

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 gap
- Gendered impacts of single parenthood result in dynamic propagation

Roadmap

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

Motivating Facts

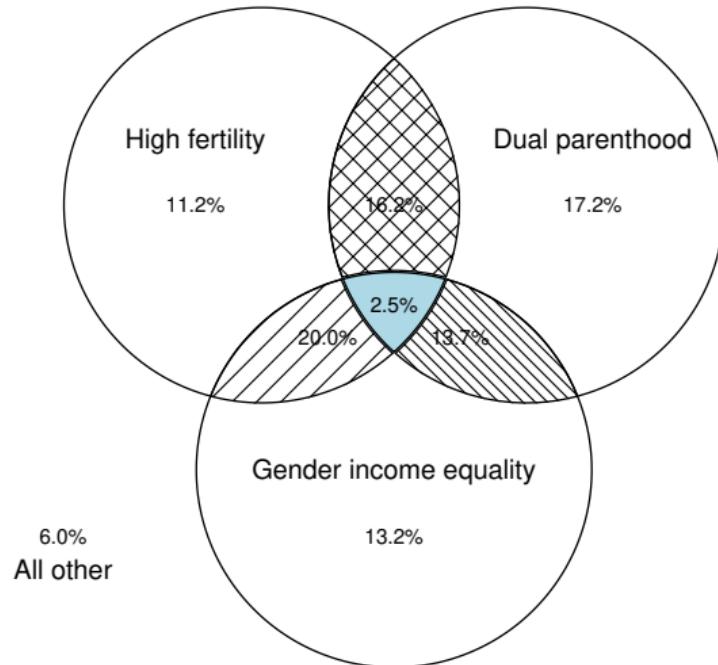
Data Source

- **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)

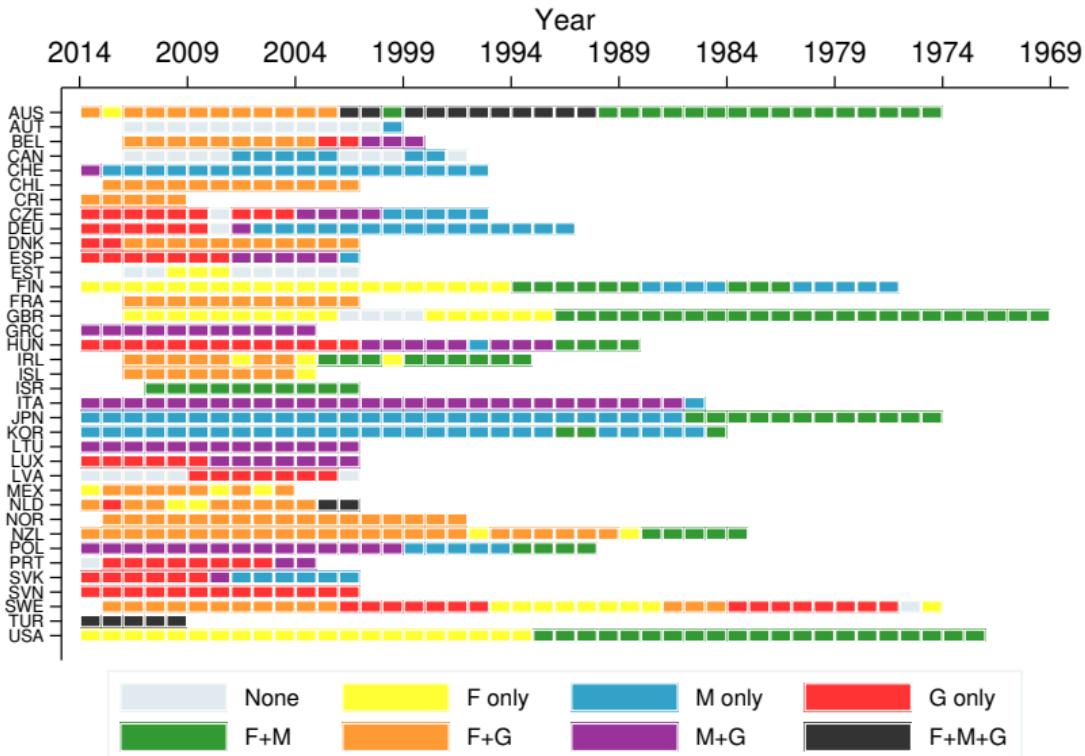
Quantifying the Trade-Off

- Motivated by the **dartboard approach** (Ellison and Glaeser 1997), assign values to dummy variables
 - High fertility
 - Dual parenthood
 - Gender income equality
- according to sample medians
- Visualize the intersections using Venn diagrams
- The random benchmark of the intersection is $0.5 \times 0.5 \times 0.5 = 12.5\%$

