The Autumn of Patriarchy

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Motivation

"...and the bells of glory that announced to the world the good news that the uncountable time of eternity had come to an end."

Gabriel García Márquez, *The Autumn of the Patriarch*

- Patriarchy is retreating around the world, most notably:
    1. Falling fertility (Guinnane 2011)
    2. Declining marriage / dual parenthood (Stevenson and Wolfers 2007)
    3. Converging gender (income) gaps (Goldin 2014)
- Existing papers that approach this phenomenon either
    → Propose distinct theories for each trend, or
    → Study two at a time (Regalia and Rios-Rull 2011, Greenwood et al. 2016)

This paper

- This paper: A unified model to endogenize fertility, marriage, and gender income gaps jointly

- Propose and empirically test a novel tension between (1) high fertility, (2) universal dual parenthood, and (3) gender income equality

- Rising factor-neutral technology A_t generates all three trends simultaneously, complementary to previous channels
  - (i) SBTC favoring low fertility (Fernandez-Villaverde 2000)
  - (ii) Household appliance revolution favoring singles (Greenwood et al. 2016)
  - (iii) Structural changes favoring women (Ngai and Petrongolo 2017)

- Social norms on marriage governs transition timing

Roadmap

- The static model

- The tension: theory and evidence

- The dynamic model

- Conclusion

Setup and Characterization

The Static Model

Basic setup

- Total factor productivity A_t

- 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 human capital within gender h_t^{σ} and h_t^{φ}

- Human capital gap is defined as

$$\Gamma_t^h = \frac{h_t^{\sigma}}{h_t^{\varphi}} \quad (2)$$

Marriage and fertility – men

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

$$V_t^{\sigma,s} = u(A_t h_t^{\sigma}, 0) \qquad (3)$$

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

$$V_t^{\sigma,m} = u((1-\alpha_t)A_t h_t^{\sigma}, n_t^m) \qquad (4)$$

  $\rightarrow$ α_t is an endogenous outcome in the marriage market equilibrium

Marriage and fertility – single women

- Single female solves

$$V_t^{\female,s} = \max_{c_t^{\female,s}, l_t^s, n_t^s} u(c_t^{\female,s}, n_t^s) \tag{5}$$

  subject to budget and time constraints

$$c_t^{\female,s} = A_t h_t^{\female} l_t^s \qquad l_t^s = 1 - \chi n_t^s$$

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

Marriage and fertility – married women

- Wives need to balance fertility and consumption

$$V_t^{\female,m} = \max_{c_t^{\female,m}, l_t^m, n_t^m} u(c_t^{\female,m}, n_t^m) \tag{6}$$

subject to budget and time constraints

$$c_t^{\female,m} = \underbrace{\alpha_t A_t h_t^{\male}}_{\text{transfer from husband}} + \underbrace{A_t h_t^{\female} l_t^m}_{\text{own labor income}} , \qquad l_t^m = 1 - \chi n_t^m$$

- Within marriage, fertility is subject to veto $\implies$ females determine fertility
- Women receive idiosyncratic taste shock of marriage $\tau \sim J(\tau)$ (i.e., other considerations of marriage) $\implies$ compare $\tau \cdot V_t^{\female,m}$ with $V_t^{\female,s}$

Aggregate quantities

- Let $\mathcal{M}_t$ denote the share of women that choose to get married
  - $\rightarrow$ Aggregate fertility rate n_t and share of children with both parents

$$n_t = \mathcal{M}_t \cdot n_t^m + (1 - \mathcal{M}_t) \cdot n_t^s \tag{7}$$

$$\mathcal{D}_t = \frac{\mathcal{M}_t \cdot n_t^m}{n_t} \tag{8}$$

  - $\rightarrow$ Average hours worked per female is

$$l_t^{\female} = \mathcal{M}_t \cdot l_t^m + (1 - \mathcal{M}_t) \cdot l_t^s = 1 - \chi n_t \tag{9}$$

  - $\rightarrow$ Gender income gap

$$\Gamma_t^y = \frac{y_t^{\male}}{y_t^{\female}} = \frac{\Gamma_t^h}{l_t^{\female}} \tag{10}$$

Marriage market equilibrium

- Men are homogeneous and are on the long side of the marriage market

- Transfer α_t makes males indifferent between single and marriage

$$V_t^{\sigma^7,m} = u((1 - \alpha_t)A_t h_t^{\sigma^7}, n_t^m) = u(A_t h_t^{\sigma^7}, 0) = V_t^{\sigma^7,s} \implies \alpha_t(n_t^m) \quad (11)$$

