. Sample



Model

Basic setup

- Becker (1973), Choo and Siow (2006)
- Individual of equal mass with gender $g \in \{\male, \female\}$ and preference

$$u^g(c^g, n) = \left((1-\beta)\cdot(c^g)^{\frac{\rho-1}{\rho}} + \beta \cdot n^{\frac{\rho-1}{\rho}}\right)^{\frac{\rho}{\rho-1}} \tag{1}$$

  where $\rho > 1$ so that $u(c, 0)$ is well-defined
- Homogeneous wage within gender $w^{\male}$ and $w^{\female}$
- Wage gap is defined as

$$\Gamma^w = \frac{w^{\male}}{w^{\female}} \tag{2}$$

Marriage and Fertility – Men

- If single, men consume their labor income but have no children

$$V^{\male,s} = u(w^{\male}, 0) \tag{3}$$

- Once married, husbands work and transfer α share of income to wives

$$V^{\male,m} = u((1-\alpha)w^{\male}, n^m) \cdot \lambda \tag{4}$$

→ α is an endogenous outcome in the marriage market equilibrium

→ λ is the psychic benefit of marriage

Marriage and Fertility – Single Women

- Single female solves

$$V^{\female,s} = \max_{c^{\female,s},l^s,n^s} \quad u(c^{\female,s}, n^s) \tag{5}$$

subject to budget and time constraints

$$c^{\female,s} = w^{\female} l^s \qquad l^s = 1 - \chi n^s$$

- Simple consumption-fertility trade-off through endogenous labor supply

Marriage and Fertility – Married Women

- Wives need to balance fertility and consumption

$$V^{♀,m} = \max_{c^{♀,m}, l^m, n^m} \quad u(c^{♀,m}, n^m) \cdot \lambda \tag{6}$$

subject to budget and time constraints

$$c^{♀,m} = \underbrace{\alpha w^{♂}}_{\text{transfer from husband}} + \underbrace{w^{♀} l^m}_{\text{own labor income}}, \qquad l^m = 1 - \chi n^m$$

- Within marriage, fertility is subject to veto $\Longrightarrow$ females determine fertility

Marriage Market Equilibrium

- Each individual draws an idiosyncratic taste shock ϵ on marriage, distributed Fréchet with scale θ
- Let $\mathcal{M}^g$ denote the share of gender g being married

$$\mathcal{M}^{♂} = \frac{1}{1 + (V^{♂,s}/V^{♂,m})^{\theta}}, \qquad \mathcal{M}^{♀} = \frac{1}{1 + (V^{♀,s}/V^{♀,m})^{\theta}}. \tag{7}$$

- Equilibrium requires

$$\mathcal{M}^{♂} = \mathcal{M}^{♀} = \mathcal{M}, \tag{8}$$

with α and n^m acting as market-clearing "prices"

Aggregate Quantities

- Aggregate fertility rate n and share of children with both parents

$$n = \mathcal{M} \cdot n^m + (1 - \mathcal{M}) \cdot n^s \tag{9}$$

$$\mathcal{D} = \frac{\mathcal{M} \cdot n^m}{n} \tag{10}$$

- Average hours worked per female is

$$l^{♀} = \mathcal{M} \cdot l^m + (1 - \mathcal{M}) \cdot l^s = 1 - \chi n \tag{11}$$

- Gender income gap

$$\Gamma^y = \frac{y^{♂}}{y^{♀}} = \frac{\Gamma^w}{l^{♀}} \tag{12}$$

Equilibrium Conditions

- A price vector (α, n^m) clears the marriage market
- For any $\mathcal{M}$, men's optimal choice yields α as a function n^m:

$$\alpha = 1 - \left[\left(\left(\frac{\mathcal{M}}{1-\mathcal{M}} \right)^{\frac{1}{\theta}} \cdot \frac{1}{\lambda} \right)^{\frac{\rho-1}{\rho}} - \frac{\beta}{1-\beta} \cdot \left(\frac{n^m}{w^{♂}} \right)^{\frac{\rho-1}{\rho}} \right]^{\frac{\rho}{\rho-1}} \tag{13}$$

