The Fertility, Marriage, and Gender Equality Trade-Off

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November 2025

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Abstract

This paper studies the interplay among fertility, family structure, and the gender income equality. Motivated by the dartboard approach in Ellison and Glaeser (1997), I identify a novel three-way trade-off in the data: simultaneously achieving high fertility, low single parenthood, and gender income equality is challenging at all levels of economic development. To explain this fact, I develop a unified model, building on the structure of Choo and Siow (2006), where the trade-off endogenously arises in equilibrium. Among various policy instruments, I show that reducing women's child-rearing costs stands out as the unique policy that could mitigate the trade-off, but the costs grow as productivity increases. Calibrating the model to Mexico's transition path as a proof of concept, I find that gender-neutral technological progress explains half of rising single parenthood and declining fertility, while gender-biased productivity growth and the gender education gap reversal account for the narrowing gender income gap.

JEL classification: D13, J11, J12, J13, J16
Keywords: Gender equality, family structure, fertility

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1. Introduction

For millennia, patriarchal structures shaped human societies. In recent decades, however, they have begun to erode, giving way to greater gender egalitarianism. Three profound and interconnected trends define this shift: fertility rates have fallen sharply, marriage and stable dual-parent families have become less common, and gender gaps in education and income have steadily narrowed—a transformation known as the "grand gender convergence" (Goldin, 2014).

While each of these developments has been studied extensively in isolation, their deep interdependence has received little attention. This paper bridges that gap by uncovering a fundamental trade-off and building a unified framework that explains how fertility, family structure, and gender income equality jointly evolve—and why policies targeting individual outcome often pull in opposing directions.

I start with the data. Using large, harmonized datasets covering OECD countries over four decades, I document a novel empirical pattern: very few countries at any time achieve high fertility, widespread dual-parent families, and strong gender income equality simultaneously. The overlap is only a small fraction of what random chance would predict, rejecting the random benchmark following the dartboard approach (Ellison and Glaeser, 1997). This scarcity holds across rich and poor countries and high- and low-education settings. I confirm the robustness of this finding under different measurements of family structure and gender income gaps using a global panel of 95 nations from 1990 to 2015 and state-level data from the United States in 2023.

To explain this empirical pattern, I develop a model in which men and women meet in a marriage market, building on the insights of Becker (1973) and the structure of Choo and Siow (2006). Men face a choice between remaining single (and childless) or entering marriage, where they allocate a portion of their income to wives' consumption and child-rearing. Women, conversely, may opt for single motherhood or raise children within a marital union. Motivated by the empirical regularity that women bear most childcare responsibilities, fertility decisions within married households are subject to wives' veto.

I characterize the model by demonstrating three key equilibrium outcomes: (1) individual optimization and marriage market clearing conditions jointly determine the equilibrium fertility rate and within-household income transfers; (2) the prevalence of dual parenthood depends on the level of within-household income transfers and the gender gap in human capital; and (3) the gender income gap is shaped by both the gender gap in human capital and the endogenous labor supply decisions of women.

The model connects marriage, fertility, and gender income gaps through two simple yet intuitive mechanisms. First, marriage and fertility are intertwined, as within-family transfers and marital fertility serve as a two-dimensional price vector to clear the marriage market—an extension of the one-dimensional case in Choo and Siow (2006). Second, fertility affects gender income gaps because women shoulder the bulk of the childcare burden, so higher fertility reduces female labor supply.

The equilibrium conditions of the model characterizes a fundamental tension in family and gender economics: there exists a trade-off among high fertility, prevalent dual parenthood, and gender income equality, such that achieving any two of these outcomes often comes at the expense of the third. For example, pro-marriage policies, such as joint taxation, boost marriage and fertility but result in larger gender income gaps. Gender equality measures, such as pay equity laws, raise women's earnings and labor supply but reduce both marriage and fertility. I find that policies that ease women's childcare burden—such as widely available, high-quality childcare—are the unique policy instruments to mitigate the tension. But even then, their cost disproportionately relative to GDP as wages rise, making them harder to sustain as economies grow.

As a proof of concept, I calibrate the model to Mexico's transformation from 1990 to 2015—a period of rapid income growth, plunging fertility, rising single motherhood, and a complete reversal of the gender education gap. The model matches these trends closely. Decomposition results show that gender-neutral productivity growth explains half of the decline in fertility and dual parenthood, while convergence in education and declining gender bias in labor markets drive most of the progress in gender income equality. When used to predict future outcomes through 2040, the model forecasts further declines in both fertility and dual-parent families alongside continued gender income convergence.

Lastly, I examine the grand gender convergence by extending the model with intergenerational evolution of the gender human capital gap. I integrate an important result from recent empirical literature: relative to dual parenthood, boys from single-parent families fare worse than girls. This finding underscores that shifts in family structures have far-reaching implications for future gender disparities in human capital, which in turn shape descendants' marriage rates, fertility decisions, and female labor market outcomes.

In the dynamic model, the co-evolution of fertility, marriage, and gender income gaps—is driven by two exogenous forces and one propagation mechanism. First, gender-neutral technological progress increases the opportunity cost of child-rearing and thus reduces fertility. The model further shows that this decline in fertility leads to lower within-household income transfers and declining marriage rates. Second, gender-biased technological progress reduces the economic gains of marriage from women's perspective, leading to lower equilibrium marriage and fertility rates. Third, the rise in single parenthood and the narrowing of gender gaps in human capital create a self-reinforcing feedback loop across generations, amplifying the direct effect of technological progress—a new mechanism consistent with the empirically documented reversal of the gender education gap.

In sum, this paper delivers a unified view of three defining trends of our time. Fertility, family structure, and gender equality are not independent policy objectives. They are tightly linked through women's time, men's incentives, and the logic of the marriage market. Policymakers who ignore these connections risk unintended consequences. Some combinations of social progress may simply be out of reach—not due to politics or culture alone, but because of deep economic constraints.

Related Literature

This paper contributes to the literature on macro and labor economics, which has extensively documented long-run declines in fertility, marriage, and gender inequality.[1] It advances the field in three ways.

First, whereas prior work typically studies one or two outcomes in isolation (e.g., fertility and gender gaps in Galor and Weil 1996; marriage and fertility in Regalia and Rios-Rull 2001; Baudin et al. 2020; or gender gaps and technology in Greenwood et al. 2016; Ngai and Petrongolo 2017), this paper documents a novel three-way trade-off and develops a unified framework, revealing their structural tensions.

Second, I show that gender-neutral technological progress alone can drive the joint decline in fertility, marriage, and gender income gaps. This complements existing theories emphasizing biased technical change—such as skill-biased innovation favoring child quality (Galor and Weil, 2000), household appliance revolution and childcare marketi-

[1]See Greenwood et al. (2017) and Greenwood (2019) for comprehensive reviews; Delventhal et al. (2021) provide long-term data on fertility.

zation reducing the need for marital specialization (Greenwood et al., 2005b; Bar et al., 2018; Greenwood et al., 2023), or structural transformation shifting labor demand toward women (Galor and Weil, 1996; Cao et al., 2024).

Third, relative to quantitative models of demographic transition (e.g., Greenwood et al. 2023), I introduce a new intergenerational propagation mechanism: lower marriage rates widen future gender gaps in human capital because boys suffer more from absent fathers than girls do—a pattern robustly documented in micro studies (Bertrand and Pan, 2013; Autor et al., 2019; Wasserman, 2020; Reeves, 2022; Frimmel et al., 2024). This is the first paper to embed this asymmetry in a dynamic macro model, showing how family structure feeds back into gender inequality across generations.

The paper proceeds as follows. Section 2 presents the empirical evidence. Section 3 develops the static model. Section 4 calibrates the model and reports quantitative results. Section 5 introduces the dynamic extension. Section 6 concludes.

2. Motivating Facts

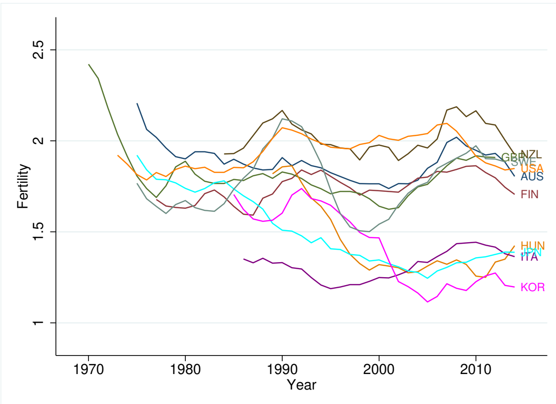
This section documents key empirical patterns in the relationship between fertility, family structure, and gender income gaps across multiple samples and measures, highlighting a fundamental trade-off among these three outcomes.

2.1 OECD Sample

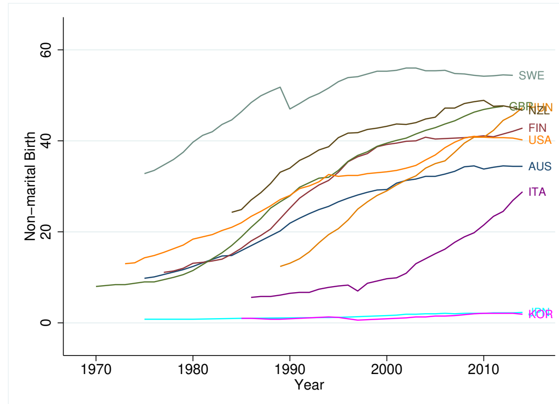
I construct an unbalanced panel of 37 OECD countries from 1970 to 2014, yielding 721 country-year observations. For each observation, I collect the total fertility rate, the share of children born out of wedlock, and the gender earnings gap—defined as the difference between men's and women's median earnings, divided by men's median earnings.