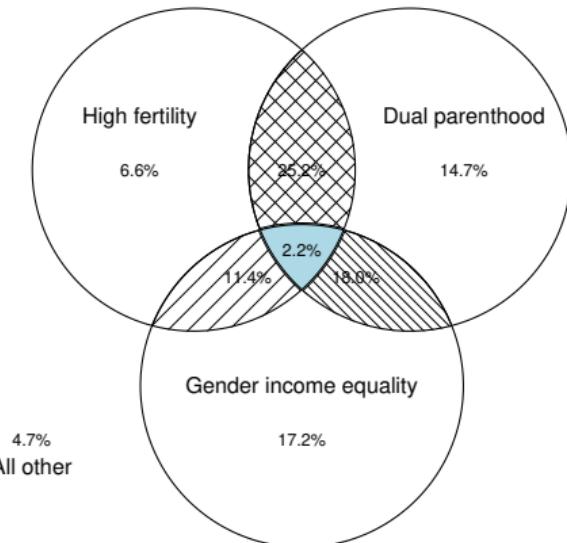
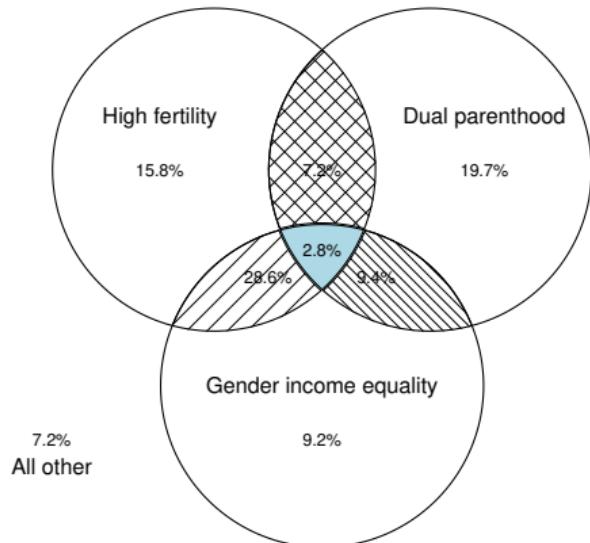
OECD Sample



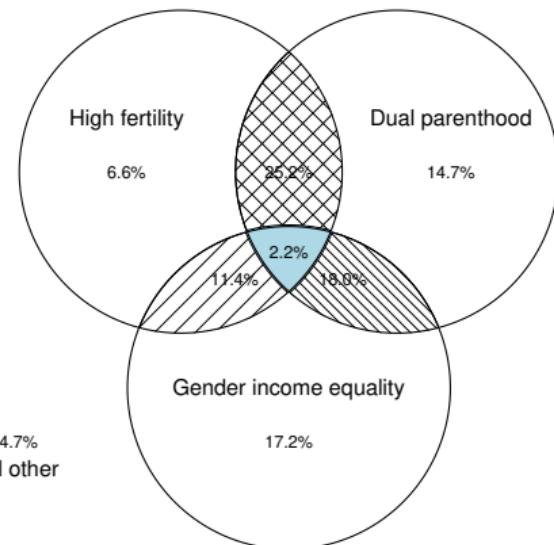
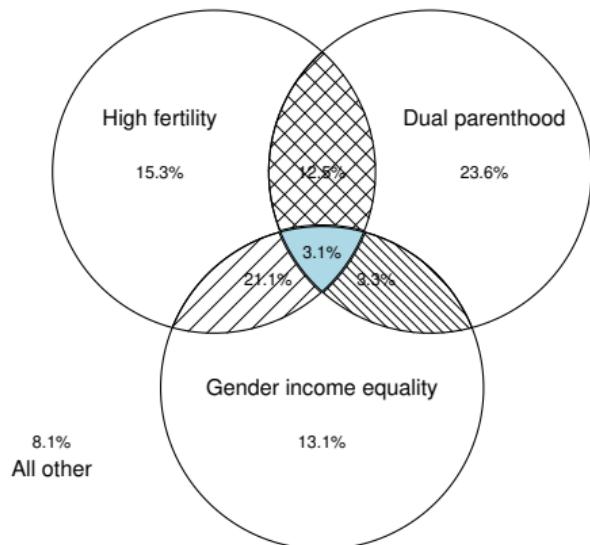
OECD Sample



