

# The Autumn of Patriarchy

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Preliminary and Incomplete

# 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 in decline, most notably:
  1. Declining fertility (Guinnane 2011)
  2. Declining marriage / dual parenthood (Stevenson and Wolfers 2007)
  3. Declining gender (income) gaps (Goldin 2014)
- Existing researches
  - Propose distinct theories for each phenomenon
  - Study two at a time (Regalia and Rios-Rull 2011, Greenwood et al. 2016)

# This paper

- This paper: develop a unified model to endogenize all three trends
- Prove and test a novel hypothesis: The Impossible Trinity of (1) high fertility, (2) high marriage rates, and (3) gender income equality
- Rising factor-neutral technology  $A_t$  can generate the transition from patriarchal to egalitarian societies, complementary to previous channels
  - SBTC favoring low fertility (Fernandez-Villaverde 2000)
  - Household appliance revolution favoring singles (Greenwood et al. 2016)
  - Structural changes favoring women (Ngai and Petrongolo 2017)

# Roadmap

- A static model
- Model characterization
- The Impossible Trinity
- The demise of patriarchy (w/ dynamics)
- Conclusion

## A 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  $\rho > 1$  following Jones and Schoonbroodt (2010)

- Homogeneous human capital within gender  $h_t^{\sigma}$  and  $h_t^{\varphi}$
- 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

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

- Once married, husbands work and transfer  $\alpha_t$  share of income to wives

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

- $\alpha_t$  is an endogenous object
- After marriage, husbands want  $n_t^m$  as high as possible

# Marriage and fertility – single women

- Single female solves

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

subject to budget and time constraints

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



# Marriage and fertility – married women

- Wives need to balance fertility and consumption

$$V_t^{\text{♀},m} = \max_{c_t^{\text{♀},m}, l_t^m, n_t^m} u(c_t^{\text{♀},m}, n_t^m) \quad (6)$$

subject to budget and time constraints

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

- Within marriage, fertility is subject to veto  $\implies$  females determine fertility
- Women receive idiosyncratic taste shock of marriage relative to being single  $\tau \sim J(\tau)$

# Aggregate quantities

- Let  $\mathcal{M}_t$  denote the share of women that choose to get married  
→ Aggregate fertility rate  $n_t$  is given by

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

- Average hours worked per female is

$$l_t^{\varnothing} = \mathcal{M}_t \cdot l_t^m + (1 - \mathcal{M}_t) \cdot l_t^s = 1 - \chi n_t \quad (8)$$

- Gender income gap

$$\Gamma_t^y = \frac{y_t^{\sigma^{\nearrow}}}{y_t^{\varnothing}} = \frac{\Gamma_t^h}{l_t^{\varnothing}} \quad (9)$$

## Model Characterization

# Marriage market equilibrium

- Men are homogeneous and are on the short side of the marriage market
- Transfer  $\alpha_t$  makes males indifferent between single and marriage

$$V_t^{\sigma^{\nearrow},m} = u((1 - \alpha_t)A_t h_t^{\sigma^{\nearrow}}, n_t^m) = u(A_t h_t^{\sigma^{\nearrow}}, 0) = V_t^{\sigma^{\nearrow},s} \implies \alpha_t(n_t^m) \quad (10)$$

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

# Determination of $\alpha_t$ and $n_t^m$

- Lemma 1: For given  $A_t$ , there exists a unique solution  $(n_t^m, \alpha_t)$

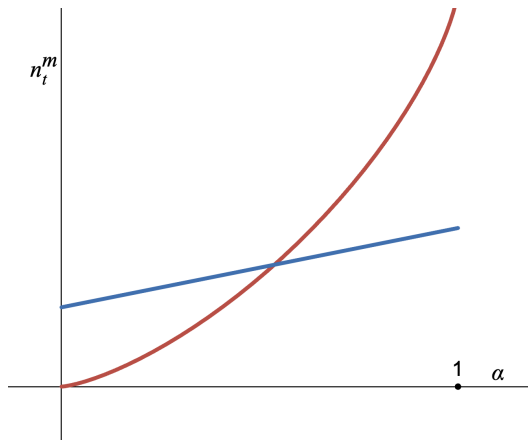


Figure 1:  $n_t^m(\alpha_t)$  (blue) and  $\alpha_t(n_t^m)$  (red)