Figure 1 displays time-series trends in these variables for selected countries. Panel (a) shows that fertility rates have fallen below the replacement level of 2.1 children per woman in all sample countries. In some nations, fertility stabilizes between 1.5 and 2.0, while in others—particularly in East Asia and Southern Europe—it has dropped to ultra-low levels near 1.3. Panel (b) reveals a sharp increase in out-of-wedlock births in most countries (with East Asia as a notable exception); for example, more than 50% of births in

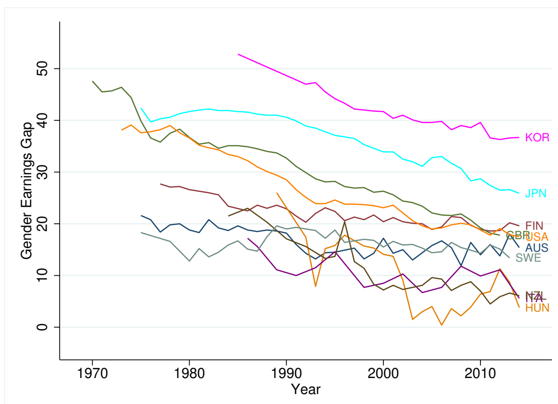
Sweden now occur outside marriage. Panel (c) documents a steady narrowing of gender earnings gaps over the past four decades, a pattern termed the “grand gender convergence” by Goldin (2014).



(a) Fertility



(b) Out-of-Wedlock Birth Share



(c) Gender Earnings Gap

Figure 1: Trends by Country

Notes: Time-series trends for selected OECD countries, 1970–2014. Fertility is the total fertility rate (children per woman). The out-of-wedlock birth share is the percentage of births to unmarried parents. The gender earnings gap is (men’s median earnings − women’s median earnings) / men’s median earnings.

To examine the joint distribution of these outcomes, I dichotomize each variable at its sample median, creating indicators for “high fertility” (total fertility rate > 1.69), “dual parenthood” (out-of-wedlock birth share $< 31.4\%$), and “gender earnings equality” (gender earnings gap $< 17.2\%$). This median-based approach ensures balanced categories and avoids arbitrary absolute thresholds that could bias the analysis.

Figure 2 presents a Venn diagram of these indicators. Under statistical independence, the overlap of all three would be $0.5 \times 0.5 \times 0.5 = 12.5\%$, i.e., the random benchmark in the dartboard approach (Ellison and Glaeser, 1997). In the data, however, fewer than 3% of observations achieve all three simultaneously—less than one-quarter of the independence benchmark—revealing a sharp trade-off among high fertility, dual parenthood, and gender earnings equality.

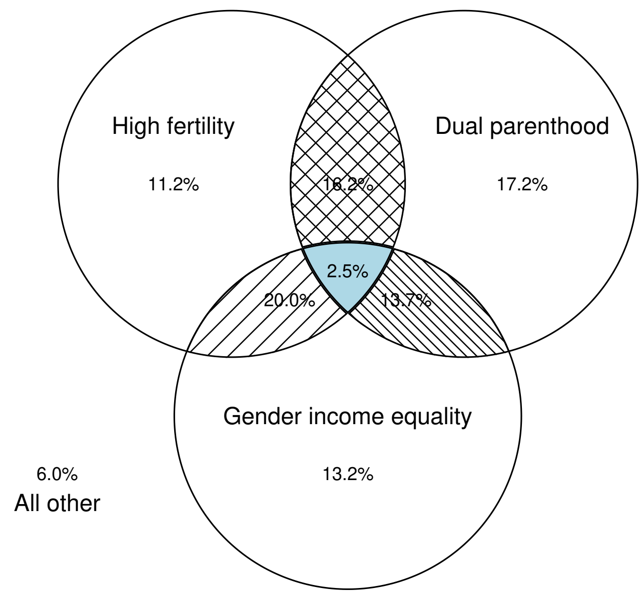


Figure 2: Trade-off Across Countries (OECD Sample)

Notes: Venn diagram of high fertility (total fertility rate > 1.69), dual parenthood (out-of-wedlock birth share $< 31.4\%$), and gender earnings equality (gender earnings gap $< 17.2\%$), each defined at sample medians. The sample includes 721 country-year observations from 37 OECD countries, 1970–2014.

Figure 3 traces countries' transitions across these categories over time, labeling high fertility (F), dual parenthood (M), and gender earnings equality (G), with three-letter ISO codes identifying countries. Many countries start with high fertility and dual parenthood but progressively sacrifice one or both to achieve greater gender equality.

To assess heterogeneity, I stratify the sample by income and human capital. I split countries at the median GDP per capita and at the median average years of schooling (Barro and Lee, 2013), redefining indicators using subsample medians in each case. Figure 4 shows that the trade-off persists across both high- and low-income groups and high- and low-human-capital groups.

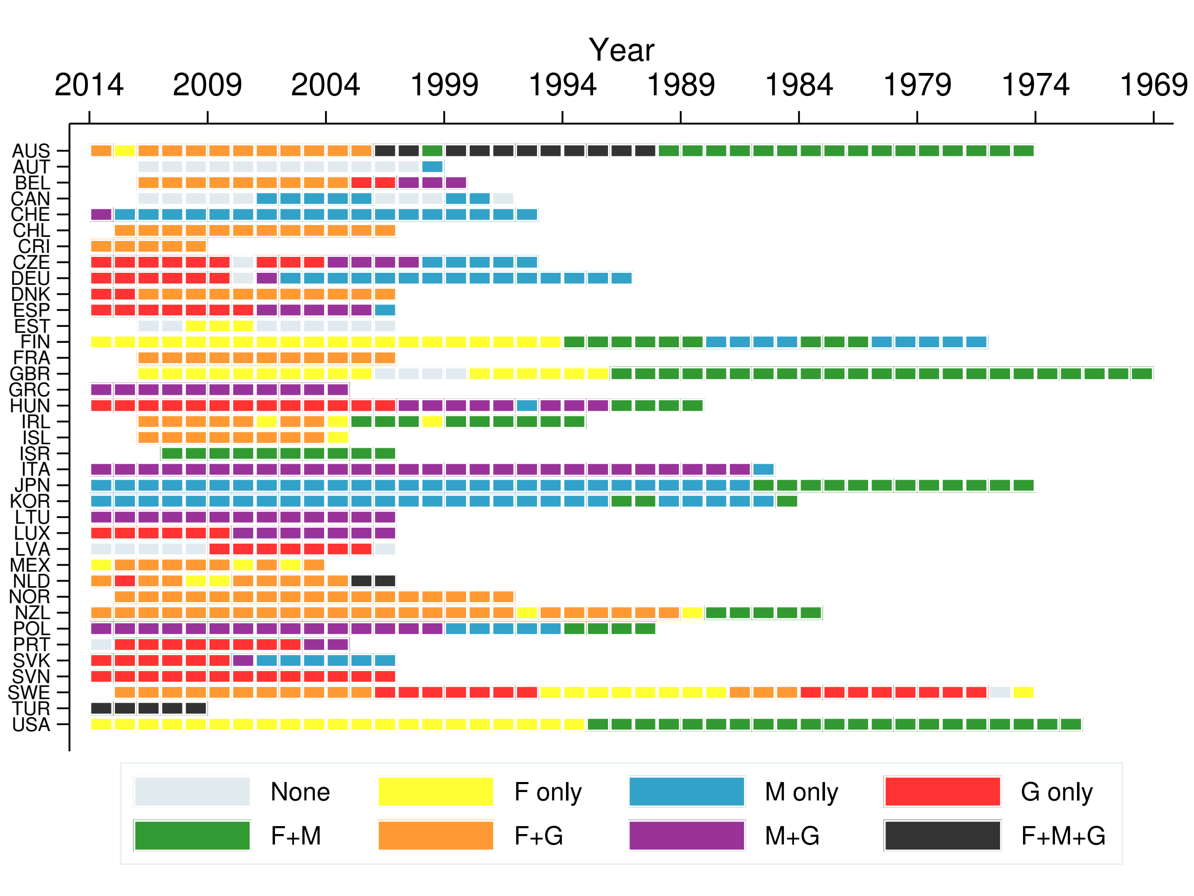


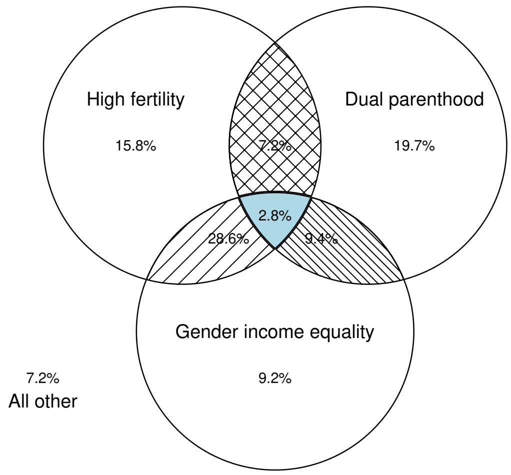
Figure 3: Transition Paths by Country (OECD Sample)

Notes: Temporal transitions in the three categories for each country (F = high fertility, M = dual parenthood, G = gender earnings equality). Countries are labeled by three-letter ISO codes. Data cover 37 OECD countries, 1970–2014.

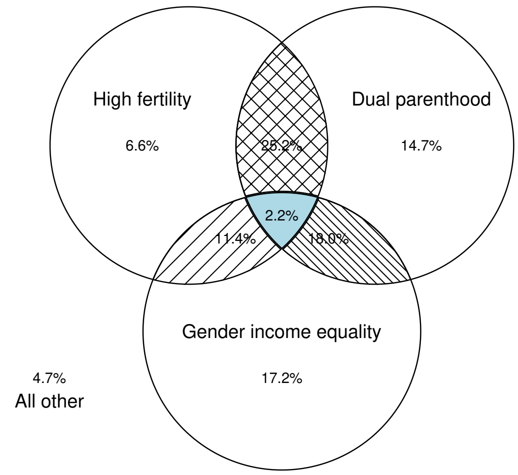
2.2 World Sample

The OECD analysis relies on measures that may imperfectly capture family structure and gender economic equality. Out-of-wedlock births do not necessarily imply absent fathers, as many children live in stable cohabiting unions. Moreover, the gender gap in median earnings among workers excludes differences in labor force participation, potentially understating disparities in total labor income.