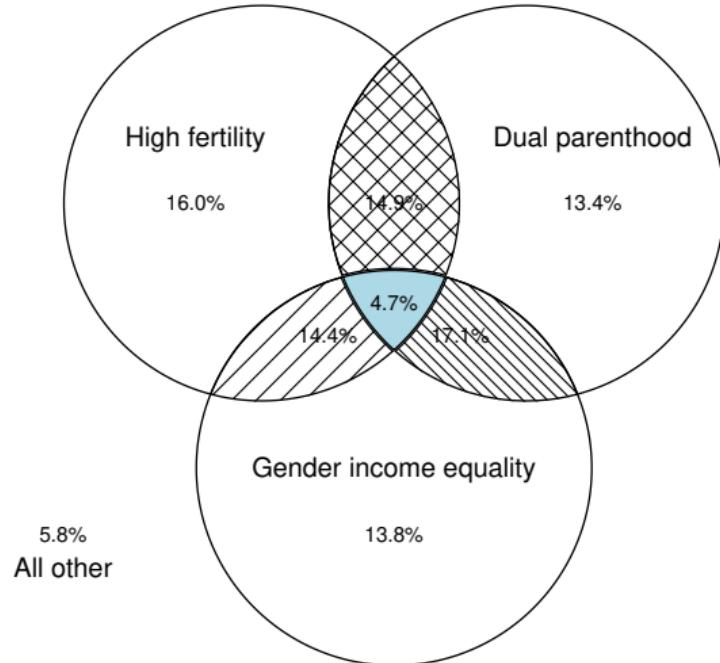
OECD Sample by Income



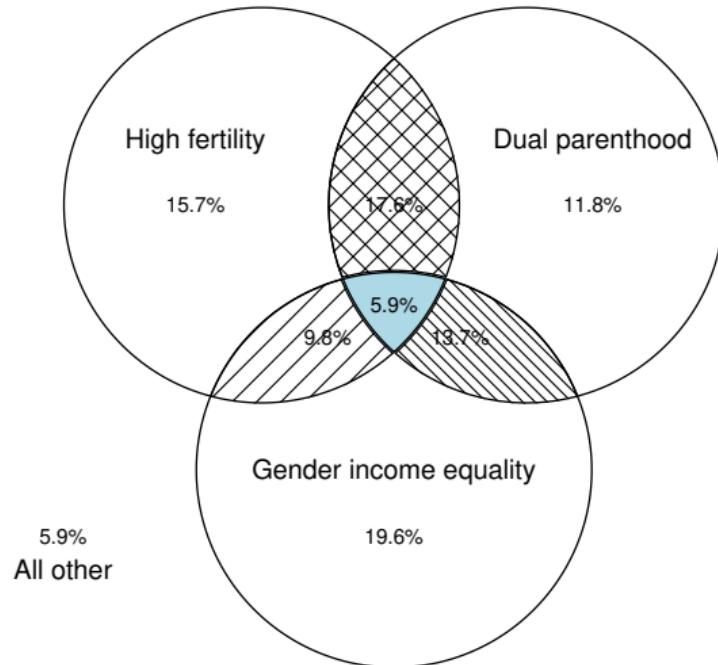
OECD Sample by Education



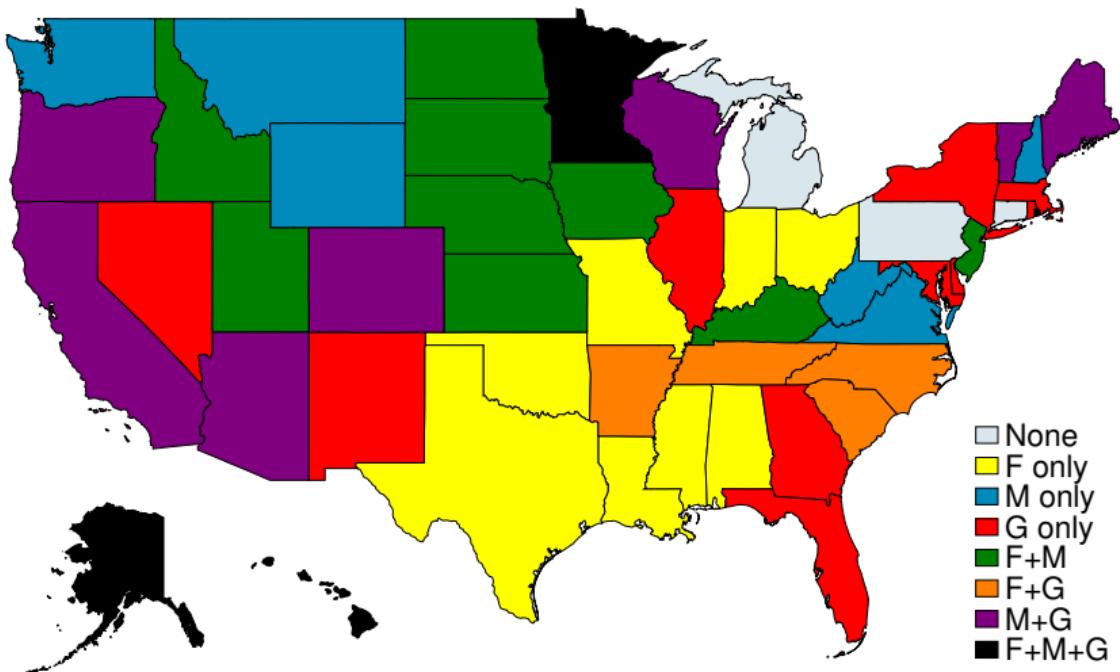
World Sample



U.S. Sample



U.S. Sample



Model

Basic setup

- Individual of equal mass with gender $g \in \{\sigma, \varphi\}$ and preference

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

where $\rho > 1$ so that $u(c, 0)$ is well-defined

- Homogeneous wage within gender w^σ and w^φ
- Wage gap is defined as

$$\Gamma^w = \frac{w^\sigma}{w^\varphi} \quad (2)$$

Marriage and Fertility – Men

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

$$V^{\vec{\sigma}, s} = u(w^{\vec{\sigma}}, 0) \quad (3)$$

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

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

- 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

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

subject to budget and time constraints

$$c^{\Omega,s} = w^{\Omega} l^s \quad l^s = 1 - \chi n^s$$

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

Marriage and Fertility – Married Women

- Wives need to balance fertility and consumption

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

subject to budget and time constraints

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

- Within marriage, fertility is subject to veto \implies 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

$$\mathcal{M}^\sigma = \frac{1}{1 + (V^{\sigma,s}/V^{\sigma,m})^\theta}, \quad \mathcal{M}^\Omega = \frac{1}{1 + (V^{\Omega,s}/V^{\Omega,m})^\theta}. \quad (7)$$