# Marriage threshold

- There exists a threshold  $\tau_t^*$  above which women get married

$$\mathcal{M}_t = 1 - J(\tau_t^*) \quad (11)$$

- Lemma 2: The threshold  $\tau^*$  can be characterized as

$$\tau_t^* = \frac{1}{1 + \alpha_t \Gamma_t^h} \quad (12)$$

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

# The Impossible Trinity

# Model-implied relationships

- The Impossible Trinity: high  $n_t$ , high  $\mathcal{M}_t$ , and low  $\Gamma_t^y$  cannot co-exist
- Relationships between  $n_t$ ,  $\mathcal{M}_t$ ,  $l_t^\varnothing$ , and  $\Gamma_t^y$  at time  $t$

$$\mathcal{M}_t = 1 - J \left( \frac{1}{1 + \alpha_t \Gamma_t^h} \right) \quad (13)$$

$$l_t^\varnothing = 1 - \chi n_t \quad (14)$$

$$\Gamma_t^y = \frac{\Gamma_t^h}{l_t^\varnothing} \quad (15)$$



# Case 1: High fertility and dual parenthood

- With high fertility, labor supply is low

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

- 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

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

## Case 2: High fertility and gender income equality

- With high fertility, labor supply is low

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

- For gender income gap to be low,  $\Gamma^h$  needs to be very low

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

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

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

## Case 3: Dual parenthood and gender income equality

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

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

- To achieve very high  $l_t^\circ$ , fertility needs to be very low

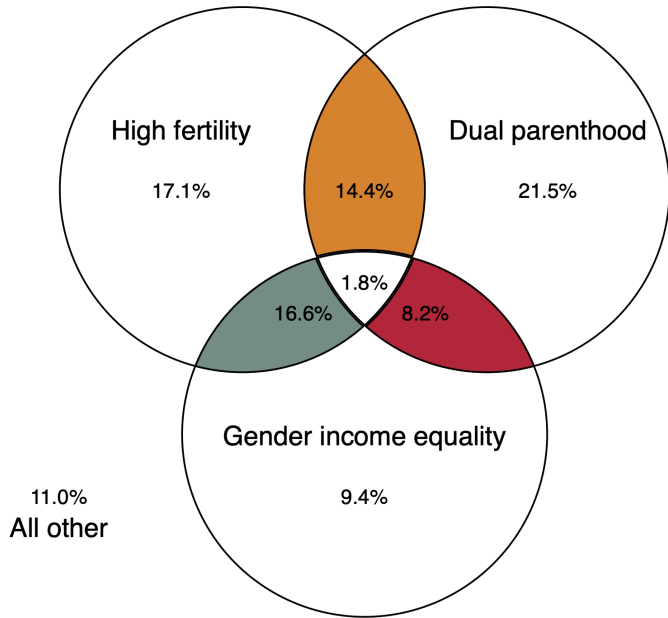
$$l_t^\circ = 1 - \chi n_t$$

# Discussions

- **Takeaway:** Even though each of the three could be a desirable policy goal, policymakers need to make trade-offs
- But countries may have only one, or even none of the three
- What does it 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
- Grouping based on sample averages of each variable:
  - Label as “High fertility” if  $TFR_{it} > 1.69$
  - Label as “Dual parenthood” if  $out\ of\ marriage_{it} < 31.4\%$
  - Label as “Gender income equality” if  $gap_{it} < 17.2\%$



## The Autumn of Patriarchy (incomplete)

# Human capital dynamics

- Evolution of gender-specific human capital

$$h_{t+1}^{\text{♀}} = (h_t^{\text{♀}})^{\theta} \cdot (\mathcal{M}_t)^{\psi^{\text{♀}}} \quad (16)$$

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

where  $\theta \in (0, 1)$  and  $\psi^{\text{♂}} > \psi^{\text{♀}}$

- 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

- Lemma 3: When  $\rho > 1$ ,  $n_t^m$  and  $\alpha_t$  both decline in  $A_t$

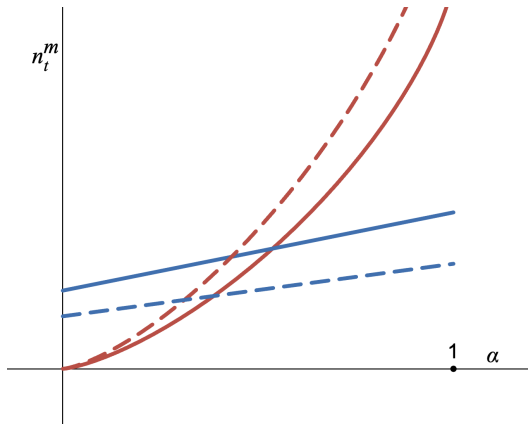


Figure 2:  $n_t^m(\alpha_t)$  (blue) and  $\alpha_t(n_t^m)$  (red)

# Dynamic interactions between $\Gamma^h$ 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

$$\Gamma_{t+1}^h = (\Gamma_t^h)^\theta \cdot (\mathcal{M}_t)^{\psi^{\sigma^{\text{♂}}} - \psi^{\text{♀}}}$$

which implies in steady-state

$$\Gamma^h = (\mathcal{M}_t)^{\frac{\psi^{\sigma^{\text{♂}}} - \psi^{\text{♀}}}{1 - \theta}} \quad (18)$$

## Channel 2: Declining $\alpha_t$ triggers a spiral

- Lemma 4: Declining  $\alpha_t$  reduces long-run  $\mathcal{M}$  and  $\Gamma^h$