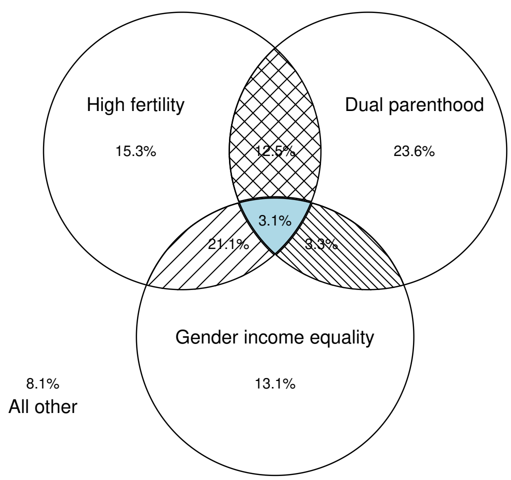
To address these limitations, I construct a global panel using improved indicators. First, I use direct measures of children's living arrangements from Brenøe and Wasserman (2025), who harmonize census data from IPUMS International. Their dataset covers 95 countries—representing 85% of the global population—from 1990 to 2019 and reports,



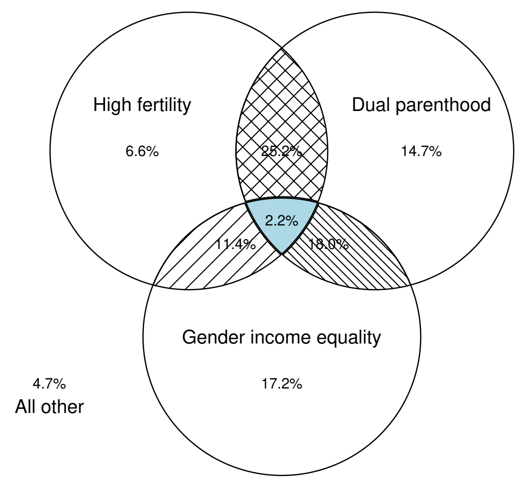
(a) High GDP per Capita



(b) Low GDP per Capita



(c) High Years of Schooling



(d) Low Years of Schooling

Figure 4: Trade-off by Income and Human Capital Levels (OECD Sample)

Notes: Venn diagram analysis for subsamples split at median GDP per capita (top row) and median average years of schooling from Barro and Lee (2013) (bottom row). Indicators are redefined at subsample medians in each case. Data from 37 OECD countries, 1970–2014.

for each country-year, the share of children living with both biological parents, mother only, father only, or neither.

Second, I use the female labor income share ("femincshare") from the World Inequality

Database (Chancel et al., 2022), which measures the proportion of aggregate labor income (wages, salaries, and other work-related earnings, excluding capital income) accruing to women. This variable, expressed as a percentage, is constructed using distributional national accounts that combine household surveys, tax records, and national accounts for over 180 countries since 1990.

Merging these sources with United Nations fertility data yields a panel of 95 countries from 1990 to 2015 with 1,130 observations. This dataset provides broader coverage of development stages than the OECD sample, at the cost of a shorter time span.

I dichotomize each outcome at its sample median: "high fertility" (total fertility rate > 2.81), "dual parenthood" (share of children living with both parents $> 75.9\%$), and "gender income equality" (female labor income share $> 32.3\%$). This ensures balanced categories and facilitates analysis of joint attainment.

Figure 5 presents a Venn diagram of these indicators. Consistent with the OECD evidence, fewer than 5% of observations achieve all three outcomes—less than 40% of the 12.5% expected under independence—confirming a global trade-off among the three objectives.

Stratifying by median GDP per capita and median average years of schooling and redefining indicators within each subsample, Figure 6 confirms that the trade-off persists across both dimensions of development.

Finally, Figure A.1 in the Appendix traces transition paths for all countries in the World sample, revealing widespread movement away from high fertility and dual parenthood toward greater gender income equality.

2.3 U.S. Sample

I now examine whether the trade-off persists in a more homogeneous institutional, cultural, and economic setting by analyzing variation across U.S. states in 2023.

For each state (including the District of Columbia), I construct the following measures. First, I compute the share of children living with a single mother as a fraction of households with children under 18, using 2023 American Community Survey (ACS) data. State-level fertility is measured as live births per 1,000 women aged 15–44, from CDC Natality files. Gender earnings equality is assessed via the gender gap in median earnings

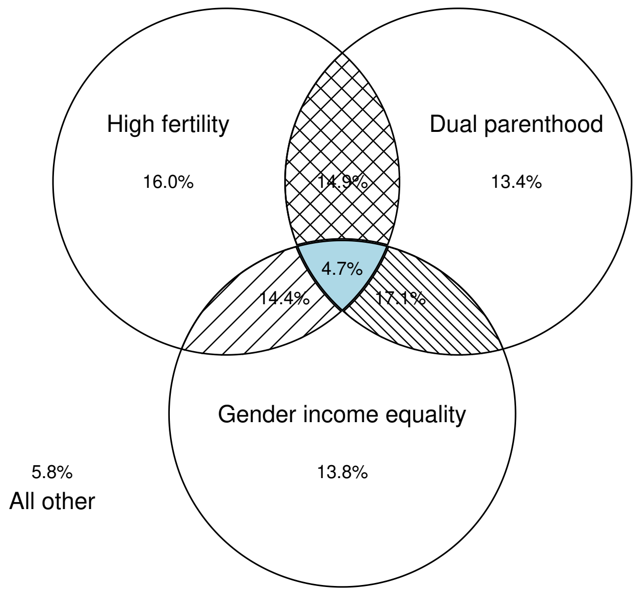


Figure 5: Trade-off Across Countries (World Sample)

Notes: Venn diagram of high fertility (total fertility rate > 2.81), dual parenthood (share of children living with both parents > 75.9%), and gender income equality (female labor income share > 32.3%), each defined at sample medians. The sample includes 1,130 country-year observations from 95 countries, 1990–2015. Data sources: Brenøe and Wasserman (2025) for living arrangements, World Inequality Database for female labor income share, United Nations for fertility.

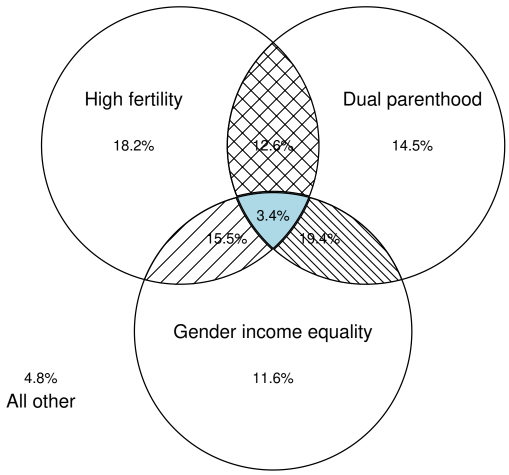
among individuals aged 16 and over, also from the ACS.

I dichotomize each outcome at its cross-state median: "high fertility" (births per 1,000 women aged 15–44 > 56.9), "dual parenthood" (single-mother household share < 17%), and "gender earnings equality" (gender earnings gap < 25.6%).

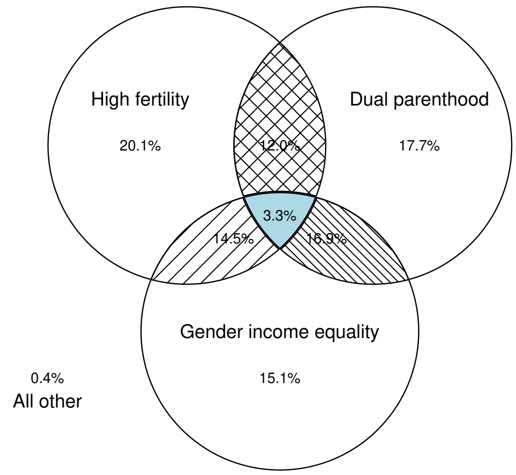
Figure 7 presents the Venn diagram for the 51 jurisdictions. Strikingly, only three achieve all three outcomes—less than 6% of the sample and far below the 12.5% expected under independence—demonstrating that the trade-off remains sharp even within a single country.

Figure 8 maps joint attainment by state. The three states achieving all three outcomes—Alaska, Hawaii, and Minnesota—are geographically and demographically diverse but share relatively high fertility, widespread dual parenthood, and greater gender earnings parity.

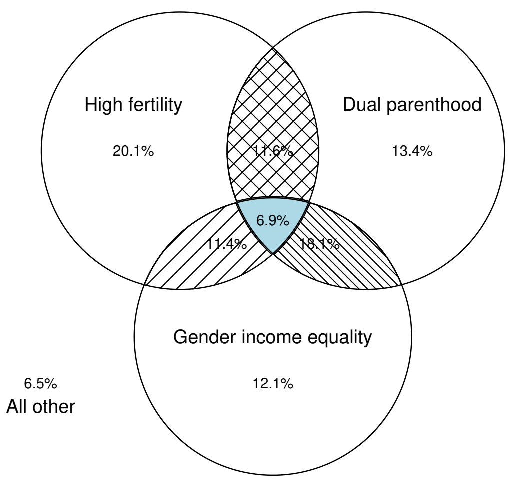
Thus, even within the institutional and cultural uniformity of the United States, the trade-off among high fertility, dual parenthood, and gender earnings equality remains



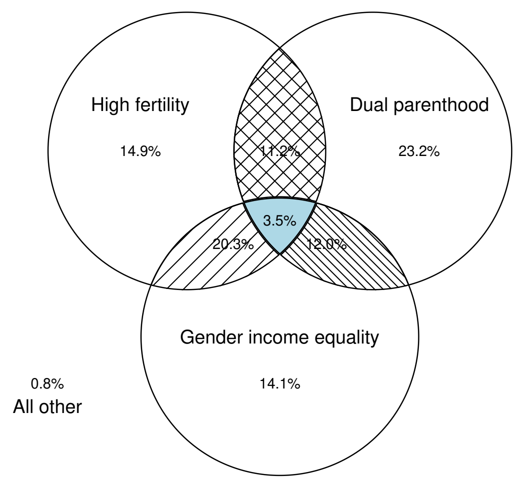
(a) High GDP per Capita



(b) Low GDP per Capita



(c) High Years of Schooling



(d) Low Years of Schooling

Figure 6: Trade-off by Income and Human Capital Levels (World Sample)

Notes: Venn diagram analysis for subsamples split at median GDP per capita (top row) and median average years of schooling (bottom row). Indicators are redefined at subsample medians in each case. Data from 95 countries, 1990–2015.

stark, underscoring its robustness across levels of aggregation and developmental contexts.