- On the other hand, n_t^m is a function of α_t from married women's utility maximization $\implies n_t^m(\alpha_t)$

- The marriage market equilibrium is characterized by a fixed-point problem of (α_t, n_t^m)

Determination of α_t and n_t^m

- <u>Lemma 1</u>: For given A_t, there exists a unique solution (n_t^m, α_t)
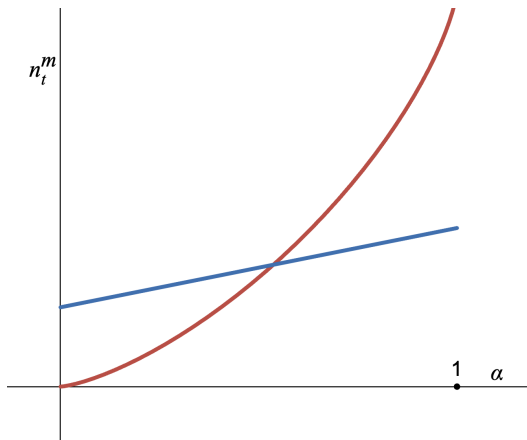

Figure 1: $n_t^m(\alpha_t)$ (blue) and $\alpha_t(n_t^m)$ (red)

Marriage threshold

- There exists a threshold τ_t^* above which women get married

$$\mathcal{M}_t = 1 - J(\tau_t^*) \tag{12}$$

- <u>Lemma 2</u>: The threshold τ^* can be characterized as

$$\tau_t^* = \frac{1}{1 + \alpha_t \Gamma_t^h} \tag{13}$$

  where $\alpha_t \Gamma_t^h$ gives the "transfer potential" of males

- Lemma 2 also implies that $\mathcal{D}_t$ is monotonically increasing in $\mathcal{M}_t \Longrightarrow$ refer to dual parenthood $\mathcal{D}_t$ and marriage rate $\mathcal{M}_t$ interchangeably

Theory and Evidence

The Tension

Model-implied relationships

- The tension: high n_t, high $\mathcal{M}_t$, and low Γ_t^y cannot co-exist
- Relationships between n_t, $\mathcal{M}_t$, $l_t^{\female}$, and Γ_t^y:

$$\mathcal{M}_t = 1 - J\left(\frac{1}{1 + \alpha_t \Gamma_t^h}\right) \tag{14}$$

$$l_t^{\female} = 1 - \chi n_t \tag{15}$$

$$\Gamma_t^y = \frac{\Gamma_t^h}{l^{\female}} \tag{16}$$

Case 1: High fertility and dual parenthood

- With high fertility, labor supply is low

$$l_t^{\female} = 1 - \chi n_t$$

- To achieve dual parenthood, the human capital gap cannot be too low

$$\mathcal{M}_t = 1 - J\left(\frac{1}{1 + \alpha_t \Gamma_t^h}\right)$$

- Gender income gap is necessarily high

$$\Gamma_t^y = \frac{\Gamma_t^h}{l_t^{\female}}$$

- Traditional patriarchal societies

Case 2: High fertility and gender income equality

- With high fertility, labor supply is low

$$l_t^{\female} = 1 - \chi n_t$$

- For gender income gap to be low, Γ^h needs to be very low

$$\Gamma_t^y = \frac{\Gamma_t^h}{l_t^{\female}}$$

- When Γ_t^h is very low, $\mathcal{M}_t$ is low

$$\mathcal{M}_t = 1 - J\left(\frac{1}{1 + \alpha_t \Gamma_t^h}\right)$$

- Nordic countries

Case 3: Dual parenthood and gender income equality

- To achieve high $\mathcal{M}_t$, human capital gap Γ_t^h needs to be high

$$\mathcal{M}_t = 1 - J\left(\frac{1}{1 + \alpha_t \Gamma_t^h}\right)$$

- To achieve low gender income gap, $l_t^{\female}$ needs to be very high

$$\Gamma_t^y = \frac{\Gamma_t^h}{l_t^{\female}}$$

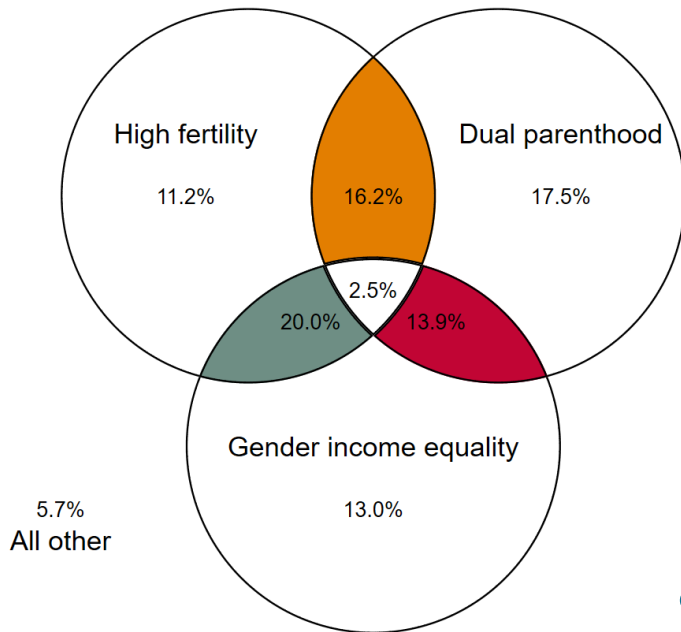- To achieve very high $l_t^{\female}$, fertility needs to be very low

$$l_t^{\female} = 1 - \chi n_t$$

Discussions

- Takeaway: Even though each of the three outcomes could be a desirable policy goal, policymakers cannot have them all

- In fact, countries may have only one, or even none of the three

- For example, policies that change χ:
  - $\rightarrow$ Raising χ reduces gender income gap Γ^y, but dampens fertility n_t
  - $\rightarrow$ Lowering χ raises fertility n_t, but boosts gender income gap Γ^y

- What about equal childcare between genders and the role of $J(\cdot)$?

- Before that, what does the tension look like in the data?

Data source and grouping

- Fertility data from the U.N.

- Share of children born outside of marriage and gender gap in median earnings from the OECD database

- Unbalanced panel of 37 countries from 1970 to 2014, 721 observations

- Data from a broader set of developing countries (but narrower time window) delivers similar results

- Grouping based on sample medians of each variable:

  $\rightarrow$ Label as "High fertility" if $\text{TFR}_{it} > 1.69$

  $\rightarrow$ Label as "Dual parenthood" if out of marriage$_{it} < 31.4\%$

  $\rightarrow$ Label as "Gender income equality" if gap$_{it} < 17.2\%$

- The random benchmark of the trinity is 12.5%

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The Dynamic Model

Human capital dynamics

- Evolution of gender-specific human capital

$$h_{t+1}^{\female} = (h_t^{\female})^{\theta} \cdot (\mathcal{M}_t)^{\psi^{\female}} \tag{17}$$

$$h_{t+1}^{\male} = Z \cdot (h_t^{\male})^{\theta} \cdot (\mathcal{M}_t)^{\psi^{\male}} \tag{18}$$

where $Z > 1, \theta \in (0,1)$ and more importantly, $\psi^{\male} > \psi^{\female} > 0$

- 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)

Channel 1: Rising opportunity costs of children

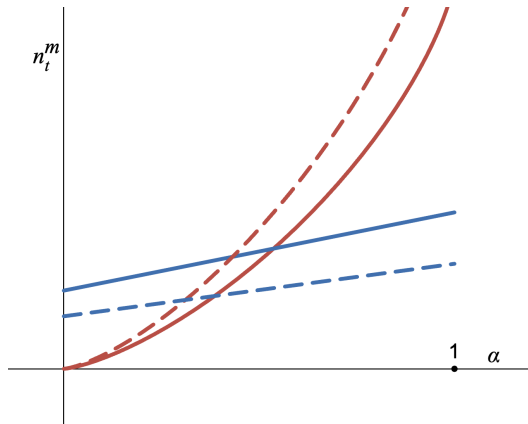- <u>Lemma 3</u>: When $\rho > 1$, n_t^m and α_t both decline in A_t

Figure 2: $n_t^m(\alpha_t)$ (blue) and $\alpha_t(n_t^m)$ (red)