  which is increasing and convex in $\alpha - n^m$ space
- The FOC for married women determines n^m as a function of α:

$$n^m \cdot \left[\left(\frac{(1-\beta)\chi}{\beta} \right)^{\rho} \cdot (w^{♀})^{\rho-1} + \chi \right] = 1 + \alpha \Gamma^w \tag{14}$$

  which is increasing and linear in $\alpha - n^m$ space

Equilibrium Characterization

- Lemma 1: For any wage pair $\{w^{♂}, w^{♀}\}$, there exists a unique fixed point (α, n^m) that clears the marriage market
- Lemma 2: The gains from marriage are $V^{g,m}/V^{g,s} = \lambda \cdot (1 + \alpha\Gamma^w)$
- Equilibrium-implied relationship

$$\mathcal{M} = \frac{(\lambda \cdot (1 + \alpha\Gamma^w))^\theta}{1 + (\lambda \cdot (1 + \alpha\Gamma^w))^\theta}, \tag{15}$$

$$\Gamma^y = \frac{\Gamma^w}{l^{♀}}, \tag{16}$$

$$l^{♀} = 1 - \chi n. \tag{17}$$

Three-Way Trade-Off

1. High fertility and high dual-parenthood

   High n implies low $l^{\female}$. To sustain high $\mathcal{M}$, Γ^w cannot be too low. Thus, Γ^y is necessarily high

2. High fertility and gender income equality

   High n again implies low $l^{\female}$. To achieve low Γ^y, Γ^w must be very small. Because α is bounded above by one, a very small wage gap reduces $\mathcal{M}$

3. High dual-parenthood and gender income equality

   Because α is bounded above, high $\mathcal{M}$ requires large Γ^w. To offset this and achieve low Γ^y, $l^{\female}$ must be high. Thus, fertility n is low

Any Way Out?

- Policy effects
  1. Pro-marriage policies (higher λ) $\Longrightarrow$ Higher $\mathcal{M}$, higher n, but also greater Γ^y
  2. Pro-equity policies (higher $w^{♀}$) $\Longrightarrow$ Achieve lower Γ^y, but lower $\mathcal{M}$ and n
  3. Pro-fertility policies (lower χ) $\Longrightarrow$ Higher $\mathcal{M}$, higher n, but reduces Γ^y because $n \cdot \chi$ falls in equilibrium

- Policies reducing child-rearing costs for women mitigate the trade-off

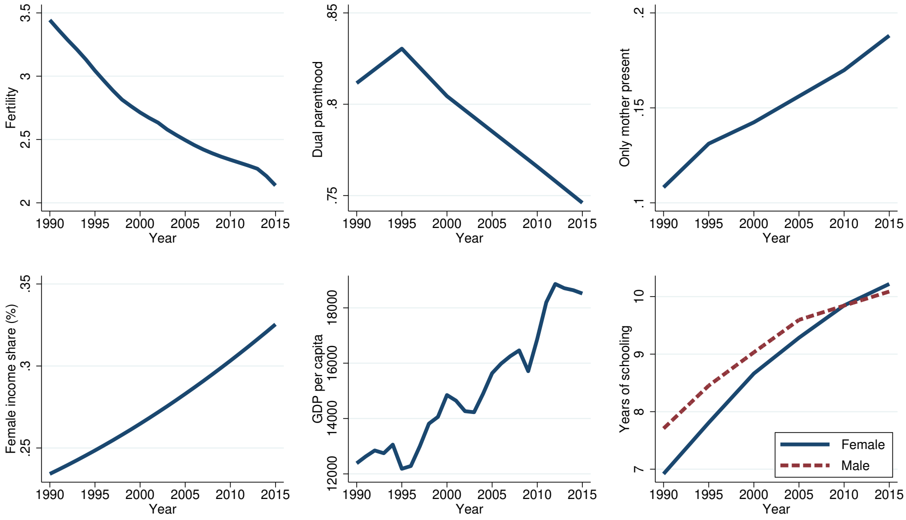
- One problem left: policy costs relative to GDP rise disproportionate as productivity grows