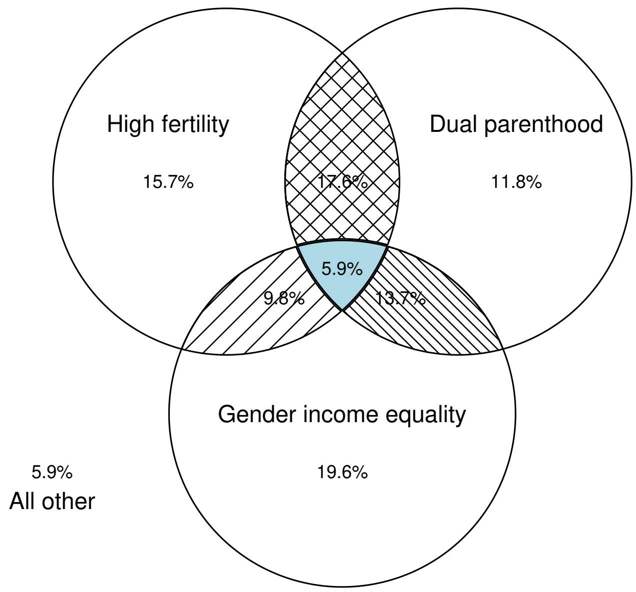


Figure 7: Trade-off Across U.S. States (2023)

Notes: Venn diagram of high fertility (births per 1,000 women aged 15–44 > 56.9), dual parenthood (single-mother household share < 17%), and gender earnings equality (gender earnings gap < 25.6%), each defined at cross-state medians. The sample includes 50 states plus the District of Columbia. Data from ACS 2023 and CDC Natality files.

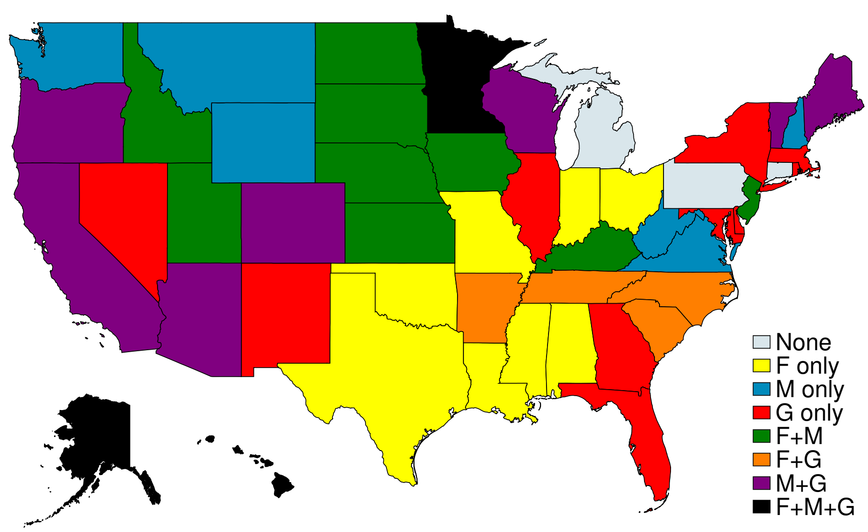


Figure 8: Joint Attainment by U.S. State (2023)

Notes: Map indicating which outcomes—high fertility (F), dual parenthood (M), gender earnings equality (G)—each state achieves, based on median thresholds. Only Alaska, Hawaii, and Minnesota attain all three. Data sources as in Figure 7.

3. Model

This section develops a theoretical framework to formalize the trade-off among high fertility, dual parenthood, and gender income equality.

Individuals are indexed by gender $g \in \{\male, \female\}$, with each gender comprising half the population. Utility depends on consumption c and fertility n:

$$u(c,n) = \left((1-\beta) \cdot c^{\frac{\rho-1}{\rho}} + \beta \cdot n^{\frac{\rho-1}{\rho}}\right)^{\frac{\rho}{\rho-1}}, \qquad \beta \in (0,1). \tag{1}$$

Following Jones and Schoonbroodt (2010) and Carlos Córdoba and Ripoll (2019), I assume $\rho > 1$, ensuring that consumption and fertility are substitutes and that utility is well-defined for childless individuals, $u(c, 0)$.

To focus on between-gender disparities, wages are uniform within each gender: $w^{\male}$ for men and $w^{\female}$ for women.[2] The gender wage gap at time t is defined as

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

so a higher Γ^w indicates a larger wage disparity.

3.1 Model Setup

Single Individuals

Single men supply one unit of labor inelastically, consume their labor income, and remain childless. Their utility is

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

where the superscript s denotes "single."

Single women, however, can bear children without support from the father.[3] They choose consumption $c^{\female,s}$, labor supply l^s, and fertility n^s to maximize

[2]Incorporating within-gender human capital heterogeneity would require modeling assortative matching (e.g., Low 2014, Chiappori 2017), which is beyond the scope of this paper.

[3]This is a modeling simplification. In reality, child support enforcement exists, but enforcement is limited: according to the Annie E. Casey Foundation using 2020–2022 Current Population Survey data, only 23% of U.S. female-headed families with children under 18 received any child support in the prior year.

$$V^{♀,s} = \max_{c^{♀,s}, l^s, n^s} \quad u(c^{♀,s}, n^s) \tag{4}$$

subject to the budget and time constraints

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

where $\chi > 0$ is the time cost per child. Fertility $n^s \in \mathbb{R}_+$ is continuous, consistent with standard models of female labor supply and fertility (e.g., Rosenzweig and Wolpin 1980).

Thus, single women face a direct trade-off between consumption and fertility via endogenous labor supply.

Married Individuals

In marriage, husbands supply one unit of labor inelastically and transfer a share α of their income to their wives. This transfer captures the economic role of marriage in supporting child-rearing. While individuals take α as given, it is determined in equilibrium (Section 3.2).

Husbands consume their remaining income and derive utility from shared fertility n^m and a psychic benefit of marriage λ. Their value is

$$V^{♂,m} = \max_{n^m} \quad u\Big((1-\alpha) w^{♂}, n^m\Big) \cdot \lambda, \tag{5}$$

where the superscript m denotes "married."

Wives choose consumption $c^{♀,m}$, labor supply l^m, and fertility n^m to maximize

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

subject to

$$c^{♀,m} = \alpha w^{♂} + w^{♀} l^m, \quad \text{and} \quad l^m = 1 - \chi n^m.$$

Husbands' transfers generate a pure income effect for wives, increasing both consumption and fertility (both normal goods). However, higher female wages induce a substitution effect: since consumption and fertility are substitutes ($\rho > 1$), rising $w^{♀}$ reduces desired fertility—a mechanism emphasized by Greenwood et al. (2005a). Conversely, higher male wages increase fertility via larger transfers. This prediction aligns with Jakobsen et al. (2022), who document these patterns using Danish registry data.

Moreover, since husbands bear no direct child-rearing costs post-transfer, they prefer higher n^m.[4] Wives, bearing the time cost χn^m, prefer lower fertility. Consistent with Doepke and Tertilt (2018), and following Doepke and Kindermann (2019), I assume fertility in marriage requires mutual consent, so *wives effectively decide marital fertility*.

Marriage Market

The marriage market is competitive. At the start of the period, each individual draws an idiosyncratic taste shock ε for marriage relative to singlehood, distributed Fréchet with scale θ. By McFadden (1972), the marriage rate for each gender is

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

Equilibrium requires

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

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

Unlike Choo and Siow (2006) and related transferable-utility models that use a scalar transfer, this framework abstracts from within-gender heterogeneity but extends the standard setup by allowing a *vector* (α, n^m) to clear the market.

From (7), the equilibrium marriage rate $\mathcal{M}$ is strictly increasing in $V^{♀,g}/V^{♀,g}$—the gains from marriage for each gender.

Aggregate Variables

Aggregate fertility is the weighted average of marital and non-marital fertility:

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

[4]Assuming men bear no childcare costs is not essential; results hold as long as wives shoulder *more* childcare responsibility—a robust empirical pattern across countries and time (Kleven et al. 2019, Doepke et al. 2023).

The share of children living with both parents is

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

Average female labor supply is

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

Labor income is $y^{♂} = w^{♂}$ for men and $y^{♀} = w^{♀} l^{♀}$ for women, so the gender income gap is

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

Equation (12) shows that the gender income gap widens if the wage gap Γ^w increases or if women reduce labor supply (i.e., $l^{♀}$ falls due to higher fertility).

3.2 Equilibrium Characterization

The equilibrium of the economy is characterized in three steps.

First, for a given marriage rate $\mathcal{M}$, men's optimal choice yields α as a function of marital fertility n^m:

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

Since $\rho > 1$, the implicit function theorem implies that $\alpha(n^m)$ is strictly increasing and concave in n^m. It equals zero when $n^m = 0$. Moreover, for fixed n^m, $\alpha(n^m)$ decreases with $w^{♂}$: higher male income allows a smaller income share to sustain any given level of marital fertility.

On the other side of the marriage market, the first-order condition for married women determines n^m as a function of α:

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

Equation (14) shows that $n^m(\alpha)$ is linear and increasing in the transfer α. Even when $\alpha = 0$, $n^m > 0$ (matching single women's positive fertility). The function shifts downward with $w^{♀}$, confirming that the substitution effect dominates the income effect as female wages rise.

The marriage market equilibrium is fully characterized by the following results.

Lemma 1: For any wage pair $\{w^{♂}, w^{♀}\}$, there exists a unique fixed point (α, n^m) that clears the marriage market.

Proof: See Appendix.

Lemma 2: The gains from marriage for women are $V^{♀,m}/V^{♀,s} = \lambda \cdot (1 + \alpha\Gamma^w)$.

Proof: See Appendix.

Lemma 2 shows that the equilibrium marriage rate $\mathcal{M}$ depends on the psychic benefit λ and the *economic* gains from marriage for women, $\alpha\Gamma^w$—the product of the transfer share and the gender wage gap. This result–that in a setting without heterogeneities within gender, marriage rate is increasing in gender wage gap–echos the classic result in Becker (1973).

Combined with Equation (23) in the Appendix, Lemma 2 implies that the share of dual parenthood $\mathcal{D}$ (defined in (10)) is strictly increasing in $\mathcal{M}$. Hence, $\mathcal{M}$ and $\mathcal{D}$ are interchangeable in the analysis that follows.