- Equilibrium requires

$$\mathcal{M}^\sigma = \mathcal{M}^\Omega = \mathcal{M}, \quad (8)$$

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

Aggregate Quantities

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

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

$$\mathcal{D} = \frac{\mathcal{M} \cdot n^m}{n} \quad (10)$$

- Average hours worked per female is

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

- Gender income gap

$$\Gamma^y = \frac{y^\sigma}{y^\varnothing} = \frac{\Gamma^w}{l^\varnothing} \quad (12)$$

Marriage Market

- Men are homogeneous and are on the long side of the marriage market
- Transfer α makes males indifferent between single and marriage

$$V^{\sigma^*, m} = u((1 - \alpha)Ah^{\sigma^*}, n^m) = u(Ah^{\sigma^*}, 0) = V^{\sigma^*, s} \implies \alpha(n^m) \quad (13)$$

- On the other hand, n^m is a function of α from married women's utility maximization $\implies n^m(\alpha)$
- The marriage market equilibrium is characterized by a **fixed-point problem** of (α, n^m)

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 :

$$\alpha = 1 - \left[\left(\left(\frac{\mathcal{M}}{1-\mathcal{M}} \right)^{\frac{1}{\theta}} \cdot \frac{1}{\lambda} \right)^{\frac{\rho-1}{\rho}} - \frac{\beta}{1-\beta} \cdot \left(\frac{n^m}{w^\sigma} \right)^{\frac{\rho-1}{\rho}} \right]^{\frac{\rho}{\rho-1}} \quad (14)$$

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

- The FOC for married women determines n^m as a function of α :

$$n^m \cdot \left[\left(\frac{(1-\beta)\chi}{\beta} \right)^\rho \cdot (w^\varphi)^{\rho-1} + \chi \right] = 1 + \alpha \Gamma^w \quad (15)$$

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

Equilibrium Characterization

- Lemma 1: For any wage pair $\{w^\sigma, w^\varphi\}$, 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

$$\mathcal{M} = \frac{(\lambda \cdot (1 + \alpha \Gamma^w))^\theta}{1 + (\lambda \cdot (1 + \alpha \Gamma^w))^\theta}, \quad (16)$$

$$\Gamma^y = \frac{\Gamma^w}{l^\varphi}, \quad (17)$$

$$l^\varphi = 1 - \chi n. \quad (18)$$

Three-Way Trade-Off

1. High fertility and high dual-parenthood

High n implies low l^{Ω} . To sustain high \mathcal{M} , Γ^w must be sufficiently large. Thus, Γ^y is necessarily high

2. High fertility and gender income equality

High n again implies low l^{Ω} . 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^{Ω} must be high. Thus, fertility n is low

Any Way Out?

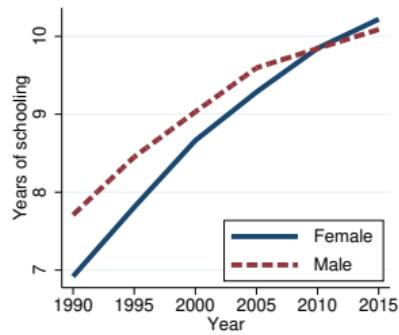
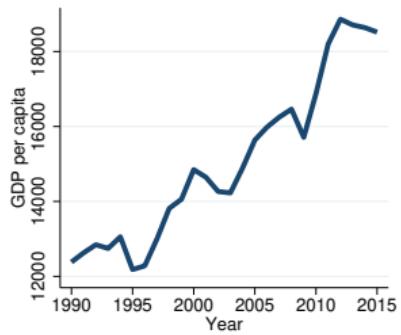
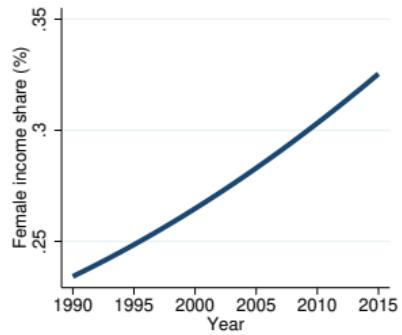
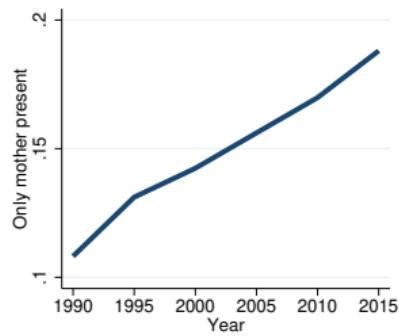
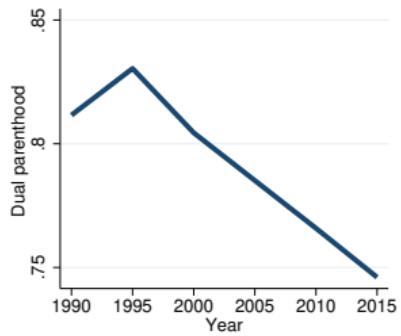
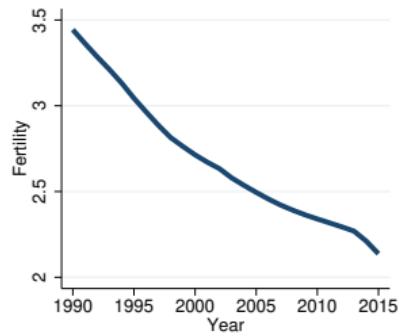
- Policy effects
 1. Pro-marriage policies (higher λ) \implies Higher \mathcal{M} , higher n , but also greater Γ^y
 2. Pro-equity policies (lower w^{Ω}) \implies Achieve lower Γ^y , but lower \mathcal{M} and n
 3. Pro-fertility policies (lower χ) \implies Higher \mathcal{M} , higher n , but reduces 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 $\{w_t^{\text{♀}}, w_t^{\text{♂}}\}$ as the exogenous driving force
- Decompose wage trends into three components:
 - $A_t = w_t^{\text{♂}}$: gender-neutral productivity
 - Γ_t^h : gender gap in human capital
 - $B_t = \frac{w_t^{\text{♂}}/w_t^{\text{♀}}}{\Gamma_t^h}$: gender-biased productivity