Dynamic interactions between Γ^h and $\mathcal{M}$

- From marriage market equilibrium

$$\mathcal{M}_t = 1 - J\left(\frac{1}{1 + \alpha_t \Gamma_t^h}\right)$$

- From human capital dynamics

$$\Gamma_{t+1}^h = Z \cdot (\Gamma_t^h)^\theta \cdot (\mathcal{M}_t)^{\psi^{\circlearrowleft} - \psi^{\female}}$$

which implies in steady-state

$$\Gamma^h = Z^{\frac{1}{1-\theta}} \cdot (\mathcal{M}_t)^{\frac{\psi^{\circlearrowleft} - \psi^{\female}}{1-\theta}} \implies \frac{d\Gamma^h}{d\mathcal{M}} > 0 \qquad (19)$$

Channel 2: Declining α_t triggers a spiral

- <u>Lemma 4</u>: Declining α_t reduces long-run $\mathcal{M}$ and Γ^h
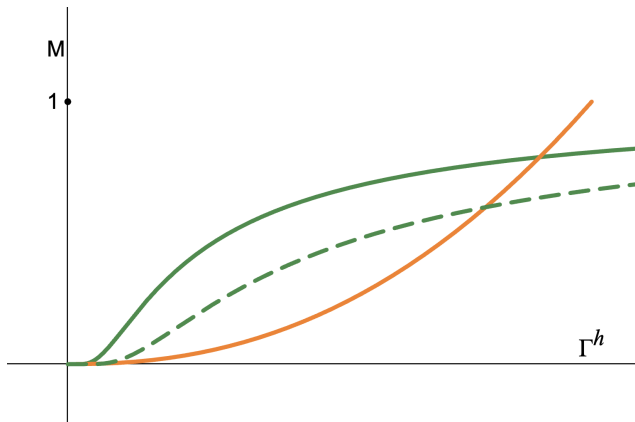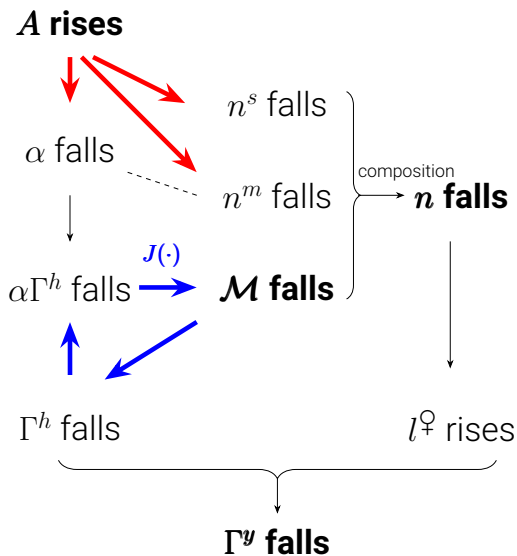

Figure 3: $\mathcal{M}(\Gamma^h; \alpha)$ (green) and $\Gamma^h(\mathcal{M})$ (orange)