3.3 Three-Way Trade-Off

The equilibrium relationships among aggregate fertility n, marriage rate $\mathcal{M}$, female labor supply $l^{♀}$, and gender income gap Γ^y are summarized by three equations:

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

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

$$l^{♀} = 1 - \chi n. \tag{17}$$

These equations reveal the model's core tensions. Equation (15) shows that higher gender wage gaps Γ^w support higher marriage rates. But (16) implies that a large Γ^w undermines gender income equality unless female labor supply is high. Yet (17) shows that high $l^{♀}$ requires low fertility.

Thus, for fixed parameters, the model establishes a *three-way trade-off* among high fertility, high dual-parenthood (or marriage), and gender income equality, mirroring the empirical patterns documented in Section 2. This is shown by considering the three pairwise combinations:

1. *High fertility and high dual-parenthood* High n implies low $l^{♀}$ via (17). To sustain high $\mathcal{M}$, Γ^w must be sufficiently large via (15). Thus, Γ^y is necessarily high via (16).
2. *High fertility and gender income equality* High n again implies low $l^{♀}$. To achieve low Γ^y, Γ^w must be very small via (16). Because α is bounded above by one, a very small wage gap reduces $\mathcal{M}$ via (15).[5]
3. *High dual-parenthood and gender income equality* Because α is bounded above, high $\mathcal{M}$ requires large Γ^w via (15). To offset this and achieve low Γ^y, $l^{♀}$ must be high via (16). Thus, fertility n is low via (17).

3.4 Policy Remedies

The trade-off documented in this paper has profound policy implications. Many governments pursue policies to boost fertility, strengthen family structure, or narrow gender income gaps—often treating these as independent objectives. This analysis shows, however, that the three outcomes are deeply interconnected. Policies targeting one dimension inevitably affect the others. I therefore use the model to evaluate the equilibrium effects of three common policy approaches.

First, pro-marriage policies—such as joint income taxation—are often motivated not only by cultural or religious values but also by evidence that family structure disparities contribute to persistent gaps in child human capital (Kearney 2023) and intergenerational income inequality (Autor et al. 2019). In the model, such policies increase the psychic benefit of marriage λ. A higher λ raises the marriage rate $\mathcal{M}$ without altering marital fertility n^m. Since $n^m > n^s$, aggregate fertility n increases via a composition effect. This reduces female labor supply and widens the gender income gap Γ^y.

Second, gender equality policies—such as anti-discrimination laws and pay equity mandates—aim to reduce labor market misallocation and boost aggregate productivity

[5] In reality, the upper bound of transfer α could be much smaller than one due to social norms or subsistence constraints.

(Hsieh et al. 2019), alongside promoting female empowerment. In the model, these correspond to an increase in $w^{♀}$ with $w^{♂}$ fixed. Higher female wages reduce both single and marital fertility (n^s and n^m) due to substitution between consumption and children. Lower n^m decreases the equilibrium transfer α, which reduces the marriage rate $\mathcal{M}$. The resulting shift toward single-hood further lowers aggregate fertility n. However, female labor supply rises, and combined with higher wages, the gender income gap Γ^y narrows.

Third, pro-fertility policies—such as baby bonuses or public childcare—are increasingly adopted to counter population aging, which threatens pension sustainability (Bongaarts 2004) and long-run growth (Jones 2022). In the model, these reduce the time cost of child-rearing χ. A lower χ increases both n^s and n^m. Higher marital fertility raises the equilibrium transfer α and marriage rate $\mathcal{M}$, generating a reinforcing composition effect that further boosts aggregate fertility n. Crucially, female labor supply *increases* despite higher fertility—see Equations (20) and (22) in the Appendix. Thus, the gender income gap Γ^y shrinks.

Among marriage, labor market, and family policies, only family policies that reduce the time cost of children mitigate the three-way trade-off: they simultaneously increase fertility, strengthen dual-parenthood, and narrow gender income gaps.

One caveat remains. The fiscal cost of such policies is proportional to female wages. As economies grow and gender discrimination falls—raising $w^{♀}$—these policies become more expensive. To sustain a given fertility level, their cost rises as a share of GDP. The intuition is straightforward: the government subsidizes a sector (child-rearing) whose output is substitutable to market goods and has seen no productivity growth.

4. Quantitative Assessment

This section calibrates the model to Mexico's transition from 1990 to 2015 as a proof of concept. Mexico is selected for two reasons. First, it offers a long time series of consistent data. Second, it has experienced rapid GDP growth alongside a full reversal of the gender education gap—making it an ideal case to study how structural transformation and gender convergence jointly shape fertility, family structure, and income inequality.

4.1 Data and Calibration

Data are drawn from the world sample. Figure 9 plots Mexico's transition path. Fertility declines sharply from 3.5 to approximately 2.1 children per woman. The share of children living with both parents falls from 81% to 75%, while the share with only the mother present rises from 11% to 19%. Gender income equality improves as women's labor income share increases from 24% to 32%. Over the same period, GDP per capita rises from about $12,000 to over $18,000 (in 2017 US dollars). Most strikingly, the gender education gap reverses: in 1990, women aged 25–35 had 0.8 fewer years of schooling than men; by 2010, the gap closed; and by 2015, women in this cohort had 0.1 more years of schooling.

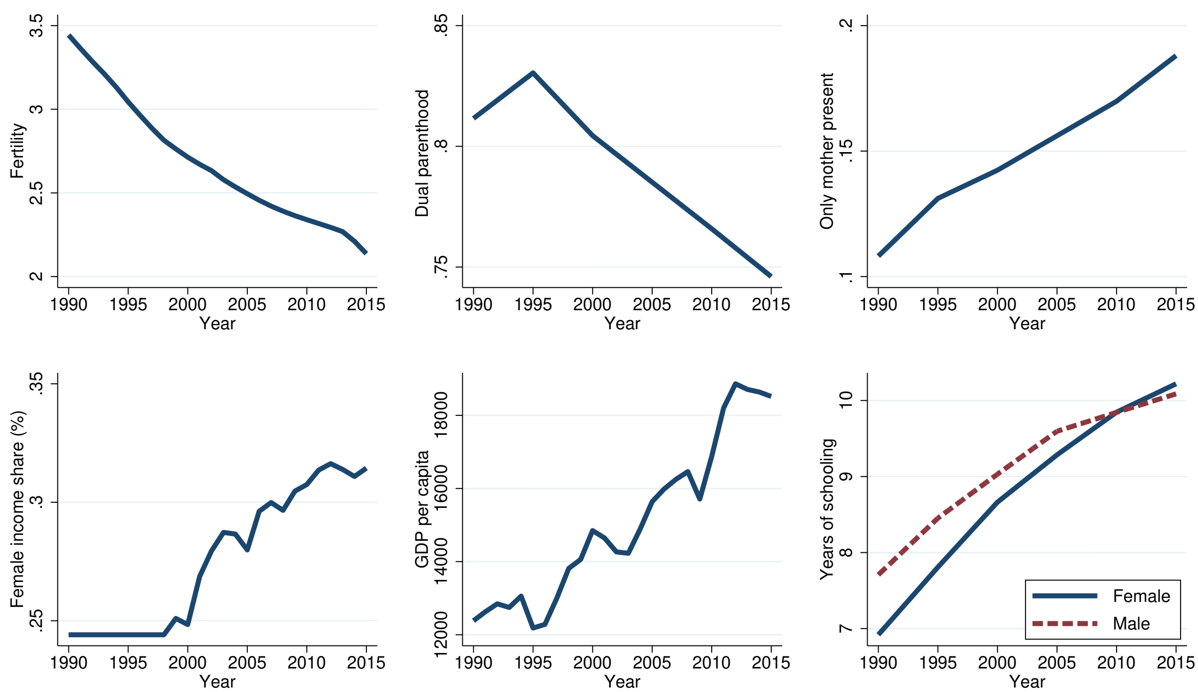


Figure 9: Mexico's Transition Path (1990–2015)

Notes: Fertility is total children per woman (United Nations). Dual parenthood is the share of children living with both biological parents; single-mother share is the share living only with mother (Brenøe and Wasserman 2025). Female labor income share is from the World Inequality Database. GDP per capita is in 2017 US dollars (OECD). Gender education gap is the difference in average years of schooling for ages 25–35 (Barro and Lee 2013).

The model is calibrated assuming that time-varying wages $\{w_t^{♀}, w_t^{♂}\}$ are the sole exogenous drivers. I further decompose these wage trends into three components:

- $A_t = w_t^{♂}$: gender-neutral productivity,

- Γ_t^h: gender gap in human capital,
- $B_t = \frac{w_t^{♂}/w_t^{♀}}{\Gamma_t^h}$: gender-biased productivity.

Calibration proceeds in three steps. First, the time cost of children is fixed at $\chi = 0.075$ following De La Croix and Doepke (2003). The human capital gender gap Γ_t^h is constructed from average years of schooling using the development accounting framework of Caselli (2005) which utilizes Mincerian return estimates. Second, female labor supply $l_t^{♀}$ is inferred from observed fertility via Equation (17). Wages $\{w_t^{♀}, w_t^{♂}\}$ are then backed out using GDP per capita and the female labor income share from Figure 9. Finally, the preference and marriage parameters $\{\beta, \rho, \lambda, \theta\}$ are jointly calibrated to match the observed time paths of fertility and dual parenthood.

Identification of these parameters is intuitive:

1. β governs the weight on fertility and targets average fertility levels;
2. ρ determines substitutability between consumption and children and targets the slope of fertility decline as productivity rises;
3. λ captures the psychic benefit of marriage and targets the average dual-parenthood share;
4. θ governs dispersion in marriage taste shocks and targets the responsiveness of dual parenthood to changes in fertility and gender wage gaps.

Table 1 reports the calibrated values. The elasticity of substitution $\rho = 1.50$ implies that rising wages reduce fertility as substitution dominates income effects. The psychic benefit of marriage $\lambda = 1.03$ implies a 3% utility premium to marriage beyond resource exchange via (α, n^m).

Figure 10 displays the calibrated driving forces (A_t, B_t, Γ_t^h) and compares model predictions with data. Gender human capital convergence ($\Gamma_t^h \to 1$) begins in 1990. The decline in gender-biased productivity B_t starts in the late 1990s. Gender-neutral productivity A_t rises steadily after the 1994 Peso Crisis. With only four calibrated parameters, the model closely tracks both fertility and dual-parenthood trends.