Mexico's Transition



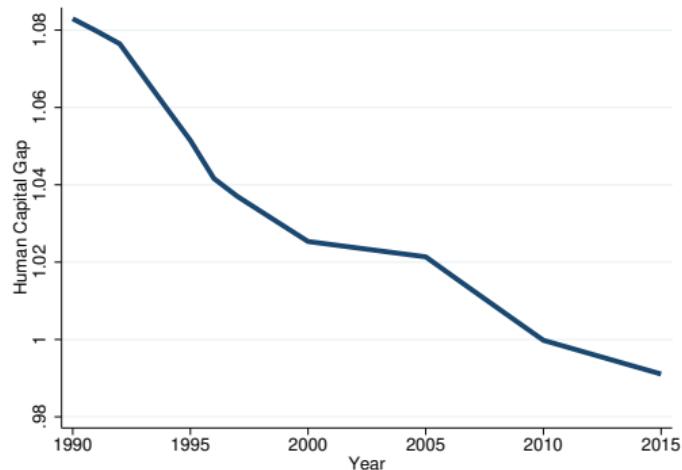
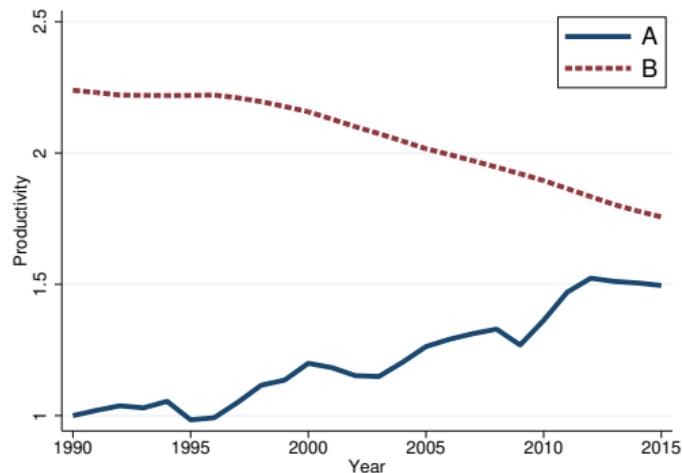
Calibration Strategy

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

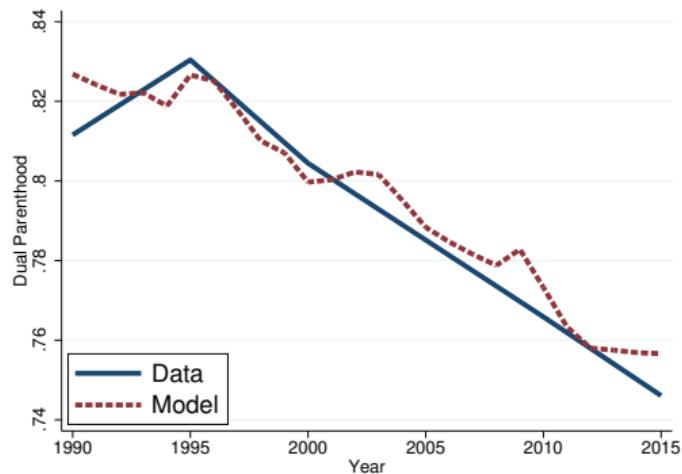
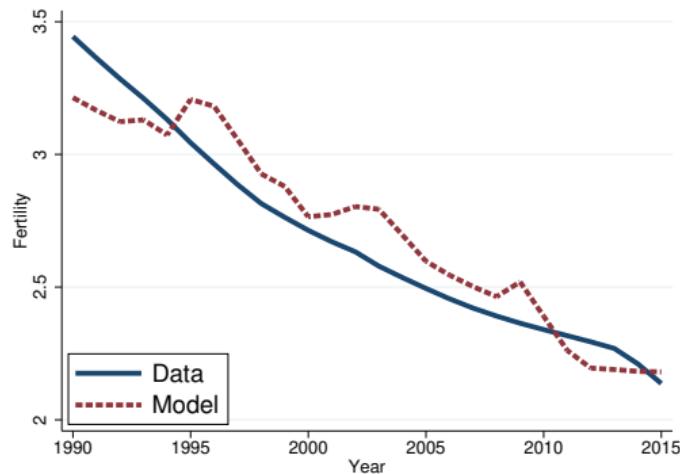
$$\underbrace{\beta = 0.104}_{n \text{ weight}}, \quad \underbrace{\rho = 1.5}_{c-n \text{ substitutability}}, \quad \underbrace{\lambda = 1.03}_{\text{psychic benefit}}, \quad \underbrace{\theta = 3.4}_{\text{shock dispersion}}$$