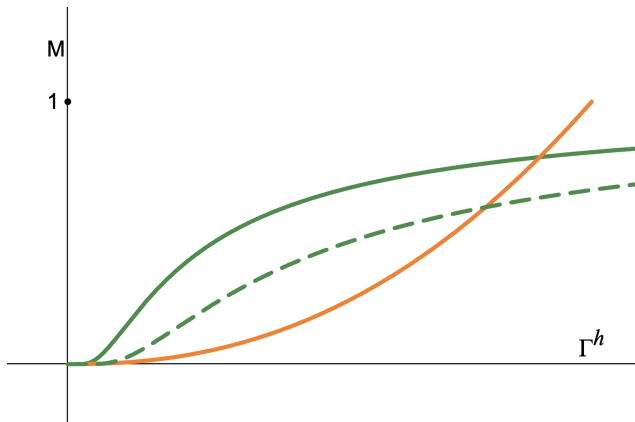


Figure 3:  $\mathcal{M}(\Gamma^h; \alpha)$  (green) and  $\Gamma^h(\mathcal{M})$  (orange)

# Mechanism

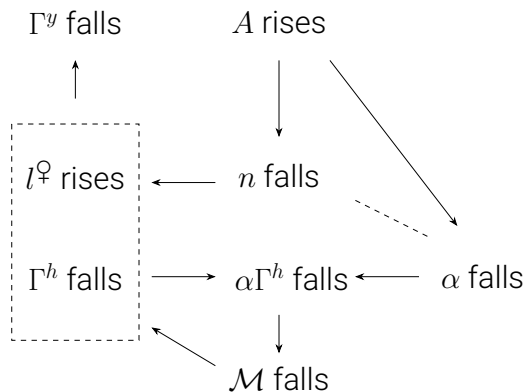
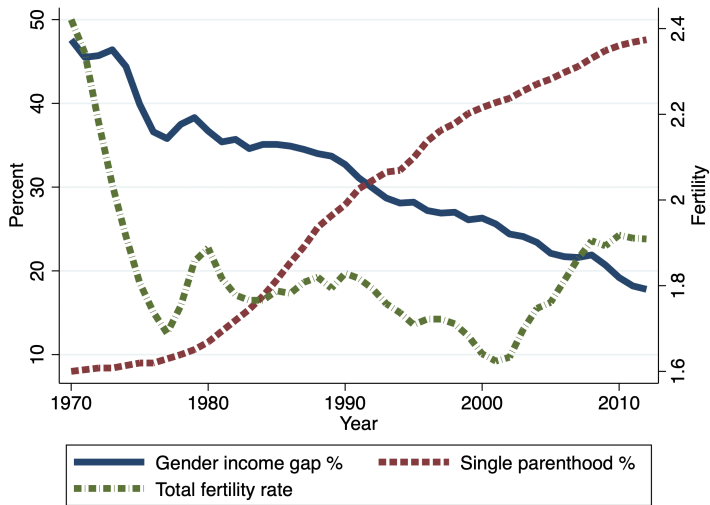


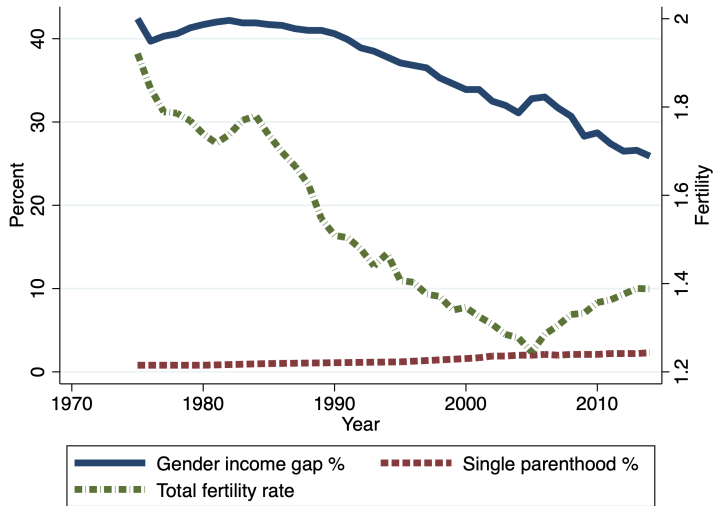
Figure 4: The demise of patriarchy

- Differences in  $J(\tau)$  lead to distinct transition path across countries

# The case of the U.K.



# 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  $\Gamma^y$  because high  $\mathcal{M} \Rightarrow$  high  $\Gamma^h$
- To reconcile high  $\mathcal{M}$  with low  $\Gamma^y$ , men need to take **more** childcare responsibilities than women
  1. How feasible is this?
  2. Is it an efficient allocation of labor when  $\Gamma^h$  is high?
  3. Because men have the outside option of staying single and having no children,  $\alpha$  needs to be low  $\Rightarrow$  low  $\mathcal{M}$ ?
- Empirically, no precedent yet

# Conclusion

- A unified model of the transition from patriarchal to egalitarian societies
- Prove and test [The Impossible Trinity](#): high fertility, dual parenthood, gender income equality
- Relentless technological growth can generate the transition



## Appendix

# 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)