	Interpretation	Value	Target	Source
χ	time cost of children	0.075		De La Croix and Doepke (2003)
A_t	gender-neutral productivity		GDP per capita	OECD
B_t	gender-biased productivity		female labor income share	World Inequality Database
Γ_t^h	gender human capital gap		years of schooling	Barro and Lee (2013)
β	preference weight on n	0.104	fertility level	United Nations
ρ	c–n substitutability	1.50	fertility trend	United Nations
λ	psychic benefit of marriage	1.03	dual parenthood level	Brenøe and Wasserman (2025)
θ	taste shock dispersion	3.40	dual parenthood trend	Brenøe and Wasserman (2025)

Table 1: Calibration Results

Notes: Time-varying inputs (A_t, B_t, Γ_t^h) are constructed directly from data. Preference and marriage parameters minimize the distance between model and data for fertility and dual parenthood over 1990–2015.

4.2 Decomposition

The model decomposes changes in fertility n_t, dual parenthood $\mathcal{D}_t$, and gender income gap Γ_t^y into contributions from rising gender-neutral productivity A_t, falling gender-biased productivity B_t, and converging human capital gap Γ_t^h.

Decomposition is sequential:

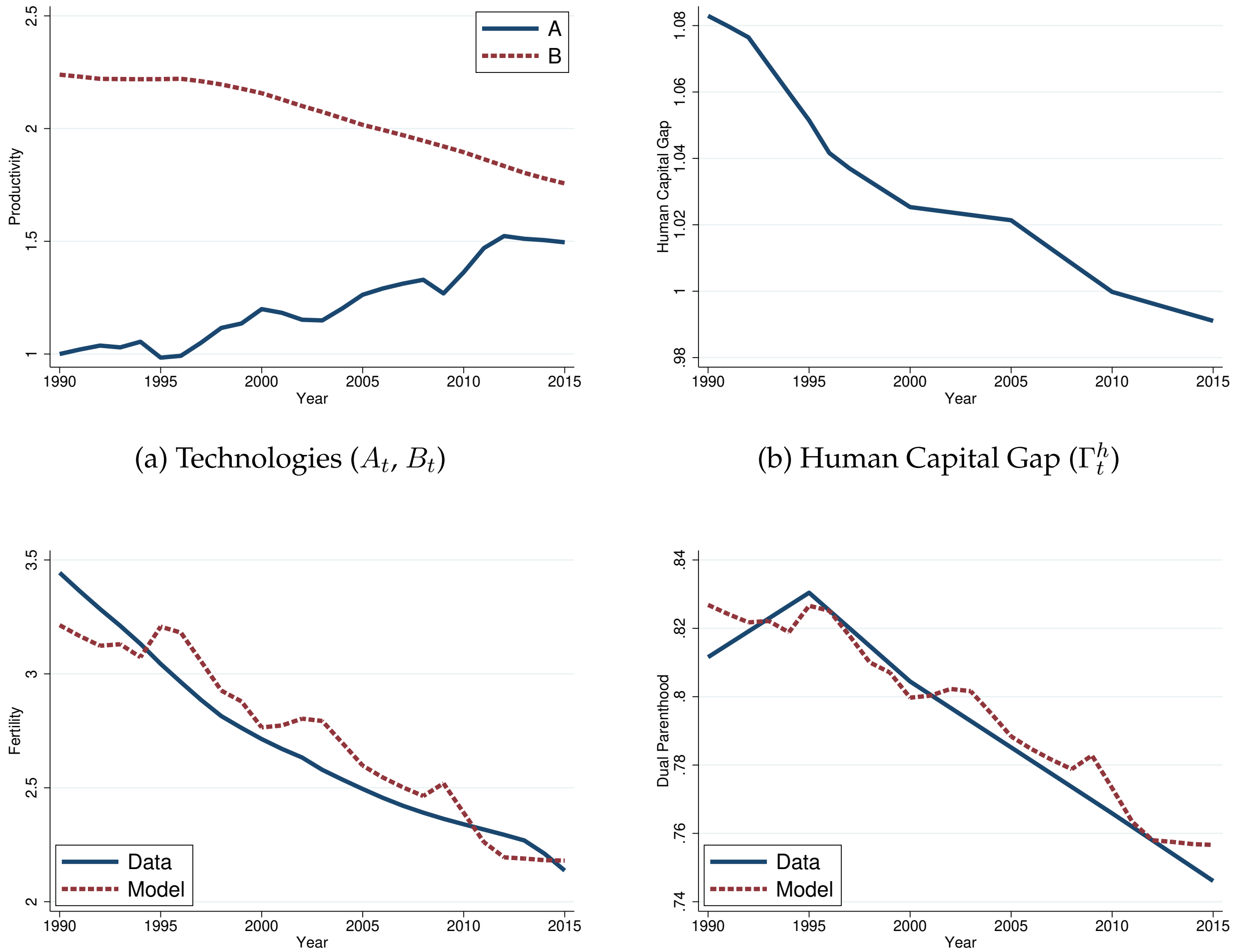
1. Vary only A_t, holding B_t and Γ_t^h at 1990 levels.

2. Allow A_t and B_t to vary, keeping Γ_t^h fixed.

3. Allow all three to evolve.

Figure 11 presents the results. Rising A_t accounts for 50% of the fertility decline: higher opportunity costs reduce childbearing. It also explains 50% of the drop in dual parenthood, as falling marital fertility n^m reduces men's gains from marriage, shifting births to single mothers. It contributes 10% to gender income gap convergence via higher female labor supply.

Declining B_t explains 40% of fertility decline, 40% of dual-parenthood decline, and the majority of gender income convergence. This operates through two channels: (i) higher absolute female wages reduce fertility and marriage while increasing labor sup-



(a) Technologies (A_t, B_t)

(b) Human Capital Gap (Γ_t^h)

(c) Fertility

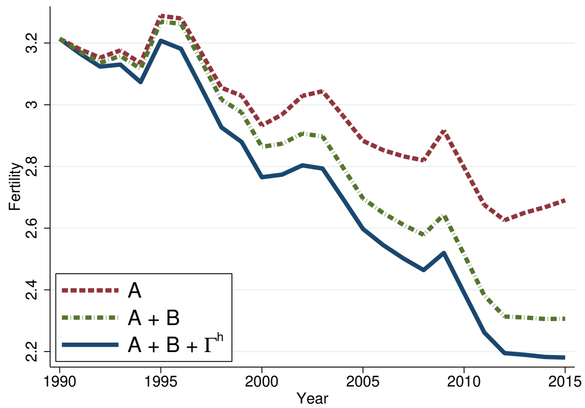
(d) Dual Parenthood

Figure 10: Model Fit: Mexico (1990–2015)

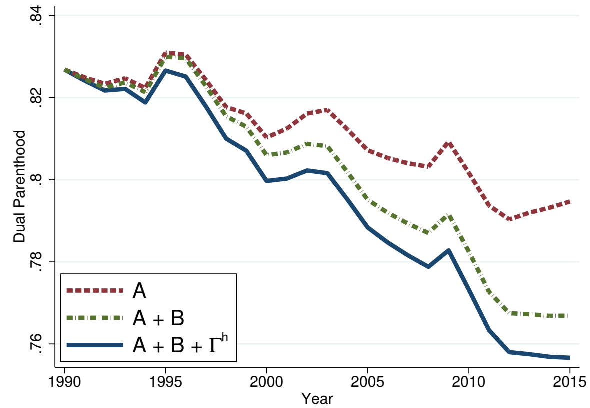
Notes: Solid lines: data. Dashed lines: model. Fertility is total children per woman (United Nations). Dual parenthood is the share of children living with both biological parents (Brenøe and Wasserman 2025). $A_t = w_t^{\male}$ is gender-neutral productivity (from GDP per capita, OECD). $B_t = (w_t^{\male}/w_t^{\female})/\Gamma_t^h$ is gender-biased productivity (from female labor income share, World Inequality Database). Γ_t^h is the gender human capital gap (from years of schooling, Barro and Lee 2013). Model calibrated using parameters in Table 1.

ply; (ii) rising relative female wages require larger transfers α to sustain n^m, lowering equilibrium marriage rates.

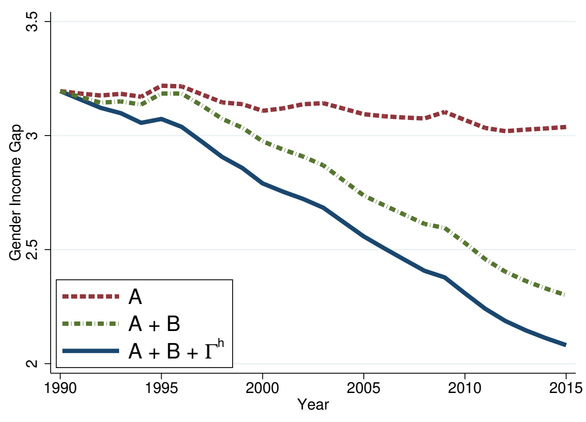
The reversal in Γ_t^h accounts for the remainder. By construction, B_t absorbs residual gender wage gaps after Γ_t^h is accounted for, so their relative contributions reflect changes in gender-specific schooling.