to fit trends in fertility and dual parenthood

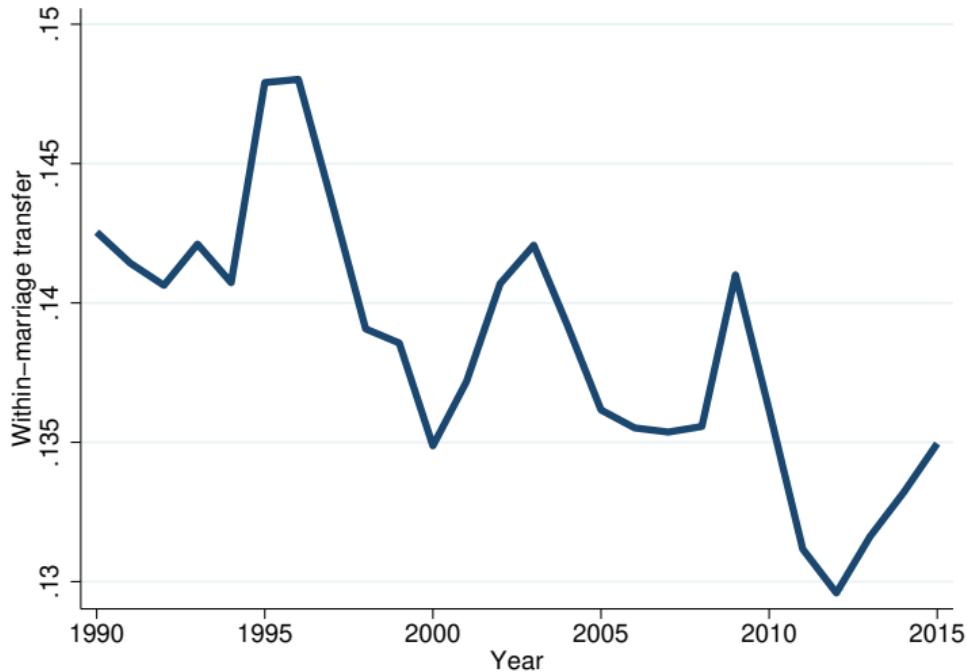
Calibration Results (1)



Calibration Results (2)