Quantitative Analysis

Data and Variable Definition

- Choose Mexico due to (1) data availability, (2) dramatic fertility decline alongside economic growth, and (3) gender education gap reversal
- Assume that $\{w_t^{\female}, w_t^{\male}\}$ as the exogenous driving force
- Decompose wage trends into three components:
  - $\rightarrow$ $A_t = w_t^{\male}$: gender-neutral productivity
  - $\rightarrow$ Γ_t^h: gender gap in human capital
  - $\rightarrow$ $B_t = \frac{w_t^{\male}/w_t^{\female}}{\Gamma_t^h}$: gender-biased productivity

Mexico's Transition



Calibration Strategy

1. Fix $\chi = 0.075$ (de La Croix and Doepke 2003)

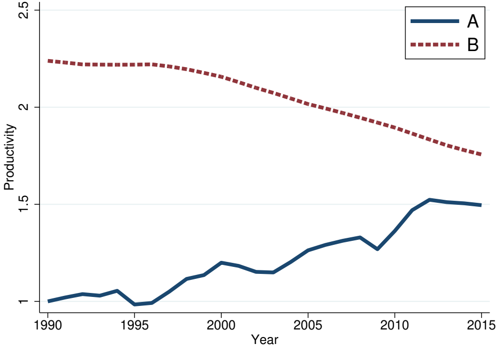
2. Compute Γ_t^h using years of schooling and Mincerian returns and back out $\{A_t, B_t\}$ from average income and female income share

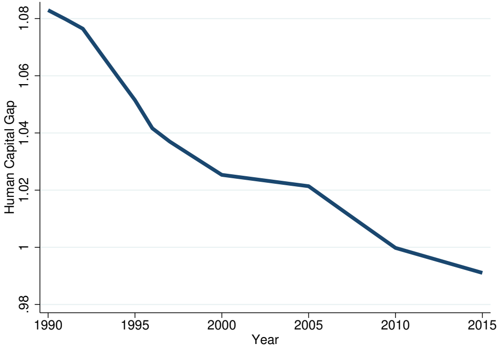
3. Jointly calibrate the remaining parameters

$$\underbrace{\beta = 0.104}_{n \text{ weight}}, \quad \underbrace{\rho = 1.5}_{c\text{-}n \text{ substitutability}}, \quad \underbrace{\lambda = 1.03}_{\text{psychic benefit}}, \quad \underbrace{\theta = 3.4}_{\text{shock dispersion}}$$

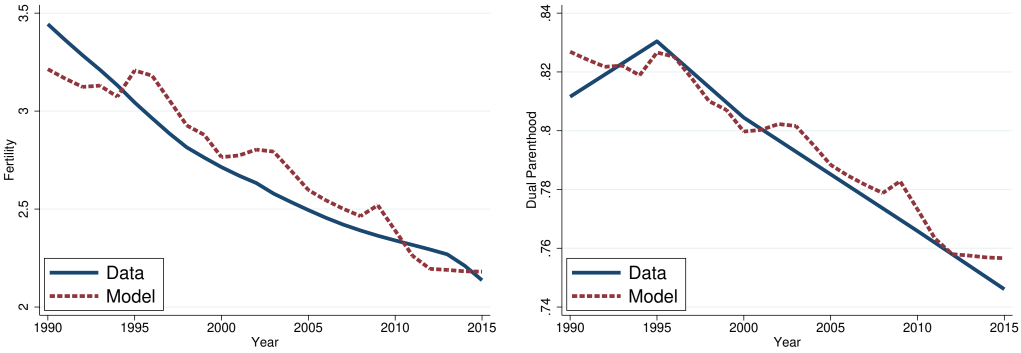
to fit trends in fertility and dual parenthood