(a) Fertility



(b) Dual Parenthood



(c) Gender Income Gap

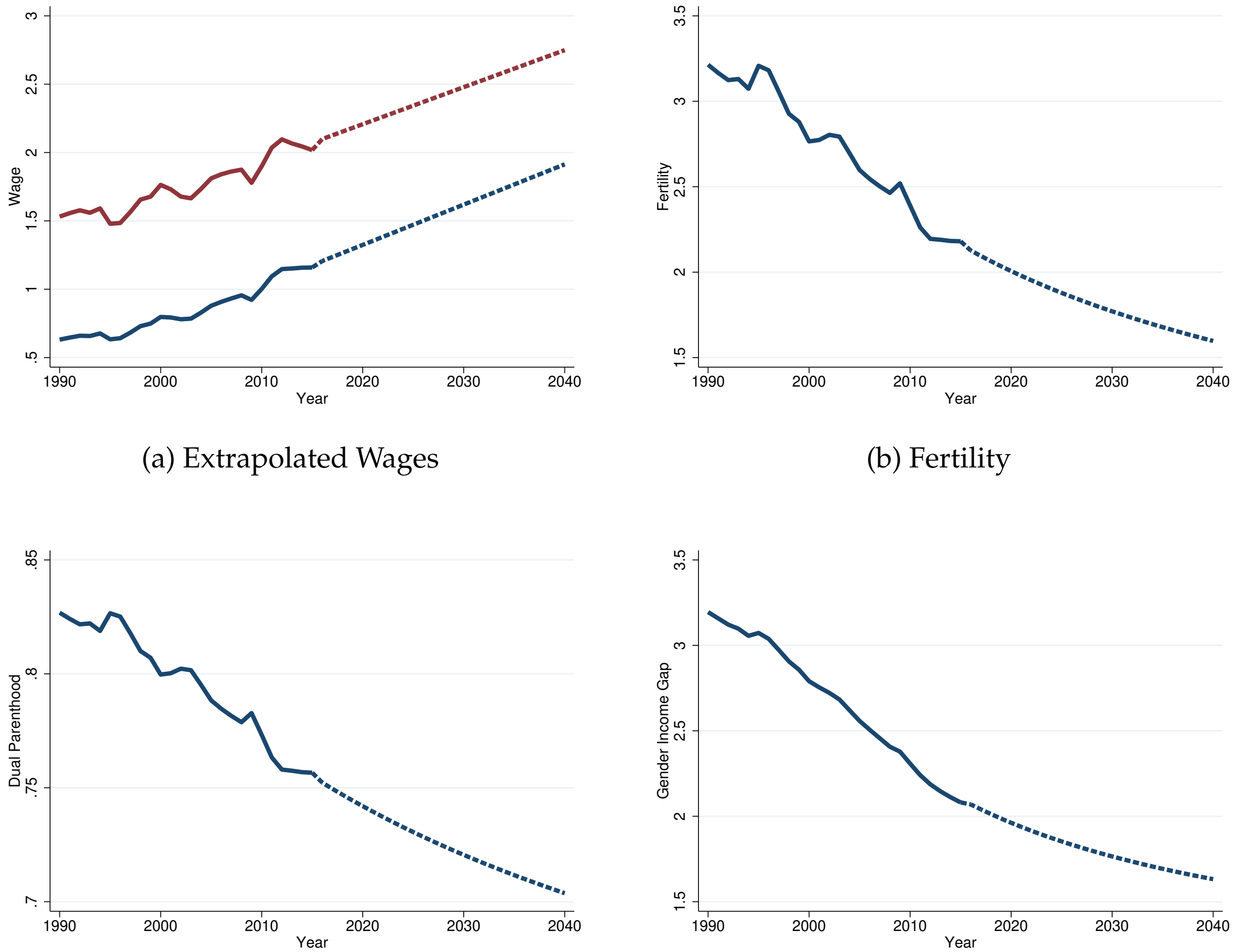
Figure 11: Decomposition of Mexico's Transition (1990–2015)

Notes: Solid line: data. Dashed lines: counterfactual paths. "A_t only": vary gender-neutral productivity, fix B_t, Γ_t^h at 1990. "$A_t + B_t$": allow both to vary, fix Γ_t^h. "All": full model. Model uses calibrated parameters from Table 1.

4.3 Prediction

The calibrated model is used to forecast fertility, dual parenthood, and the gender income gap to 2040. Gender-specific wages $\{w_t^{♀}, w_t^{♂}\}$ are linearly extrapolated from 1990–2015 trends. The model is then solved period-by-period using fixed parameters.

Figure 12 shows the results. Continued wage growth—especially for women—drives fertility to 1.5 children per woman by 2040. Dual parenthood falls from 75% in 2015 to 70%. The gender income gap continues to narrow, reaching 60% of male income (down from 220% in 1990).



(a) Extrapolated Wages

(b) Fertility

(c) Dual Parenthood

(d) Gender Income Gap

Figure 12: Model-Based Predictions: Mexico to 2040

Notes: Dashed lines: linear extrapolation of gender-specific wages from 1990–2015. Solid lines: model predictions using calibrated parameters (Table 1). Fertility in 2023: model predicts 1.93, actual is 1.91 (United Nations).

Fertility data through 2023 provide an out-of-sample check: the model predicts 1.93 children per woman; actual is 1.91.

This exercise underscores the model's value. Rather than extrapolating fertility, marriage, or gender gaps in isolation, it treats them as joint endogenous outcomes of gender-specific wage dynamics. Decomposing wages into A_t, B_t, and Γ_t^h enables refined forecasts under alternative assumptions about technological or educational convergence.

5. Dynamic Extension

This section introduces a dynamic extension in which the gender human capital gap evolves endogenously with the marriage rate. Specifically, the law of motion is

$$\frac{\Gamma^h_{t+1}}{\Gamma^h_t} = (\mathcal{M}_t)^{\psi}, \qquad \psi < 0. \tag{18}$$

The key assumption $\psi < 0$ is motivated by a large empirical literature documenting that growing up without both biological parents harms boys more than girls (e.g., Sommers 2001, Bertrand and Pan 2013, Chetty et al. 2016, Autor et al. 2019, Wasserman 2020, Reeves 2022, Frimmel et al. 2024). This gender-differentiated impact may arise from (1) same-gender role model effects, (2) differential sensitivity to parental inputs, or (3) varying exposure to alternative institutions such as schools or neighborhoods.

The magnitude is economically significant. For instance, Autor et al. (2019) show that racial differences in single motherhood explain much of the black–white gender gap in outcomes. Autor et al. (2023) find that family structure, via socioeconomic status, accounts for a substantial share of gender disparities in high school performance.

With this dynamic linkage, Figure 13 illustrates the self-reinforcing decline of fertility, marriage, and gender income gaps—through two exogenous shocks and one propagation channel.

The decline unfolds through two exogenous drivers and one reinforcing feedback:

1. **Gender-neutral productivity growth ($A_t \uparrow$)** raises the opportunity cost of children, reducing both single (n^s) and marital (n^m) fertility. Lower n^m reduces men's gains from marriage, lowering $\mathcal{M}$. The resulting composition shift further reduces aggregate fertility n. Freed from childcare, women increase labor supply $l^{♀}$, narrowing the gender income gap Γ^y.

2. **Gender-biased productivity decline ($B_t \downarrow$)** narrows the wage gap Γ^w. From women's perspective, lower Γ^w reduces the economic value of marriage ($\alpha\Gamma^w$), lowering $\mathcal{M}$. The composition effect again reduces n, increases $l^{♀}$, and shrinks Γ^y.

3. **Dynamic propagation via human capital** (feedback loop): Lower $\mathcal{M}_t$ implies more children grow up without both parents. Since boys suffer greater human capital

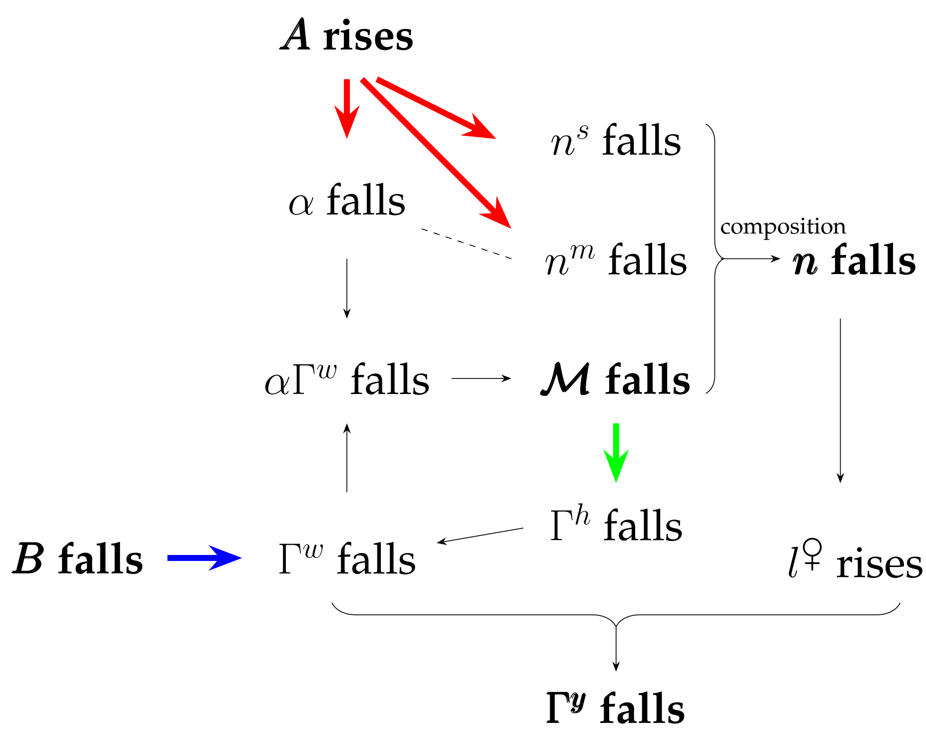


Figure 13: The Dynamic Mechanism

Notes: Red arrows: effects of rising gender-neutral productivity A_t. Blue arrow: effects of falling gender-biased productivity B_t. Green arrow: dynamic human capital effect via $\mathcal{M}_t \to \Gamma^h_{t+1}$ (Equation (18)).

losses, Γ^h_{t+1} falls (Equation (18)). These less-skilled men become less "marriageable," further reducing $\mathcal{M}$ and n in the next period—while accelerating Γ^y convergence.

6. Conclusion

This paper establishes a fundamental three-way trade-off: societies rarely achieve high fertility, widespread dual parenthood, and gender income equality simultaneously. Across OECD countries, a global panel of 95 nations, and U.S. states, the joint attainment of all three outcomes is only a small fraction of what independence would predict—a scarcity that persists across income levels, human capital, and institutional settings.

A unified marriage market model explains this empirical regularity. Fertility and marriage are linked through a two-dimensional price vector—income transfers and marital childbearing—while women's disproportionate childcare burden ties fertility directly to gender income gaps. The result is structural tension: sustaining any two goals often requires sacrificing the third. Pro-marriage policies boost dual parenthood but reduce fertility and widen income gaps. Gender equality measures narrow gaps but erode marriage and fertility. Only policies that ease women's time cost of child-rearing—such as high-quality public childcare—advance all three outcomes at once, though their fiscal cost escalates with female wages and economic development.