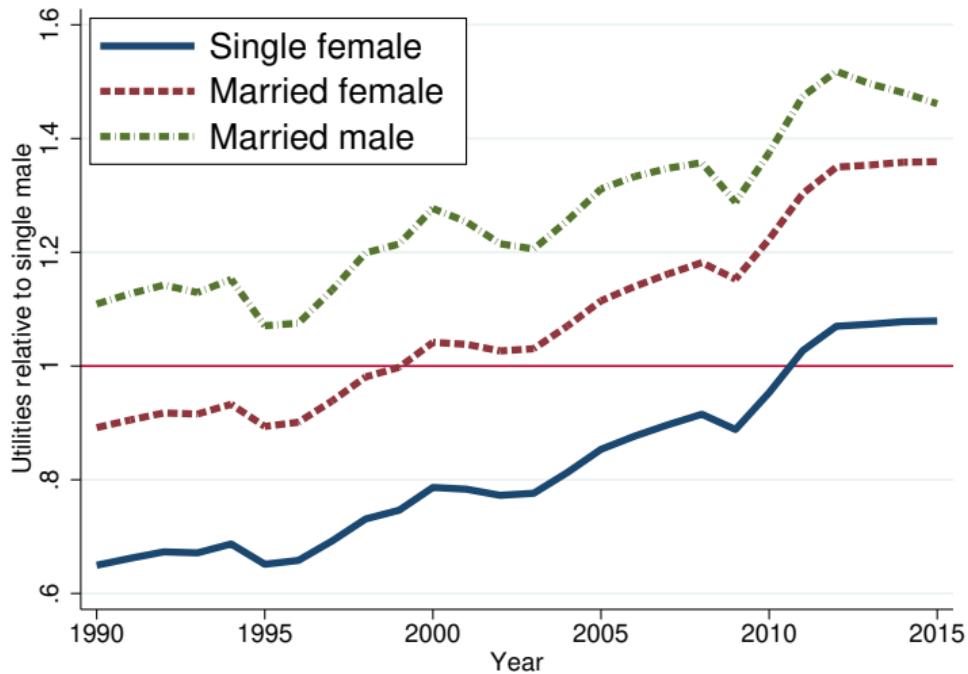


Within-Marriage Transfers



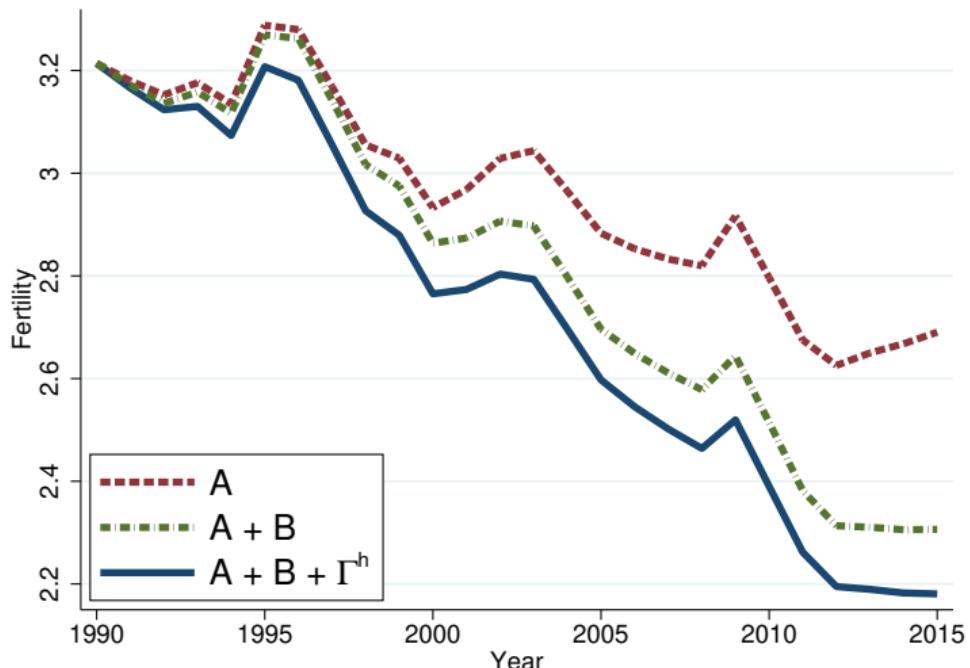
- Smaller decline in α_t relative to n_t^m because Γ_t^w falls