The autopsy of patriarchy

A rises

n^s falls

α falls

n^m falls $\xrightarrow{\text{composition}}$ **n falls**

$J(\cdot)$

$\alpha\Gamma^h$ falls $\longrightarrow$ **$\mathcal{M}$ falls**

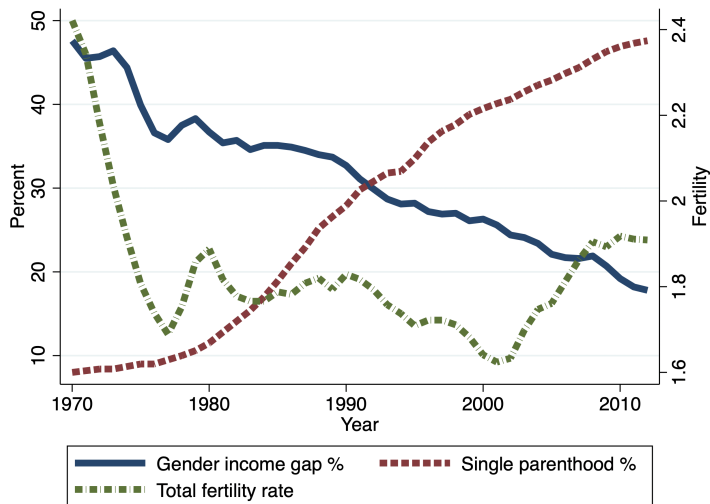Γ^h falls

$l^{\female}$ rises

Γ^y falls

1. The demise of patriarchy is the inevitable result of technological progress

2. Differences in $J(\tau)$ lead to distinct timing and patterns across countries
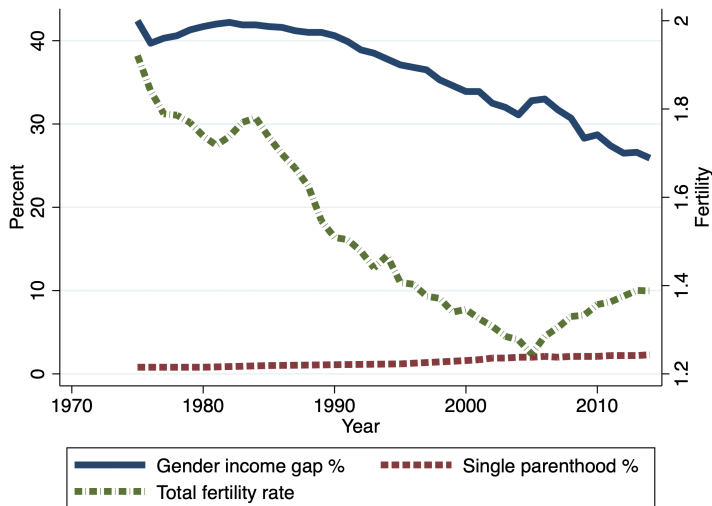
Correlations with A_t

	(1)	(2)	(3)	(4)	(5)	(6)
	n	Single	Γ^y	n	Single	Γ^y
log(gdppc)	-1.28	18.26	-11.84	-0.11	22.40	-12.20
	(0.09)	(3.14)	(2.49)	(0.09)	(5.22)	(2.25)
# of Obs.	10399	1764	782	721	721	721
Within-group R2	0.36	0.53	0.41	0.04	0.53	0.46
Country FE	✓	✓	✓	✓	✓	✓

Role of $J(\cdot)$ – The case of the U.K.

Role of $J(\cdot)$ – The case of Japan

Is gender equality in childcare a way out?

- If both genders share the same childcare burden, then $\Gamma^y = \Gamma^h$

- There is still a tension between $\mathcal{M}$ and Γ^y because high $\mathcal{M} \Rightarrow$ high Γ^h

- To reconcile high $\mathcal{M}$ with low Γ^y, men need to take more childcare responsibilities than women
    1. How feasible is this?
    2. What is the efficiency cost when Γ^h is high?
    3. Because men have the outside option of staying single and having no children, α needs to be low $\Rightarrow$ low $\mathcal{M}$?

- Empirically, no precedent yet

Conclusion

- A unified model of the transition from patriarchal to egalitarian societies

- Establish and validate the tension: high fertility, dual parenthood, gender income equality

- Rising TFP is sufficient to generate the transition

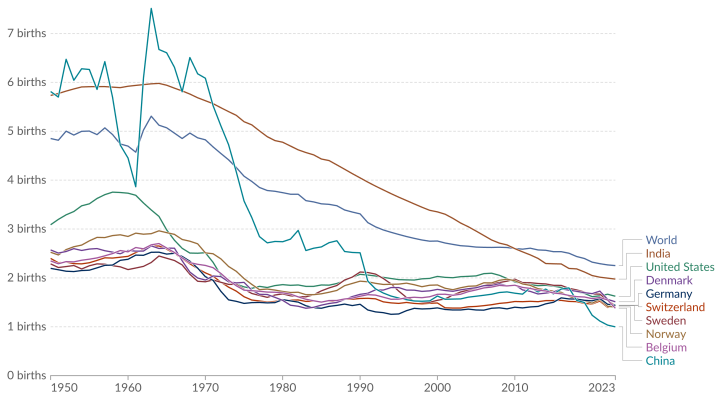- Social norms result in differential pace across countries

Appendix

Fertility rate: children per woman

The fertility rate[1], expressed as the number of children per woman, is based on age-specific fertility rates in one particular year.