Calibration Results (1)

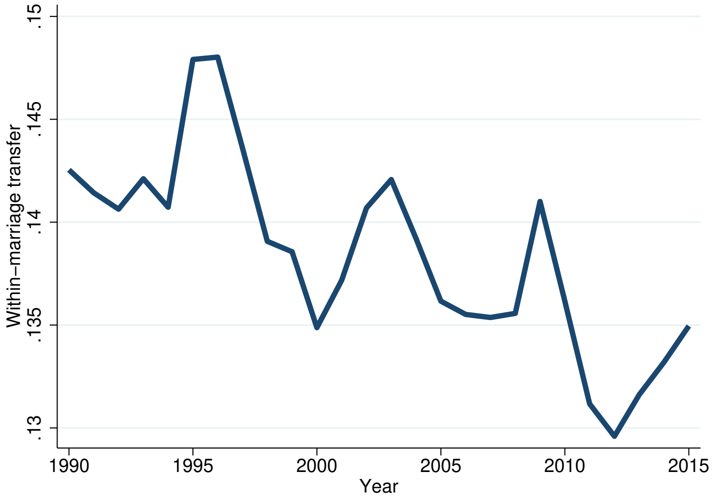




Calibration Results (2)

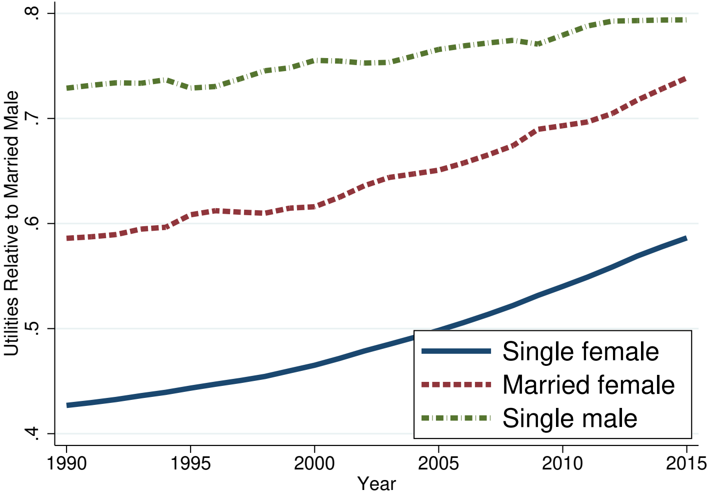


Within-Marriage Transfers

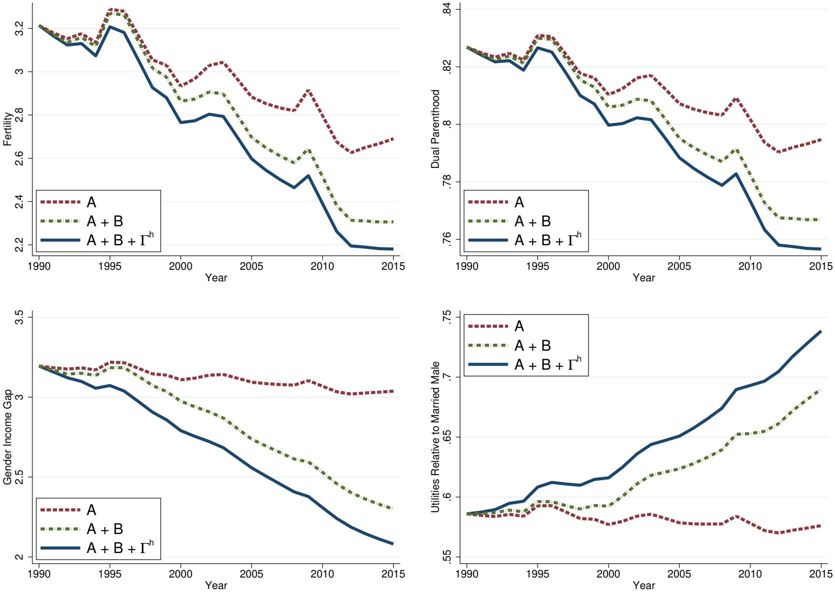


- Smaller decline in α_t relative to n_t^m because Γ_t^w falls

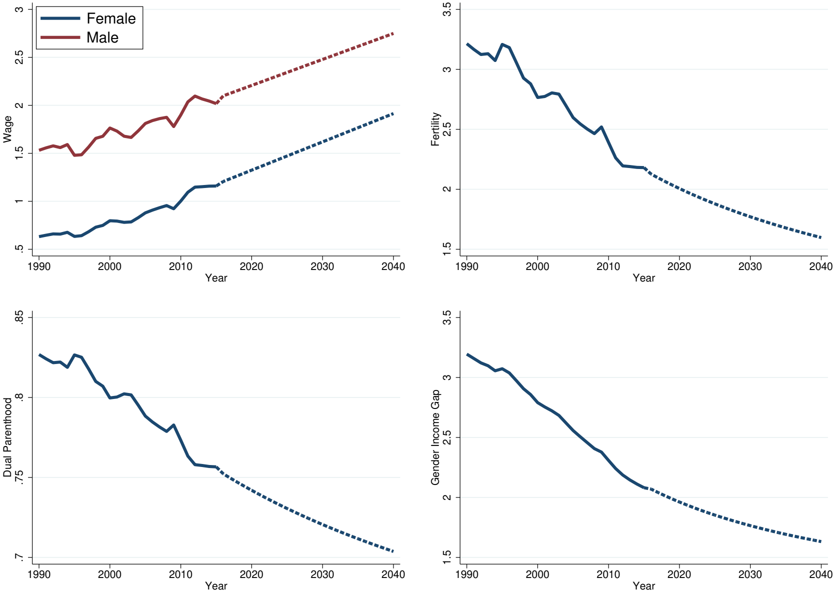
Relative Utilities



Decomposition



Model-Based Prediction



Dynamic Extension

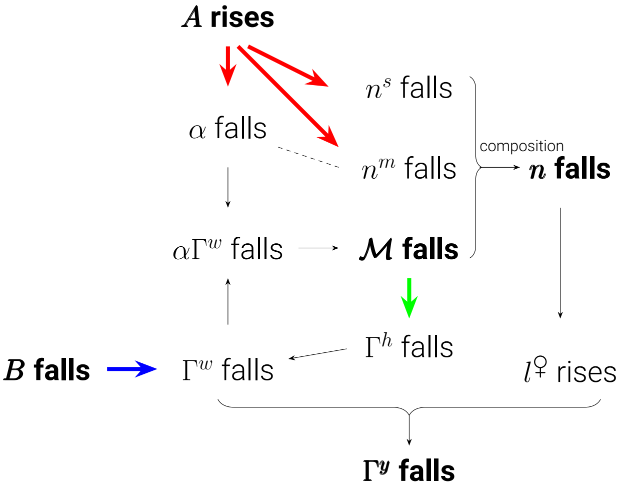
Endogenous Gender Human Capital Gap

- Assume that gender human capital gap depends on marriage

$$\Gamma_{t+1}^{h} = \mathcal{H}(\mathcal{M}_t) \qquad \text{where } \mathcal{H}'(\mathcal{M}_t) < 0. \tag{18}$$

- Motivated by Bertrand and Pan (2013), Autor et al. (2019, 2023), Wasserman (2020), Reeves (2022), Frimmel et al. (2024)
- "The evidence supports an emerging consensus that growing up in a family without biological married parents produces more adverse consequences for boys than for girls." — Wasserman (2020)

Dynamic Mechanism



Two exogenous forces and one propagation mechanism

Conclusion

- A three-way trade-off between fertility, marriage, and gender equality
- A unified framework to explain the empirical pattern
- Family policies offer a way out, but are getting costlier
- Quantitative analysis of Mexico's transition path
- Dynamic propagation through human capital formation