Relative Utilities

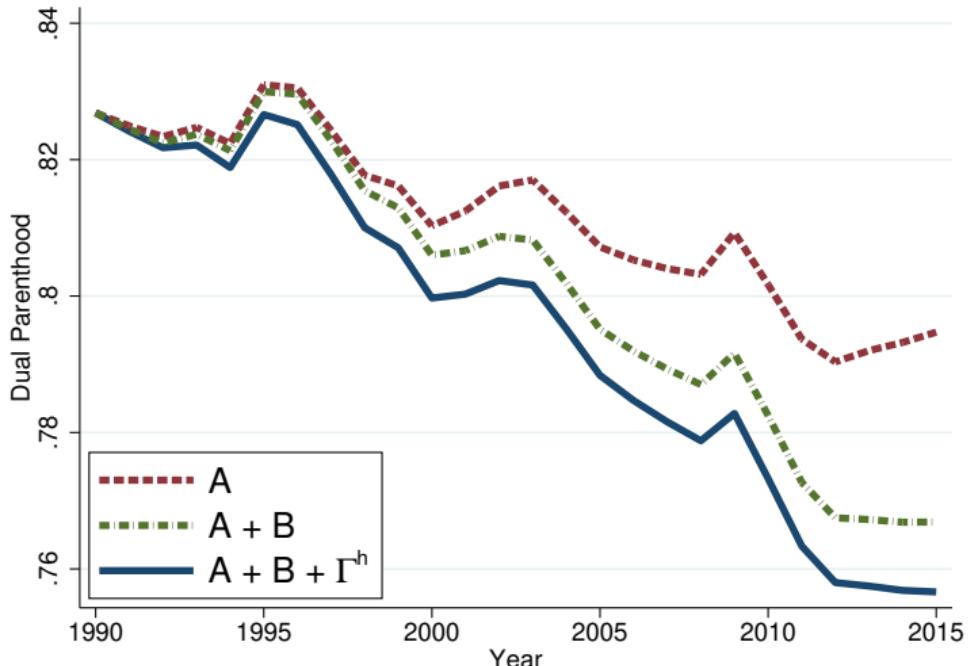


- Changing utility ordering and converging spousal gap

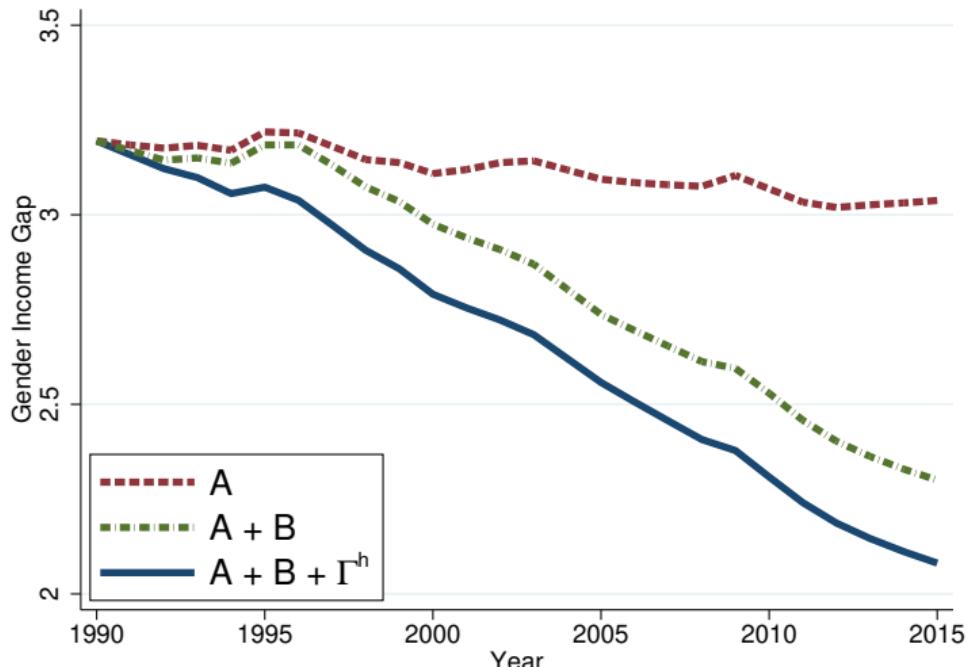
Decomposition - Fertility



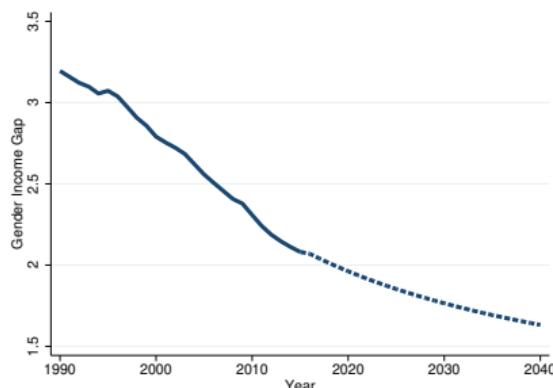
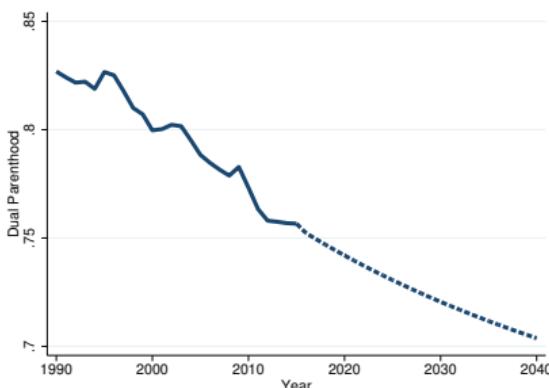
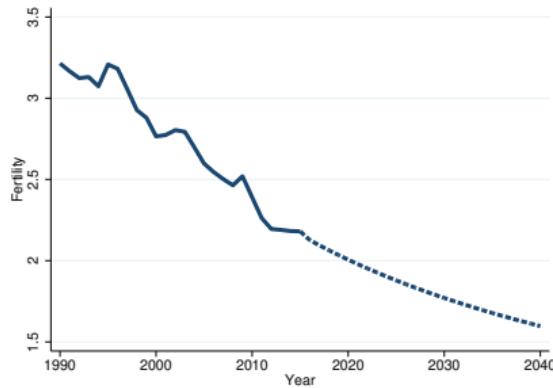
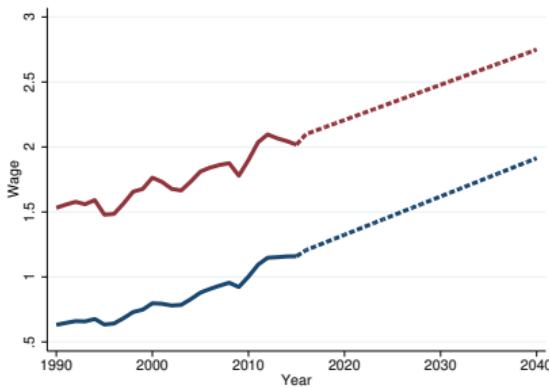
Decomposition - Family Structure



Decomposition - Gender Income Gap



Model-Based Prediction



Dynamic Extension

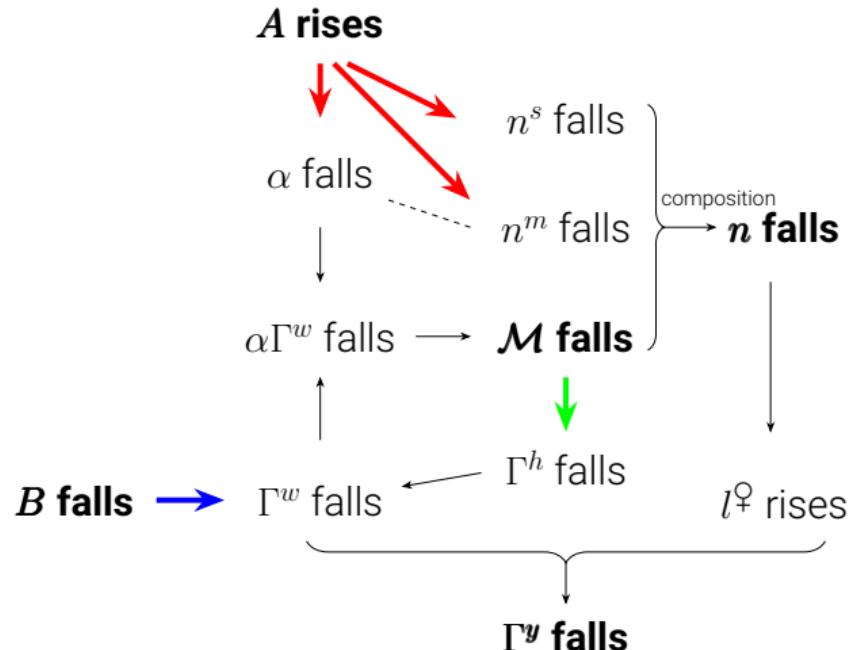
Endogenous Gender Human Capital Gap

- Assume that gender human capital gap depends on marriage

$$\frac{\Gamma_{t+1}^h}{\Gamma_t^h} = (\mathcal{M}_t)^\psi, \quad \psi < 0. \quad (19)$$

- 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