Legend (right side, top to bottom):
World
India
United States
Denmark
Germany
Switzerland
Sweden
Norway
Belgium
China

Y-axis: 7 births, 6 births, 5 births, 4 births, 3 births, 2 births, 1 births, 0 births
X-axis: 1950, 1960, 1970, 1980, 1990, 2000, 2010, 2023

Data source: UN, World Population Prospects (2024)   OurWorldinData.org/fertility-rate | CC BY
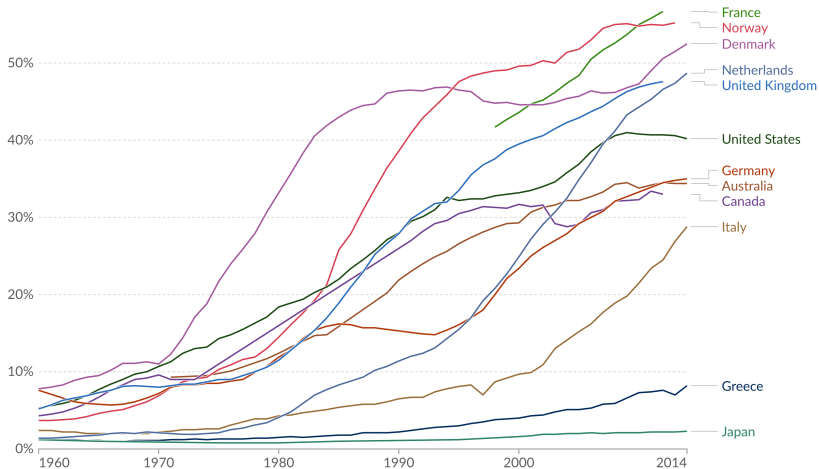
1. **Fertility rate**: The total fertility rate is a period metric. It summarizes fertility rates across all age groups in one particular year. For a given year, the total fertility rate represents the average number of children that would be born to a hypothetical woman if she (1) lived to the end of her childbearing years, and (2) experienced the same age-specific fertility rates throughout her whole reproductive life as the age-specific fertility rates seen in that particular year. It is different from the actual average number of children that women have. The fertility rate should not be confused with biological fertility, which is about the ability of a person to conceive. ▸ Read more: Fertility rate

Share of children who were born outside of marriage

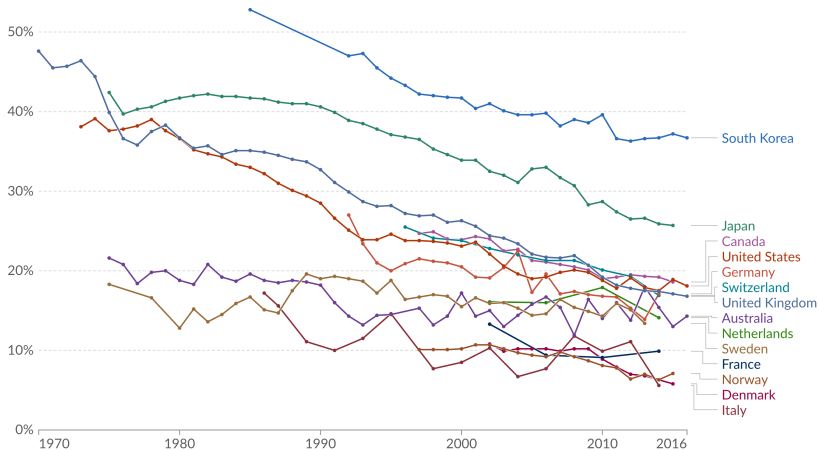Share of all children born to mothers who were not married at the time of birth.

France
Norway
Denmark

Netherlands
United Kingdom

United States

Germany
Australia
Canada

Italy

Greece

Japan

50%

40%

30%

20%

10%

0%

1960   1970   1980   1990   2000   2014

OurWorldinData.org/marriages-and-divorces | CC BY

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Unadjusted gender gap in median earnings, 1970 to 2016

The gender wage gap is unadjusted and is defined as the difference between median earnings of men and women relative to median earnings of men. Estimates refer to full-time employees and to self-employed workers.

South Korea
Japan
Canada
United States
Germany
Switzerland
United Kingdom
Australia
Netherlands
Sweden
France
Norway
Denmark
Italy

Data source: OECD, Gender Wage Gap (2017)

OurWorldinData.org/women-rights | CC BY

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Some examples

D – dual parenthood, G: gender income equality, F – high fertility

- None: Austria, United Kingdom 1995-2003
- Only D: Canada, Switzerland, Germany 1992-2006, Japan, South Korea
- Only G: Germany 2009-2014, Hungary, Portugal
- Only F: United States 1994-2013, Finland
- $D + G$: Greece, Italy, Poland
- $F + G$: Belgium, Norway, New Zealand, Sweden
- $F + D$: United Kingdom 1970-1994, Israel, USA 1973-1993
- $F + D + G$: Australia 1991-2003 ($F + G$ afterwards)

Number of Outcomes Achieved