Quantitatively, the model accounts for Mexico's transformation from 1990 to 2015. Gender-neutral productivity growth explains half the decline in fertility and dual parenthood, while convergence in education and declining labor market bias drive most of the progress toward gender income equality. Out-of-sample, the calibrated framework accurately predicts Mexico's 2023 fertility and forecasts continued convergence in gender outcomes alongside further erosion of fertility and family structure through 2040.

Extending the model dynamically reveals an important self-reinforcing mechanism. Lower marriage rates disproportionately impair boys' human capital accumulation, rendering future generations of men less ″marriageable.″ This feedback loop amplifies the direct effects of technological progress, accelerating the joint decline in fertility and dual parenthood while hastening gender convergence—even under gender-neutral shocks.

Taken together, these findings deliver a cohesive account of three defining trends of modernity. Fertility, family structure, and gender equality are not independent policy levers; they are tightly interconnected through women's time allocation, men's marriage incentives, and equilibrium in the marriage market.

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Appendix

A. More Figures

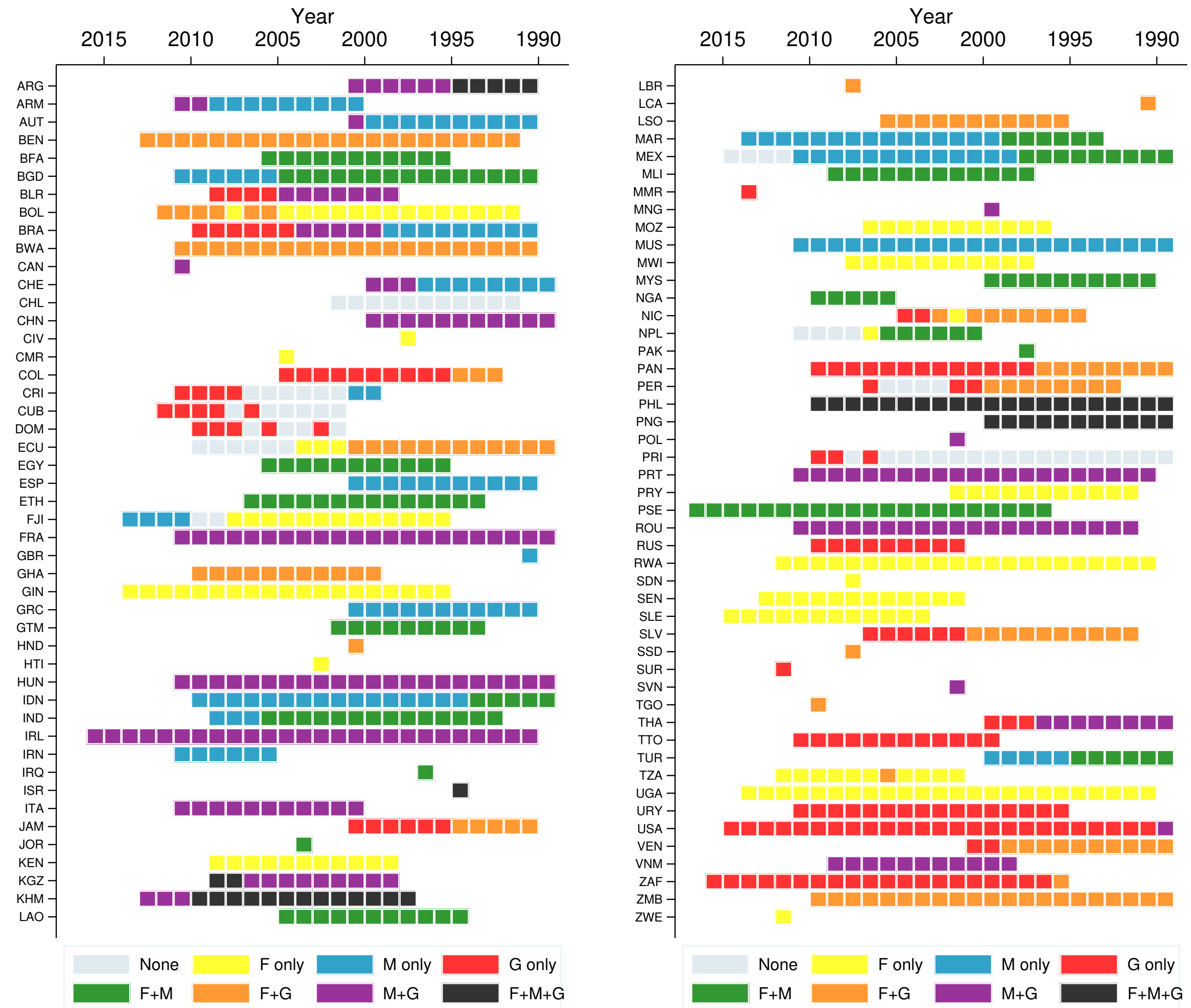

Figure A.1: Transition Paths by Country (World Sample)

Notes: Temporal transitions in the three categories (F = high fertility, M = dual parenthood, G = gender income equality) for all countries in the world sample, 1990–2015.

B. Proofs

B.1 Proof of Equation (13)

The value of single men is given by

$$V^{s,♂} = (1-\beta)^{\frac{\rho}{\rho-1}} \cdot w^{♂}$$

The value of married men is given by

$$V^{m,♂} = \left((1-\beta)[(1-\alpha)w^{♂}]^{\frac{\rho-1}{\rho}} + \beta n^{\frac{\rho-1}{\rho}}\right)^{\frac{\rho}{\rho-1}} \cdot \lambda$$

Therefore, taking ratios,

$$\frac{V^{m,♂}}{V^{s,♂}} = \left((1-\alpha)^{\frac{\rho-1}{\rho}} + \frac{\beta}{1-\beta} \cdot \left(\frac{n^m}{w^{♂}}\right)^{\frac{\rho-1}{\rho}}\right)^{\frac{\rho}{\rho-1}} \cdot \lambda$$

On the other hand, for any equilibrium level of marriage rate $\mathcal{M}$, Equation (7) implies

$$\frac{V^{m,♂}}{V^{s,♂}} = \left(\frac{\mathcal{M}}{1-\mathcal{M}}\right)^{\frac{1}{\theta}}$$

Combining two conditions, we have

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

B.2 Proof of Lemma 1

Define function

$$f_1(\alpha) = w^{♂} \cdot \left(\frac{1-\beta}{\beta} \cdot \left[\left(\left(\frac{\mathcal{M}}{1-\mathcal{M}}\right)^{\frac{1}{\theta}} \cdot \frac{1}{\lambda}\right)^{\frac{\rho-1}{\rho}} - (1-\alpha)^{\frac{\rho-1}{\rho}}\right]\right)^{\frac{\rho}{\rho-1}}, \qquad \alpha \in [0,1]$$

For $\rho > 1$, $f_1(\alpha)$ is strictly increasing and convex. Moreover, for any equilibrium level of marriage rate $\mathcal{M}$, the function $n^m = f_1(\alpha)$ satisfies men's optimality condition (13) and represents the indifference curve of the marginal man.

Define function

$$f_2(\alpha) = \frac{1 + \alpha\Gamma^w}{\left(\frac{(1-\beta)\chi}{\beta}\right)^{\rho} \cdot (w^{♀})^{\rho-1} + \chi}, \qquad \alpha \in [0, 1]$$

For $\rho > 1$, $f_2(\alpha)$ is strictly increasing, linear, and $f_2(0) > 0$. Moreover, $n^m = f_2(\alpha)$ satisfies women's optimality condition (14).

Thus, $f_3(\alpha) = f_1(\alpha) - f_2(\alpha_2)$ is strictly increasing and convex. Therefore, for any equilibrium level of marriage $\mathcal{M}$ that balances the supply and the demand, the associated pair α must be unique as long as it is an interior solution, i.e., $\alpha \in (0, 1)$ – the empirically relevant case.

B.3 Proof of Lemma 2

For married women, the first-order condition is

$$(1-\beta) \cdot (c^{♀,m})^{-\frac{1}{\rho}} = \frac{\beta \cdot (n^m)^{-\frac{1}{\rho}}}{w^{♀}\chi} \Longrightarrow c^{♀,m} = n^m \cdot \left(\frac{(1-\beta)w^{♀}\chi}{\beta}\right)^{\rho} \tag{19}$$

Substituting (19) into the budget constraint, n^m satisfies

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

which is equivalent to

$$n^m \cdot \left[\left(\frac{(1-\beta)w^{♀}\chi}{\beta}\right)^{\rho} + w^{♀}\chi\right] = (1 + \alpha\Gamma^w)w^{♀} \tag{20}$$

For single women, the first-order condition is

$$(1-\beta) \cdot (c^{♀,s})^{-\frac{1}{\rho}} = \frac{\beta \cdot (n^s)^{-\frac{1}{\rho}}}{w^{♀}\chi} \Longrightarrow c^{♀,s} = n^s \cdot \left(\frac{(1-\beta)w^{♀}\chi}{\beta}\right)^{\rho} \tag{21}$$

Substituting (21) into the budget constraint, $c^{♀,s}$ satisfies

$$n^s \cdot \left(\frac{(1-\beta)w^{♀}\chi}{\beta}\right)^{\rho} = w^{♀}(1 - \chi n^s)$$

which is equivalent to

$$n^s \cdot \left[\left(\frac{(1-\beta)w^{♀}\chi}{\beta} \right)^{\rho} + w^{♀}\chi \right] = w^{♀} \tag{22}$$

Take the ratio between (20) and (22) gives

$$\frac{n^m}{n^s} = 1 + \alpha\Gamma^w \tag{23}$$

On the other hand,

$$V^{♀,m} = n^m \cdot \left((1-\beta) \cdot \left(\frac{(1-\beta)w^{♀}\chi}{\beta} \right)^{\rho-1} + \beta \right)^{\frac{\rho}{\rho-1}} \cdot \lambda \tag{24}$$

$$V^{♀,s} = n^s \cdot \left((1-\beta) \cdot \left(\frac{(1-\beta)w^{♀}\chi}{\beta} \right)^{\rho-1} + \beta \right)^{\frac{\rho}{\rho-1}} \tag{25}$$

Combining (23), (24), and (25) gives

$$\frac{V^{♀,m}}{V^{♀,s}} = \lambda \cdot (1 + \alpha\Gamma^w) \tag{26}$$